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School of Mining Engineering



UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

AN INVESTIGATION INTO EQUITY MARKET TIMING PRACTICES BY SOUTH AFRICAN MINING COMPANIES

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A research report submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Engineering.

Johannesburg, 2024

DECLARATION

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ABSTRACT

This research examines the practice of equity market timing among 30 Johannesburg Stock Exchange (JSE)-listed mining companies from 2006 to 2022. Mining companies, characterised by their capital-intensive nature, rely on management for optimal capital management, which includes both the acquisition of capital through debt or equity and its optimal allocation. The concept of equity market timing, introduced by Wurgler and Baker in the 1990s, suggests that company management may engage in timing the equity market when they perceive their stock to be mispriced. This study incorporated control variables such as market-to-book value (a relative valuation metric that investors use to assess a company's market value in relation to its book value), asset tangibility, degree of leverage, and profitability.

Panel regression analysis, utilising both fixed effects and random effects, revealed that market-to-book value was not statistically significant at the 5% level. The overall R-squared value was 58.8%. Given the lack of significance for market-to-book value and asset tangibility, it is recommended to consider other capital structure theories, such as the pecking order or trade-off theory. Additionally, incorporating variables like interest rates and other macroeconomic factors could help address the potential for omitted variable bias.

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This research has provided me with insights into the South African mining industry beyond just capital structure, company financial analysis and regression modelling. I have acquired knowledge I will forever cherish and use for the advancement of my career. I acknowledge the contributions of the following individuals:

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LIST OF ACRONYMS

Alt-X	Johannesburg Alternative Exchange, a segment of the JSE
AUD	Australian Dollar
CAD	Canadian Dollar
D/A	Debt to Total Assets Ratio
D/V	Ratio of Debt to Total Company Value
DOL	Degree of Operating Leverage
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortization
E/V	Ratio of Equity to Total Company Value
GBP	British Pound Sterling
GDP	Gross Domestic Product
JSE	Johannesburg Stock Exchange
MTBV	Market to Book Value
NCC	Non-Cash Costs
NPV	Net Present Value
PPE	Property, Plant, and Equipment
r_debt	Cost of Debt
r_equity	Cost of Equity
ROA	Return on Assets
S&P GSCI	Standard & Poor's Goldman Sachs Commodity Index
GCIS	Government Communication and Information System

SARS	South African Revenue Service
USD	United States Dollar
WACC	Weighted Average Cost of Capital
ZAR	South African Rand

1 INTRODUCTION

1.1 Chapter Overview

Business decision-makers in the mining sector are faced with the choice of raising capital through debt or equity to maximise company value through an optimised cost of capital. Equity market timing, a strategic practice of issuing shares during high stock valuations and repurchasing them during perceived undervaluation, is a subject of interest. This research focused on Johannesburg Stock Exchange (JSE), Alt-X and A2X listed mining companies and examined a sixteen-year period, from 2006 to 2022, to gain insights into the use of equity market timing as a tool to create shareholder value.

In this chapter, the importance of an optimal capital structure and the relevant stakeholders are discussed. The chapter introduces and explores the research problem and question. It also details the criteria used to select the companies analysed and concludes with a concise overview of the chosen companies for the study.

1.2 Research Background and Context

The investigation addresses the problem of commodity market cyclicality and its impact on capital structure management for South African mining companies. Understanding equity market timing practices within the mining sector is important due to the industry's significant contribution to South Africa's Gross Domestic Product (GDP) and its capital-intensive operations. By exploring how mining companies respond to equity market-timing opportunities and factors influencing capital structure decisions, the aim of the research was to provide valuable insights for optimising company value and enhancing shareholder returns through an optimal cost of capital.

The Standard and Poor GSCI commodity index (S&P GSCI) is a production-weighted index that comprises a diverse range of commodities across various sectors. It evaluates the performance of the commodity market using futures contracts and is specifically designed to represent the relative importance of each

constituent commodity to the global economy (Standard and Poor, 2013). Figure 1 shows the historical index of the S&P GSCI, and prices of copper and brent crude oil from 2014 to 2023.



Figure 1: Dynamic price movements: A comparative analysis of commodity prices (GSCI), copper, and oil between 2010 and 2023. (Source: www.investing.com, 2023)

During this period, the index experienced fluctuations, starting at 5,143 in June 2014 and reaching a low of 1,783 in April 2020 during the Covid-19 pandemic, but later retraced to 3,650 in March 2022 marking a remarkable 51% improvement over a period of two years. Copper and brent crude oil, which are commonly recognised as cyclical commodities demonstrated a correlation with the overall commodities cycle which indicates fluctuations due to the economic cycle. These commodities typically experience price increases when the economy is expanding and decreases during economic downturns such as the Covid-19 pandemic and significant geo-political events such as the Russia-Ukraine war.

This period of price cyclicality in the commodities market provides an opportunity to investigate equity market timing practices within the South African mining industry. The swings in commodity prices may have significant implications for

mining companies' capital structure decisions taken in pursuit of shareholder value creation. Understanding how mining companies respond to such fluctuations and engage in equity market timing may shed light on the relevance and impact of corporate equity market timing strategies in the mining sector.

1.3 Problem Statement

Business leaders are faced with the challenge of choosing the optimal sources of capital to fund the business' capital needs. The mix of debt and equity used to finance these activities, known as a company's capital structure, is a crucial decision that directly affects the cost of capital and overall company value. The choice between debt or equity financing is influenced by various economic factors.

One specific strategy that impacts capital structure is equity market timing, where companies issue shares when their stock seems overvalued and buy back shares when they seem undervalued. This strategy aims to take advantage of changes in the cost of capital from equity and debt sources (Baker & Wurgler, 2002). Given that the South African mining industry heavily relies on capital investment, this research investigated whether South African mining companies employ equity market timing to their advantage.

1.4 Research Aim

The aim of this research was to investigate whether South African mining companies employ equity market timing as a strategic approach to make optimal capital structure decisions and create shareholder value. The objectives of this study were to:

- Evaluate the extent to which South African mining companies engage in equity market timing activities in response to perceived market opportunities.
- Identify the key determinants and factors influencing equity market timing practices within the South African mining industry.
- Assess the impact of equity market timing on the capital structure dynamics of mining companies and its implications for shareholder value.

- Contribute to the existing body of knowledge on equity market timing practices within the context of the South African mining industry.

By addressing these research objectives, this study shed light on the prevalence and implications of equity market timing in the South African mining sector. The findings provided insights for mining companies, investors, and policymakers, informing strategic decisions related to capital structure and value creation.

1.5 Justification for Research

Different minerals have independent cyclical market trends which have an impact on the economics of mining companies. These trends present both risks and opportunities for market participants. The mining industry was chosen for its significant price variability, which may directly influence market timing strategies.

The mining sector contributed 8.7% to South Africa's GDP in 2022 and has long been considered the key differentiator opportunity to boost the economy (Mineral Council South Africa, 2022). Mining is a capital-intensive industry and, as a result, capital structure decisions are an important consideration for the delivery of shareholder value in the form of shareholder return on capital.

Figure 2 shows South African monthly total minerals sales between 2003 and 2023, depicting distinctive peaks and troughs that show evidence of the volatile nature of the mining sector. Despite these fluctuations, there is a clear overall upward trend in cumulative total minerals sales, indicating a notable industry-wide growth pattern.

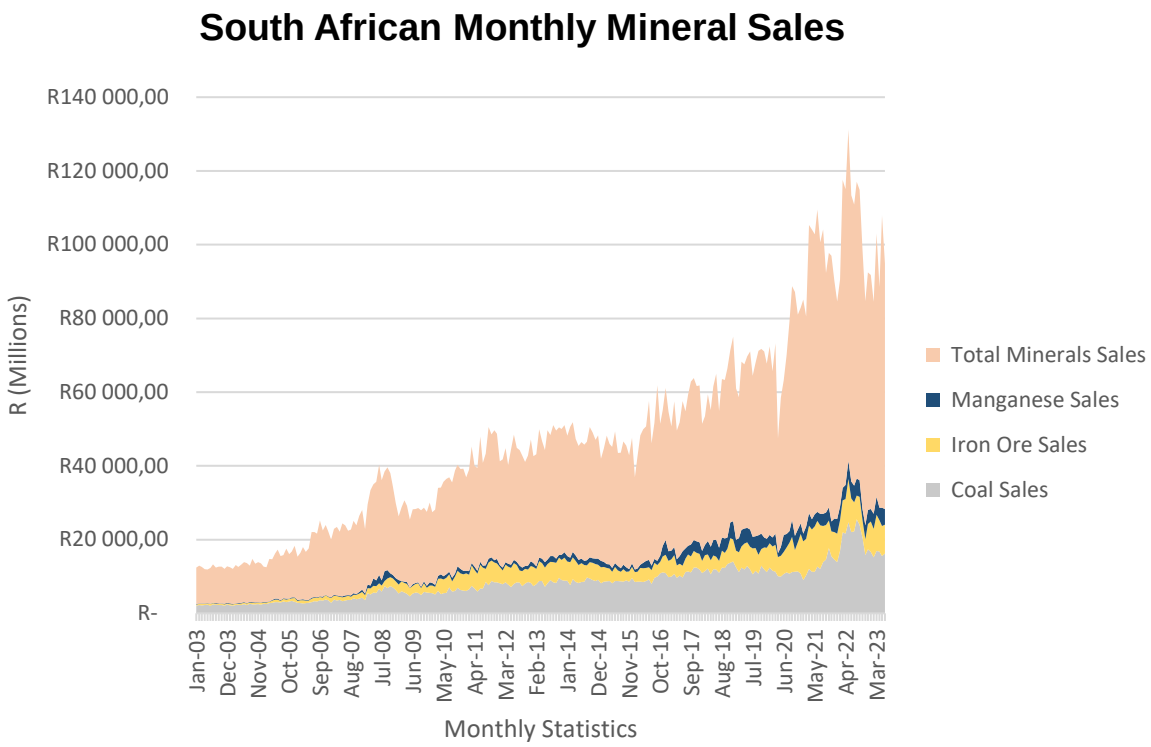


Figure 2: Mineral sales cumulative total minerals sales fluctuations from 2003 to 2023 (Source: Statistics South Africa Mining Production and Sales, 2023).

During this period, the cumulative total minerals sales was R8.3 trillion, reinforcing the sector's substantial contribution to the South African economy. South African mineral sales experienced a decline in 2008, 2015, 2020 due to the sub-prime mortgage crisis, reduced Chinese commodity demand and the Covid-19 pandemic, respectively (World Economic Forum, 2015). The data shows a highest sales figure of R89.8 billion in May 2022, indicating the industry's potential for robust growth under favourable conditions.

Given the dynamics, an investigation into JSE-listed mining companies' response to equity market-timing opportunities is important, as the sector plays a significant role in the South African economy. It is also a major contributor to employment, with a total of 458,954 jobs and a direct contribution of R480.9 billion to GDP in 2022 (Mineral Council South Africa, 2022).

1.6 Research Significance

Mining companies are affected by factors such as fluctuations in market supply and demand, geopolitical events, and currency exchange rates which contribute to commodity prices unpredictability. To navigate these challenges and maximise shareholder value, market participants may employ equity market timing strategies to optimise their cost of capital. By exploring the relationship between equity market timing and changes in company leverage, this research contributes valuable insights to the field of capital structure economics.

Through this research, mining companies can gain valuable insights to enhance their financial strategies and ultimately improve their ability to maximise shareholder value and total shareholder return for on-going shareholders in a dynamic commodities market. The study's findings and recommendations can empower mining industry stakeholders to make informed decisions about their businesses and improve shareholder value.

1.7 Research Methods

The study followed a quantitative research approach, utilising panel regression analysis to examine the relationships between variables over time. The panel dataset, constructed from financial statements of JSE-listed mining companies, provides a comprehensive overview of equity market timing practices in the South African mining sector. To ensure the validity and reliability of the findings, rigorous statistical tests and validation measures were applied to the model results.

To construct a panel dataset, financial statements from JSE-listed companies were collected using BFA McGregor's filings data. A panel regression model was employed to analyse the data, which examines how the dependent variable changes over time for different companies as well as how it varies across companies at a given point in time. This approach allowed for the exploration of the relationships between variables over time and provided a comprehensive overview of the equity market timing practice by the mining sector in South Africa.

1.8 Research Scope

This dataset comprised 15 years of financial data from mining companies that publicly traded in South Africa between 2006 and 2021 on the JSE, Alt-X, A2X stock exchanges. Company financial data was collected at consistent reporting periods to create a panel dataset that examines the behaviour of the companies over time and across the panel.

To capture the impact of the Covid-19 pandemic and the Russia-Ukraine war, dummy variables were introduced to the panel regression model. Sasol was included in the study to assess the applicability and extensibility of the research to a chemicals-producing entity. As a chemicals, oil, and gas company, Sasol is subject to commodity price fluctuations due to similar dynamics to the mining companies under consideration.

The following 30 companies listed in one of the exchanges were considered from the (JSE, A2X, Alt-X) were selected for analysis:

- AFT (Afrimat), AGL (Anglo American plc), AMS (Anglo Platinum), ANG (Anglo Gold Ashanti), ARI (African Rainbow Minerals), BAU (Bauba Resources), BHG (BHP), BUC (Buffalo Coal), CMO (Chrometo), DRD (DRD Gold), EPS (Eastern Platinum), EXX (Exxaro Resources), GFI (Goldfields), GML (Gemfields), GLN (Glencore), HAR (Harmony Gold), IMP (Impala Platinum), JBL (Jubilee), KIO (Kumba Iron Ore), MCZ (MC Mining), MRF (Merafe), NPH (Northam Platinum), PAN (PAN), RBP (Royal Bafokeng Platinum), RNG (Rand Gold and Exploration), S32 (South 32), SOL (SASOL), SSW (Sibanye-Stillwater), TGA (Thungela), WEZ (Wesizwe).

The following companies were excluded either due to a limited sample size based on listing date, delisting, or the fact that mining was not exclusively the core business of the company:

    - APH (Alphamin), established as a tin and cobalt mining entity, joined the JSE in 2017.

- KP2 (Kore Potash) focuses on potash mineral exploration and development, listed on the JSE in 2018.
- MDI (Master Drilling), which does not consider mining operations its main business, was listed in 2012.
- OMN (Omnia), a producer of explosives and fertilisers, falls within the chemicals industry and was listed in 1980.
- PPC, known for its Portland cement production and categorised in the industrial and construction sector, has been listed on the JSE since 1910.
- ORN (Orion Metals), which started trading in 2017, is involved in the development of Copper-Zinc deposits.
- THA (Tharisa), specialising in the extraction of platinum group metals and chrome, was listed in 2014.
- TGA (Thungela) entered the JSE in 2019, following the spin-off of coal assets from Anglo American.
- Several companies, including Assore Limited, were delisted by December 2022.

The sample of companies represented a diverse range of mining activities, including diversified miners, precious metals miners, and base metals miners. Each sub-group is briefly described in the next sub-sections.

1.8.1 Precious Metals Miners

South Africa has the largest proven world platinum group metal reserves with an estimated 85% of world reserves in the Bushveld Complex (SA GCIS, 2023). ANG (Anglo Gold), AMS (Anglo Platinum), IMP (Impala Platinum), MRF (Merafe Resources), NPH (Northam Platinum), RBP (Royal Bafokeng Platinum), and SSW (Sibanye Stillwater) are listed on the JSE and classified as precious metals miners. These companies primarily focus on mining and producing precious metals like gold, platinum, and palladium. The performance of precious metals miners is heavily dependent on global demand and supply dynamics for these valuable metals which cause shifts in price levels and profitability.

1.8.2 Diversified Miners

Diversified mining companies produce multiple commodities, giving them exposure to various sectors of the mining industry. Their portfolios encompass a range of commodities, such as coal, iron ore, copper, nickel, and precious metals. The performance of diversified miners is influenced by the combined dynamics of different commodity markets. ARI (African Rainbow Minerals), AGL (Anglo American), GLN (Glencore PLC), and S32 (South 32) fall under this category of JSE listed companies.

1.8.3 Other Miners

These companies are involved in the extraction and production of minerals, such as iron ore, coal, uranium, manganese, chrome, and other industrial minerals. The performance of this category of miners is closely linked to industrial demand, economic growth, and manufacturing activities. AFT (Afrimat), BUC (Buffalo Coal), EXX (Exxaro Resources), ASR (Assore Limited), MRF (Merafe), KIO (Kumba Iron Ore), THA (Tharisa Minerals), and TGA (Thungela), belong to this group of miners.

SOL (Sasol) was included in the study, as a company which focuses on the chemicals, oil, and gas industry and is subject to commodity price fluctuations due to dynamics that also affect mining companies. Sasol, being a petrochemical producer, sees its performance shaped by elements like oil prices and the worldwide demand for energy.

1.9 Structure of the Research Report

The research report is divided into six chapters, focusing on different aspects of the topic. Chapter 1 serves as the introduction, covering the background, research problem, objectives, methodologies, data sources, criteria, and potential contributions to the existing body of knowledge.

Chapter 2 provides literature review, evaluating established theories and existing literature associated with capital structure such as Modigliani-Miller, pecking order theory, trade-off theory and equity market timing. This chapter assesses prior research into equity timing and capital structure implications. Key variables that influence equity market timing are also introduced.

Chapter 3 introduces the research approach and methodology, encompassing research design, data collection procedures, data validation processes, and data analysis approaches. This chapter also establishes the quantitative modelling framework for the panel regression data. Chapter 4 presents the dataset, offering crucial business metrics for the mining companies under consideration. Chapters 5 presents and discusses the outcomes derived from the historical analysis of equity market timing, focusing on the selected mining companies across the timeframe of 2006 to 2021.

Chapter 6 concludes the research, summarising the research findings and insights drawn from the equity market timing analysis of listed South African mining companies. This chapter also outlines recommendations for future research, ensuring a comprehensive exploration and coverage of the subject. The conclusions and recommendations chapter covers research observations, initial and complimentary studies, key findings and observations, research contributions, research limitations, and suggestions for future research endeavours.

2 LITERATURE REVIEW

2.1 Introduction

Capital, in the field of corporate finance, broadly refers to the tangible and financial assets deployed in a production process to extract economic value. For industries like mining, where the extraction of valuable resources requires significant initial capital outlay and working capital, optimising capital deployment is an important strategic initiative. In the pursuit of optimising operations and growth prospects, mining companies must carefully consider their capital structure, which essentially reflects the proportion of debt and equity financing they employ. This structure which depends on a variety of mechanisms within both the debt and equity channels, has implications for a company's financial health and strategic decision-making.

The management of capital structure involves a balancing act between debt and equity levels to minimise the cost of capital. This equilibrium is achieved through various financial mechanisms known as equity and debt channels. Equity channels encompass strategies such as share repurchases or buybacks, which allow a company to influence its capital structure by adjusting the number of outstanding shares. Furthermore, corporate finance actions taken by company representatives may signal a company's financial health and attractiveness to investors, further impacting the composition of its capital.

On the other hand, the debt channel is characterised by fixed-interest transactions that involve borrowing through loans or issuing bonds. These debt-related activities also directly affect the company's capital structure, which may be inferred from financial reports, including the balance sheet and cash flow statement. As a result, the management of capital structure becomes a strategic objective for mining companies as it impacts financial stability and growth potential.

Market timing, as introduced by Baker and Wurgler (2002), extends the discussion beyond static assumptions such as the Modigliani-Miller theorem and suggests that capital structure decisions are not solely determined by factors such as tax considerations or agency costs. Instead, market timing theory suggests that the

company's capital structure can be influenced by the market's valuation of the company, in relation to management's perception of the company's intrinsic value.

This theory has added a dynamic perspective to the study of capital structure, recognising that companies may strategically adjust their capital structure to take advantage of market conditions, leading to variations in their financial decisions over time. This literature reviews capital structure theories and examines how various financial mechanisms, encompassing both equity and to a lesser extent, debt channels, affect a company's capital structure decisions.

2.2 Capital Structure Theories

The history of capital structure theoretical frameworks can be traced back to the 1950s, when it was postulated that a company's optimal capital structure is one that minimises its cost of capital, and therefore maximises the value of the company (Modigliani & Miller, 1958). The trade-off theory of capital structure, which suggests that companies balance the benefits of debt financing with the costs of financial distress, became widely accepted in the 1980s and has since been the focus of extensive research (Durand 1952, Myers 1984; Kraus and Litzenberger 1973; Rajan & Zingales 1995; Shyam-Sunder & Myers 1999; Graham 2001).

The pecking order theory of capital structure was proposed by Myers (1984) and Myers & Majluf (1984), asserts that companies prefer to use internal financing, such as retained earnings, followed by debt, and finally, equity as a last resort. This theory suggests that companies have asymmetric information regarding their financial conditions and prospects, and as a result, external financing is seen as a negative signal to investors (Shyam-Sunder & Myers, 1999; Frank & Goyal, 2009).

The market timing theory, which departs from traditional financial theories such as the trade-off and pecking order, argues that company capital structure decisions are also affected by the broader market environment beyond internal factors. As proposed by Baker & Wurgler (2002), this theory suggests that companies tend to time their financing decisions by issuing equity when their stock prices are high and use debt when interest rates are low. In contrast to the pecking order theory, the market timing theory suggests that companies can benefit from external

financing for both debt and equity when the cost of capital is low, even if they have sufficient internal funds.

Baker & Wurgler (2002) included Market to Book value (MTBV), profitability, asset tangibility and company size as factors that may have significance in equity market timing practices by companies and consequently affect a company's capital structure. The study did not consider macroeconomic factors such as interest rates in the market due to their monthly reporting nature, while capital structure decisions are based on a longer-term horizon of at least a year. As a result, accurately isolating and measuring the true impact of interest rates on market timing may prove difficult, leading to potential challenges in drawing meaningful conclusions from the analysis.

In conclusion, the history of capital structure is marked by different theories which include the Modigliani-Miller theorem, trade-off theory, pecking order theory and market timing theory. While these theories have varying arguments on the optimal capital structure, they all provide insights into the factors that influence corporate financing decisions. Companies that seek to make decisions regarding their capital structure, to increase their value and reduce financial distress, must understand these theories and the insights they generate.

2.2.1 Modigliani-Miller Theorem

The Modigliani-Miller Theorem published in 1958, is widely considered a key development in corporate finance theory and addresses how a company's financing choices, particularly the mix of debt and equity, affect its value and the cost of capital (Modigliani & Miller, 1958). This theorem asserts that, under certain assumptions and in the absence of taxes, the capital structure of a company does not impact its overall market value.

The fundamental premise of the Modigliani-Miller Theorem, as established by Modigliani and Miller (1958), is that the value of a company depends primarily on its capacity to generate future cash flows and its tangible assets. This concept underscores that in a frictionless and idealised financial world, the composition of a company's capital does not affect the intrinsic valuation of the enterprise.

This has the implication that management should focus on non-capital structure related activities such as on-going operational and project execution excellence.

The essence of the Modigliani-Miller Theorem can be summarised in the following propositions (Modigliani & Miller, 1958):

I. **Modigliani-Miller Proposition 1:** Under ideal conditions without taxes, transaction costs, bankruptcy costs, or information asymmetry, a company's total value is independent of its capital structure.
II. **Modigliani-Miller Proposition 2:** In the absence of taxes or costs, the cost of equity increases linearly with leverage, with the result that higher debt levels lead to higher required returns for equity investors.

Equation 1 underscores that the weighted average cost of capital (WACC) reflects the combined cost of raising funds considering both debt and equity, within a company and is at the foundation of all capital structure theories (Modigliani & Miller, 1958).

$$r_{WACC} = \frac{D}{V} r_{debt}(1 - t) + \frac{E}{V} r_{equity} \quad [2.1]$$

- r_{WACC} represents the Weighted Average Cost of Capital (WACC).
- D/V represents the ratio of debt to the total value of the company's financing (debt + equity).
- E/V signifies the ratio of value of equity to the total value of the company's financing.
- r_{debt} denotes the cost of debt.
- r_{equity} represents the cost of equity.
- t represents the corporate tax rate.

Modigliani-Miller Theorem Proposition 1

Modigliani-Miller Proposition 1 implies that in a tax-free environment, shareholders' wealth remains unaffected by the capital structure of a company. Figure 3 shows the relationship between cost of capital (WACC) at different levels of company leverage.

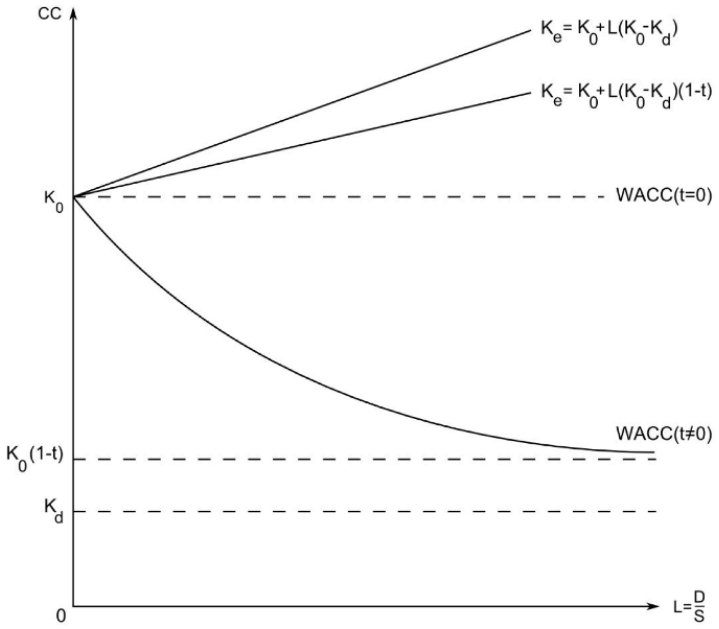


Figure 3: Dependence of WACC, cost of equity, cost of debt on company leverage with and without taxes (Brusov *et al*., 2021).

The theorem suggests that if a company increases leverage levels while maintaining the value of its assets and cash flows, shareholders' equity should decrease proportionally. Conversely, if the company reduces its leverage, shareholders' equity should increase in a corresponding manner. Importantly, this proposition implies that the cost of equity and the required rate of return for shareholders are directly related to the risk of the company's underlying assets, rather than its capital structure.

Initially, the cost of debt remains constant, reflecting stable risk perceptions by lenders, but may rise as perceived default risk increases with higher leverage. The graph also highlights WACC under scenarios with and without taxes, showing a

lower WACC when tax effects are considered because of the tax shield provided by debt.

Furthermore, Modigliani-Miller Proposition 1 focuses exclusively on the company's value in a static framework, neglecting potential dynamic considerations. In dynamic environments, companies may alter their capital structures to exploit market conditions, suggesting that market timing and other strategic factors can influence capital structure decisions.

Modigliani-Miller Theorem Proposition 2

Modigliani-Miller Proposition 2 is a fundamental principle in corporate finance introduced by Franco Modigliani and Merton Miller in 1958. This proposition, building upon the first proposition, provides insights into the effect of leverage, specifically debt financing, on a company's cost of equity.

Proposition 2 posits that, under the same idealised assumptions as Proposition 1 perfect capital markets without taxes, transaction costs, bankruptcy costs, or information asymmetry, the cost of equity for a leveraged company is a linear function of its debt-equity ratio. In simpler terms, as a company increases its reliance on debt financing, the required rate of return demanded by equity investors also rises proportionally. This is due to the added financial risk imposed on equity holders as more debt is used in the capital structure.

In practice, Proposition 2 highlights that the cost of equity is not constant but varies based on the capital structure choices made by a company. As a company employs more debt, investors will seek higher returns to compensate for the increased financial risk associated with potentially larger financial obligations. This proposition underscores the trade-offs companies must consider when determining their optimal capital structure, balancing the tax advantages of debt financing with the rising cost of equity.

Modigliani-Miller Theorem implications – Capital Structure Irrelevance

Modigliani and Miller argued that, under certain idealised conditions, the value of a company is independent of its capital structure. In other words, the way a company chooses to finance its operations – whether through debt, equity, or a mix of both – should not affect its overall value if markets are efficient and the assumptions of no taxes, transactions costs and no bankruptcy costs are met.

Modigliani-Miller Theorem implications – Perfect Capital Markets

The theorem assumes a world of perfect capital markets, where there are no taxes, transaction costs, bankruptcy costs, or information asymmetry. In such a world, investors can borrow or lend money at the risk-free rate, and there is no advantage to a company's shareholders from leveraging or de-leveraging the company.

Modigliani-Miller Theorem implications – Arbitrage Process

Modigliani and Miller argued that if a company's capital structure did affect its value, an arbitrage process by investors would eliminate any advantage. For example, if a company with a low debt level was valued higher than a similar company with a high debt level, investors would buy shares in the high-debt company and simultaneously sell short the low-debt company, effectively eliminating the difference.

The Modigliani-Miller Theorem has important implications for corporate finance. It suggests that companies should focus on investment decisions and cash flows rather than obsessing over the optimal capital structure. It also implies that there is no universally optimal capital structure; the choice between debt and equity depends on various factors, including a company's specific circumstances and objectives.

While the Modigliani-Miller theorem provides valuable insights, it is noteworthy that real-world markets are far from the idealised conditions it assumes. In practice, real-world financial decisions often involve trade-offs between the advantages of debt, such as interest tax shields, and the associated costs, like financial distress. These trade-offs ultimately guide a company towards its optimal capital structure in practice.

2.2.2 Trade-off Theory

Following the Modigliani-Miller Theorem, which provided insights into capital structure in idealised market conditions, several subsequent theories and models were developed to account for real-world complexities and factors that influence a company's optimal capital structure. The Trade-off Theory of capital structure recognises that companies face a trade-off between the benefits and costs of debt financing. Unlike the Modigliani-Miller Theorem's idealised assumptions, the Trade-off Theory takes into consideration real-world factors such as taxes, financial distress costs, and agency costs (Kraus & Litzenberger, 1973; Myers, 1984; Rajan & Zingales, 1995).

Taxation and Tax Shield Benefit

A key central idea of the Trade-off Theory is that interest on debt is tax-deductible, which provides a tax shield benefit. The implication is that companies can reduce their taxable income by deducting interest expenses, resulting in lower tax payments. As a result, companies are incentivised to use debt to the extent that the tax benefits outweigh the costs of debt (Kraus & Litzenberger, 1973).

Financial Distress Costs

The theory acknowledges that taking on excessive debt can lead to financial distress and potentially bankruptcy. Financial distress costs include legal fees, the loss of business value, and the cost of renegotiating debt agreements. Therefore, companies aim to strike a balance in their capital structure to minimise the likelihood of financial distress (Myers, 1984).

Optimal Capital Structure

According to the Trade-off Theory, there is an optimal capital structure for each company that maximises its overall value. This optimal structure reflects the balance between the tax benefits of debt and the costs associated with financial distress. Companies seek to find this balance to maximise their value to shareholders (Myers, 1984; Harris & Raviv, 1991; Frank & Goyal, 2009).

Dynamic Process

The Trade-off Theory also recognises that a company's capital structure is not irrelevant, as assumed by the Modigliani-Miller Theorem and can change over time in response to changes in business conditions, interest rates, and other factors (Rajan & Zingales, 1995; Shyam-Sunder & Myers, 1999; Graham & Harvey, 2001). While the Trade-off Theory provides a more realistic framework for understanding capital structure decisions, it is noteworthy that other theories and models, such as the Pecking Order Theory and the Agency Cost Theory, also contribute to understanding real world financing choices by companies. These theories consider factors like information asymmetry, managerial incentives, and the availability of internal funds when determining the optimal capital structure for a given company (Myers, 1984; Myers & Majluf, 1984).

Following the development of the Trade-off Theory, several other theories and models emerged in the field of corporate finance to further explore and explain capital structure decisions. Two notable theories that gained prominence are the Pecking Order Theory and the Agency Cost Theory.

2.2.3 Pecking Order Theory

The Pecking Order Theory, proposed by Myers and Majluf in 1984, suggests that companies have a preferred order or hierarchy when it comes to financing their investments and operations. According to this theory, companies prefer to use internal funds (retained earnings) first, followed by debt, and then, as a last resort, equity (Myers & Majluf, 1984).

The key principles of the Pecking Order Theory are:

I. Companies prefer internal funds because they have no information asymmetry or signalling problems. Debt is preferred over equity because it imposes fewer information costs.
II. Equity issuance is considered a last resort because it can send negative signals to the market about the company's financial health or management’s perception of the valuation of the company.

The Pecking Order Theory explains observed financing behaviour where companies tend to rely on internal funds and debt rather than issuing new equity when they need financing thus affecting capital structure (Myers, 1984).

2.2.4 Agency Cost Theory

The Agency Cost Theory focuses on the conflicts of interest that arise between different stakeholders in a corporation, such as shareholders, board of directors, managers, and creditors (Jensen & Meckling, 1976; Myers, 1977; Ross, 1977). It suggests that these conflicts can lead to agency costs, which influence a company's capital structure decisions.

Key elements of the Agency Cost Theory suggest that managers may have their interests misaligned with those of shareholders, leading to agency problems. Debt can be used as a disciplining mechanism to mitigate managerial agency problems. When managers know they have debt obligations, they may be more motivated to maximise company value to meet these obligations. However, excessive debt can also lead to agency conflicts with bondholders, as shareholders may engage in riskier actions that benefit them at the expense of bondholders (Jensen, 1986; Shleifer & Vishny, 1997; Stulz, 1990)

The Agency Cost Theory highlights how considerations related to agency conflicts and governance influence a company's choice of capital structure. These theories, along with the Trade-off Theory, provide different perspectives on company capital structure decisions. In practice, companies may draw on elements from multiple theories to determine their optimal capital structure based on their unique circumstances and goals.

2.2.5 Equity Market Timing

Market timing theory asserts that companies strategically time the issuance of equity shares to coincide with periods of high share prices and repurchase shares when prices are lower, with implications on a company's capital structure. Two versions of this theory exist, namely the rational agent and the irrational agent. The rational agent version, as proposed by Myers & Majluf (1984) suggests that companies issue equity following information releases that reduce information

asymmetry between management and shareholders, often leading to rising stock prices. The irrational agent version, presented by Baker & Wurgler (2002), assumes that economic agents are irrational, resulting in time-varying mispricing of a company's stock. Managers align their financing decisions with the equity market, issuing equity when stock values are high and repurchasing when they are low. This lowers the company's cost of capital, benefiting current shareholders by reducing the discount rate used in the discounted cash flow (DCF) method, which in turn increases the company's market valuation.

Baker & Wurgler (2002) provide evidence supporting the persistent effect of equity market timing on a company's capital structure, defining a market timing measure based on past external capital needs weighted by the company's market-to-book values. Baker & Wurgler (2002) find a strong, positive relationship between changes in leverage and their market timing measure, suggesting that a company's capital structure reflects cumulative past efforts to time the equity market.

Subsequent studies, such as those by Jenter (2005), Elliott *et al*. (2007), Huang and Ritter (2009), have corroborated the influence of market timing on capital structure. Furthermore, empirical evidence has extended beyond the equity market to the debt market, as observed in studies such as Bancel & Mittoo (2004) and Henderson *et al*. (2006). These studies collectively support the idea that historical market values strongly influence a company's capital structure, highlighting that capital structure represents the cumulative result of past attempts at equity market timing, as proposed by Baker & Wurgler (2002).

2.2.6 Capital Structure Company Factors

Corporate finance theories provide a solid theoretical framework for guiding corporate finance practitioners in their pursuit of value creation through optimal policies. These theories underpin the considerations that practitioners focus on when making financial decisions for companies. In this section, company-specific factors that play a crucial role in shaping a company's capital structure are presented. While theories like the Trade-off Theory, Pecking Order Theory, and Agency Cost Theory provide overarching principles, real-world financial decisions often require a deeper understanding of a company's unique circumstances. The

company specific factors presented provide additional insights into other variables that may have an impact on capital structure beyond equity market timing.

2.2.7 Market to Book Value

The intrinsic value of a company refers to the “true value” of the company and exists only in theory and as such is a subject for debate (Tiwari, 2016). Generally, two broad measures of company value exist based on either market value or book value. The market value of a company can be determined by multiplying the total number of outstanding shares with the price per share in the market to obtain market capitalisation. Book value may be represented as an excess of the total assets over the total liabilities. Equation 2.1 shows the relative comparison between the market value and book value and is derived from the Market to Book Value ratio which is a measure of whether a company is undervalued or overvalued in the market (Damodaran, 2012).

$$\text{Market to Book Value} = \frac{\text{Market Capitalisation}}{\text{Stockholders' Equity}} \qquad [2.2]$$

When the ratio is less than one, the company is considered undervalued and overvalued when the ratio is greater than one. Uses of Market to Book ratios market timing practices by company agents are reported in Baker & Wurgler (2002), Ater (2017) and, Zavertiaeva & Nechaeva (2017) wherein the relationship between company leverage and Market to Book value ratio was investigated.

2.2.8 Asset Tangibility

Assets are categorised as either tangible or intangible depending on the physical nature of such assets. Rajan & Zingales (1995) found that companies with few tangible assets exhibited low leverage and thus must resort to other sources of funding. Shleifer & Vishny (1992), Liberti & Sturgess (2016) report that tangible assets (for example, property, plant, and equipment), given their relative ease of valuation and high recovery rates, are the most posted collateral in external financing. According to Leia *et al.* (2018), collateral is widespread in corporate

lending around the world but despite this, information specific to South African collateralisation levels was not readily available for this study.

Companies with low asset tangibility (for example, intellectual property, brand equity, and goodwill) generally, in contrast, face costly external financing which leads to own capital contribution to enhance creditworthiness (Bates *et al.*, 2009; Lyandres & Palazzo, 2016). The asset makeup of a company is an important factor in the determination of a company's accessibility to credit facilities as it determines the amount of collateral available to moderate credit risk.

2.2.9 Company Size

Revenue is measured as the total amount of money that is brought into a company by its business activities. It is the figure from which profitability is determined after costs are deducted and an important financial metric to consider for the degree of operating leverage (DOL), a key measure of risk (Gitman & Zutter, 2015; Reilly & Brown, 2011).

Mallik *et al.* (2022) found evidence of a non-linear relationship between company size and the need for credit. The study indicates that as firm size increases, measured by proxies such as total sales and the number of employees, the need for credit initially grows, increasing the likelihood of loan applications. However, once the firm reaches a certain threshold level of financial need, the propensity to apply for additional loans declines. Other company size proxies that have been used in literature include company sales, the total number of employees and Book Value and Net Assets (Dang, et al., 2017).

2.2.10 Profitability

The profitability of a company is the primary interest of all stakeholders in a company and may be measured using various metrics such as gross profit margin, Earnings Before Interest Taxes, Depreciation and Amortization (EBITDA), Net Income margin, among others. EBITDA was chosen in this study for two reasons. Firstly, it is a widely reported metric by South African mining companies and it provides ease of comparability between companies of different capital structures and secondly, it is considered a reasonable proxy for cash flow (Laxe, et al., 2021).

EBITDA is calculated before non-operating costs such as interest taxes, and non-cash costs (NCC) such as depreciation and is thus independent of a company's capital structure but may affect future capital-raising decisions. In this study, profitability was tested against other factors to investigate the most significant drivers for changes in leverage, an indication of market timing practices.

2.3 Chapter Summary

The literature review delved into the concepts, theories, and studies related to capital structure decisions and equity market timing. It traced the historical development of capital structure theories, including the Modigliani-Miller Theorem, Trade-Off Theory, Pecking order theory and Market Timing theory. These theories provide insights into how companies balance debt and equity financing to optimise their capital structure. The market timing theory challenges conventional theories by suggesting that external market conditions influence capital structure decisions.

Furthermore, the chapter reviewed factors such as book value per share, profitability, asset tangibility, and company size in relation to their impact on market timing practices. The review of existing literature underscores the necessity for companies to evaluate a multitude of factors to enhance their value through optimal capital structuring. Following this, Chapter 3 outlines the research approach, emphasizing the quantitative nature of the study's design.

3 RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the research methodology employed to analyse the influence of specific company characteristics on capital structure, serving as an empirical test for the prevalence of equity market timing. Utilising a panel regression model, this study explores the dynamic relationship between shifts in company leverage and factors such as market-to-book value, profitability, company size, and tangible assets. The objective was to dissect and understand the factor-specific significance and their contribution to the capital structure decisions of companies.

The analysis was aimed at uncovering any substantial insights that underscore the practice of equity market timing, whereby companies capitalise on perceived mispricing of their stock. By testing these relationships, the analysis ascertained the existence and extent of evidence supporting the strategic alignment between market timing practices and capital structure adjustments.

3.2 Research Design

The research is designed to explore the practice of equity market timing among South African mining companies and its impact on their capital structure. The study focused on mining companies listed on the JSE and spanned a 15-year period from 2006 to 2021, analysing equity market timing activities in response to stock valuation changes to identify market timing practices. Additionally, the research includes hypothesis testing to examine the potential relationship between market timing opportunities and shifts in company leverage within the industry. To gain insight into market timing practices in the South African mining industry, the following main questions were formulated:

- Do South African mining companies respond to equity market-timing opportunities in the form of raising capital through equity issuance when share price is overvalued and buy back equity when the share price is undervalued?

- Which other independent variables have a significant impact at a 5% significance level on the capital structure of companies within the mining industry in South Africa? A 5% significance level was chosen as it is widely used in practice and minimises the probability of a Type I error occurrence.

This quantitative study employed statistical methods, specifically panel regression analysis, to examine the data and assessed hypotheses concerning the relationships between variables and the presence of equity market timing. The research model, inspired by the work of Baker & Wurgler (2002), primarily focuses on investigating the impact of market timing on capital structure. Within the model, various independent variables, including market-to-book value, profitability, company size, and tangible assets, are considered as control variables. Changes in gearing, serving as the dependent variable, were evaluated for each company from one year to the next and the following hypothesis formulated:

Null Hypothesis: There is no significant relationship between equity market timing and changes in company leverage within South African mining companies.

$$H_{null}: b_1 = 0$$

Alternative Hypothesis: There is a significant relationship between equity market timing and changes in company leverage within South African mining companies.

$$H_a: b_1 \neq 0$$

Consistent with previous studies conducted by Rajan & Zingales (1995) and Baker & Wurgler (2002), the variable expected to have the most significant influence on market timing practices is anticipated to be market to book value. The model incorporates coefficients (β_0, β_i) to represent the intercept and slope coefficients, respectively, and includes an error term (ε). Additionally, the study took into consideration additional variables such as asset size, debt turnover, asset tangibility, fixed effects, and random effects.

The model equation is as follows (Baker & Wurgler, 2002):

$$\left(\frac{D}{A}\right)_{it} = \beta_0 + \beta_1 (MTBV)_{it} + \beta_2 \left(\frac{PPE}{A}\right)_{t-1} + \beta_3 \left(\frac{EBITDA}{A}\right)_{i,\ t-1} + \beta_4 log(S)_{i,\ t-1} + \beta_5 \left(\frac{D}{A}\right)_{i,\ t-1} + F_i + T_j + \varepsilon \quad [3.1]$$

Where:

- $\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1}$ represents changes in gearing book-debt/total assets.
- $(MTBV)_t$ denotes Market to Book Value.
- $log(S)_{t-1}$ refers to the asset size in the preceding year.
- $\left(\frac{D}{A}\right)_{t-1}$ represents Debt turnover.
- $\left(\frac{PPE}{A}\right)_{t-1}$ represents Asset Tangibility.
- F_i is the model Fixed Effects.
- T_j represents the model Random Effects.
- β_0 corresponds to the intercept.
- β_i denotes the slope coefficient.
- ε symbolises the error term.

The analysis involved the estimation of coefficients for the independent variables within the panel regression model, with a particular focus on investigating the impact of equity market timing on capital structure. The model considered various factors, including market to book value, which was postulated to have a substantial influence on the practice of equity market timing. Additionally, the model incorporates fixed effects and random effects, encompassing individual-specific and time-specific effects, to account for the unique characteristics of each of the 30 companies between 2006 and 2022. The estimation of coefficients for the independent variables allowed for an assessment of the impact of these variables on changes in company leverage as a proxy for equity market timing.

3.3 Model Selection

Panel data modelling combines cross-sectional and time-series data, facilitating the examination of individual variations across entities and changes within entities over time. It involves observing multiple entities with associated variables at various time points, providing more comprehensive insights beyond traditional regression methods, making it a preferred choice in econometric research (Greene, 2012; Wooldridge, 2010). Figure 4 is a visual illustration of the multidimensional nature of panel data and its relevance in analysing complex datasets.

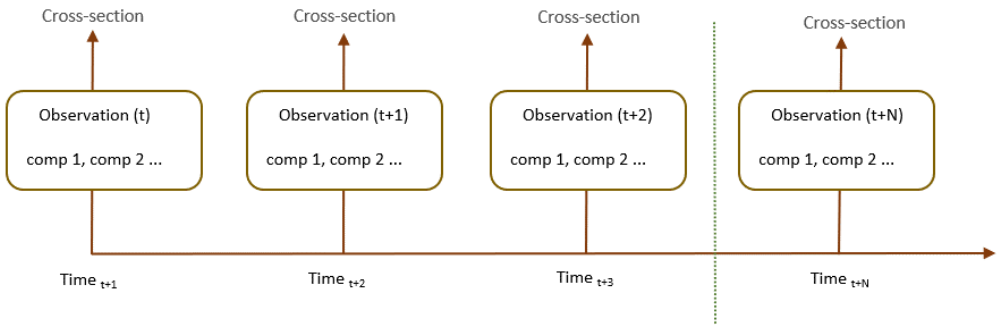


Figure 4: Illustration of the panel data logical structure used for model estimation.

Various approaches were considered for estimating the relationships between variables in the panel data. Time series regression alone was not chosen because it estimates separate models for each company over time, which may fail to capture the collective influence of independent variables across companies and provide a comprehensive understanding of their impact on the dependent variable. Panel data regression was selected as the most suitable approach due to its capacity to incorporate all observations for each company over time. This approach considers company-specific attributes that distinguish companies within their environment, including factors such as management quality, geographic location, and corporate culture, among others (Greene, 2012). Panel data regression offers a comprehensive analysis by capturing the impact of both time-varying and company-specific factors which makes it a multi-dimensional approach. In contrast, cross-sectional regression, where data for each company is pooled by year and analysed separately, imposes limitations on degrees of freedom and hinders

comprehensive analysis. Other variations, such as between-group cross-section regression, which calculates averages for each company over the entire period, reduce the sample size and eliminate time-dependent information (Hsiao, 2014).

The fixed effects model and random effects models were employed since these models enable the control of time-invariant factors specific to individual companies (fixed effects) or accommodate heterogeneity across companies (random effects) which ensures a more comprehensive analysis (Greene, 2012; Wooldridge, 2010). The selection of the most appropriate model was based on model assessment, specifically employing the Hausman test, to ensure the validity and reliability of the estimated results. Figure 5 provides an overview of the model estimation process, where only the fixed effects and random effects models were estimated and evaluated to obtain the best estimation model.

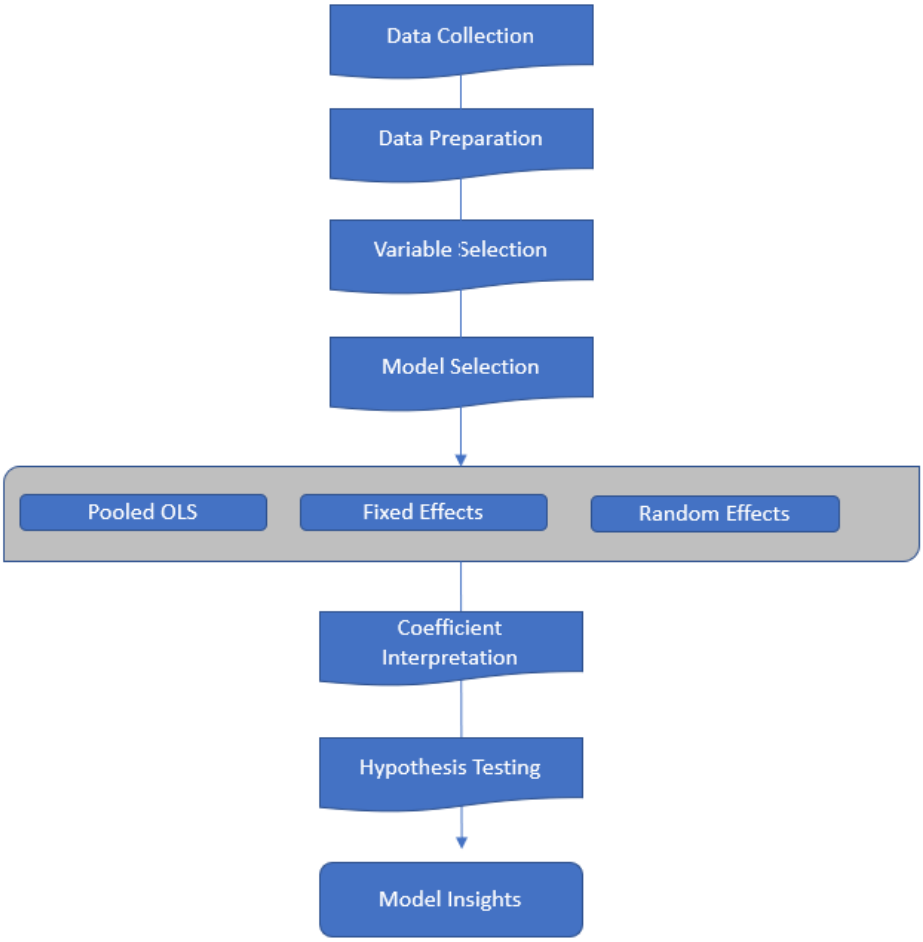


Figure 5: Panel regression model workflow for model estimation.

3.3.1 Model Specification Tests

In panel regression, data validation ensures that panel data is suitable for regression analysis, considering its unique characteristics encompassing both cross-sectional and time-series elements (Greene, 2012). On the other hand, model validation focuses on verifying the correct specification of the panel regression model, adherence to underlying assumptions, and its ability to reliably represent economic or social phenomena (Greene, 2012). Both data and model validation are crucial for ensuring the reliability and credibility of findings derived from panel regression analysis.

To assess the performance and adequacy of the panel regression model, a series of hypothesis tests were conducted, aimed at evaluating the significance of relationships between the variables under examination. The research hypothesis, which posited a connection between equity market timing and fluctuations in company leverage were tested against the null hypothesis, suggesting the absence of such a relationship.

P-values were calculated to assess the statistical significance of estimated coefficients associated with the independent variables. These p-values were derived from the hypothesis tests done on both independent variables through the model coefficients and overall model performance determined by an F-test that evaluate the empirical evidence supporting the research hypothesis.

Typically, researchers set a predetermined significance level (often denoted as α or alpha, e.g., α = 0.05) (Wooldridge, 2010). If a coefficient's p-value falls below this threshold, it signifies strong evidence against the null hypothesis, implying that the variable is statistically significant in explaining variation in the dependent variable. Conversely, if the p-value exceeds the chosen significance level, it indicates insufficient evidence to reject the null hypothesis, suggesting the variable may lack statistical significance in explaining variation in the dependent variable.

Additionally, the panel regression model's overall goodness of fit was evaluated using the R-squared value and adjusted R-squared value. These metrics provided a quantitative assessment of the model's effectiveness in explaining variations observed in the dependent variable (Wooldridge, 2010). Table 1 demonstrates the interpretation of correlation coefficient values, offering insights into the strength and direction of linear relationships between variables. Through this analysis of statistical significance and explanatory power, this assessment ensured the reliability and validity of research findings, improving the credibility of insights derived from the study.

Table 1: Pearson correlation coefficient interpretation (Onifade & Genc, 2018).

Correlation Coefficient Value	Correlation Interpretation
Zero	No linear relationship
0 to 0.1 (0 to -0.1)	Very weak positive/ (negative) linear relationship
0.1 to 0.24 (-0.1 to -0.24)	Weak positive/ (negative) linear relationship
0.25 to 0.5 (-0.25 to -0.5)	Moderate positive/ (negative) linear relationship
0.51 to 0.94 (-0.51 to -0.94)	Strong positive/ (negative) linear relationship
0.95 to 1.0 (-0.95 to -1.0)	Perfect positive/ (negative) linear relationship

3.3.2 Residual Diagnostics

Analysing residuals for homoscedasticity, autocorrelation, and normality is crucial in confirming the foundational assumptions of regression modelling. This process not only validates model accuracy but also pinpoints areas for improvement and refinement (Gujarati & Porter, 2009). Residuals, defined as the differences between observed and predicted values, were analysed to uncover insights for model enhancement. Visual examination is a key aspect of this analysis. Various residual plots, including residuals versus fitted values, normal probability plots, and residuals versus independent variables, were utilised to detect patterns or anomalies. These visual tools are instrumental in identifying inconsistencies, thereby improving the model's accuracy and reliability.

Heteroscedasticity, a phenomenon where the variance of residuals is not constant throughout the predicted values, was assessed using the Breusch-Pagan test, a statistical test which uses regression analysis to detect this violation of

homoscedasticity assumption (Breusch & Pagan, 1979). Autocorrelation among residuals in time-series panel data was examined using the Durbin-Watson test, a widely used method to detect the presence of autocorrelation. This step is crucial as autocorrelation can significantly affect both the validity and the performance of the model (Durbin & Watson, 1951).

In summary, residual analysis served as a key approach in refining the model specification and ensuring its robustness. This involved performing checks by estimating alternative models, such as comparing fixed effects with random effects, to evaluate the consistency and reliability of the results. This step ensures the identification of potential issues and enable the necessary adjustments to the model specifications, enhancing the overall quality and accuracy of the research findings.

3.4 Research Limitations

Despite providing valuable insights, the panel regression model employed in this study comes with certain limitations that should be acknowledged. First, the validity of the model relies heavily on the quality and accuracy of the data used. Any measurement errors or inaccuracies in the data could potentially introduce bias into the results. Therefore, ensuring the data's reliability and consistency was important. Data validation included procedures to address missing data, ensuring the dataset's completeness and reliability throughout the study.

Secondly, the model assumes that the relationships observed in the data are causal in nature (Baker & Wurgler, 2002). However, establishing causality can be challenging in panel data analysis, as it often requires controlled experiments, which may not always be feasible in real-world settings. While the model can highlight associations between variables, it cannot definitively prove causation (Hanck *et al,* 2009; Greene, 2012).

The effectiveness of the model heavily relies on the appropriate selection of independent variables. The phenomenon known as omitted variable bias can arise if key factors that influence the dependent variable are not included in the model. For instance, overlooking variables like the level of interest rates in the country or

foreign exchange fluctuations may skew results. Therefore, a comprehensive range of variables were carefully selected to ensure the validity of the research findings. Additionally, the model operates under the assumption that the relationships between variables remain stable throughout the study period. However, this assumption may not always be accurate in dynamic sectors where conditions change over time, highlighting the importance of considering stationarity in the model's framework (Hyndman & Athanasopoulos, 2018).

In summary, while the panel regression model offers a valuable approach to exploring relationships in panel data, it is not without its limitations. Caution was exercised when interpreting findings, acknowledging potential biases arising from data quality, the complexity of establishing causation, and the importance of careful variable selection. These limitations underscore the significance of combining quantitative analysis with qualitative perspectives and a detailed understanding of the specific research context.

3.5 Chapter Summary

This chapter introduced the chosen research methodology, emphasizing panel regression as a tool to understand equity market timing in the South African mining sector. The foundation of this approach relies on Baker & Wurgler's (2002) model, investigating equity market timing effects on capital structure. Market-to-book value, profitability, company size, and tangible assets were selected as key independent variables.

Fixed and random effects models within panel regression were chosen as the quantitative research tools for the analysis. Alternative methods such as time series and cross-sectional regression were reviewed, highlighting panel data regression's advantages. The research methodology emphasized the significance of appropriate econometric models, hypothesis testing, and result interpretation, underscoring research findings' significance in unveiling equity market timing. Chapter 4 is dedicated to presenting the data collected during the research and addressing the quality of this data to ensure the reliability and validity of the research findings. This chapter emphasized the importance of data integrity, detailing the methods employed to verify the accuracy and consistency of the data.

4 DATA FOR THE STUDY

4.1 Introduction

The data utilised in this study was sourced from IRESS Expert, a South African financial reporting database that provides comprehensive historical and fundamental information of both South African and international listed and unlisted companies. This dataset encompasses published financials, including preliminary and interim financials, and spans a period from 2006 to 2022. Foreign exchange data for currency conversion was obtained from SARS to ensure data consistency.

Furthermore, data cleaning procedures were applied to address any inconsistencies, missing values, or outliers. For instance, missing data points were handled using appropriate techniques such as imputation or exclusion as a last resort, depending on the extent of the missing data. The data was validated and cross-referenced with the original source of data where required.

The presentation of the data through bar charts was done to visualise trends and insights. Descriptive statistics, as discussed earlier, were utilised to explore the distributional properties of the data and assess overall variability. Summary statistics for variables such as asset tangibility, profitability, market-to-book ratio, and company gearing ratio were calculated to examine central tendency and dispersion.

4.2 JSE Listed Mining Companies Average Gearing Levels from 2006 to 2022

Figure 6 presents a visualisation of the average leverage ratio across the 30 mining companies. Leverage is a financial metric that assesses the degree to which a company's operations are funded by debt versus equity. The bar chart ranks the companies in ascending order of their leverage levels, providing a range of levels of leverage within the industry, from conservative financial structures to more aggressive borrowing strategies.

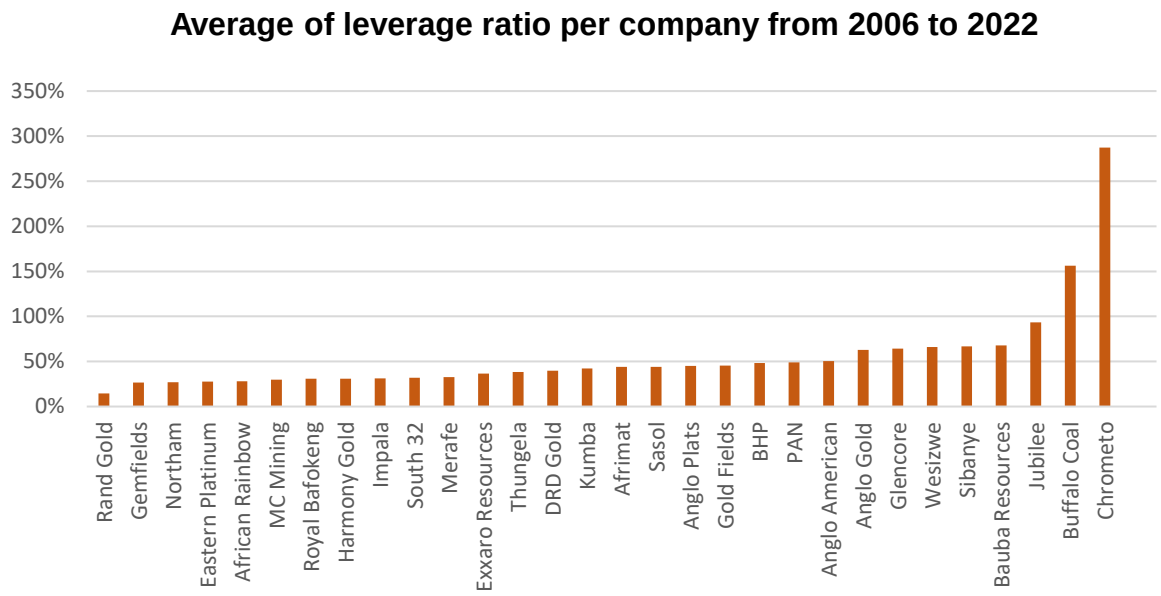


Figure 6: JSE-listed mining companies' leverage ratios between 2006 and 2022.

Rand Gold shows a conservative financial profile with the lowest gearing ratio of 14.5%, perhaps suggesting a cautious approach to leveraging and a potential preference for equity financing over debt. This may be reflective of a strategic stance towards minimising financial risk by reducing external borrowing. Conversely, Chrometo stands out with the highest gearing ratio of 287%, an outlier that implies a highly leveraged position. Such an elevated ratio raises concerns about the company's long-term financial sustainability and its vulnerability to shifts in interest rates or mining sector volatility.

The cluster of companies with leverage ratios around the industry's median of 43%, including Anglo American, Pan African Resources and BHP, indicates a balanced approach to leveraging, possibly aiming to optimise their capital structure for growth while maintaining financial resilience. The diversity in gearing ratios underscores the varying risk appetites and operational models in the mining industry, from conservative to highly speculative financial strategies.

Table 2 provides summary statistics of the gearing levels for the mining sector for the period under review.

Table 2: Summary statistics of leverage levels for JSE-listed mining companies leverage between 2006 and 2022.

Gearing Leverage Levels Summary Statistics	
Mean	55,3%
Median	43%
Standard Error	9,3%
Standard Deviation	50,5%
Sample Variance	26,2%
Minimum	14,5%
Maximum	287,4%

The median value of 43% is indicative of the overall industry's leaning towards moderate leveraging. The companies with lower-than-average gearing ratios may be exercising prudence, possibly due to a strategic emphasis on financial stability and independence from creditors, or because of substantial retained earnings and equity. However, the existence of companies with significantly higher gearing ratios, notably Buffalo Coal and Chrometo, suggests aggressive financial leveraging that could be driven by expansive growth strategies, substantial capital investments, or potentially, challenging operational environments that necessitate increased borrowing.

4.3 Relative Valuation (MTBV)

Figure 7 is a visual representation of the average market to book value (MTBV) ratios for the selection of companies. This ratio serves as an indicator of market valuation in relation to the company's book value, with a lower ratio potentially signalling undervaluation and a higher ratio suggesting market optimism about future growth prospects. The chart organises companies from the lowest MTBV on the left, indicating companies with market values at close to or below their book values, to the highest on the right, denoting companies that are highly valued by the market relative to their recorded assets. This distribution offers insights into

investor sentiment and perceived future performance within the mining industry, providing a spectrum of market trust from scepticism to confidence about a company's future.

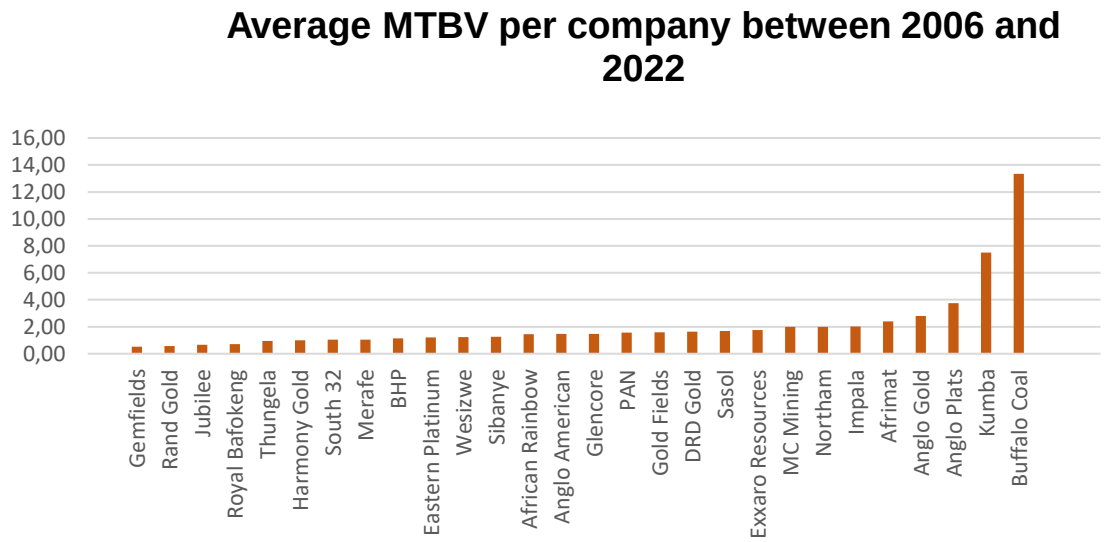


Figure 7: JSE-listed mining companies' MTBV ratios between 2006 and 2022.

Chrometo displays a negative MTBV ratio of -28.85 due to a negative book value. This suggests that the company is facing severe challenges, potentially including market scepticism about its future profitability, asset impairments, or write-downs. Such a negative value often warrants a closer look into the company's operations and status as a going concern. In contrast, Bauba Resources towers over other entities with an MTBV ratio of 54.12, indicating a high level of market confidence in its growth prospects or possibly speculative interests inflating its market valuation. Bauba Resources, Chrometo were omitted as outliers from Figure 8 to retain information content.

Most companies, however, cluster around the lower end of the spectrum, with MTBV ratios closer to 1. This grouping suggests that their market valuation is in close alignment with their book values, which might be expected in an industry such as mining, where most assets are often tangible, and their values reported on the balance sheets. Companies significantly above this average, such as Kumba and Buffalo Coal, are viewed by the market as having robust prospects.

Kumba which was formed following a successful merger between Anglo American Holdings Ltd and Kumba Resources Ltd in 2005, largely reflected positive prospects with an average MTBV of 7.5, well above the average. Companies whose MTBV is below the average are perceived as more accurately valued or possibly undervalued, presenting different strategic considerations for investors. Table 3 presents the summary statistics of the MTBV for JSE-listed mining companies over the period from 2006 to 2022, detailing measures such as the mean, median, standard deviation, and the range of values observed.

Table 3: Summary statistics of JSE-listed mining companies MTBV between 2006 and 2022.

MTBV Summary Statistics	
Mean	2.83
Standard Error	2.09
Median	1.45
Standard Deviation	11.48
Sample Variance	131.94
Minimum	-28.85
Maximum	54.12

4.4 Companies Return on Assets

Figure 8 shows the companies' return on assets (ROA), a key indicator of operational productivity and asset performance. The ratio measures a company's ability to generate earnings before interest, taxes, depreciation, and amortization (EBITDA) relative to its total assets. This metric shows how well each company is leveraging its asset base to produce operational profits. A lower or negative value, as seen on the left of the chart, may indicate underperforming assets or a challenging operational environment. Conversely, higher ratios on the right suggest a more efficient use of assets in generating earnings.

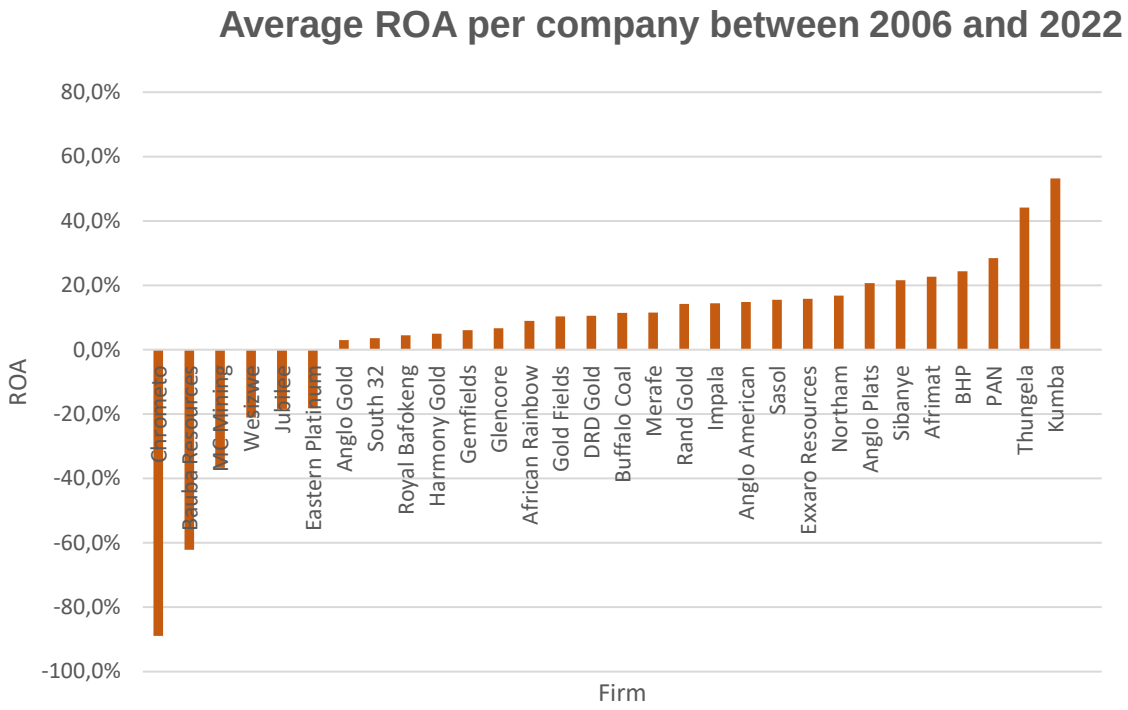


Figure 8: JSE-listed mining companies' ROA between 2006 and 2022.

A key observation is the negative ratios for Chrometo, Bauba Resources, MC Mining, Wesizwe, Jubilee and Eastern Platinum which may be indicative of operational challenges. These challenges could stem from various factors, including high depreciation costs, significant overheads, or inefficient asset utilisation, which ultimately detract from profitability.

On the other end of the spectrum, companies such as Kumba and PAN demonstrate relatively high ROA. This suggests that these companies are not only effectively managing and utilising their assets but are also likely benefiting from favourable market conditions, operational efficiencies, or strategic advantages that allow them to maximise earnings from their asset base. The ROA results further supports the argument of a bullish sentiment about Kumba Iron Ore which was reflected in the high MTBV discussed in the previous section.

Table 4 presents the summary statistics of ROA levels for JSE-listed mining companies over the period from 2006 to 2022, detailing key measures such as the mean, median, standard deviation, and the range of values observed.

Table 4: Summary statistics of ROA levels for JSE-listed Mining Companies between 2006 and 2022.

Return on Asset (ROA) Summary Statistics	
Mean	4.8%
Standard Error	5.2%
Median	11%
Standard Deviation	28.3%
Sample Variance	8%
Minimum	-88.88%
Maximum	53.2%

The summary statistics shows that the South African mining industry exhibits a variation in ROA, indicative of varied operational models and financial health within the sector. The average figure, while useful, can be skewed by extreme values, such as PAN's high ratio of 2.66, which may not be representative of the sector's typical operational efficiency. The summary statistics provide a useful aggregation but should be considered in conjunction with the broader distribution of data to inform balanced and contextual financial analysis.

4.5 JSE Listed Mining Companies Average Asset Tangibility

Figure 9 illustrates the average asset tangibility percentages for the 30 companies, with each bar representing the percentage of a company's total assets that are tangible. The asset tangibility percentage varies significantly across companies, reflecting the diverse nature of their asset compositions. This visualization helps in understanding the extent to which each company relies on physical assets in their operations.

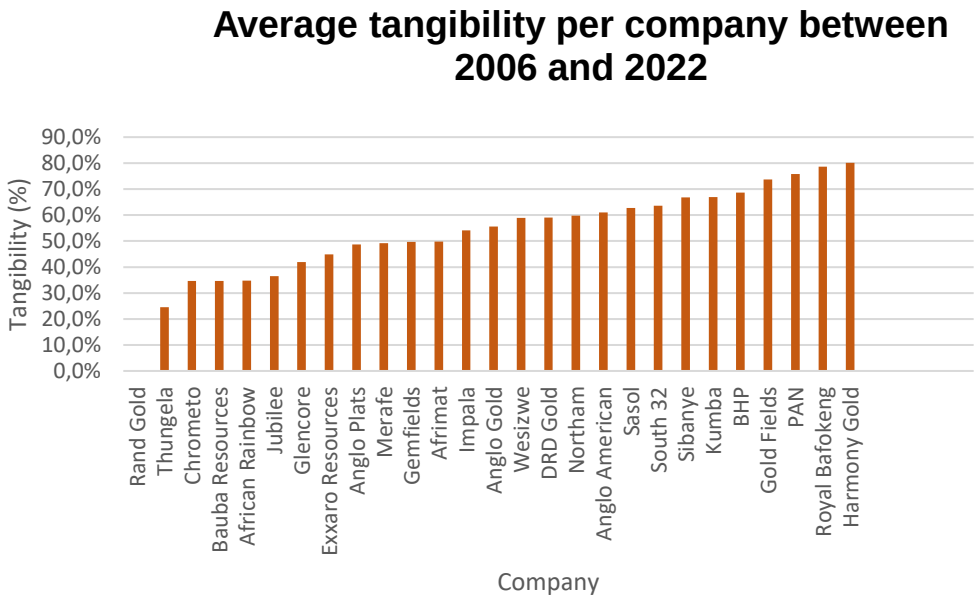


Figure 9: JSE-listed mining companies average percentage tangibility between 2006 and 2022.

Figure 9 shows variation in asset tangibility percentages across the mining companies listed, indicating diverse asset utilisation strategies and levels of asset backing for profitability. Notably, Rand Gold (an exploration company) exhibits an asset tangibility close to 0%, suggesting a scenario where intangible assets such as mineral rights, exploration licenses, and geological data are the primary assets owned by the company. Table 5 summarises the summary statistics for tangibility for the period under review.

Table 5: Summary statistics of asset tangibility levels for JSE-listed Mining Companies (2006-2022).

Asset Tangibility Levels Summary Statistics	
Mean	77.3%
Standard Error	17.19%
Median	58.98%
Standard Deviation	94.1%
Sample Variance	88.71%
Minimum	0.08%
Maximum	80.1%

The industry's average asset tangibility ratio standing was 77.3% and the median of 58.9%. These figures align with expectations, considering the inherent capital-intensive nature of mining operations where assets are mostly tangible in nature. Companies such as Exxaro Resources, Anglo Platinum, and Merafe, with asset tangibility ratios around 45 to 50%, demonstrate a balanced relationship between their asset base and profitability. A median of 58.98% is indicative of the capital-intensive nature of the mining sector, where large asset bases are necessary to mining operations.

4.6 Chapter Summary

This chapter focused on the data used for the research study. It provided an overview of the data sources and the characteristics of the dataset. The chapter describes the systematic approach taken to collect the necessary financial information, ensuring consistency in reporting periods and variables. The chapter also presented the financial ratios leverage, return on assets, asset tangibility and market to book visually using charts and summary statistics calculated for per company over the period between 2006 and 2022.

The availability of a comprehensive and reliable dataset forms the foundation for the subsequent data analysis and enables the study to address the research objectives effectively. Chapter 5 focuses on the model estimation results using fixed effects models and random effects model to derive the insights around the practise of equity market timing.

5 ANALYSIS AND FINDINGS

5.1 Introduction

This chapter focuses on model estimation analysis and results to gain insights for the relationship between equity market timing and changes in company leverage within the South African mining industry. By analysing the data collected from mining companies between 2006 and 2022, this chapter presents a comprehensive analysis of the factors influencing capital structure decisions and the practice of equity market timing.

The data analysis presents panel regression modelling insights where the fixed effects model and random effects model results are deployed. The Hausman test was also performed to choose between the fixed effects and random effects model. Modelling results are presented, and conclusions drawn about the practise of equity market timing.

5.2 Fixed Effects Model

The fixed effects model was applied to investigate the impact of MTBV, asset tangibility, and ROA on gearing, and by extension, equity timing practices across JSE-listed mining companies. This model allows for controlling unobservable, time-invariant differences among companies, focusing on how changes within companies over time affect their equity timing decisions.

In interpreting the coefficients, it is important to consider their magnitude and statistical significance. A larger coefficient magnitude indicates a stronger relationship between the independent and dependent variables, while statistical significance indicates the reliability of the estimated relationship. To illustrate insights from the results of the fixed effects regression for equity market timing, Table 6 shows the regression results table. This presents the coefficients, standard errors, t-statistics, and p-values for each independent variable included in the model.

Table 6: Regression results for equity market timing for the fixed effects model.

Variable	Estimate	Standard Error	T-value	P-Value
Market to Book Value	-0.0000218	0.0015536	-0.0140	0.9888
Profitability (ROA)	-1.5136	0.062458	-24.2345	< 2.2e-16
Asset Tangibility	-0.018498	0.064056	-0.2888	0.7729
Size	0.19255	0.042902	4.4881	9.397e-06
R-Squared	0.60869			
Adj. R Squared	0.57754			
F-Statistic	156.329 on 4 and 402 DF, p-value: < 2.22e-16			

The key findings are outlined:

- **MTBV (Market to Book Value)**: The coefficient for MTBV is negative and not statistically significant at the 5% level. This analysis of the market to book value (MTBV) reveals that it does not have a statistically significant impact on the gearing ratio, as indicated by its coefficient estimate of approximately -0.0000218 and a high p-value of 0.9888. This suggests that changes in MTBV are not associated with significant changes in the gearing ratio, holding other factors constant. The lack of significance implies that companies' market valuations relative to their book values do not significantly influence their capital structure decisions through the practise of equity market timing. Consequently, managers may not be particularly sensitive to market-to-book value considerations when determining their companies' optimal capital structure.

- **Asset Tangibility**: The analysis of percentage tangibility reveals that it does not exhibit a statistically significant relationship with the gearing ratio. The coefficient estimate for tangibility is approximately -0.018498, with a corresponding p-value of 0.7729, indicating a lack of statistical significance. This suggests that changes in the percentage of tangible assets in a company's asset structure do not lead to significant alterations in its capital structure decisions, after accounting for other factors in the model. Consequently, managers may not consider the composition of tangible assets as a primary determinant when determining the optimal mix of debt and equity financing. This lack of significance implies that other factors, such as profitability or company size, may have a more substantial influence on capital structure decisions compared to the tangibility of assets.
- **Profitability:** In contrast, the analysis of profitability reveals a highly significant negative relationship with gearing ratio. With a coefficient estimate of approximately -1.5136 and an extremely low p-value of less than 2.2e-16, profitability exerts a substantial influence on companies' capital structure decisions. This suggests that as profitability increases, companies tend to rely less on debt financing, opting for alternative sources of capital or retaining earnings for investment purposes. The strong statistical significance underscores the importance of profitability as a determinant of capital structure, highlighting the crucial role of earnings generation in shaping companies' financial policies.

- **Company Size**: In contrast to tangibility, the analysis of revenue size reveals a highly significant positive relationship with the gearing ratio. The coefficient estimate for revenue size is approximately 0.19255, with a very low p-value of 9.397e-06, indicating strong statistical significance. This suggests that larger companies, as measured by their revenue size, tend to have higher gearing ratios, indicating a preference for debt financing. The significant positive coefficient underscores the importance of company size in shaping capital structure decisions, highlighting the potential advantages larger companies may have in accessing debt markets or leveraging their scale to negotiate more favourable borrowing terms. Consequently, managers of larger companies may strategically utilise debt

financing to capitalise on growth opportunities or enhance shareholder value.

The coefficients table presents the estimates, standard errors, t-values, and p-values for the regression model. In this analysis, the coefficients represent the estimated effect of each independent variable on the dependent variable, the gearing ratio, after controlling for other variables in the model. The significance of each coefficient is assessed based on its associated p-value.

The results provide evidence that the MTBV and percentage tangibility variables do not demonstrate statistical significance, with p-values of 0.9888 and 0.7729, respectively. This suggests that changes in MTBV and tangibility are not associated with significant alterations in the gearing ratio, holding other factors constant. On the other hand, profitability and the size of revenue exhibit strong statistical significance, with p-values below 0.05, indicating their substantial impact on the gearing ratio.

The overall model's statistical significance is confirmed by the F-statistic, which has a highly significant p-value of less than 2.22e-16. The R-squared and adjusted R-squared values of 0.609 and 0.578, respectively, suggest that the model explains only a reasonable proportion of the variation in the leverage ratio. This implies that there may be other unobserved factors influencing the leverage ratio that are not captured by the variables included in the model.

In summary, while profitability and revenue size have significant effects on the leverage ratio, the lack of significance for MTBV and TANG highlights the need for further investigation into the determinants of capital structure decisions in the context of the analysed data. Specifically, the lack of statistical significance for MTBV in the model underscores the complexity of factors influencing companies' financing decisions beyond those included in the regression model. However, the following were considered to improve model performance:

1. **Robustness Checks**: Robustness checks were done through residual analysis to examine the distribution and patterns of residuals, checking for violations of model assumptions such as homoscedasticity and normality.

Subsequently, the Durbin-Watson statistic was calculated to test for autocorrelation in the residuals, ensuring that the independence assumption of the model was met. These steps enhanced the rigor of the analysis and provided further confidence in the validity of the results.

2. **Model Comparison**: The performance of the fixed effects model was compared with an alternative model, that incorporated random effects models. This was done to assess whether the alternative model provides better explanatory power to choose the model that best fits the data and theoretical considerations.

Figure 10 shows the residual plot the distribution of residuals (the differences between the observed and predicted values) from the fixed effects panel regression model covering 30 companies over the period from 2006 to 2022. Each point in the plot represents a residual for a given prediction, with the predicted values on the x-axis and the residuals on the y-axis.

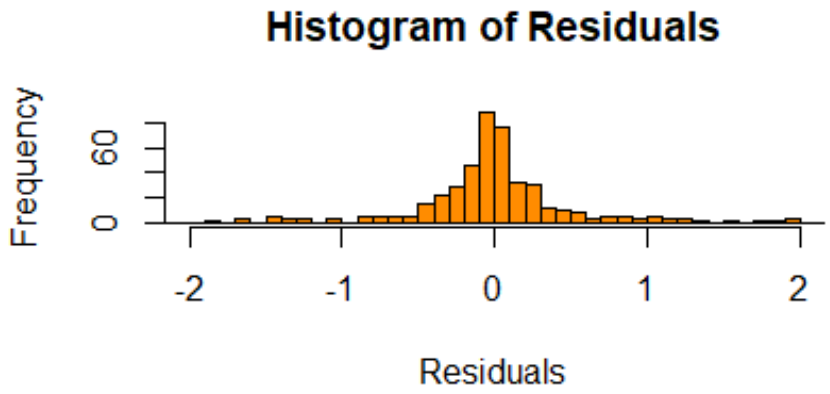


Figure 10: The distribution of residuals for the fixed effects model for model fitness assessment for JSE listed mining companies between 2006 and 2022.

The residuals appear to be evenly distributed around a mean of zero without any discernible pattern, suggesting that the model's assumptions might not be severely violated. However, no significant patterns such as a funnel shape indicating heteroscedasticity or clear trends that could suggest non-linearity or omitted variable bias were observed. This randomness indicates that the model is appropriately capturing the data's variability and that the assumptions of linearity and homoscedasticity (constant variance of residuals) are being met.

5.3 Random Effects Model

Following the estimation of the fixed effects panel regression model, the analysis was extended to the application of the random effects model. The random effects model was estimated for the purpose of examining the robustness of the model estimates. Table 7 shows the random effects model outputs.

Table 7: Regression results for equity market timing for the random effects model.

Variable	Estimate	Standard Error	T-value	P-Value
Market to Book Value	-0.00027959	0.00156348	-0.1788	0.8581
Profitability (ROA)	1.50860986	0.06184323	-24.2345	2.2e-16
Asset Tangibility	-0.04185909	0.06135069	-0.6823	0.4951
Size	0.10337524	0.02519309	4.1033	4.073e-05
R-Squared	0.59221			
Adj. R Squared	0.58842			
F-Statistic	623.401 on 4 DF, p-value: < 2.22e-16			

The key findings are outlined:

- **MTBV (Market to Book Value)**: The analysis of MTBV reveals that it does not exhibit a statistically significant relationship with gearing ratio. With a coefficient estimate of approximately -0.00027959 and a p-value of 0.8581, MTBV fails to demonstrate statistical significance. This suggests that changes in the market valuation relative to book value do not significantly influence companies' decisions regarding their capital structure. Thus, companies may not adjust their leverage based on market valuations compared to the book value of their assets, at least within the context of the analysed model.

- **Asset Tangibility**: The examination of asset tangibility, represented by the percentage of tangible assets, reveals a lack of statistically significant relationship with gearing ratio. With a coefficient estimate of -0.04185909 and a p-value of 0.4951, asset tangibility does not demonstrate statistical significance. This suggests that changes in the composition of tangible assets relative to total assets do not substantially impact companies' capital structure decisions. Consequently, companies may not adjust their leverage based on the proportion of tangible assets they possess.

- **Return on Assets**: In contrast, the analysis of profitability, measured by ROA, shows a significant positive relationship with the gearing ratio. With a coefficient estimate of 1.50860986 and an extremely low p-value of 2.2e-16, profitability exhibits high statistical significance. This implies that more profitable companies tend to have higher gearing ratios, indicating a preference for debt financing over debt regardless of the MTBV. Such findings align with theoretical expectations that profitable companies may be less reliant on equity financing due its dilutive nature and choose to use internally generated funds to meet their interest payment obligations.

- **Company Size**: Similarly, the analysis of size, measured by the size of revenue, reveals a significant positive association with the gearing ratio. With a coefficient estimate of 0.10337524 and a p-value of 4.073e-05, size exhibits high statistical significance. This indicates that larger companies

tend to have higher gearing ratios, implying a preference for debt financing. Such findings are consistent with the expectation that larger companies may have greater access to debt markets and may leverage their size to negotiate more favourable borrowing terms, resulting in higher debt levels relative to their smaller counterparts.

The results from the analysis fail to provide evidence of a significant relationship between the gearing ratio and certain key factors within the context of the examined model. Specifically, the lack of statistical significance for MTBV and asset tangibility suggests that these variables do not substantially influence companies' decisions regarding their capital structure. This finding contradicts theoretical expectations that companies might adjust their leverage based on market valuations or the composition of tangible assets. Additionally, the absence of significance for ROA and the positive coefficient for size offer insights into the determinants of the gearing ratio, highlighting the complex interplay of factors that drive companies' financing decisions beyond market opportunism.

The regression analysis output provides a comprehensive overview of the coefficients of the regressors and their associated statistical significance, as indicated by the F-statistic. Moreover, the R-squared value offers valuable insights into the proportion of variation in the gearing ratio explained by the independent variables included in the model. These analytical metrics aid in assessing the overall goodness-of-fit of the model and contribute to the understanding of factors driving companies' capital structure decisions within the studied context.

Figure 11 is a histogram of residuals from the random effects model. A well specified model must have residuals that are normal distributed around zero. If the residuals are not normally distributed, show clear patterns, or are skewed, it may indicate that the model is not a good fit for the data.

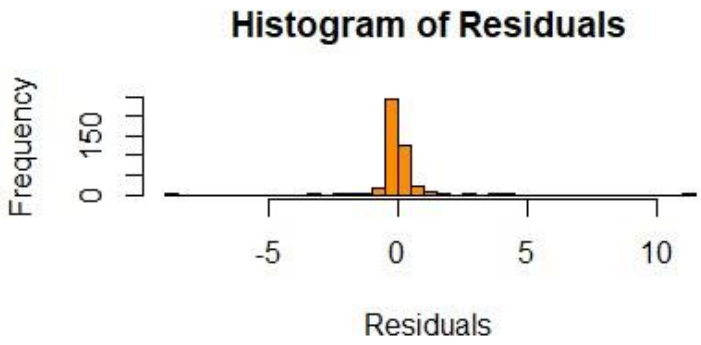


Figure 11: The distribution of residuals for the random effects model for model fitness assessment for JSE listed mining companies between 2006 and 2022.

The residual values in the histogram are centred around zero, and most of the data seems to be within -2 and +2, which generally indicates a good fit of the model to the data, assuming the residuals are normally distributed. This kind of diagnostic plot is crucial for regression analysis as it helps to validate the assumptions of linear regression, including the assumption that the residuals are normally distributed and have constant variance (homoscedasticity). However, the results of the Breusch-Pagan test provided show a very low p-value (< 2.2e-16), which is significantly less than the significance level of 5%. This suggests that there is strong evidence against the null hypothesis of constant variance, indicating that the residuals may indeed be heteroscedastic.

This finding seems to contrast with the initial visual assessment of the histogram of residuals, which did not clearly suggest heteroscedasticity. However, it is important to note that a histogram of residuals may not always effectively reveal heteroscedasticity. It can show if the residuals are normally distributed and centred

around zero, but it does not necessarily show if the variance of the residuals is constant across the range of fitted values.

5.4 Hausman Test

To conduct the Hausman test, the difference between the coefficients estimated by the fixed effects and random effects models was calculated. A significant Hausman statistic implies that the random effects model is inconsistent, and the fixed effects model should be favoured (Hausman, 1978). The null hypothesis of the test is that the preferred model is random effects, and it is consistent and efficient. A significant p-value leads to the rejection of the null hypothesis, suggesting that the fixed effects model is the consistent one.

In the analysis, the Hausman test indicates a Chi-Square statistic of 15.722 with 4 degrees of freedom and a p-value of 0.003416. Given that the p-value is less than the specified significance level of 0.05, the null hypothesis is rejected. This suggests that the fixed effects model is the more appropriate model for this data set because it is consistent, whereas the random effects model may produce inconsistent estimates. The test essentially suggests that there are fixed characteristics within each individual or group in the panel data that are correlated with the predictors, which the random effects model fails to account for. The implication of this result is that using the random effects model may generate biased estimates leading to poor insights into the practise of equity market timing.

5.5 Chapter Summary

This chapter delved into the model estimation and diagnostics aspect for the panel data analysis using the chosen two primary modelling approaches in panel data analysis: fixed effects and random effects models. Both models were found to have explanatory power with an R-squared value of 55% and 60% for the fixed effects model and random effects model respectively. However, MTBV was found not statistically significant with a p-value of 0.9888 which is above the 5% chosen statistical significance level.

Subsequently, graphical methods were used to assess the fitness of these models using residual plots. To supplement the residual plots, the Breusch-Pagan test for

detecting heteroscedasticity in residuals was the chosen statistical method. The Breusch-Pagan test for both models suggested that heteroscedasticity may be present in the model, indicating potential for model improvement. The absence of statistical significance for MTBV and asset tangibility indicates that these factors do not have a significant impact on companies' capital structure choices.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Chapter Overview

In this chapter, conclusions from the analysis of equity market timing by the 30 JSE-listed mining companies are presented and recommendations made based on linkages derived between the research question, literature review and model insights presented in the analysis and findings chapter. The chapter considers broader implications of these findings and specifically raise consideration that significant factors, such as interest rate levels which also directly impact preference for debt, may have been overlooked, thus potentially omitting a significant variable in the optimal capital structure decision making process.

6.2 Summary of Results From The Research Study

Table 8 summarises findings from the analysis conducted on the capital structure decisions of the companies from 2006 to 2022. The core of this analysis is the MTBV regression coefficient, which serves as an indicator of equity market timing. The table presents the outcomes derived from both fixed effects and random effects models, focusing on the impact of MTBV on the companies' capital structures. It also incorporates crucial statistical metrics, including R-Squared and Adjusted R-Squared values, to evaluate the explanatory power of the models, and F-Statistic values to ascertain the significance of the observed relationships. Through this detailed examination, the table aims to highlight the financial strategies these companies do in response to market valuation changes, offering a comprehensive view of their approach to leveraging and financing in the context of equity market timing.

Table 8: Summary of the fixed effects and random effects model estimation results.

	Fixed Effects Model	**Random Effects Model**
MTBV-coefficient	-0.0000218	-0.00027959
R-Squared	0.60869	0.59221
Adjusted R-Squared	0.57754	0.58842
F-Statistic	156.329 on 4 and 402 DF, p-value: < 2.22e-16	623.401 on 4 DF, p-value: < 2.22e-16

A key finding from the study is the apparent absence of a consistent practice of equity market timing among the sampled JSE listed mining companies. Despite varying market conditions over the review period, the evidence does not robustly support the hypothesis that these companies systematically engaged in timing the market to leverage equity capital.

The analysis, depicted in Table 8, utilises fixed effects and random effects models to explore the impact of MTBV on capital structure decisions. Specifically, the MTBV regression coefficient in the fixed effects model is -0.0000218, while the random effects model reports a coefficient of -0.00027959, indicating a subtle but insignificant impact of equity market timing on capital structure across both models.

The R-Squared values from the fixed effects model (0.60869) and the random effects model (0.59221) suggest a moderate explanatory power, indicating that approximately 60% of the variance in the capital structure can be explained by the models. Additionally, the adjusted R-squared values, 0.57754 for the fixed effects model and 0.58842 for the random effects model, adjust for the number of predictors in the model, reinforcing the reliability of these findings.

The analysis of these results also points to the potential omission of significant variables that might affect the robustness of the conclusions drawn. For instance, the role of interest rates was not explicitly accounted for in the model, which could be a pivotal factor influencing a company's decision to raise capital through equity. This oversight indicates that the current model may not have captured all relevant factors that drive the market timing behaviour of these companies.

6.3 Conclusions

The central tenet of the investigation—the practice of equity market timing—does not appear to be a prevalent strategy for the companies that were analysed. Contrary to what might be expected in an efficient market where companies capitalise on stock prices to time equity issues, the results do not find consistent evidence to support this theory among the studied sample. This conclusion is drawn from the analysis of panel regression model, where the MTBV model coefficient was found not to be statistically significant, indicating an absence of typical equity market timing behaviour. As such, the research was unable to assess the impact of equity market timing on shareholder value.

This absence of equity market timing could be indicative of various underlying factors, including the possibility that the companies' internal assessments do not align with the theoretical gains of such timing or other factors that the research could not prove. Furthermore, this could be an indication that some companies choose to implement different corporate finance theories such as the Pecking order theory or Trade-off theory to optimise company value.

Given the complexities inherent in the financial strategies of companies and the dynamic nature of markets, there is evidence that traditional models may fall short in capturing the nuances of corporate behaviour when it comes to optimal capital structure. Based on these findings, while direct evidence of equity market timing is not observed, the potential value of a well-executed equity market strategy serves as motivation that further research is necessary to conclusively rule out its presence or highlight the limitations.

6.4 Recommendations for Further Studies

This analysis underscores the complexity of equity timing strategies, highlighting the need for mining companies to consider a multitude of factors when making capital structure decisions. Based on the conclusions drawn from the analysis of equity market timing practices among 30 JSE listed mining companies over a 16-year period, recommendations aimed at both researchers and practitioners in the field of corporate finance are presented. These recommendations are designed to enhance the understanding and application of equity market timing strategies, address the limitations identified in the study, and guide future research directions.

- **Incorporate a broader set of variables:** Future studies should aim to include a wider array of variables that may influence equity market timing decisions. Specifically, macroeconomic factors such as interest rates, inflation, and economic growth indicators should be considered. These factors have the potential to significantly impact a company's capital raising activities and could provide deeper insights into the timing strategies employed.

- **Limit sample for more detailed analysis:** Future studies could benefit from a more detailed analysis of specific corporate actions, such as share buybacks and equity issuances, to enhance insights into company strategies. Additionally, while this study aimed to capture an industry-wide perspective, focusing on a smaller sample—such as the top five companies on the JSE—could allow for a more in-depth examination of stock price movements, equity adjustments, and leverage strategies. These adjustments would provide a focused understanding of equity market timing dynamics and capital structure management within leading firms in the sector.
- **Adopt dynamic panel data models:** To overcome the limitations of traditional models, researchers should consider using dynamic panel data models that account for endogeneity and autocorrelation. These models can capture the temporal dynamics and the potential lagged effects of financial decisions, offering a more accurate depiction of equity market timing behaviours.

- **Explore alternative financing strategies:** Beyond equity market timing, future research should explore the use of alternative financing strategies by companies, such as debt issuance and hybrid instruments. Understanding the interplay between different financing options and market conditions could provide a comprehensive view of corporate finance strategies.
- **Enhance model robustness through advanced techniques:** Employ advanced statistical and econometric techniques to improve model robustness. Techniques such as machine learning and artificial intelligence could be leveraged to detect complex patterns and relationships that traditional models may overlook.
- **Practitioner engagement and policy implications:** Practitioners should be engaged in the research process to provide real-world insights and validate findings. Additionally, the implications of research findings for policy and regulatory frameworks should be explored, particularly in terms of how companies are guided and regulated regarding disclosure and timing of equity issues.

Given the absence of statistical significance for MTBV and Asset Tangibility, it is recommended that companies re-evaluate these factors when considering capital structure decisions. Alternative variables or factors should be explored, as current findings suggest that MTBV and asset tangibility may not significantly influence leverage adjustments. This approach may provide a more accurate assessment of the drivers behind capital structure choices.

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