GREEN LEVERAGE: FINANCIAL ENABLERS AND CONSTRAINTS

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DEDICATION

This dissertation is dedicated to my parents, whose unwavering faith and prayers have guided every step of my journey; to my family, for their constant encouragement and support; and to my son Aalishan, whose presence has been a continuous source of strength, motivation, and purpose. This achievement would not have been possible without them.

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ABSTRACT

This study investigates the determinants of green leverage adoption—defined as the integration of environmentally linked debt instruments such as green bonds and green loans within a firm's capital structure—and evaluates its subsequent impact on stock performance. Using a comprehensive dataset of firms listed on the United Kingdom's Alternative Investment Market (AIM) from 2010 to 2023, and drawing contextual insights for the Pakistan Stock Exchange (PSX), the research examines financial, institutional, and policy-related factors that enable or constrain firms in adopting green leverage. Three interconnected empirical studies are conducted using Ordinary Least Squares (OLS), Least Absolute Shrinkage and Selection Operator (LASSO), and Extreme Bound Analysis (EBA) to enhance robustness and address model uncertainty. The first study identifies firm-level and institutional determinants of green leverage. Results show that innovation funding, institutional ownership, and credit ratings significantly encourage green leverage adoption, whereas carbon taxation and compliance-related costs act as key constraints. These findings are theoretically supported by pecking order, agency, and trade-off theories, illustrating how internal financing preferences and external regulatory pressures influence sustainable financing choices. The second study evaluates the short- and long-term stock market effects of green leverage using Market-Adjusted Abnormal Returns (MAAR) and Buy-and-Hold Abnormal Returns (BHAR). Findings show modest, positive short-term market reactions, while long-term effects remain weak. This aligns with signalling theory and prior studies (e.g., Flammer, 2021; Tang & Zhang, 2020), suggesting that although green financing signals responsible governance, its signalling strength remains limited in developing markets due to information asymmetry, evolving ESG standards, and low certification awareness. The third study extends the event study to green bond issuance events, finding no statistically significant abnormal returns for either green or non-green firms, signalling limited investor sensitivity in emerging market contexts. Overall, the thesis concludes that while green leverage offers short-term signalling benefits and long-term strategic value, its broader adoption is constrained by regulatory burdens, institutional inefficiencies, and underdeveloped green finance ecosystems. For PSX, the findings highlight the need for stronger ESG disclosures, targeted incentives for green debt issuance, and innovation-driven financing policies.

Keywords: *Green Finance, Leverage, Sustainability, AIM*

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LIST OF ABBREVIATIONS

AIM	Alternative Investment Market
LSE	London Stock Exchange
SOA	Speed of Adjustment
SMEs	Small-Medium Firms
OLS	Ordinary Least Square
FE	Fixed-Effect Model
GMM	Generalized Moments of Method
Std Error	Standard Error
FTSE 100	Largest 100 Companies
FTSE 250	Largest 250 Companies
FTSE 350	Largest 350 Companies
Industry Dummy	Dummy Variables by
Industry VIF	Variance Inflation Factor
Nomads	Nominated Advisors
M&M	Modigliani and Miller
BLEV	Book Leverage Ratio
MLEV	Market Leverage Ratio
CV	Coefficient Of Variation
LSDV	Least Square Dummy Variable Approach
GFC	Global Financial Crisis
MAAR	Market Adjusted Abnormal Return
BHAR	Buy And Hold Abnormal Return

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CHAPTER 1

INTRODUCTION

1.1. Aim and Scope of the Study

"***When the Last Tree Is Cut Down, the Last Fish Eaten, and the Last Stream Poison, You Will Realize That You Cannot Eat Money***." Cree Proverb. (n.d.).

The ongoing paradox revolves around whether priority should be given to environmental sustainability or economic benefits, particularly within the realm of corporate finance where firms are increasingly engaging in green initiatives. Green initiatives are inherently costly, involving significant capital expenditures, compliance with stringent regulatory frameworks, and potential operational inefficiencies (Zeng et al., 2020; Jang et al., 2020; Huang & Li, 2019). These factors can increase a firm's financial risk lower the return in the short term, creating a disincentive for firms to pursue green financing options (Clark, Feiner, & Viehs, 2015). However, the long-term benefits of such investments, including enhanced corporate reputation, reduced regulatory risks, and improved access to new markets, have been shown to outweigh these initial costs (Flammer, 2021; Kölbel & Lambillon, 2022; Park & Kim, 2024).This creates a challenging decision-making environment for firms, as they must weigh the immediate economic implications of green initiatives against the potential long-term advantages (Bocken et al., 2014). Consequently, firms are increasingly recognizing that their long-term viability may depend not only on their ability to generate profits but also on their capacity to contribute to environmental sustainability and social well-being. This evolving paradigm challenges the traditional profit-maximization model and underscores the importance of integrating sustainability factors into the core business strategy to ensure both economic success and environmental responsibility. To addresses this paradox between economic gains and environmental responsibility green leverage has emerged as a novel and increasingly relevant financing mechanism. Green leverage refers to the use of debt—such as green bonds, sustainability-linked loans, or other certified financial instruments—specifically allocated to environmentally sustainable projects. Unlike traditional debt, green leverage explicitly ties financing decisions to ESG (Environmental, Social, and Governance) criteria, thereby influencing both the capital structure and the firm's sustainability profile. (Ehlers & Packer, 2017).

Utility theory provides a robust framework for analysing this paradox, positing that firms

make decisions by weighing the perceived benefits against the associated costs (This study assumes utility function). According to the utility function, as the perceived benefits of adopting green initiatives increase—such as through improved reputation, regulatory compliance, and access to green financing—the likelihood that firms engage in such initiatives also rises (Clarkson et al., 2020). Conversely, the propensity to adopt green initiatives diminishes when the costs, including capital expenditures, operational disruptions, and compliance burdens, outweigh the perceived benefits (Lioui & Sharma, 2012). This cost-benefit analysis becomes particularly critical when firms consider the impact of their financing decisions on their overall capital structure (Tang & Zhang, 2020). In traditional capital structure theories, particularly the Trade-off Theory (Modigliani & Miller, 1958; Kraus & Litzenberger, 1973) and the Pecking Order Theory (Myers, 1984)—firms balance the tax advantages of debt against financial distress costs to determine their optimal leverage level. Within this framework, debt is often preferred over equity due to its lower cost, tax deductibility, and preservation of managerial control. However, in the context of sustainable finance, equity financing, while offering long-term ownership stability, is often more expensive as it requires additional approval processes, disclosure, and compliance with investor-driven ESG expectations. Conversely, debt financing, consistent with trade-off and pecking order theories, may be a more cost-effective option when structured as green leverage, since it can attract investors seeking sustainability-aligned returns and signal a firm's environmental commitment.

Yet, the adoption of green leverage introduces new dynamics into capital structure decisions. While green bonds and sustainability-linked loans offer potential benefits such as lower borrowing costs and broader investor appeal, they also impose additional compliance, verification, and reporting obligations that may raise overall financing costs (Flammer, 2021; Reid et al., 2024; Li, 2025). This ongoing debate over green versus non-green debt financing illustrates the complexity firms face in balancing environmental objectives with financial prudence. Although green financing can enhance corporate reputation and investor confidence, many firms remain hesitant due to the uncertainty of financial returns and the high transaction and certification costs involved (Hachenberg & Schiereck, 2018; Tang & Zhang, 2020). Nevertheless, the growing global emphasis on sustainability and the expansion of green finance frameworks have created opportunities for firms to integrate environmental responsibility into their financing structures (Kölbel & Lambillon, 2022). Green leverage can enhance market reputation, attract ESG-focused investors, and potentially reduce the cost of capital over time (Flammer, 2021). Furthermore, the

establishment of standardized frameworks, coupled with supportive government policies and incentives, continues to reduce the transaction and compliance barriers associated with green financing (Ehlers & Packer, 2017). Despite these developments, firm-level decisions regarding the adoption of green leverage remain complex and context-dependent, influenced by financial capacity, market conditions, governance structures, and regulatory environments. Despite the growing adoption of green financing mechanisms, there remains limited research that systematically investigates the determinants of green capital structure and the market's reaction to green leverage adoption, especially in emerging markets. Previous studies have examined the environmental or financial effects of green bonds and loans, but few have integrated both the enablers and constraints of green leverage within a comprehensive capital structure framework.

To address this gap, the present study investigates green leverage adoption in the UK's Alternative Investment Market (AIM)—a sub-market of the London Stock Exchange (LSE), launched in 1995 to support small and medium-sized enterprises (SMEs) through flexible and cost-effective listing requirements. Unlike the main market, AIM offers relaxed regulatory obligations, making it an ideal environment to observe firm-level sustainability financing behavior. Importantly, AIM operates within a voluntary ESG disclosure framework, allowing firms to adopt green financing without mandatory regulatory pressure. This provides an ideal empirical setting for identifying financial, institutional, and policy-related enablers and constraints influencing green leverage adoption. Furthermore, the study draws comparative insights for Pakistan's PSX, where green finance ecosystems are still developing. By examining the AIM context—a flexible yet mature capital market—this research provides actionable implications for emerging markets seeking to expand sustainable financing practices under similar institutional challenges. Therefore, the study aims to bridge this research gap by identifying the determinants of green leverage adoption, assessing its impact on firm performance, and examining market reactions to green financing events. Specifically, it addresses two overarching research questions:

1. What financial, institutional, and firm-level factors enable or constrain firms in adopting green leverage?
2. Does green leverage improve firm performance in both the short and long term?

Through these objectives, this research aims to contribute to the ongoing discourse on green leverage by identifying the key enablers and constraints of green debt adoption in the

Alternative Investment Market (AIM), and their market reactions with implications for broader markets.

1.2. Problem Statement

The global transition toward a sustainable and low-carbon economy has intensified the demand for green financing mechanisms capable of funding environmentally responsible projects (Kelliher et al., 2020). However, such projects are often characterized by high uncertainty, longer gestation periods, and elevated compliance costs, including environmental certification, disclosure, and monitoring obligations (Chen & Chen, 2023; Kölbel & Lambillon, 2022). These structural challenges increase the cost of capital and reduce short-term returns, creating a persistent financing dilemma for firms—balancing environmental responsibility with economic efficiency. While investors increasingly value sustainability-linked commitments, the tension between profitability and environmental stewardship continues to shape firms' capital structure decisions. The inherently high-risk nature, lengthy development timelines, and significant compliance costs associated with green projects present formidable challenges in securing adequate financing. While equity financing is a viable option, it is often expensive and requires more stringent compliance, potentially hindering the affordability and scalability of these projects. Within this theoretical context, green leverage - particularly in the form of green leverage through green bonds and green loans - emerges as a strategic mechanism to align financial and sustainability objectives (Flammer, 2021; Tang & Zhang, 2020) provides a relatively cost-effective mechanism for mobilizing capital for sustainable projects. This preference aligns with the Modigliani and Miller (1958) capital structure principles, the Trade-off Theory (Kraus & Litzenberger, 1973), and the Pecking Order Theory (Myers, 1984), which suggest that firms tend to favour debt when it minimizes the cost of capital, preserves control, and optimizes tax advantages. Yet, the adoption of green leverage is influenced by multiple firm-level and institutional dynamics—ranging from internal financial resources and governance quality to external market conditions, policy incentives, and regulatory costs. Firms must weigh the financial advantages of leverage (such as tax shields and cost efficiency) against the incremental costs of environmental compliance, as articulated in trade-off and pecking order theories (Myers, 1984; Kraus & Litzenberger, 1973).

Despite growing global emphasis on sustainable finance, empirical evidence explaining

what drives or constrains firms' decisions to adopt green leverage and how these decisions affect firm performance remains limited. Most prior studies have examined broader aspects of green finance—such as green bonds, ESG ratings, and sustainability disclosure primarily in developed economies, (e.g. Mumtaz and Yoshino, 2022; Merit et al., 2019; Bo, 2011; Liobikiene and Butkus, 2018; Flammer ,2021; Tang & Zhang ,2020), offering little insight into how capital structure decisions incorporate environmental objectives. Moreover, limited research addresses whether green leverage yields tangible performance benefits in stock markets, particularly in emerging and transition economies.Recent studies have started bridging this gap. For example, Reid et al. (2024) demonstrate that strong ESG disclosure reduces leverage and cost of capital among Fortune 500 firms, while Li (2025) finds that higher leverage stimulates green innovation in Chinese firms but with diminishing efficiency returns. However, the complex interplay between financial enablers (e.g., cash flow, governance, credit rating), institutional constraints (e.g., carbon taxes, compliance costs), and market-level dynamics in shaping green leverage adoption remains underexplored. Furthermore, the Alternative Investment Market (AIM) of the UK—though situated in a developed economy—offers an empirical proxy for emerging markets due to its flexible regulations, voluntary ESG disclosure environment, and dominance of small and medium enterprises (SMEs). Examining AIM firms thus provides lessons for markets like the Pakistan Stock Exchange (PSX), where green finance mechanisms are still evolving amid limited investor awareness and regulatory support.

Accordingly, this study addresses a critical research problem: the lack of integrated theoretical and empirical understanding of the enablers and constraints influencing firms' adoption of green leverage and its implications for stock performance. By drawing on evidence from AIM and contextualizing its lessons for PSX, this study contributes to the literature on sustainable capital structures and provides actionable insights for policymakers and financial market practitioners in emerging economies. Building upon the contextual justification provided in the problem statement, the following section identifies specific gaps in the literature concerning green leverage adoption and its implications.

1.3. Research Gap

Building upon the contextual justification outlined in the problem statement, it becomes evident that the integration of sustainability into corporate capital structure remains an evolving

area of inquiry within finance. While the past decade has witnessed growing interest in green finance, the focus of most research has been limited to green bonds, ESG performance, or environmental disclosure, rather than examining how firms strategically incorporate *green leverage*—that is, debt instruments specifically tied to environmental outcomes—within their overall financing architecture. Existing studies largely centre on developed economies and address isolated aspects of green finance. For instance, Flammer (2021) and Tang and Zhang (2020) demonstrate that green bond issuance can enhance firm reputation and investor confidence, yet these studies stop short of explaining how such instruments fit into the broader capital structure or interact with firm-level determinants such as governance, innovation capacity, or cash flow constraints. Similarly, recent empirical findings (Reid et al., 2024; Li, 2025) show that stronger ESG disclosure and leverage ratios can influence green innovation and cost of capital, but their implications for *green leverage adoption* remain ambiguous.

Furthermore, the theoretical integration between classical capital structure models—such as the Trade-Off Theory (Kraus & Litzenberger, 1973), Pecking Order Theory (Myers, 1984), and Signalling Theory (Spence, 1973)—and contemporary sustainability frameworks is still underdeveloped. Most studies fail to reconcile financial decision-making logics with environmental objectives, leaving a gap in understanding how firms negotiate trade-offs between profitability, compliance burden, and environmental responsibility. Most studies fail to reconcile financial decision-making logics with environmental objectives, leaving a gap in understanding how firms negotiate trade-offs between profitability, compliance burden, and environmental responsibility. The contextual gap is even more pronounced for emerging economies, where access to green finance is constrained by weak institutional structures, limited regulatory incentives, and shallow capital markets (Mumtaz & Yoshino, 2022; Ozili, 2023). Yet, empirical insights from such contexts are scarce due to limited green finance data availability. Consequently, the UK's Alternative Investment Market (AIM) offers a valuable empirical proxy: although situated in a developed economy, AIM's flexible listing requirements, voluntary ESG disclosure regime, and concentration of small and medium enterprises (SMEs) resemble institutional features of developing markets like Pakistan's PSX (Weber & ElAlfy, 2022). Hence, there is a twofold research gap:

1. **Empirical gap**: Limited evidence exists on the financial, institutional, and governance-based enablers and constraints that determine firms' propensity to adopt green leverage.

2. **Theoretical gap:** Insufficient integration of capital structure theory with sustainability finance literature restricts understanding of how green leverage affects firm performance across different market maturities.

Addressing these gaps, this study contributes to the literature by offering a comprehensive empirical analysis of green leverage determinants and their market consequences. It extends theory by contextualizing classical capital structure models within sustainability-driven financing environments, and it provides practical lessons for developing markets—particularly the Pakistan Stock Exchange (PSX)—seeking to strengthen their green finance frameworks

1.4. Objective of the Study

The goal of this research is twofold. We aim to investigate the factors that effects firm's propensity to go for green leverage. This study also wants to explore stock market reaction to an announcement of firm going to be green (issuance of green debt). An investor could perceive labelling the green bond as signal of value adding in line with the findings of Flamer (2021). The study has the intention of shedding light upon if a company can use sustainability ratings to alter their optimal debt levels, operate at higher efficiency with access to cheaper capital, and help the manager maximize firm value. The main premise is further manifested in to following research objectives:

- To determine and evaluate the financial, institutional, and firm-level factors that influence the adoption of green leverage in corporate capital structure decisions.
- To examine the key factors that enhance firms' propensity to adopt green leverage.
- To determine the major factors that reduce firms' propensity to adopt green leverage.
- To measure the impact of green leverage on short and long run pricing performance of stock.
- To examine market reactions to green bond issuance events using event study methodology.

1.5. Research Questions and Contributions

1.5.1. Empirical Study 1 Determinants of Green capital structure of AIM firms

There is a growing body of research exploring the optimal capital structure of firms, particularly in the context of green finance. However, there is limited research specifically addressing the optimal capital structure of firms utilizing green leverage. This gap in the literature

presents an opportunity to explore how firms balance debt and equity while considering green financing instruments like green bonds and green loans. Green leverage is increasingly recognized for its potential to finance environmentally sustainable projects, yet its impact on the short-term and long-term financial health of firms remains understudied. The first empirical study aims to address the following research question:

Research Question 1: ***What financial, institutional, and firm-specific factors effects firms' adoption of green leverage decisions?***

This study contributes to the literature by examining green capital structure in both temporal dimensions and comparing it with traditional capital structures to assess its efficacy and sustainability.

This empirical study also delves into the factors that motivate firms to adopt green leverage. Existing research has highlighted various determinants that influence a firm's financing decisions; however, studies focusing on green leverage adoption drivers are sparse. Factors such as regulatory incentives, environmental performance, and corporate social responsibility may increase a firm's likelihood of shifting toward green financing. Understanding these drivers is essential to promote sustainable financial practices. This study aims to address the following research question:

Research Question 2: ***Which enablers strengthen firms' likelihood of adopting green leverage?***

This study contributes to the green finance literature by identifying key enablers of green leverage adoption and offering insights into how these enablers influence corporate financial strategies. Despite growing interest in green finance, firms may still face substantial challenges when integrating green leverage into their capital structures. This study explored these barriers to provide a comprehensive understanding of the obstacles that firms encounter when considering green leverage. This study is designed to address the following core research question:

Research Question 3: ***What constraints or barriers limit firms' inclination to adopt green leverage?***

This investigation contributes to the literature by highlighting the constraints and risks that firms face in their transition to green finance, providing policymakers and practitioners with insights into how these challenges can be mitigated.

1.5.2. Empirical Study 2: Impact of Green Leverage on Short- and Long-Term Price Performance

Green leverage is expected to influence the financial performance of firms, including their stock performance. Previous studies have demonstrated that financing decisions can affect a firm's stock price, but little research has focused specifically on how green leverage impacts stock performance. The goal here is to assess how green leverage impacts a firm's stock price performance over different time horizons. This study would focus on analysing short-term vs. long-term effects, investigating whether firms utilizing green leverage experience distinct financial outcomes in comparison to their non-green counterparts. This study examined the short-term and long-term effects of green leverage on stock prices, offering insights into whether green financing creates value for shareholders and how it compares to traditional financing strategies. The study addresses the following research question:

Research Question 4: ***How does green leverage affect short-term and long-term firm performance (MAAR and BHAR)?***

This research contributes to the literature by evaluating the financial performance of firms that adopt green leverage, helping investors and companies make informed decisions about green financing options. This inquiry aims to understand the financial outcomes associated with green capital choices, examining if green-leveraged firms exhibit distinct performance metrics over time compared to their non-green counterparts.

1.5.3. Empirical Study 3: Market Reactions to Green Bond Issuance Events

This study would analyse stock price responses to green bond issuance events using event study methodology. The focus would be on determining if and how the market reacts to announcements of green bond issuances and the significance of these reactions in terms of abnormal returns. By focusing on pre-and post-event windows, this study would explore short-term market reactions as well as cumulative effects. It would highlight investor sentiment and market attitudes toward green financing, providing insights into whether green bond issuance can positively influence stock performance and enhance firm reputation in the eyes of investors. The study aims to answer the following research question:

Research Question 5: ***How does the market react to green bond issuance?***

Through an event study framework, this question evaluates how stock prices respond around the issuance of green bonds, capturing both immediate and prolonged market reactions. This question investigates potential distinctions in market performance between firms that adopt green financing strategies and those that do not, with implications for investor sentiment and capital structure preferences in the market.

1.5.4. Contributions

This study overall offers several novel contributions to the field of green finance:

1. The first empirical study is among the first to investigate the optimal capital structure of firms using green leverage, considering both short-term and long-term perspectives.
2. The empirical study of thesis contributes to the limited literature on the factors that enhance the propensity of firms to switch to green leverage, offering fresh insights into green financing decisions.
3. The study fills a gap in literature by identifying the causes that reduce the propensity to switch to green leverage, contributing to a better understanding of the challenges faced by firms.
4. The second empirical study is one of the few to explore the effect of green leverage on stock performance, contributing to both finance and sustainability literature.
5. The third study provides valuable insight, by exploring short-term market reactions as well as cumulative effects. It would highlight investor sentiment and market attitudes toward green financing, providing insights into whether green bond issuance can positively influence stock performance and enhance firm reputation in the eyes of investors.

This research provides a comprehensive view of the determinants and consequences of green leverage, making significant contributions to both academic theory and practical application in green finance.

1.6. Data Sample and Estimation Approaches

The sample of the study includes all those AIM firms listed on FTSE 100 over sample period issued green debt over a period 2010 to 2023. AIM market is first market awarded Environmental Finance Bond Award in green, social and sustainability practice in investment, such a sample structure enable to answer the research objectives outlined for the study.

Furthermore, this study uses purpose sampling as population consisting AIM's firm go for leverage and then segregating this into green and non-green bases on green index. The main goal of purposive sampling is to focus on characteristics of a population that are of interested. levered firms which would best enable you to answer your research questions. The price of stocks and market index data would be obtained from LSE website and database; Company's annual reports and websites are used to obtain firm specific data. Furthermore, data regarding macro-economic factors are extracted from data sources of World Bank.

Furthermore, the study uses event study methodology. Event study is a tool of evaluating treatment effect of pre and post event. To conduct an event study, require first to identify an event of interest and period over which stock prices of firm would be analysed. In this study event considered as issuance of green debt or firm going for green leverage. Event window was the day of announcement. This study examines antecedents before events to find factors by analysing factors that influence the firm decisions of adopting green leverage by examining data for five-year prior event and also examine the impact of green leverage on pricing performance of stock both in short run and long run.

The primary estimation method used in this study is Ordinary Least Squares (OLS) with robust standard errors. This technique is applied to mitigate the impact of heteroscedasticity, ensuring that the OLS coefficient estimates have unbiased standard errors. To determine the main variables influencing a company's capital structure and the elements that affect stock performance, the OLS robust standard error approach is used. To address any endogeneity issues, several robustness tests are carried out in addition to this baseline method. These include the lagged variable method, the Extreme Bound Analysis (EBA), and the fixed effects model, which is backed by the Hausman test. Chapter 4 goes into more detail about these techniques.

1.7. Main Findings of this Thesis

The aim of this research was to explore what drives the adoption of green leverage and to examine its effects on stock performance both in the short term and over extended periods. This analysis was split into three main parts. In the first empirical part of the study, several enabling factors emerged as influential for green leverage. These include access to innovation funding, institutional ownership, and strong credit ratings, which collectively support a firm's ability to invest sustainably. The positive effect of institutional ownership aligns with recent research,

showing that institutional investors often prioritize firms with solid ESG commitments, reflecting a preference for investments that may offer stability over time (e.g., Clark et al., 2015; Flammer, 2021). Additionally, higher credit ratings were shown to positively influence green financing, suggesting that firms with strong credit histories may be more willing to incorporate sustainable debt due to favourable borrowing terms (Myers, 1984).

At the same time, the study identified key barriers to green leverage adoption. Carbon taxes and high compliance costs present significant obstacles, as they impose additional financial burdens on firms considering sustainable investments. This supports insights from Weber and Elafy (2019), who note that compliance-related expenses and regulatory complexities are often challenging in emerging markets. These findings underscore the potential value of regulatory adjustments aimed at reducing the financial load on firms pursuing green financing, echoing similar calls for balanced environmental policies (Tang and Zhang, 2020).

The second empirical analysis assessed the impact of green leverage on stock price performance in the short and long run. For short-term stock performance (MAAR), the results showed a neutral to modestly positive influence, indicating that green investments may not generate immediate gains in stock value, though they are unlikely to harm short-term returns. This observation aligns with prior studies suggesting that sustainable investments generally require more time to deliver financial benefits, thereby showing minimal immediate impact (Hachenberg and Schiereck, 2018). The long-term stock performance (BHAAR) analysis, however, revealed that leverage have a substantial negative impact on BHAAR for both green and non-green firms, with a higher magnitude for non-green firms. This significant negative coefficient for non-green firms supports the hypothesis that higher debt levels introduce risks detrimental to long-term performance. Conversely, green firms' negative leverage impact is present but less pronounced, potentially due to the growing investor preference for sustainable companies, which aligns with studies suggesting lower capital costs for green-oriented firms over time. The findings resonate with Bocken et al. (2014), who suggest that green financing can build firm value by promoting sustainable growth. Similarly, Flammer (2021) highlights that green bonds and related financial practices enhance corporate reputation and yield favourable long-term performance, aligning with best governance practices.

The third study's findings indicate that events (green bond issuance) do not lead to significant short-term or long-term abnormal returns for either green or non-green firms. Across both types of firms, p-values exceed the 0.05 significance level in all observed event windows, including both short-term windows (e.g., -1 to +1 days) and extended long-term periods (e.g., 1-year, 2-year, and 3-year comparisons). While green firms show positive mean values in short-term windows, the absence of statistical significance implies that these returns are not robust. Similarly, the negative returns observed for non-green firms also lack significance. These results align with literature suggesting that the financial benefits of sustainable initiatives, if they exist, may take time to materialize and may be influenced by broader market trends.

In summary, this thesis offers a thorough assessment of green leverage's determinants and its implications for stock performance. These insights can inform policymakers and market stakeholders in designing supportive frameworks that facilitate green financing, encourage sustainable growth, and enhance the resilience of financial markets, particularly within emerging contexts such as PSX.

1.8 AIM's Operational Framework and Lesson for PSX

The transition toward a green economy is not only a global priority but also a national necessity for countries like Pakistan, where climate vulnerability is among the highest in the world. To address the escalating environmental challenges, Pakistan must accelerate its shift toward cleaner, more sustainable development practices. However, achieving this requires significant financial investment in green projects such as renewable energy, sustainable infrastructure, and pollution reduction technologies. The financial landscape for these projects, both globally and domestically, is fraught with challenges due to the high risk, long gestation periods, and substantial compliance costs that accompany green investments.

Green finance is a relatively nascent field in Pakistan, but its importance is growing as the country seeks to meet international environmental standards and fulfil its commitments under the Paris Agreement. Financing green projects in Pakistan faces several hurdles, including limited access to capital, a nascent green bond market, and regulatory inefficiencies. Equity financing, although viable, presents high costs due to the stringent compliance required by ESG standards. This scenario makes green projects less affordable and harder to scale, particularly for firms listed on the PSX, which often operate under resource constraints.

This study focuses on green leverage in the context of AIM in the UK, which provides an innovative platform for high-growth firms to access capital for sustainable projects. AIM-listed firms often share characteristics with those listed on the PSX, such as smaller size and greater growth potential but higher risks. By examining the enablers and constraints of green leverage within AIM, this study aims to derive lessons that can be applied to the Pakistani context, offering insights into how firms on the PSX can optimize their capital structures to support green investments.

While the primary sample in this study is drawn from firms listed on the UK's Alternative Investment Market (AIM)—a platform known for its regulatory flexibility and innovative financing practices—the implications of the findings extend beyond the UK context. AIM serves as a benchmark for how developing or semi-regulated markets, such as Pakistan's PSX, might evolve in terms of green finance adoption.

Although structural and institutional differences exist between AIM and PSX, Both markets serve as platforms for smaller firms seeking cost-effective listing opportunities. They operate under relatively flexible regulatory regimes compared to main exchanges and face growing pressure from investors and stakeholders to integrate ESG considerations.

However, differences exist in institutional capacity, investor sophistication, and green finance infrastructure. Therefore, lessons drawn from AIM are not directly transferrable but provide guiding insights for emerging markets like Pakistan .By studying AIM as a more mature yet flexible green finance environment, this research extracts applicable lessons and policy insights relevant to PSX's ongoing transition toward sustainable capital markets.

The findings of this thesis hold important implications for the Pakistan Stock Exchange (PSX). First, enablers such as innovation funding, institutional ownership, and credit ratings highlight the need for policies that strengthen innovation ecosystems, encourage institutional participation, and enhance credit rating transparency. Second, constraints like carbon taxation and compliance costs suggest that regulators should streamline ESG verification processes and reduce reporting burdens through subsidies or incentives. Third, since green leverage shows modest short-term but weaker long-term financial impacts, PSX policymakers could design incentive structures (e.g., preferential rates, guarantees) to support firms in sustaining green financing commitments. Fourth, the muted investor response to green bond issuance indicates the necessity of awareness

campaigns, investor education, and transparent listings to build market confidence. Overall, for firms and investors in Pakistan, green leverage should be understood not only as a financial instrument but also as a long-term strategic tool to enhance sustainability, reputation, and access to global capital markets.

By applying the insights gained from the AIM market to the PSX, this research aims to bridge the gap between theory and practice in green finance. Key factors such as innovation funding, firm size, regulatory frameworks, and the role of institutional investors are examined to understand how these variables impact the adoption of green leverage in both markets. In particular, the study focused on how Pakistan can create a more conducive environment for green leverage by learning from the successes and challenges faced by AIM-listed firms. In summary, this study seeks to explore the enablers and constraints of green leverage in the AIM market with the intent of applying its findings to Pakistan's PSX. As Pakistan embarks on its journey toward a greener economy, understanding the dynamics of green leverage is be crucial in ensuring that firms have the financial resources needed to undertake sustainable projects. By investigating the factors that facilitate or hinder the adoption of green leverage, this research contributes to the development of a more effective green finance strategy for Pakistan, enabling the country to meet its sustainability goals while fostering economic growth.

1.9. Alignment with Sustainable Development Goals (SDGs)

This study aligns with the United Nations Sustainable Development Goals (SDGs), particularly:

- **SDG 7** (Affordable and Clean Energy): By examining how firms finance green projects, this research contributes to the discourse on sustainable energy investment.
- **SDG 12** (Responsible Consumption and Production): Findings highlight mechanisms through which corporate financing decisions can promote sustainable production practices.
- **SDG 13** (Climate Action): By exploring enablers and constraints of green leverage, the study directly informs strategies for financing climate mitigation initiatives.

By explicitly linking corporate capital structure decisions to SDGs, the thesis underscores the dual role of green leverage as both a financial and sustainability.

1.10. Overview of Thesis Structure and Content

There are six chapters in this thesis. As the introduction portion, the first chapter describes the goals and parameters of the study, the main estimating technique used, and the main conclusions drawn from the investigation. To bolster and validate the contributions provided by this thesis as well as AIM's Operational Framework and Lesson for PSX, Chapter 2 offers a thorough analysis of AIM, highlighting the distinctive features of this market. A thorough explanation of the theoretical foundations supporting the research is provided in the third chapter. The Modigliani-Miller irrelevance theory, trade-off theory, agency theory,signalling theory, pecking order theory, lifecycle theory, and net income approach are among the models and ideas it incorporates. The theoretical underpinnings of the investigation are established in this chapter.

The study's hypotheses are developed based on a comprehensive evaluation of the literature, which is presented in Chapter 4. The predicted results are intended to inform the research hypotheses after this chapter critically assesses earlier research findings pertaining to the factors studied in this study. The study methodology is explained in depth in chapter five, which also covers the data collecting strategy, the kinds of data collected, and the statistical techniques used to evaluate the data and answer the research questions raised by the three empirical investigations. In accordance with the goals of the research, the empirical findings of the first investigation are presented and discussed in the sixth chapter. It investigates the several elements that affect the capital structure of AIM companies as well as the short- and long-term effects of green leverage on stock price performance.

CHAPTER 2

BACKGROUND ON ALTERNATIVE INVESTMENT MARKET(AIM)

2.1. Introduction

Traditional stock exchanges have historically played a crucial role in the global financial landscape, including that of the United Kingdom. These exchanges typically operate under strict regulatory frameworks that dictate the conduct of both listed companies and investors. However, the associated high costs and rigorous entry requirements can create barriers, particularly for small and medium-sized enterprises (SMEs). Alternative marketplaces that are especially suited to the requirements of these smaller businesses have arisen in response to this problem. AIM in the UK is one such example. LSE replaced the Unlisted Securities Market with the AIM in mid-1995 to provide SMEs a more accessible platform (Carpentier et al., 2010; Mallin & Ow-Yong, 2012). AIM's main goal is to offer a stock exchange environment with less stringent listing requirements, making it possible for smaller firms that cannot meet the demanding criteria of the LSE's main market to access public capital. Although the AIM features a more lenient regulatory framework, it does require that companies appoint "nominated advisors" (commonly referred to as Nomads) to guide them through the listing process and act as both financial and regulatory advisors. These Nomads are responsible for certifying applicant firms and ensuring their compliance with market rules and regulations (Espenlaub et al., 2012).

Many UK firms seek to raise capital through investment, but initial investments are often insufficient. Consequently, these firms turn to financial markets to secure the necessary funding. However, many newer and smaller firms do not meet the stringent requirements of the main market. The AIM fills this gap by offering a more flexible regulatory environment. In contrast to main market, AIM is not subject to European Union's investment directives but operates under the LSE authority's policies and regulations. This independent framework, managed by the private sector, allows the AIM to maintain its flexibility and adapt to the needs of smaller firms. AIM's regulatory controls and rules are less stringent compared to traditional markets. It is not directly regulated by FCA in the UK (Farinha et al., 2018) and operates independently of EU financial directives, allowing for greater operational freedom. Listing requirements are generally lower than

those in similar markets, such as NASDAQ. For example, AIM does not mandate minimum size, age, or economic sector requirements for firms. There is also no requirement for a minimum free float or shareholder approval for most transactions (Nielsson, 2013). Admission procedures require firms to provide a disclosure document detailing the management background, financial position, and nature of activities. Based on the firm's capacity for good judgement, the Nomad decides whether a company's stock is suitable for listing. The Nomad also certifies the firm's commitment to fulfilling further disclosure standards (Espenlaub et al., 2012).

Since its founding, AIM has grown steadily and gained worldwide recognition for its adaptable regulatory structure that caters to the demands of SMEs. The AIM has had strong growth and is now a desirable centre for both local and foreign investors, in contrast to other markets that have experienced periods of considerable delisting (Khurshed et al., 2016). The AIM was governed by the LSE authorities from the time of its founding until 2000. The UK Listing Authority, which is under the UK Financial Services Authority, took over this duty after 2000 (Doukas & Hoque, 2016). Particularly in terms of their capital structure, companies listed on the AIM vary significantly from those on the main market. Companies listed on the main market have higher debt ratios than those listed on the AIM, which suggests a larger ability to issue debt. Conversely, AIM companies often possess less fixed assets and more concentrated stock (Doukas & Hoque, 2016). Regarding regulatory pressure, AIM operates in a largely voluntary disclosure environment for ESG; it does not impose the same mandatory ESG reporting regimes that apply to main market issuers. The London Stock Exchange and AIM support voluntary initiatives (e.g., the Green Economy Mark and guidance on ESG reporting), but the formal regulatory framework for sustainability disclosure in the UK has evolved only recently through FCA Sustainability Disclosure Requirements and anti-greenwashing rules (FCA, 2023; LSE, 2024). In practice, AIM firms face limited mandatory ESG constraints but growing investor and regulatory pressure for credible disclosure — a dynamic that can both encourage voluntary green issuance and increase compliance costs for issuers seeking credible certification. This duality helps explain why issuance incentives in AIM may differ from those in more tightly regulated markets.

2.1.1 Why AIM

The study captures firms listed on Financial Stock Market. The reasons behind why we are selected these firms for our study and not bringing lenses toward Pakistani Capital Markets

are: (a) AIMs (FTSX) working under the guidance of principals of PRI, SGDs practices and is first capital market declared green market by Green Economy Mark -recognizes more than 50% of their revenues from environment-friendly products and services focusing on climate change mitigation and adaptation, waste and pollution reduction, and the circular economy (London Stock Exchange, 2022).Non-green firms or firms with traditional production approaches would be unable to sustain on the AIM due to the competitive green environment and low regulatory burden for green firms. b). there is a drastic increase in the transition of the firm towards green due to low regulatory burden and competitive green environment. For example, housing, transport, and consumer product recycling increased year-over-year (YOY) revenue from green products and services by 163 %, 25 newly listed firms were recognized as green which is 56% increase YOY (London Stock Exchange, 2022). This shows that investors and firms listed on the AIM are more conscious of green investments and funds. c): Green finance market in Pakistan is still immature. Non development of sustainability related index and sustainability disclosure reports are major barriers in accessing data about sustainability. ESG Task Force established by PSX strive to spread the ESG reporting guidelines and ensuring regular reporting disclosure but no company listed in PSX has annual sustainability report yet. DE capitalization (delisted of firm) and market squeezing are major issues in Pakistan. According to 5 years progress report by PSX no of listed companies reduced from 720 to 520 as 200 companies delisted in stock market. Market data also reveals that no debt instruments is issued in past 2 years. So these are reasons not considering PSX and focus on AIMs (FSTX).

2.1.2. AIM Listing Requirements

The AIM is known for its relaxed regulatory controls and requirements. Unlike the main market, it is not directly regulated by the Financial Conduct Authority but operates under the oversight of the LSE authority (Farinha et al., 2018). This allows the AIM to operate without adhering to the European Union's Markets in Financial Instruments Directive, providing it with greater flexibility.

Compared to other markets, such the NASDAQ, the AIM has less demanding listing standards. Firms are not subject to sector-specific restrictions or minimum size or age limitations. Furthermore, for most transactions, the AIM does not need shareholder approval or free float criteria (Nielsson, 2013). Firms must submit a disclosure document detailing their financial

position, managerial background, and business activities. The Nomad assesses the appropriateness of the firm's stock for listing, based on its ability to make sound judgments and meet ongoing disclosure obligations (Espenlaub et al., 2012). However, the relatively low listing requirements can lead to a "race to the bottom" effect, where Nomads approve firms of varying quality to maximize their own benefits, potentially undermining the market's reliability and trustworthiness (Piotroski, 2013). Therefore, comparing the AIM's listing requirements with those of other markets highlights its distinctive flexibility.

Table 2.1

Comparative View of Listing Criteria Across the AIM Market and Other Comparable Equity Market, As Adopted from Espenlaub et al. (2012)

Criteria	AIM Market	(Main Market) London Stock Exchange	OTCQX Market	NASDAQ Market
Free Float	No requirements	25% of shares must be publicly owned investors	No specific requirement	Must have at least 300 shareholders, with ownership of 1 million shares valued at $4-5 million
Trading History	No prior trading record necessary	Must have at least three years of trading history	Not required	0-2 years of trading history necessary
Minimum Market Capitalization	No minimum market capitalization	Must meet a threshold of £10 million	At least $5 million	Must meet a threshold of $50 million
Profitability	No profitability benchmarks	No specific profitability requirements	No requirements	No specific profitability standards or net income of $750k, based on selected criteria

Advisors	to oversee and regulate transactions, nominated advisors are appointed	No requirements	Disclosure advisors are appointed to supervise all transactions	No requirements
Documents for Admission	The United Kingdom Literacy Association is responsible for reviewing admission documents	The United Kingdom Literacy Association does not review admission	The U.S. Securities and Exchange Commission does not conduct document reviews	The U.S. Securities and Exchange Commission is responsible for document reviews

2.1.3. Characteristics of the AIM Market

The AIM's unique model results in several distinguishing characteristics, which contribute to its strengths and weaknesses (Nielsson, 2013; Khurshed et al., 2016; Doukas & Hoque, 2016; Mortazian et al., 2019):

1. **Size of Firm**: The AIM hosts smaller firms compared to major exchanges like the NYSE and Euronext. Despite this, it has seen significant growth, in contrast to other significant exchanges that have gone through delisting phases (Nielsson, 2013).
2. **Regulatory Framework**: AIM is an exchange-regulated market, overseen by the LSE authority rather than the Financial Conduct Authority, which regulates the main market-LSE (Khurshed et al., 2016). LSE (Main Market), the OTCQX Market, and NASDAQ.
3. **Ownership by Major Shareholders**: Unlike the LSE main market, which limits block holder ownership to 30% of a firm's total value, the AIM imposes no such restrictions, resulting in higher ownership concentration.
4. **Functions of Nominated Advisors**: AIM firms are not obliged to follow to the UK Corporate Governance Code, leading to lower investor protection like main market. However, the presence of Nomads offers some degree of investor protection.
5. **Dividend Policy**: AIM firms do not face the same pressure to pay dividends, allowing them to reinvest cash flow into growth opportunities. This is particularly beneficial for firms with strong growth prospects but limited cash flow (Doukas & Hoque, 2016).

These features make the AIM an appealing destination for SMEs and retail investors, encouraging great variety in the market in terms of enterprises' countries of origin and economic sectors.

2.1.4. Role of Nomads

Unlike most major exchange markets regulated by government bodies, the AIM adopts a private sector-based regulatory system anchored on nominated advisers (Nomads) (Piotroski, 2013). Nomads are private entities responsible for regulating the activities of AIM-listed firms and determining the eligibility of new applicants. This Nomad-based framework contributes to the AIM's flexibility and has been instrumental in its growth. Nomads play a dual role, offering regulatory oversight and growth opportunities. They provide financial advice, particularly to firms managed by entrepreneurs lacking financial expertise, and advise on corporate governance to help firms utilize their resources more efficiently (Revest & Sapio, 2013). During the application and admission process, Nomads assist firms by:

1. Evaluating their suitability for AIM admission.
2. Explaining AIM rules and ensuring managerial understanding of responsibilities.
3. Coordinating with professionals like lawyers and accountants.
4. Consulting on required admission documents.
5. Providing ongoing support and consultancy post-admission (LSE, 2018).

In conclusion, the AIM's unique characteristics and regulatory framework, centred on Nomads, make it a distinct and attractive market for smaller firms and investors. This combination of flexibility, growth support, and diverse participation has established the AIM as most rapidly-growing exchange globally.

2.1.5. Success and Growth of AIM

AIM has demonstrated remarkable success in attracting new firms, especially as opposed to the primary market in the UK. Between 1995 and 2023, the AIM accounted for the vast majority of new listings, with 8,578 out of 8,579 firms (approximately 78.1%) choosing the AIM over the main market. This success highlights the AIM's appeal to smaller firms seeking a more accessible platform for raising capital. The AIM was specifically designed to meet the requirements of

growing and young firms, and it has been highly successful in achieving this objective. Today, it is recognized as the most successful and prolific secondary exchange market in Europe. Its success has established it as a model for other secondary markets across the continent (Colombelli, 2010).

1. Inspiration and International Influence

The achievements of AIM have prompted the creation of comparable exchange markets around the globe. For example, LSE and TSE have joined forces to introduce a new alternative financial market in Tokyo, which is modelled after the AIM. This initiative seeks to offer smaller companies a venue for securing external financing while also drawing investment from both international and domestic investors (Espenlaub et al., 2012).

In 2008, AIM Italia was established in Italy, adopting a similar operational approach to the original AIM. The following year, the Tokyo AIM was launched in Japan, resulting from cooperation between the LSE and TSE (Gerakos et al., 2013). These initiatives underscore the AIM's role as a pioneering model for secondary markets globally.

2. International Attention and Investor Appeal

The AIM has attracted considerable international interest, positioning it as a distinctive financial market in Europe. However, its achievements should not be interpreted as a reflection of any deficiencies in U.S.-based exchange markets. A significant number of foreign companies listed on the AIM come from regions, including tax havens within the UK (such as Jersey), countries with long-standing connections to the UK like the United States and Canada, as well as Israel. In contrast, firms from other areas are less represented (Vismara et al., 2012).

A key advantage of the AIM is its capacity to accommodate small investors. In contrast to other markets where high-growth companies may be accessible primarily to wealthy individuals, the AIM offers small investors the chance to engage with a wide range of firms that demonstrate strong performance and substantial growth potential. This inclusiveness enables companies to secure funding that might be difficult to obtain in alternative markets (Gerakos et al., 2013).

2.1.6. AIM Market: Historical Summary

The AIM has gone through many phases of expansion and contraction since its founding in 1995. The market's dynamic character has been influenced by its capacity to draw in a wide variety of businesses, both domestic and foreign. Its flexibility and tenacity in the face of shifting

market circumstances are shown by the historical patterns in the number of companies listed on the AIM. A historical overview of the variations in the number of local and foreign companies listed on the AIM is shown in Table 2.

Table 2.2

Historical Summary of Firm Numbers in the AIM Market (LSE, 2020)

Year	Number of Companies			Market Value (£m)	Number of New Issues			Money Raised (£m)		
	UK	International	Total		K	International	Total	Few	Further	Total
1995	118	3	21	2,382.40	118	3	121	71.2	25.3	96.5
1996	35	17	52	5,298.50	129	14	143	522.1	297.1	819.2
1997	86	22	08	5,655.10	94	13	107	344.1	350.1	694.2
1998	291	21	312	4,437.90	68	7	75	267.5	317.7	585.2
1999	325	22	347	13,468.50	96	6	102	333.7	600.2	933.9
2000	493	31	524	14,935.20	265	12	277	1,754.10	1,338.30	3,092.40
2001	587	42	629	11,607.20	163	14	177	593.1	535.3	1,128.40
2002	654	50	704	10,252.30	147	13	160	490.1	485.8	975.8
2003	694	60	754	18,358.50	146	16	162	1,095.40	999.7	2,095.20
2004	905	116	1,021	31,753.40	294	61	355	2,775.90	1,879.50	4,655.30

From its founding on June 19, 1995, to the end of 2007, the AIM market had a notable increase in the number of both local and foreign companies, as shown in Table 2. There were just 10 UK-based businesses at first, but by 2007, that number had skyrocketed to 1,347. The number of international businesses rose from zero to 347 throughout that time. As a result, at the end of 2007, AIM had 1,694 listed companies, the highest year-end number in the market's history. This indicates a remarkable 16,940% increase in the overall number of businesses throughout that period. Furthermore, the total market value increased dramatically, from £82.2 million at launch to £97.5 billion by the end of 2007, the largest value ever recorded for AIM at the time, representing a startling 118,687.3% rise.

Reduction after 2008. The number of listed firms, both locally and globally, did, however, noticeably fall after 2008. The number of UK-listed companies dropped from 1,347 in 2007 to 740 by the end of 2019, while the number of foreign companies dropped from 347 to 123. The overall number of listed companies decreased by around 51%, from 1,694 to 863. There were 119 foreign and 724 UK-based businesses as of March 2020, for a total of 843 listed businesses. This early drop seems to be directly linked to the global financial crisis of 2007–2008, which saw a significant drop in the number of listed companies in 2008 and 2009, with losses of 114 companies (8.5%) and 181 companies (14.7%), respectively. Notably, both in terms of raw numbers and percentages, 2009 saw the biggest decrease in AIM's history. At the same time, by the end of 2008, the entire market value of listed companies had fallen to £37.7 billion, a substantial reduction of more than 61% and the worst decline in AIM's history.

Trends in Market Value It's noteworthy to note that AIM's overall market value has not declined in tandem with the steady decline in the number of listed companies since 2008. Rather, it has shown general expansion. For example, the market value of AIM peaked in 2017 at £106.9 billion. Even though there were fewer listed companies in 2019—from 922 to 863—the overall market value was still very near to its high in 2017, with just a little 2.5% decrease in new issues and fundraising trends. The amount of new issues, such as IPOs, transfers to AIM, re-admissions, and introductions, shows a similar pattern. AIM had a continuous increase in new issues from 1995 until the start of the global financial crisis, reaching a high of 519 in 2005, with 399 from UK-based enterprises and 120 from foreign firms. But since 2006, the quantity of new issues has been continuously decreasing, and in 2019, there were a record-low 23 new issues, of which only 20 were from the UK and three were from other countries. Only seven new complaints were reported to AIM by March 2020, and they were all from the UK.

The patterns of new listings and new issues are reflected in the volume of fundraising. In 2007, AIM raised a record-breaking £16.18 billion. But since then, compared to the mid-2000s, the overall amount of cash raised has dropped dramatically. The exercise of options or warrants and cash placement are examples of subsequent offerings that have notably produced more money than fresh issues since 2006. Just £489 million (12.7%) of the £3.8 billion that AIM raised in 2019 came from fresh offerings. Just £55.3 million of the £879 million in total cash generated by March 2020 came from new offerings. In conclusion, while there have been fewer companies listed on

AIM since 2008, these companies' total market values have usually grown. This pattern implies that AIM is drawing bigger companies and generating expansion prospects. The results of Doukas and Hoque (2016), who pointed out that many businesses choose AIM because of its much reduced initial and continuing listing fees, are consistent with this conclusion.

2.1.7. Regional Distribution of Firms Listed on AIM

Since its establishment in 1995, the AIM has evolved into a prominent international investment platform, showcasing considerable growth and diversification in its listings. Currently, AIM features companies from a diverse range of countries, as depicted in Table 3 below, which categorizes firms based on their region of incorporation.

Table 2.3

Regional Distribution of Firms Listed on the AIM (LSE, 2023)

Region	Number of Companies
Europe	755
North America	53
Pacific	20
Middle East	6
Asia	5
Latin America	2
Africa	1
TOTALS	**842**

As illustrated in Table 2.3, the majority of firms listed on AIM are incorporated in Europe, with European entities accounting for approximately 89% of the total listings. A further analysis of the distribution by region indicates that the United Kingdom is the most significant contributor, with 654 UK-based firms comprising around 77% of all European companies listed on the market. This concentration underscores the UK's pivotal role within the European segment of AIM-listed entities.

Following Europe, firms based in North America denote the second-largest group,

highlighting AIM's global appeal and reach for companies seeking flexible listing alternatives outside their domestic markets. This varied geographical distribution reflects AIM's attractiveness as a global investment marketplace, enabling firms from diverse regions to access capital, drive growth, and expand their international market presence. The platform's ability to attract a significant majority of European firms, particularly from the UK, coupled with an increasing presence from North America, Asia, and other regions, further reinforces its position as a critical hub in the global financial landscape.

This diverse geographic distribution reflects AIM's appeal as a global investment marketplace, providing opportunities for firms from different regions to access capital, foster growth, and expand their market presence internationally. The platform's ability to attract a vast majority of European firms, particularly from the UK, combined with a growing representation from North America, Asia, and other regions, further cements its status as a crucial hub in the global financial landscape.

2.1.8. AIM and Green Finance

The AIM has increasingly become a focal point for green finance and the greening of firms, reflecting a broader trend towards sustainability in global financial markets. Green finance encompasses financial investments that support sustainable environmental practices, and AIM-listed firms have been active participants in this movement.

- **Green Bonds and Sustainable Investment Initiatives**

The issuing of green bonds, which are designated especially to finance projects with positive environmental or climatic effects, is an important component of green financing. Green bonds have become a more popular option for companies listed on the AIM to finance their environmental projects.

In addition to assisting these businesses in achieving their environmental objectives, this has drawn in a new group of investors that prioritise ethical and sustainable investing. For instance, several AIM-listed firms in the renewable energy sector have issued green bonds to finance projects such as wind farms, solar power installations, and other renewable energy ventures. These efforts align with the UK’s broader commitment to reducing carbon emissions and transitioning to a low-carbon economy.

- **Environmental, Social, and Governance (ESG) Practices**

In addition to green bonds, AIM-listed firms are increasingly adopting comprehensive ESG practices. Socially conscious investors employ SG criteria, which are standards for a company's operations, to evaluate possible investments. AIM firms have recognized that strong ESG performance can enhance their reputation, improve risk management, and provide a competitive advantage. The AIM market has seen a rise in firms reporting on their ESG practices, including detailed disclosures on how they manage environmental impacts, ensure social responsibility, and uphold governance standards. This trend is supported by the growing demand from investors for transparency and accountability in these areas.

- **Green Economy Mark**

LSE introduced The Green Economy Mark which is awarded to companies and investment funds that generate over 50% of their revenue from products and services that support the global green economy. This mark provides greater visibility to investors looking to invest in green and sustainable companies. Several AIM-listed companies have been awarded the Green Economy Mark, underscoring their commitment to sustainability and their significant contribution to the green economy. This recognition not only helps attract investment but also positions these companies as leaders transitioning to a sustainable economy.

2.1.9. Role of AIM in Green Economy

The AIM plays a crucial role in the green economy by providing a platform for smaller, innovative companies that are at the forefront of sustainable development. These companies often find it easier to raise capital on the AIM compared to more traditional markets, due to the AIM's flexible regulatory framework and supportive investor base. Although the AIM has achieved considerable progress in fostering development green finance and the greening of firms, there are challenges that need to be addressed. These include:

- **Regulatory Harmonization**: Ensuring that green finance standards and reporting requirements are consistent with international best practices to enhance credibility and investor confidence.
- **Investor Education**: Increasing awareness among investors about the benefits of investing in green and sustainable firms.

- **Market Volatility**: Managing the inherent volatility in the green finance sector, which can be influenced by policy changes, technological advancements, and market demand shifts.

2.1.10. Conclusion

This chapter included a comprehensive summary of the AIM in the UK.Despite AIM is relatively new, it has experienced swift and consistent expansion, emerging as the most rapidly growing and successful alternative exchange globally. This remarkable achievement can be attributed to the market's lenient and adaptable regulatory structure, which is managed by its parent body, LSE authority. AIM's regulatory environment is unique. Unlike the LSE and other global exchange markets, which typically operate under official government oversight, the AIM relies on a system of nominated advisors (Nomads). These Nomads play a crucial role in maintaining market regulation. Their work is governed by stringent guidelines, and failure to adhere to these guidelines can result in severe punitive actions.

Since its founding, the AIM has seen growing success, mostly because of its adaptable operating processes and regulatory structure. This adaptability has facilitated significant growth in new listings on the AIM, surpassing the pace of growth observed on LSE over the same period. The expansion is notable not only in the rising number of firms listed but also in the substantial increase in market capitalization. AIM's growth has not been confined to the UK; it has garnered considerable international attention, leading to an influx of foreign firms seeking listings. This global reach is further evidenced by the establishment of other markets that replicate AIM’s model and by the creation of partnerships with foreign stock exchanges. AIM’s competitive position on the global stage is particularly striking, given the emergence of rival markets in North America, Europe, and Asia in recent years. Despite this competition, AIM has successfully attracted a diverse array of international companies and investors, especially from regions with more stringent regulatory frameworks, such as the United States. This competitive advantage underscores AIM’s appeal to foreign firms looking for more flexible listing options compared to the stricter regulatory environments in their domestic markets.

Additionally, the chapter explored the implications of AIM listings on corporate capital structure. Drawing from the existing body of literature, it can be inferred that firms listed on AIM exhibit a preference for equity financing over debt. This tendency is driven by the firms' desire to capitalize on shifts in their market valuations and take advantage of emerging growth

opportunities. The equity-focused capital structure aligns with AIM's emphasis on fostering high-growth companies that may prefer less leverage to maintain flexibility in their operations. From a corporate governance perspective, AIM operates under a distinct framework that stresses the dual role of the firm's management and its Nominated Advisors (NOMADs). The governance structure is guided by a set of principles defined by LSE, which includes a clear delineation of managerial responsibilities and the implementation of regular evaluations to ensure compliance and transparency. These practices contribute to the market's success by ensuring that companies listed on AIM adhere to robust governance standards while benefiting from the flexibility that the market offers. Overall, AIM's strategic focus on flexibility, internationalization, and governance, combined with its ability to attract firms from around the globe, positions it as a vital player in the global financial ecosystem. Despite increasing competition, its unique approach continues to draw firms seeking a less restrictive yet well-regulated environment conducive to growth and innovation.

The progress of green finance and the greening of firms listed on the AIM reflects a broader commitment to sustainability and responsible investment. By supporting green bonds, ESG practices, and recognizing companies through the Green Economy Mark, the AIM has positioned itself as a leader in the transition to a sustainable economy. AIMs (FTSX) working under the guidance of principals of PRI, SGDs practices and isfirst capital market declared green market by Green Economy Mark -recognizes more than 50% of their revenues from environment-friendly products and services focusing on climate change mitigation and adaptation, waste and pollution reduction, and the circular economy (London Stock Exchange, 2022).

Non-green firms or firms with traditional production approaches would be unable to sustain on the AIM due to the competitive green environment and low regulatory burden for green firms. b). there is a drastic increase in the transition of thefirm towards green due to low regulatory burden and competitive green environment. For example, housing, transport, and consumer product recycling increased year-over-year (YOY)revenue from green products and services by 163 %, 25 newly listed firms were recognized asgreen which is 56% increase YOY (London Stock Exchange, 2022). This demonstrates that investorsand firms in AIM are more conscious of green investments and funds. Moving forward, continued efforts to address challenges and promote green finance is crucial in sustaining this momentum and achieving long-term environmental and economic benefits.

2.2 AIM's Operational Framework and Lesson for PSX:

2.2.1. Introduction to PSX

The KSE's founding on September 18, 1947, is where the PSX, had its start. Originally serving a small number of enterprises, it was formally formed on March 10, 1949, as KSE (Guarantee) Limited. The stock exchange landscape in Pakistan expanded with the establishment of the LSE in October 1970, addressing the trading and investment needs of Lahore and its surrounding regions. Further expansion occurred with the formation of the ISE in October 1989 to cater to the northern parts of Pakistan.

- **Evolution of KSE**

Starting modestly with just five listed companies and with total paid-up capital of Rs 37 million, KSE introduced its first index, the KSE 50 Index, as the market grew. The increasing number of listed companies and trading activities necessitated a more representative index, leading to the creation of the KSE 100 Index on November 1, 1991. Over time, additional indices like the KSE 30 Index and KMI 30 Index, as well as sectoral and ETF indices, were introduced, culminating in a total of 16 indices currently maintained by PSX.

- **Functionality of Stock Exchanges**

Stock exchanges provide a platform for issuers to raise capital through equity or debt. Companies make initial public offerings (IPOs) in the primary market to get listed, while subsequent trading occurs in the secondary market. Registered brokers facilitate these transactions, ensuring that listed companies return dividends or profits to their shareholders or investors.

- **Transition from Traditional to Modern Trading**

Initially, share trading was conducted via open outcry on the trading floor, with brokers using verbal communication and hand signals. This method was phased out in 2002 with the introduction of the Karachi Automated Trading System (KATS), later replaced by the New Trading & Surveillance System (NTS) in 2023, marking a significant technological advancement for PSX.

- **Corporatisation, Demutualization, and Integration**

The Stock Exchanges (Corporatisation, Demutualization, and Integration) Act of 2012 was

a pivotal moment for Pakistan's stock exchanges, converting them into companies limited by shares and separating ownership rights from trading rights. Initial shareholders, primarily brokers, were issued shares along with Trading Right Entitlement Certificates (TRECs). The Act mandated divesting 40% equity to strategic investors and 20% to the public. This consolidation led to the integration of all three stock exchanges, culminating in the formation of the PSX on 11th January 2016. Subsequently, a 40% equity stake was sold to a Chinese consortium, and PSX self-listed in June 2017.

- **Technological Advancements and Innovations at PSX**

Recent years have witnessed significant technological upgrades at PSX, including the implementation of a new Trading & Surveillance System. Innovations such as the Online Account for digital account opening, the simplified Sahulat Account, the PSX WhatsApp Service for accessible information, and the My Portfolio virtual trading platform have enhanced user experience. Educational resources like the PSX Knowledge Center and the comprehensive PSX Glossary further support investor knowledge. Additionally, nine Exchange Traded Funds (ETFs) have been launched, spanning equities, debt, and Islamic categories.

- **Ecosystem of Pakistan's Capital Market**

The capital market ecosystem in Pakistan comprises various entities that collectively enable its functioning. Central Depository Company of Pakistan (CDC) and NCCPL are key players, with CDC handling electronic custody and transfer of shares, and NCCPL providing clearing and settlement services.

- **PSX: The Premier Capital Market of Pakistan**

With 524 companies listed on the Main Board and three on the GEM Board across 37 industrial sectors, PSX boasts a total market capitalization exceeding Rs 9.31 trillion. It has consistently outperformed regional markets, earning accolades such as the Best Islamic Stock Exchange Award from GIFA for three consecutive years (2021-2023).

- **Economic Impact and Investor Appeal**

PSX plays a vital role in Pakistan's economy by channelling domestic savings and foreign capital into economic activities. It attracts over 313,000 investors and offers a competitive Price to Earnings Ratio of 3.97, the lowest in the region and MSCI Emerging Markets, reflecting

attractive stock valuations. Moreover, it provides the highest Dividend Yield of 9.38% compared to regional markets and MSCI Emerging Markets. For companies, listing on PSX facilitates access to essential financing for growth and new projects, contributing to employment, exports, and tax revenue. PSX, as a dynamic and evolving entity, continues to drive economic growth and innovation in Pakistan's capital market, providing robust opportunities for investors and issuers alike.

2.2.2 Green Finance in Pakistan and the Role of PSX in Promoting It

Introduction to Green Finance in Pakistan. Green finance refers to the allocation of financial resources to support sustainable development initiatives, eco-friendly products, and policies aimed at facilitating a transition to a more sustainable economy. This encompasses a range of financial instruments, including green bonds, green loans, investments in renewable energy sources, and funding for energy-efficient projects. In Pakistan, the idea of green finance is slowly taking root as the nation faces increasing environmental challenges.

Environmental Challenges in Pakistan. Pakistan faces a multitude of environmental issues, including air and water pollution, deforestation, and the adverse impacts of climate change such as increased frequency of extreme weather events. These challenges not only threaten the country's ecological balance but also have significant socio-economic implications. Addressing these issues requires substantial financial investments in sustainable and environmentally-friendly projects.

2.2.3 Pakistan's Efforts and Challenges in Addressing Climate Change

- **Achievement of SDG 13 on Climate Change**

Pakistan is among the few countries that have successfully achieved the "on track status" for SDG 13, which focuses on Climate Action. This achievement is the result of various proactive policies and initiatives by the government aimed at improving environmental conditions and managing climate change. Prominent initiatives include the 'Clean and Green Pakistan' campaign, the 'Ten Billion Tree Tsunami', the 'Protected Areas Initiative', and the 'Recharge Pakistan' project.

- **Vulnerability to Climate Change**

Notwithstanding these noteworthy efforts, Pakistan remains especially vulnerable to the consequences of climate change. It is the fifth most climate-vulnerable nation, according to the

Global Climate Risk Index 2020. The nation saw 152 severe weather occurrences between 1999 and 2018, which led to significant economic losses of over 3.8 billion USD. These occurrences have serious negative effects on people's health and finances, with heat waves in places like Peshawar and Karachi and intense fog in Lahore.

- **Government Policies and Initiatives**

Pakistan has responded to these concerns by addressing environmental issues via a number of public sector programs and regulations. Important turning points include the development of environmental courts and laboratories, the enforcement of National Environment Quality Standards, the foundation of NEECA, and the fortification of EPAs at the federal and provincial levels. The government's dedication to environmental sustainability is shown by these initiatives.

- **Role of Stakeholders in Environmental Conservation**

While the government plays a crucial role in regulating and leading environmental sustainability efforts, the responsibility of conserving the environment and its resources is shared by all stakeholders, including the public and private sectors, as well as individuals. The private sector has initiated various efforts such as awareness campaigns, cleaning drives, and Water, Sanitation, and Hygiene (WASH) programs. However, there remains a lack of effective monitoring and regulation of harmful environmental practices. These practices include irresponsible disposal of hospital and municipal waste, deforestation, and unsustainable water usage in agriculture. Furthermore, individual behaviours, such as littering, extensive use of motorized transport, and burning of crop residues post-harvest, continue to exacerbate environmental challenges.

- **Expanding Efforts and Initiatives**

To strengthen Pakistan's environmental resilience, it is essential to enhance both governmental and private sector initiatives. This includes increasing investments in renewable energy, promoting sustainable agricultural practices, and implementing more stringent regulations and enforcement mechanisms to curb harmful environmental practices. Additionally, public awareness campaigns should be intensified to encourage responsible environmental behaviours among individuals.

- **Collaborative Approach for a Sustainable Future**

A collaborative approach is vital for achieving long-term environmental sustainability in

Pakistan. Government agencies, private enterprises, non-governmental organizations, and individual citizens must work together to address the multifaceted challenges posed by climate change. By fostering a culture of environmental responsibility and leveraging innovative solutions, Pakistan can build a more resilient and sustainable future.

2.2.4. Green Finance Initiatives in Pakistan

Several initiatives have been launched in Pakistan to promote green finance, including:

1. **Green Banking Guidelines by the State Bank of Pakistan (SBP):** In 2017, the SBP issued Green Banking Guidelines to encourage banks and financial institutions to incorporate environmental considerations into their lending and investment decisions. These guidelines aim to promote environmentally responsible banking practices and support green projects.
2. **Green Bonds:** The issuance of green bonds is a significant step towards financing sustainable projects. These bonds are specifically earmarked for projects that have positive environmental benefits, such as renewable energy, energy efficiency, and waste management.
3. **Renewable Energy Financing:** Financial institutions in Pakistan are increasingly providing financing for renewable energy projects. This includes investments in solar, wind, and hydropower projects, which are crucial for reducing the country's reliance on fossil fuels and mitigating greenhouse gas emissions.

2.2.5. Role of PSX in Promoting Green Finance

The PSX plays a pivotal role in promoting green finance and fostering a sustainable financial ecosystem in Pakistan. Some of the key contributions of PSX in this regard include:

1. **Introduction of Green Bonds and Sukuk:** PSX has facilitated the issuance of green bonds and green Sukuk, providing a platform for companies to raise capital specifically for environmentally-friendly projects. This has enabled the flow of funds into sustainable initiatives and raised awareness about green finance among investors.
2. **Sustainable Finance Reporting:** PSX has introduced regulations and guidelines to encourage listed companies to adopt sustainable finance practices and report on their environmental, social, and governance (ESG) performance. This promotes transparency and accountability, making it easier for investors to identify and support green projects.

3. **Capacity Building and Awareness:** PSX conducts workshops, seminars, and training sessions to educate market participants about the importance of green finance and sustainable investing. By raising awareness and building capacity, PSX helps create a more informed and proactive investor base.
4. **Collaboration with International Bodies:** PSX collaborates with international organizations and networks, such as the Sustainable Stock Exchanges (SSE) initiative, to align its practices with global standards and bring international best practices to Pakistan's financial market. This helps in enhancing the credibility and attractiveness of green finance instruments in Pakistan.
5. **Encouraging Green IPOs:** PSX encourages companies operating in green sectors, such as renewable energy and sustainable agriculture, to go public. By listing on the exchange, these companies can access a broader pool of capital, thereby accelerating their growth and contribution to the green economy.

2.3. AIM–PSX Parallels

A comparative analysis between AIM and PSX is critical to understanding the transferability of insights. AIM is a mature market with flexible listing requirements and voluntary ESG disclosure, while PSX faces structural challenges including limited investor incentives and absence of standardized green taxonomies. Both markets, however, share the prevalence of SMEs and increasing demand for sustainable finance. The following table highlights the similarities and differences between the UK's Alternative Investment Market (AIM) and Pakistan's Stock Exchange (PSX), focusing on regulatory, financial, and institutional dimensions relevant to green leverage adoption.

Table 2.4

Comparison Between AIM and PSX

Feature	AIM (UK)	PSX (Pakistan)
Market Type	Sub-market of LSE, established in 1995	National stock exchange, emerging market
Regulatory Framework	Flexible, voluntary ESG disclosure	Limited ESG reporting, evolving framework
Investor Base	Institutional + retail, global reach	Primarily local investors, smaller foreign presence
Green Finance Ecosystem	Active issuance of green bonds and loans	Nascent stage, few labeled green instruments
Relevance for SMEs	High – designed for growth firms	Moderate – SMEs face higher financing hurdles

For Pakistan to solve its environmental issues and make the shift to a sustainable economic model, green money is crucial. By allowing the issuing of green bonds, supporting sustainable finance reporting, increasing awareness, and working with international organisations, the PSX plays a critical role in advancing green finance. PSX can contribute to the development of a more resilient and sustainable economy in Pakistan by keeping up its support of green financing projects.

CHAPTER 3

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

3.1. Introduction

The capital structure of a firm is a pivotal aspect of its financial strategy, influencing its investment returns and overall financial health. A well-structured capital framework can significantly enhance a firm's ability to generate returns on investment, thereby contributing to improved financial performance (Bae et al., 2022; Chen & Chen, 2023; Li & Zhao, 2024). Effective management of capital structure involves a rigorous evaluation of financing options and resource allocation, which is critical for fostering sustainable growth and ensuring long-term stability.(Priyan, Nyabakora, & Rwezimula, 2024; Akmal Hussain, Shabbir, & Nawaz, 2024). Over the past decade academic attention has moved beyond green investment per se to examining how sustainability considerations are integrated into firms' financing choices. The notion of green leverage — debt instruments (bonds/loans) explicitly linked to environmental projects — reframes capital-structure debates by adding policy, certification and reputational dimensions to classical financial trade-offs.(Green Debt: Systematic Literature Review and Future Research Agenda, 2025; Lin, Ma, & Cao, 2024)." Firms typically engage in a comparative analysis of the benefits and costs associated with debt financing—such as tax shields and the mitigation of free cash flow issues—against potential drawbacks, including heightened bankruptcy risk, asset substitution, fire sales of assets, and the phenomenon of debt overhang. This process of trade-off evaluation aids firms in determining the most advantageous capital structure (Korteweg, 2010).

To explain why the debt ratio in capital structures varies from company to company, many theoretical frameworks have been created in recent decades. Despite differences in their underlying assumptions, these theories typically concur that businesses base their capital structure choices on a careful analysis of the costs and advantages of debt and equity financing (Titman & Wessels, 1988). The Modigliani-Miller theorem, which asserts that capital structure has no bearing on firm value in a frictionless market; the trade-off theory, which advises businesses to weigh the tax advantages of debt against the costs of bankruptcy; the agency theory, which deals with disputes between managers and shareholders; the asymmetric information theory, which emphasises the influence of information asymmetry on financing decisions; the pecking order theory, which

asserts that businesses favour internal financing over external sources; and the market timing theory, which suggests that businesses time their financing decisions according to market conditions.

Each of these theories offers distinct hypotheses regarding the determinants of capital structure and the roles of various factors in shaping it. This chapter aims to provide a comprehensive discussion of these key theoretical perspectives, offering insights into the decision-making processes surrounding capital structure and their implications for firm performance. The exploration of these theories would facilitate a deeper understanding of how firms select their financial resources and the subsequent effects on their financial outcomes. The researcher posits that examining these topics would be valuable as it enhance understanding of the decision-making process involved in choosing among various financial resources. Such insights would elucidate how these financial decisions impact and potentially improve the financial performance of firms.

3.2. Capital Structure Theories: An Overview

There is no reason to assume a general theory of debt-equity decision, and none exists (Myers 2001, p. 1). A broad perspective on capital structure and its causes has been examined by theoretical study in the extensive literature on corporate finance, while empirical investigations provide varying but rather contradictory findings. Here, we prioritise capital structure research in addition to green finance research. Most of the empirical evidence now accessible is based on two well-known theories: pecking order theory and trade-off theory. The fundamental study of capital structure's irrelevance by Modigliani and Miller (1958) served as the foundation for corporate capital structure in terms of trade-off theory. In the absence of both corporate taxes and bankruptcy risk, this well-known remark suggests that a firm's value is unaffected by its capital structure. According to this hypothesis, a company's value and its capital structure are unrelated. The worth of the company is based on its profits before interest and associated risk. According to the following idea, tax According to Modigliani and Miller (1963), the interest tax shield causes a positive correlation between a firm's worth and its leverage. Leverage is what businesses seek, especially when the corporate income tax rate is rather high. When there was no chance of bankruptcy, Modigliani and Miller (1963) extended the model to include corporation taxes, acknowledging the practical significance of these two elements.

The extended model of Modigliani and Miller emphasizes the tax advantages associated

with gain on interest payments of debt which also suggests that businesses should maximize their leverage by taking on as much debt as they can. Therefore, under this proposition 100% is the ideal leverage level that businesses should strive for. However, as debt levels rise, so do the chances of experiencing bankruptcy and financial hardship (Jensen & Meckling, 1978). The trade-off hypothesis that resulted from this suggests that companies should choose a financing plan that maximises the difference between bankruptcy costs (CB) and tax advantages (ST). Put another way, businesses should take on more debt if the tax savings from paying off debt interest remains more than the expenses associated with filing for bankruptcy (i.e., ST > CB). In essence, various organizations may have significantly different optimal leverage levels (Myers, 1984). Specifically, based on how far they deviate from the ideal levels, two businesses with identical amounts of leverage could be exposed to disparate financial consequences. Therefore, to achieve the ultimate goal of value maximization, businesses typically strive for a capital structure that may minimize the risks that investors and lenders perceive in them. This helps to lower the total cost of capital.

There is numerous research that back up the trade-off theory's claims about determining the ideal capital structure, or target leverage. Clark, Francis, and Hasan (2009) carried out one such study. Using data from 26,395 businesses across more than 40 nations, the researchers set out to ascertain whether enterprises adapt to their goal capital structure. The study's findings supported the trade-off hypothesis by demonstrating that businesses in each country shifted towards target capital structures, although at differing speeds. Lemma and Negash (2014) examined the variables affecting the rate of capital structure adjustment in emerging countries using a sample size of 986 businesses. The study's conclusions supported the trade-off hypothesis by showing that businesses in every country tended to adapt towards their goal capital structures, although at varying rates depending on the country under investigation. The foundation of this research rests on several interlinked financial theories as given below:

3.2.1. Details of Financial & Capital Structure Theories

The main theories of capital structure are covered in depth in this section. One of the main areas of interest for corporate finance theorists has been capital structure. Scholars have attempted to understand the capital structure idea, the factors that impact it, and how it impacts a firm. Many theoretical contributions have been made by scholars in the subject of capital structure theory; however they are often categorised under a few distinct ideas. These theories include the trade-off

theory, the pecking order theory signalling & life cycle theory and utility theory. Each of these concepts focusses on a different area of dispute, and there are several situations when they overlap.

3.2.2. Trade-off Theory

Despite having a lot of supporters since its inception, the M&M theorem has not been without its detractors. Due to its impracticality, the theorem's fundamental premise—that choices on capital structure are independent of the sources of funding—has been contested. In particular, the theory ignores important aspects of real-world situations, such taxes and bankruptcy expenses. A more sophisticated perspective that considers the trade-offs between the tax benefits of debt and the possible costs of financial hardship was proposed by the trade-off theory in response to these constraints (Frank & Goyal, 2005). Based on the trade-off theory, the M&M theory's underlying assumptions should consider the costs of debt, especially the danger of bankruptcy. According to this viewpoint, weighing the tax benefits of debt (tax shields) against the possible costs, including bankruptcy risk, is necessary to determine the best capital structure. According to this concept, businesses identify the ideal degree of leverage by balancing the advantages of debt, such as tax shelters, against potential drawbacks (Frank & Goyal, 2009; Serfling, 2016).

This viewpoint was further supported by Myers (1984), who suggested that businesses adopt a target capital structure ratio, in which they progressively modify their capital composition to match an optimal debt-to-value ratio. The tax advantages of debt are balanced against the dangers of financial difficulties, including bankruptcy, to reach this "target" (Frank & Goyal, 2005). Accordingly, the trade-off hypothesis highlights that businesses may maximise their value by adjusting their debt levels to maximise tax advantages while accounting for the possible costs of financial risk. The trade-off theory also posits that adjustments to a firm's capital structure are not arbitrary but are aimed at achieving a specific target ratio of debt. This 'target capital structure' represents a carefully chosen debt-equity ratio that the firm strives to attain. According to the theory, deviations from this optimal ratio incur costs, known as the 'cost of deviation. As a result, firms make financing decisions that focus on minimizing these costs as effectively (Chang & Dasgupta, 2009).

Occasionally, businesses modify their financial strategy to conform to their desired capital structure. A firm's adherence to the concepts of trade-off theory is significantly impacted by the expenses associated with this adjustment process, which are sometimes referred to as

adjustment costs. Many businesses choose to adopt these changes only when the advantages exceed the disadvantages, making them selective rather than continually (Hovakimian & Li, 2011). Considering this, the researcher argues that the trade-off theory is an important and essential development in the field of corporate tax theory. Its main contribution is to highlight the importance of taxes in influencing a company's capital structure choices, providing a more realistic and useful approach than the more theoretical M&M theorem. However, the trade-off approach is noted to focus primarily on the benefits and drawbacks of debt financing, often ignoring the factors associated with equity financing. The theory does not sufficiently address the potential role of equity in the capital structure decision-making process, instead concentrating on weighing the advantages and disadvantages of debt. Other theoretical frameworks, on the other hand, such the agency theory and the pecking order theory, focus a lot of emphasis on the variables that affect the decision to use equity financing, giving a more thorough understanding of capital structure choices.

3.2.3 The Pecking Order Theory

In today's highly competitive business environment, the landscape has undergone significant transformations, requiring managers to be increasingly vigilant in ensuring their organizations maintain a robust capital structure. The structure of a firm’s financing relies significantly on accessing dependable and appropriate funding sources. Identifying the best options to maximize firm value is a complex task that requires careful evaluation and strategic planning. Finding the best capital structure has been at the heart of several theories of corporate finance, with the pecking order idea having the most sway. This theory, significantly advanced by Myers and Majluf (1984), highlights information asymmetry role in shaping financing preferences. Theory’s revised framework highlights that managers may, at times, bypass profitable investment prospects to prioritize current shareholders' interests, potentially at the expense of new investors (Leary & Roberts, 2010). This dynamic reflects how information asymmetry can guide financing choices and affect a firm’s approach to capital sourcing (Chatzinas & Papadopoulos, 2018).

To mitigate the challenges associated with information asymmetry, firms typically prioritize internal financing as their primary source for capital, given its advantage of being free from the complications of information asymmetry and related costs (Bhama et al., 2016). Once internal funds are exhausted, firms turn to external financing options, carefully considering the

associated risks in a hierarchical manner. Consequently, firms tend to prefer debt over equity, beginning with the least risky debt options and progressively moving towards riskier sources as needed (Fama & French, 2005). This framework underscores the importance of risk assessment in determining the hierarchy of financing choices. Internal sources are prioritized due to their lack of associated risks, followed by debt options, where those with the lowest risk levels are selected first. Equity issuance, being the most risk-laden financing option, is least preferred. This decision-making process is strategically designed to protect the firm's value, aiming to minimize the potential for value erosion by carefully managing the risk profile of the capital structure.

Myers (1984), in his discussion of pecking order theory, emphasized that firms naturally seek to avoid issuing equity whenever possible. This aversion is largely driven by the desire to prevent the dilution of wealth among external stakeholders. Furthermore, equity issuance is frequently linked with negative business consequences, with undervaluation being one of the most significant risks. When firms issue new equity, it may signal to the market that the firm's shares are overvalued, leading to a potential decline in stock price, which can harm the firm's overall market valuation. Myers (1984), in his discussion of pecking order theory, emphasized that firms naturally seek to avoid issuing equity whenever possible. This aversion is largely driven by the desire to prevent the dilution of wealth among external stakeholders. Furthermore, equity issuance is frequently linked with negative business consequences, with undervaluation being one of the most significant risks. When firms issue new equity, it may signal to the market that the firm's shares are overvalued, leading to a potential decline in stock price, which can harm the firm's overall market valuation.

The valuation of a firm is heavily influenced by the extent of information available to investors. For instance, when a company chooses to issue new equity, investors might infer that this action is a response to an overvaluation of the firm. This inference can be perceived as a negative indicator of potential organizational deficiencies, which can lead to a reduction in both the firm's overall value and its equity price. Transaction costs function in choice determination of external financing sources. These costs vary between debt and equity, with contemporary financial practices often observing higher transaction costs for equity compared to debt. This disparity persists even when considering increases in financing levels; the transaction costs associated with raising equity generally exceed those of raising debt. Consequently, debt financing is frequently preferred over equity. However, as noted by Holmes and Kent (1991) and Hamilton and Fox

(1998), firms often prioritize debt options that minimize impacts on managerial control. Managers typically prefer short-term debt over long-term debt due to its lower risk of imposing financial constraints, such as collateral requirements. Equity issuance, therefore, is usually considered only as a last resort, when other financing options are unavailable and there is an urgent need for additional capital. Despite its prominence in corporate finance theory, the pecking order theory has faced substantial criticism.

The idea that debt financing offers advantages such using free cash flows and avoiding agency issues related to other external funding sources, notably equity, is a major subject of controversy. It is like the trade-off hypothesis. Notwithstanding these parallels, there hasn't been much communication between the proponents of these two ideas. According to Yang et al. (2014), this split has remained, with theorists on both sides often criticising the other. According to the researcher, the pecking order theory provides a comprehensive and sophisticated understanding of capital structure in contemporary commercial settings. This theory states that there is a hierarchical order to the selection of funding sources that comprise the capital structure, with priority given to those that are seen to be less expensive and safer. Furthermore, the theory links the choice of funding sources to several variables that may impact a company's financial health by influencing its propensity to pursue or forego outside funding possibilities.

3.2.4. Signalling Theory

To overcome the difficulties caused by the information asymmetry between managers and investors, Ross (1977) and other academics developed the capital structure signalling theory in the late 1970s. These models are based on the idea that senior executives, who have access to insider knowledge, are obligated to share such information with outside investors in a way that would increase the value of the company's shares. However, it is difficult to communicate positive internal information directly since managers are likely to face investor skepticism. According to signalling theory, to effectively communicate their confidence in the company's future, managers must use indirect strategies, such changing the capital structure of the company. By raising the company's leverage via debt issuance, for example, management may demonstrate to the market their confidence in the company's future cash flows and debt-paying capacity, which demonstrates financial strength. The stock price may increase because of this calculated move, which closes the information gap between management and investors. Investors may perceive the

signal favourably as an indication of the company's intrinsic worth.

Additionally, the signalling theory has been developed further in later studies to examine different consequences of information asymmetry in business finance. Numerous signalling methods, including as dividend policy and share repurchases, have been studied as ways for management to convey private information with the market. These signals are intended to affect the opinions of investors and, eventually, the market value of the company. However, the market's capacity to accurately understand these signals and the managers' credibility in communicating them are both critical to their efficacy (Spence, 1973; Leland & Pyle, 1977). One approach to addressing the issue of undervaluation for firms is to communicate valuable insider information to investors by adopting a specific financial policy. For firms with lower value, this strategy is typically impractical due to the associated costs. The credibility of the signal to external investors hinges on its costliness. Bhattacharya and Dittmar (2004) discussed the distinction between costless and costly signals, arguing that managers are unlikely to announce positive internal information directly, as any firm could make such claims without substantiation.

Instead, managers may opt to increase the firm's leverage, thereby signalling their confidence in the firm's future prospects. This action serves as a credible commitment that firms with weaker financial health would avoid, as they would be unwilling to take on the increased risk associated with higher debt levels. Firms that wish to signal strong future prospects tend to raise their leverage, while overvalued firms avoid this strategy due to the heightened risk of bankruptcy it entails. The accuracy of such signals is also crucial (Veronesi, 2000). Ultimately, changes in capital structure are often employed by managers as a means of conveying information about the firm's profitability and risk to external stakeholders. The foundation of signalling theory lies in the premise that internal stakeholders possess more information than external ones. Furthermore, the compensation and benefits received by managers are sometimes tied to the market value of the company, providing an incentive for them to signal to investors when the firm is undervalued. While increased leverage can indicate a higher risk of bankruptcy, it also signals positive developments, as the decision to take on additional debt suggests that management believes the firm's good performance would enable it to meet its debt obligations.

The credibility of information hinges on the high cost associated with false disclosures,

which compels firms to provide truthful information. An increase in leverage, such as taking on more debt, is a strong signal because loan agreements require the firm to maintain stable cash flows to meet its debt obligations. Failure to do so can lead to serious consequences, including bankruptcy. Unlike debt, equity financing allows more flexibility, as companies can adjust or even skip dividend payments during tough financial times. Thus, when a firm takes on new debt, it sends a credible signal that it expects strong future cash flows and is confident in its ability to fulfill its financial commitments. Changes in a firm's capital structure can influence how the market perceives the firm's value. The aforementioned scholars argue that the issuance of stock generally has a detrimental effect on stock prices. For example, Ross (1977), Noe (1988), and Narayanan (1988) suggest that an increase in debt tends to elicit a positive market reaction, boosting stock prices. In contrast, Myers and Majluf (1984) contend that stock prices remain unaffected by the acquisition of a risk-free loan. Additionally, Lucas and McDonald (1990) observe that while stock prices initially decline following the announcement of an equity issuance, they eventually recover after a short period. Krasker (1986) further finds that stock prices are inversely related to the size of the equity issue. Summing up signalling theory explains how signals can help in reducing information asymmetry among market participants. Investor reaction is based on perception, signal could convey positive (desirable) or negative (undesirable) behaviour of sender. Market can have access desirable and negative signals. One of the positive and desirable signal today is firm’s environmental commitments (Hartzmark and Suusman; 2019). Issuance of sustainability report and green bond issuance could seem to be a credible signal showing their environmental commitments. Investing in green and sustainable projects, firm wants to send strong and positive signal to market actor toward their commitment and concern for clean and friendly environment (Flammer, 2021).

3.2.5. Utility Theory and Green Financing Decisions

Utility theory, widely used in economics and finance, posits that decision-makers, such as firms, seek to maximize expected utility rather than just monetary gain. In this context, utility is a composite of economic and non-economic benefits. Applying this to green leverage, a firm may opt for green bonds or loans not solely for financial advantage, but because such instruments enhance its ESG profile, attract responsible investors, or reduce long-term regulatory risks.

Recent literature has begun to incorporate behavioural and strategic decision-making

frameworks to understand corporate adoption of green financial strategies. Utility Theory, traditionally rooted in microeconomic choice models, now plays an increasingly relevant role in corporate finance. It suggests that firms make decisions not solely to maximize profit, but to maximize utility—a concept that includes financial returns, reputational outcomes, regulatory alignment, and stakeholder satisfaction. In the context of green leverage, this theory explains why firms may choose to engage in environmentally sustainable debt financing, even when it appears more costly or uncertain in the short term. If the perceived utility—through ESG credibility, future investor appeal, or alignment with sustainability goals—exceeds the marginal cost of financing, green debt becomes a rational strategic decision. This perspective is especially important in semi-regulated and voluntary ESG environments like the UK's Alternative Investment Market (AIM), where firms are not required, but encouraged, to disclose and act on ESG issues. Utility Theory thus complements classical capital structure theories by incorporating intangible benefits into the firm's financing calculus, making it particularly relevant for understanding the motivations behind green capital structures.

The evolution of capital structure theory provides the foundation for understanding green leverage. Classical frameworks such as Modigliani and Miller (1958), the Trade-Off Theory (Kraus & Litzenberger, 1973), and the Pecking Order Theory (Myers, 1984) offer insights into firms' financing choices under traditional conditions. These theories emphasize balancing tax benefits, financial distress costs, and information asymmetry. However, the integration of sustainability considerations into capital structure decisions introduces new dynamics that these classical models alone cannot fully explain. Recent studies have highlighted the growing role of environmental, social, and governance (ESG) pressures in shaping firms' financing structures. For instance, Flammer (2021) shows that green bonds are associated with positive market reactions, suggesting that investors view sustainability-oriented financing as a credible signal of long-term commitment. Similarly, Tang and Zhang (2020) find that shareholders benefit from green bond issuance, although the magnitude of benefits depends on certification quality and investor perception. These findings suggest that green leverage can enhance reputation and investor confidence, even if short-term returns are modest.

At the same time, challenges remain. Hachenberg and Schiereck (2018) argue that compliance requirements and certification costs may reduce the net financial benefits of green debt. Likewise, Kölbel and Lambillon (2022) note that greenwashing risks undermine the

credibility of green financing mechanisms. These insights underscore the dual role of green leverage as both an enabler of sustainable growth and a constraint on financial flexibility, depending on regulatory design and market maturity.

The integration of green financing into capital structure theories introduces new complexities for decision-makers. For instance, under the Trade-Off Theory, firms adopting green debt must weigh the tax advantages of debt financing against the potential costs of financial distress—particularly relevant for green projects, which often involve high capital intensity and delayed returns. From a Signalling Theory perspective, issuing green bonds or loans may send strong positive signals to the market regarding a firm's environmental commitment, potentially enhancing reputation, investor trust, and market valuation while reducing perceived risk. The Pecking Order Theory further supports the view that firms prefer internal financing first, followed by debt, and lastly equity. In this context, green debt instruments offer an attractive middle ground: they allow firms to fund sustainable projects without resorting to external equity markets, which could signal uncertainty or result in dilution. Green bonds, therefore, become a strategic financing option when internal funds are insufficient, but transparency and control are still priorities.

Complementing these theories, Utility Theory adds a behavioural and multidimensional lens. It suggests that firms may pursue green leverage not solely for its financial advantages, but because it offers broader utility—such as regulatory alignment, stakeholder approval, ESG index inclusion, or long-term reputational benefits. From a utility-maximizing standpoint, firms adopt green debt when the combined financial and non-financial value outweighs conventional cost-benefit logic. This explains why green leverage may be pursued even in cases where traditional models would predict reluctance due to perceived risk or cost. Therefore, utility theory complements the Trade-Off, signaling, and Lifecycle theories by introducing a behavioral dimension to capital structure choices, especially under ESG-oriented pressures. It helps explain why firms may voluntarily adopt green financing even when financial returns are not immediately superior.

While classical theories of capital structure remain foundational, recent work has adapted these models to sustainability. For instance, Tang and Zhang (2020) show that green bonds reduce financing costs, while Flammer (2021) highlights positive investor responses to green debt issuance. These insights suggest that green leverage can be theorised as an extension of existing

models rather than a departure from them. By analysing green leverage through these theoretical lenses, this study offers a multidimensional understanding of how firms balance sustainability with financial structure—particularly in markets where ESG policies are voluntary or evolving.

3.2.6. Green Leverage and Capital Structure: Recent Developments

Over the past decade academic attention has moved beyond green investment per se to examining how sustainability considerations are integrated into firms' financing choices (Flammer, 2021; Kölbel & Lambillon, 2022; Park & Kim, 2024). The notion of green leverage, debt instruments (bonds/loans) explicitly linked to environmental projects, reframes capital-structure debates by adding policy, certification and reputational dimensions to classical financial trade-offs. Foundational capital-structure theories remain useful: the trade-off theory explains the tax and bankruptcy considerations of debt (Kraus & Litzenberger, 1973), the pecking-order theory highlights internal finance preference (Myers, 1984), and signalling theory captures how financing choices communicate private information to markets (Spence, 1973). However, these frameworks require enrichment to capture institutional and environmental constraints that distinguish green instruments from conventional debt. Recent empirical work demonstrates the multidimensional influence of green finance on firm outcomes. Flammer (2021) finds that corporate green bonds can lower borrowing costs and signal commitment to sustainability, producing measurable positive market responses in many contexts. Tang and Zhang (2020) document shareholder benefits from green bond issuance, although their results underline substantial heterogeneity across issuers and markets. Subsequent contributions emphasize institutional determinants — for instance, Kölbel and Lambillon (2022) highlight the role of institutional investors in accelerating green instrument adoption, while Chen and Chen (2023) and Park and Kim (2024) show that high-quality ESG disclosure reduces financing frictions and improves access to sustainable capital. These studies collectively indicate that creditworthiness, governance, and disclosure are central enablers of green leverage.

At the same time, policy and compliance costs constitute important constraints. Empirical evidence (Flammer, 2021; Tang & Zhang, 2020) and more recent analyses (Reid et al., 2024; Li, 2025) show that carbon taxes, verification expenses and monitoring can deter issuance or increase effective financing costs, especially for smaller firms or in markets with weak green finance infrastructure. The literature therefore suggests a taxonomy of drivers: (i) internal financial

resources and innovation funding; (ii) corporate governance and investor structure; (iii) firm characteristics and creditworthiness; and (iv) policy and market environment — each shaping the propensity to adopt green leverage and moderating its performance effects. Methodologically, studies have moved toward richer identification strategies and robustness checks. OLS remains common for cross-sectional and panel analysis, but contemporary work employ s LASSO for variable selection and Extreme Bound Analysis to probe coefficient stability (Kölbel & Lambillon, 2022; Chen & Chen, 2023). Event studies (Flammer, 2021; Tang & Zhang, 2020) continue to be the standard for assessing short-run market reactions, while long–horizon buy-and-hold abnormal returns (BHAR) or long-window cumulative abnormal returns are used to examine persistence in performance effects.

3.3. Literature review and Hypothesis Development

3.3.1. Introduction

A thorough analysis of the body of research examining the factors influencing a company's financing decisions is provided in this section. Due to the large and varied amount of research in the field of capital structure determinants, this review is structured based on the many scenarios that have been investigated. Particularly with respect to the capital structure choices made by AIM enterprises, this comprehensive research provides a solid foundation for the current study's scholarly contributions. Furthermore, by referencing earlier studies, a broad range of important factors impacting choices on green capital structure was found. Rajan and Zingales (1995) focused on big publicly listed corporations in major industrialized nations and carried out a thorough investigation of the determinants affecting corporate capital structure.

Using data from 1987 to 1991, the research examines 8,000 organizations from the Global Vantage database, with a particular emphasis on companies in the G-7. The research includes book-value leverage and market-value leverage, two different metrics of financial leverage. These are determined by the ratio of total debt to equity's book value and market value, respectively. The explanatory elements that influenced financing decisions were examined in this study, including the market-to-book ratio, return on assets, logarithmic sales, and asset tangibility. The findings indicated that leverage (both book and market measures) was considerably influenced by the market-to-book ratio in every country that was examined. The reasoning behind this was that businesses with market values higher than book values are more easily able to access equity

markets, which in turn encourages them to issue more equity capital and reduce their debt ratios.

Additionally, the research found a positive relationship between company size and book and market leverage and asset tangibility. It implies that businesses have lower agency fees for financing when they have more physical assets that can easily utilised as collateral. Offering substantial collateral reduces the danger of moral hazard, gives creditors more assurance, and enables businesses to get loans at better interest rates (Jensen & Meckling, 1976). Furthermore, by boosting creditor trust, a solid creditor-firm relationship might successfully eliminate the requirement for tangible collateral, according to Berger and Udell (1994). In terms of firm size, larger firms are generally subject to increased scrutiny by market players—such as financial analysts, regulatory bodies, and media outlets—thereby reducing information asymmetries between these firms and capital markets, unlike smaller firms. Consequently, larger companies may find it easier to issue securities sensitive to information, such as equity, and often exhibit lower dependency on debt financing. However, Rajan and Zingales found a positive association between firm size and leverage, attributing it to the credibility larger firms have in asset valuation and their established market reputations, which can improve access to debt markets. As a result, these firms may leverage debt to benefit from tax shields.

The study also observed that firms with higher profitability levels generally exhibit lower reliance on debt in comparison to equity, indicating a negative relationship. This trend is likely due to profitable firms' ability to generate adequate retained earnings, reducing the need for external debt financing. However, if companies prioritise debt financing soon to maintain consistent dividend policy and investment programs, this tendency may change. In contrast to Rajan and Zingales' (1995) more global approach, Panno (2003) examined how capital structure determinants may change over time and across financial environments, concentrating only on UK and Italian enterprises between 1992 and 1996. Leverage was defined in this research as the ratio of long-term debt to the total of long-term debt and equity book value. Long-term debt was determined by deducting current obligations and shareholder funds from total liabilities. Panno (2003) examined how financing choices changed over time and in various financial environments using data from 87 UK firms and 63 Italian companies that issued debt and equity, respectively. He also found that size of firm significantly positively influenced capital structure decisions, suggesting that larger companies are more likely to secure long-term loans, leading to higher leverage.

Furthermore, it was found that operating risk was a significant factor in determining capital structure. Lenders' worries about uncertainty caused increased operational risk to have a negative impact on leverage ratios, which in turn restricted access to the debt markets. It's interesting to note that Panno (2003) discovered a negative link between tangibility and leverage, but Rajan and Zingales (1995) found a positive correlation, emphasising the power of fixed assets as collateral. This was explained by the liquidity of assets, where a firm's capacity to pay its debt commitments is questioned by creditors as its tangibility increases, hence lowering debt utilisation. Chen conducted an analysis in 2004 on the variables affecting capital structure in Chinese publicly traded companies. Using yearly reports from the DOW-China 88 Index, which included 88 companies between 1995 and 2000, the research focused on leverage, which is the ratio of total assets to total and long-term debt. Profitability, business size, growth prospects, asset tangibility, tax benefits, and financial distress expenses were among the important factors that were investigated. The research found that Chinese companies had a distinct financing hierarchy, giving retained profits priority, followed by the issuing of shares, and debt as a last resort. In Huang's (2006) research, which used a sample of more than 1,200 Chinese listed businesses between 1994 and 2003, several characteristics were shown to be important in explaining the difference in financing choices made by enterprises. The study found that tangibility with leverage and business size were positively correlated, but that leverage was negatively correlated with industry, profitability, non-debt tax shields, growth prospects, and management shareholding. The research also discovered that there was no discernible impact of institutional or governmental ownership on capital structure. Since business size was positively correlated with leverage, Huang's results were more in line with the conventional pecking order theory than Chen's (2004) proposal for a new Chinese pecking order.

By using a large dataset of publicly listed American companies from 1950 to 2003, which was obtained from Compustat, Frank and Goyal (2009) investigated the factors that influence capital structure to answer the same issue. The Centre for Research in Security Prices provided the stock return data, the GDP deflator was used to adjust the data for inflation to 1992 USD, and a variety of public sources were used to gather macroeconomic information. The market long-term debt ratio, book long-term debt ratio, book leverage, and market leverage—the ratio of total debt to market value of assets—were among the several leverage metrics used in the research. In addition to larger macroeconomic issues, the authors looked at several explanatory factors,

including supply-side factors, risk, industry impacts, asset type, tax concerns, profitability, business size, growth prospects, and circumstances in the stock and debt markets. What they found was that companies in sectors with greater median leverage ratios also tended to have higher leverage. In contrast, companies with better profitability and market-to-book ratios were linked to lower levels of leverage, most likely because of easier access to equity financing and increased shareholder perceptions of the firm's worth. In contrast, enterprises with more tangible assets and higher asset values were more inclined to carry more debt, as seen by the positive correlations found between leverage and tangibility, asset value, and predicted inflation. With strong effects across several definitions of leverage, the authors concluded that industry leverage, tangibility, and profitability were the most important elements influencing leverage. In thorough worldwide research, Öztekin (2015) examined a dataset of 15,177 enterprises from 37 countries between 1991 and 2006 to analyse the factors that influence capital structure. Long-term and short-term debt to total asset ratios were used in the research to assess capital structure. A wide variety of explanatory factors were considered by Öztekin, including industry leverage, total assets, profitability, market-to-book ratio, and tangibility. The study also considered several industry-specific and country-specific regulatory factors, such as inflation rates, the time and cost of insolvency resolution, bankruptcy efficiency, effective tax rates, creditor rights, legal formalism, contract enforcement, law and order, government risk (such as levels of corruption, the risk of expropriation, and repudiation), and more. Insights for further study are provided by this comprehensive examination of the factors influencing capital structure, especially for major publicly listed companies globally. The results showed that industry leverage, company size, tangibility, profitability, and inflation are the main factors that determine a business's degree of leverage. Higher debt levels are often seen in larger companies with more tangible assets and in sectors with higher median leverage levels. More lucrative businesses, on the other hand, often have lower leverage ratios in nations with higher predicted rates of inflation. Furthermore, the link between company size and leverage was shown to be dependent on the institutional context; in poor institutional environments, the statistical significance of the positive association between firm size and leverage is lost. These findings provide a multifaceted knowledge of capital structure choices by being analysed at the business, industry, and macroeconomic levels.

3.3.2. Capital Structure Determinants in Small and Medium-Sized Enterprises (SMEs)

Over the years, research on the determinants of capital structure has expanded significantly, encompassing a variety of firm types with unique characteristics. This includes investigations into small and medium-sized enterprises (SMEs), specific industry sectors, and specialized business categories such as family-owned firms. These studies aim to understand how unique attributes of these firms shape their financing choices and capital structure decisions. For SMEs, capital structure determinants have been a focal point of academic inquiry over the past two decades. Michaelas et al. (1999) conducted a seminal study on UK SMEs, utilizing a dataset of 3,500 firms spanning from 1986 to 1995. They explored multiple factors influencing leverage, including firm age, size, profitability, growth rates (both historical and projected), operating risk, asset composition, tax effects, non-debt tax shields (like depreciation), and net debt. Leverage was measured through total debt-to-assets, long-term debt-to-assets, and short-term debt-to-assets ratios. The findings revealed positive associations of leverage with factors such as firm size, growth rates, asset structure, operating risk, and non-debt tax shields, specifically for long-term debt. Conversely, age, profitability, and effective tax rates exhibited negative correlations with leverage, challenging traditional finance theories. Notably, the observed negative relationship between tax rates and leverage for SMEs contrasts with the theoretical expectation of higher tax rates encouraging debt usage due to tax savings. Jordan et al. (1998) posited that this inverse relationship might stem from the relatively straightforward financing strategies employed by small firms.

Additionally, firms with strong growth prospects often depend on external debt financing, particularly when investing in research and development activities. The behavior of younger, more profitable firms aligns with the pecking order theory proposed by Myers (1984), as these entities tend to favor internal funds and turn to external debt only as a secondary option. Similarly, larger firms, as noted by Rajan and Zingales (1995), benefit from easier access to debt markets and lower borrowing costs, leading to higher leverage levels. Firms with higher net debtor positions may also increase leverage, potentially indicating inefficiencies in working capital management. Cassar and Holmes (2003) extended this research by examining the capital structure choices of Australian SMEs using data from 1,555 firms between 1995 and 1998. Their study tested the applicability of the static trade-off theory and the pecking order theory, evaluating factors such as firm size, asset structure, tangibility, profitability, growth, and risk. Asset structure and growth emerged as significant determinants, while profitability negatively correlated with leverage across multiple

financing sources, supporting the pecking order theory. The findings also suggested that high-growth firms might seek non-traditional financing options outside bank loans, and firm size showed a limited relationship with capital structure.

In Spain, Sogorb (2005) analysed SME capital structure determinants using data from 6,482 firms during 1994–1995. The study highlighted the influence of variables such as firm size, profitability, tangibility, growth opportunities, and non-debt tax shields. Psillaki and Daskalakis (2009) expanded on this approach, investigating capital structure determinants across SMEs in Greece, France, Italy, and Portugal from 1998 to 2002. Despite country-specific differences, their findings indicated consistent financing behaviours among European SMEs, emphasizing common factors like asset tangibility, firm size, profitability, and growth. Further exploring SME financing dynamics, Bhaird and Lucey (2010) studied 299 Irish SMEs, examining determinants such as age, size, R&D activities, and collateral availability. Their findings supported both the pecking order and agency theories, emphasizing the role of internal and external factors in shaping financing decisions. Mateeva et al. (2013) focused on SMEs in Central and Eastern Europe, analysing the impact of variables like cash flow, growth opportunities, liquidity, and profitability on financial leverage. Their findings underscored the role of firm-specific and macroeconomic conditions in shaping leverage decisions.

Robb and Robinson (2014) provided valuable insights into the financing behavior of start-ups, analysing data from the Kauffman Firm Survey tracking U.S. firms from 2004 to 2011. Contrary to conventional perspectives, they observed a reliance on external debt in the early stages of operation, with debt usage stabilizing as firms matured. This trend highlights the critical role of credit market liquidity and lifecycle financing patterns in entrepreneurial ventures. In addition to SMEs, sector-specific studies have also enriched the literature on capital structure. For example, Morri and Cristanziani (2009) compared the capital structures of real estate investment trusts (REITs) and non-REIT firms, focusing on variables such as firm size, profitability, growth opportunities, cost of debt, ownership structure, and risk. These studies demonstrate the diverse approaches firms adopt to optimize their capital structure based on their industry and operational contexts.

3.3.3. Setting Industry: Determinants of Capital Structure Across Different Industries

Recent research has increasingly explored the factors influencing corporate financing decisions across various sectors, with a focus on industries such as real estate, financial services, hospitality, and shipping. These sectors possess unique characteristics that make them intriguing for academic and practical investigation into financial decision-making processes. For example, Morri and Cristanziani (2009) conducted a study comparing the capital structures of Real Estate Investment Trusts (REITs) and non-REIT firms, using data from the EPRA/NAREIT Index for the period 2002–2006. Their analysis incorporated several key variables, including firm size, profitability, growth opportunities, and cost of debt, ownership structure, risk, and REIT classification. The study found that profitability was negatively associated with leverage, consistent with the pecking order theory. This aligns with findings from earlier international studies, such as those by Fama and French (2002), Hovakimian (2004), and Rajan and Zingales (1995). Furthermore, risk was shown to negatively affect leverage, supporting both pecking order and trade-off theories. According to the authors, firms with strong financial performance tend to minimize leverage due to their competitive advantage and robust equity market presence.

Ownership structure, particularly block-holding ownership, emerged as a significant factor positively correlated with leverage. This is likely because major shareholders prefer to avoid diluting their ownership stakes, thus favouring debt over equity financing. Another noteworthy finding was the REIT classification's negative impact on leverage, attributed to the limited tax benefits available to REITs due to their tax-exempt status. Additionally, firm size was positively linked to leverage, as larger firms typically have better access to debt at favourable terms. However, some nuances exist in the literature, with certain studies reporting a negative relationship between firm size and leverage under specific circumstances. Harrison et al. (2011) examined the factors that influence REIT capital structures to further this area of research. 2,409 firm-year observations from the NASDAQ, American Stock Exchange, and NYSE were included in their study, which covered the years 1990–2008. They used an OLS model to analyse the dependent variable, which was the ratio of total book debt to the sum of book debt and equity market value, coupled with explanatory factors based on previously published research. The results showed that debt and growth prospects were negatively correlated, which is in line with most of the research on non-REIT companies. Some studies, like Feng et al. (2007), did discover a favourable link between these factors, however. Pecking order theory was further supported by profitability's negative correlation with leverage, whereas firm size's positive correlation with leverage was

consistent with the predictions of trade-off theory.

It is noteworthy that Harrison et al. used a dummy variable for rated debt to ascertain if a corporation has an S&P long-term issuer credit rating. The results showed that rated debt and leverage were negatively correlated, which went against earlier studies by Boudry et al. (2010) and Faulkender and Petersen (2006). The authors hypothesize that this disparity may be the consequence of differences in REIT-specific attributes. The Maryland REIT dummy was another intriguing variable that took on a value of one if the REIT was established in Maryland and zero otherwise. Hartzell et al. (2008) found a significant inverse relationship between leverage and Maryland REIT. Maryland-based REITs often experience less external pressure, which results in more entrenched management and a tendency for lower debt levels since managers are less likely to be monitored when debt levels are lower.

Furthermore, the study considered the impact of the UPREIT structure, a dummy variable indicating whether the REIT operated as an umbrella partnership form. Contrary to expectations, UPREITs exhibited a negative relationship with leverage. This result contrasts with the predictions of pecking order theory, which originally suggested that UPREITs should have a positive relationship with leverage due to their potential for tax-efficient partnerships. However, the authors posited that the complex organizational structure of UPREITs might result in lower informational transparency, making it harder for these firms to access debt financing. Lastly, Harrison et al. accounted for the availability of revolving credit lines and their current utilization. As expected, firms with a higher remaining credit capacity were associated with lower debt levels, while firms that actively utilized their credit lines tended to have higher leverage. This underscores the role of credit capacity in shaping REITs' capital structure decisions.

In recent years, a growing body of research has delved into the determinants of capital structure in the hospitality sector, including restaurants, hotels, and tourism industries. Studies such as those conducted by Upneja and Dalbor (2001), Karadeniz et al. (2009), Pacheco and Tavares (2017), and Li and Signal (2019) have contributed to this field. For instance, Upneja and Dalbor examined the factors influencing capital structure in the restaurant industry. Their findings revealed that firms with a higher probability of bankruptcy tend to have increased levels of total debt, as they are compelled to rely more on debt financing due to limited access to equity markets. Additionally, their research demonstrated that operating cash flow had a significant positive

relationship with total debt. This can be explained by the fact that strong cash flows reflect good liquidity, which enhances a firm's ability to meet debt obligations and improves access to debt markets. From the perspective of agency theory, higher levels of cash flow increase the likelihood of managerial opportunism. As a result, firms may opt to take on more debt to limit opportunities for resource exploitation by managers.

An important insight from the literature is the relationship between firm age and total debt. Firm age has been found to have a significant positive correlation with total debt; however, this relationship becomes negative when profitability is included in the analysis. This shift highlights the influence of the financial growth cycle, where older, more established firms with higher profitability increasingly rely on internal financing sources, thereby reducing their dependence on external debt. Another notable observation involves the interaction between cash holdings and firm age, represented by the Cash_Age variable. The analysis suggests a significantly negative relationship between this interaction term and leverage. This indicates that, although firms with higher cash reserves generally exhibit greater leverage, older firms with substantial cash holdings are less inclined to rely on debt compared to their younger counterparts. Pacheco and Tavares (2017) looked at the factors that affect capital structure in the context of small and medium-sized businesses (SMEs) in Portugal's hospitality sector. The researchers used fixed effects models (FEM), random effects models (REM), and pooled ordinary least squares (POLS) to examine how several characteristics, such as business size, liquidity, risk, growth prospects, tax advantages, profitability, asset tangibility, and firm age, affected leverage.

The findings highlighted five key determinants of leverage in this context: profitability, asset tangibility, firm size, liquidity, and risk. Consistent with broader empirical evidence, profitability demonstrated a negative relationship with leverage, indicating that SMEs with higher earnings are less reliant on external borrowing due to greater availability of internal funds. Similarly, liquidity was negatively associated with leverage, suggesting a preference for short-term over long-term debt among SMEs in the hospitality sector. This reliance on short-term financing may reflect their need for flexibility and the operational nature of the industry which can be attributed to their lower liquidity levels. Furthermore, firm size, asset tangibility, and risk were positively correlated with leverage. Higher asset tangibility suggests that firms with more collateral can secure more debt. Similarly, riskier firms tend to incur more debt to mitigate agency costs, despite the associated increase in bankruptcy risk. Larger firms were found to prefer long-term

debt, likely due to their stronger market credibility and more stable financial positions.

Li and Singal (2019) investigated the role of ALFO in shaping capital structure decisions within the hospitality sector. ALFO was conceptualized using four specific measures: FA, CapInt, Fee, and DOF. The findings indicated a positive relationship between ALFO and leverage, as franchising-based fee structures tend to lower capital costs and enhance firms' borrowing capacity. Moreover, while debt financing can help mitigate agency conflicts, the study highlighted that substantial investments in tangible assets also address these conflicts by limiting excess free cash flow, thereby reducing the reliance on debt. Additionally, the analysis revealed a negative association between capital intensity and leverage, suggesting that firms with more significant capital expenditures may prefer equity or internal funding. In contrast, the fee-income ratio displayed a positive association with leverage, reflecting how stable and predictable fee-based revenue streams enhance a firm's creditworthiness and capacity to manage debt. Similarly, Drobetz et al. (2013) examined capital structure determinants within the global shipping industry, focusing on a sample of 115 publicly traded shipping firms between 1992 and 2010. The study observed that shipping companies, compared to other industrial sectors in G-7 economies, tend to operate with higher leverage and elevated financial risk. Key findings indicated a positive relationship between leverage and factors such as firm size, asset tangibility, and the likelihood of obtaining a favourable credit rating. The authors reasoned that firms with larger tangible asset bases are more capable of securing debt, as these assets function effectively as collateral. Additionally, larger firms benefit from better access to debt markets due to their financial stability and scale.

Conversely, several variables demonstrated a negative relationship with leverage. Profitability was inversely associated with debt usage, consistent with the pecking order theory, as profitable firms typically rely on retained earnings rather than external borrowing. Asset risk was also negatively related to leverage, in line with the trade-off theory, which suggests that firms facing higher bankruptcy risk are less inclined to increase debt. Inflation and dividend pay-outs further exhibited negative impacts on leverage, as firms with higher dividend distributions generally possess substantial retained earnings, reducing their dependence on external financing. These findings collectively underscore the complexity of capital structure decisions across industries with unique operational and financial characteristics. In summary, the determinants of capital structure across the hospitality and shipping industries, as explored by Pacheco and Tavares (2017), Li and Singal (2019), and Drobetz et al. (2013), suggest that profitability, liquidity, and

firm size are critical factors shaping the leverage decisions of SMEs and larger firms. While asset tangibility provides firms with greater borrowing capacity, higher risk, profitability, and inflation tend to discourage debt usage, highlighting the complexities of capital structure decisions across different industries.

3.3.4. Capital Structure Decisions: Determinants of Green Financial Leverage; Its Enablers and Constraint

To obtain the objective of the Paris Agreement, a lot of financial resources are needed. These financial resources required to meet the needs of green economic activity or transforming to low carbon economy called green finance or green financial instruments (Dikau and Volz, 2021; Lamperti et al, 2019; Sachs et al, 2019). Advocates of green economy are therefore proposing green finance as vital solution to combat this. Green finance requires a significant shift in investment patterns (Li et al., 2021). Initiatives of green finance include green loans, green bond and issuance of green stocks, green banks, and other new methods of financing green projects are currently being developed. Green bond and green bank some have the potential to aid in the expansion of clean energy. Green banks provide better credit conditions for clean energy projects, as well as expansion of market and financial products through spreading news about the benefit of clean energy. Green bonds due to safety and publicly traded are regarded as the most popular instrument. Green bond supporters believe green bonds as a long-term, less costly capital to refinance a project that it has completed the construction phase and is operating successfully. The development of the green bond market, which raied to about 2.5 trillion dollars has introduced new dimensions to corporate financing. Unlike conventional debt, green bonds require certification, reporting standards, and compliance with environmental taxonomies. These features provide transparency but also increase issuance costs, potentially affecting firms' capital structure decisions (Flammer, 2021; Tang & Zhang, 2020). However, concerns have been raised over greenwashing, where firms issue green bonds without genuinely aligning projects to environmental outcomes, undermining investor trust (Bachelet, Becchetti, & Manfredonia, 2019; Larcker & Watts, 2023).

3.3.5 Capital Structure Decisions: Determinants of Green Financial Leverage; Its Enablers and Constraint AS Basis for Hypotheses Development

In recent years drastic climate change and increased keen interest of environmental

protection alter the financial structure of firms. Firms trying to deliver their commitment to “strive to reach the peak of carbon emissions by 2030 and work towards carbon neutrality by 2060”, by effectively meeting their environmental obligations. This requires a huge challenge to firms, altering capital structure even whole social environment (Wang, 2022). The financing decision of a firm for their operation is essential. A wrong capital structure decision can destroy the value of enterprise. One case is when some investment firms acquired the energy company TXU in 2007. The company made decision of taking debt amount $50 billion. But later on, due to increase in gas production, price of electricity and gas dropped heavily, make the company default as not to meet their financial obligations. So, cost of capital critical while determining capital structure of a firm. (Brealey et al., 2017, p.5).

The decision to adopt green leverage can be interpreted through classical and contemporary theoretical lenses. According to the Modigliani-Miller theorem, under ideal market conditions, capital structure is irrelevant; however, real-world frictions such as taxes, asymmetric information, and policy constraints make financing choices strategically important. Under Pecking Order Theory, firms with ample internal funds tend to avoid external debt, particularly when the cost of green verification and ESG reporting is high. This implies that cash-rich firms may be less inclined to pursue green leverage, even if environmentally aligned. Trade-Off Theory, by contrast, suggests firms weigh the tax benefits of debt against potential bankruptcy costs. In the context of green finance, this translates into a balancing act between environmental impact and financial efficiency. Further, Stakeholder and Signalling Theories provide critical insight into the reputational motivations behind green debt issuance. Firms may use green leverage not only to access capital but also to demonstrate alignment with societal values and investor expectations. These theoretical perspectives collectively frame the empirical investigation of what drives or inhibits green leverage adoption.

Since trade off theory there are a lot of empirical research done related to capital structure. Previous studies examined the optimal financial leverage and identified various factor that cause firms to go for debt financing. Handoo & Sharma (2014) analysed the different factors that impact firm’s capital structure in India. Findings of study suggested that factors as size, asset tangibility, tax rate, debt service capability and cost of debt have significant on capital structure and financial leverage. Similarly, Chen (2003) conducted study to measure the factor of optimal structure of firms listed on Shanghai stock exchange. The findings also indicate that asset tangibility, size and

profitability influence the financial leverage. Moreover Bhabra, Liu, and Tirtiroglu (2008) suggested that size and growth opportunity have positive impact on firm's financial leverage.

Different factors that enhance firm ability to go for green financing are discussed in literature. Financial regulation, regulatory environment and investment structure are main drivers discussed in literature. (D'Orazio & Popoyan;2019). Micro economic factors as foreign direct investment and population size and have a positive influence on green financing (Nawaz et al.; 2021). Jiang et al. (2020), stated that gross domestic product (GDP) and per capita income are major drivers that affect the green financing. A financial mechanism and qualified skills are necessary for the development and deployment of modern and innovative technology (Clark, 2018; Samuwaj, 2018). Technology advancement helps investment risk be reduced as well. According to Chowdhury et al. (2013) decrease interest rate on green investment encourages firms to go for borrowing from banks. A large literature in corporate finance examines how various frictions in the process of raising external capital can cause financial constraints for firms. Study conducted by (Hennessy and Whited, 2007) have assumed that the financial constraints may have a substantial effect on firm's decision including investment and capital structure choice.

Capital structure theories such as the Pecking Order Theory and the Trade-off Theory make one think that for the firm having environmental practices debt financing should be better choice than equity as cost of debt in form of bankruptcy and agency cost would be decline with these practices. Firms with better environmental performance can raise investor trust and reduce information asymmetry and agency costs and can have positive impact on financial decision (Cheng et al. 2014; Li et al. 2021). Firm's environment protection activities can serve as bases for credit buildings reduces the risk associated with leverages, we expect that greenness is important factor in capital structure decision and have positive influence on financial leverage of a firm. Firm's optimal capital structure is the ideal ratio of debt to equity with lowest possible cost of capital. Optimal capital structure makes firm more value to share holder by maximizing its wealth by lowering cost of capital.

3.3.6. Firm's Greenness and Cost of Capital

1. Prices of green debt

Since drastic climate change and increased keen interest of environmental protection for firms and investors to engage with environmentally friendly instruments, issuance of green bonds

has increased over five years followed by increased extensive research about green bond. Several studies compared the prices of green bond with ordinary one (Fatica, Panzica & Rancan; 2019) suggested that green bonds of corporations are priced with small premium as compared to ordinary issued bond. Chava (2014) studied the effect of CSR on firm's rate of return and interest level. The finding of his study suggests that firm with having higher environmental risk tend to have more yield from their loans. In contrast study conducted by Sharfman and Fernando (2008) on effects of environmental risk on cost of capital suggest that firm with their lower cost of capital has had in better position to manage environmental risk. Gianfrate and Peri (2019) studies the extra cost while issuing green bonds. They argue that no doubt issuing, monitoring green bond incur additional cost but their monetary benefit is more than issuing cost of these green bond. In addition, study conducted by Liu and Ge (2015) suggested that firm's CSR performance has positive effect on credit rating and lower yield of issuing new bond. While green debt instruments can lower financing costs for some issuers (the so-called "greenium"), the claim that green leverage is unambiguously cost-effective is contestable. While green leverage instruments such as green bonds and loans are often promoted as cost-effective sources of financing, this assertion requires nuanced consideration. Empirical evidence suggests that while firms may initially incur higher costs due to disclosure, certification, and monitoring requirements, the long-term financial benefits tend to outweigh these short-term expenses. Studies have demonstrated that green debt issuance can lead to lower yields, improved investor confidence, and reduced information asymmetry, collectively known as the "greenium" effect (Flammer, 2021; Zerbib, 2019). However, other studies highlight that compliance with environmental, social, and governance (ESG) standards introduces significant upfront costs, particularly in markets with weak institutional frameworks (Kölbel & Lambillon, 2022; Baker et al., 2023). Importantly, these costs are often proportionally larger for smaller firms or firms in emerging markets, where certification and disclosure burdens can raise the effective cost of green debt and reduce its net cost advantage (Nguyen et al., 2021; Luo, 2024). Therefore, whether green leverage is "cost-effective" depends on market context, firm size, the quality and cost of verification, and the presence of credible investor demand — conditions that must be empirically tested rather than assumed.

In the context of the Alternative Investment Market (AIM), firms operate under a relatively flexible disclosure environment with limited mandatory ESG requirements. Nonetheless, increasing investor scrutiny and societal expectations exert informal pressure on firms to adopt

transparent sustainability reporting and responsible investment practices (Reid et al., 2024). This allows firms to voluntarily align with sustainability norms while facing increasing investor and societal pressure to demonstrate environmental accountability (London Stock Exchange Group, 2023; Reid et al., 2024). Thus, while short-term compliance raises costs, long-term strategic and reputational gains make green leverage an economically and environmentally rational choice. This dynamic creates a dual scenario in which AIM firms balance voluntary ESG engagement with cost considerations, reflecting both reputational incentives and compliance challenges associated with green leverage adoption.

2. Cost of equity (green IPO)

Green IPO is a vital element of the green financial system. Environmentally conscious companies and firms are raising funds through issuing of stock. Green IPO are contributing their efforts for achieving sustainable growth (Mumtaz and Smith, 2019). In literature there are several studies that investigated the impact greenness of firm on cost of equity in last decade (Ng & Rezaee, 2015). From the academic's perspective, the first valuable contribution in term of cost of equity is made by Sharfam & Fernando (2008). Findings of study suggested that environmental practices diminish the cost of equity. Their findings are also confirmed by Kwok, & Mishra (2011), Guedhami, and Reverte (2012); El,et.al (2014); Crifo & Forget (2015). It is commonly agreed that firms' green practices have positive effect on equity cost. Equity cost would be declined by increasing environmentally friendly production. (Ferris, Javakhadze, & Rajkovic, 2017; M.-L. Matthiesen & Salzmann, 2015; Ng & Rezaee, 2015). Their findings revealed that substantial business practices and increased social practices lead to decrease cost of equity.

Long-term financial strategy decisions require careful consideration of a number of internal and external factors, including industry trends, organizational dynamics, and general macroeconomic conditions. A firm's profitability, size, and development potential all have an impact on its green capital structure, according to Zhang et al. (2024). Businesses that maintain a healthy cash flow and consistently turn a profit should think about allocating funds to environmental projects, claim Zhang and Wang (2021). The shift to sustainable business practices is supported by green funding, which these firms are well-positioned to participate in. Additionally, Zhou, M., & Fan, R. (2023) contended that a green capital structure is more conducive to the growth of a business the more cash flow from operations, the more equity

concentration, and the more non-state-owned businesses there are. Green financing markets are more accessible to larger companies and those with significant development potential, which enables them to take the lead in ecologically conscious endeavours (Zhou et al., 2020).

Sector-specific dynamics also have a role in determining the green capital structure. Businesses that operate in sectors with strict environmental restrictions or those situated in ecologically sensitive locations, for example, are more likely to use green finance techniques. Financial institutions, particularly banks, have restricted finance for the conventional coal-fired, high-energy-consuming sector in compliance with the National Carbon Peak and Carbon Neutrality principles. These businesses find it challenging to secure long-term loans to mitigate any possible environmental hazards (Zhou & Fan, 2023). Heavily polluting businesses frequently actively modify their behavioural choices in response to stricter environmental restrictions. These measures help mitigate potential legal risks and enhance corporate reputation (Zhou et al., 2020). Environmental pressures in sectors such as energy generation, utilities, and manufacturing are particularly acute, attracting significant scrutiny from interest groups advocating for sustainable production practices. Consequently, these industries are often compelled to integrate greener financial strategies to meet regulatory and societal expectations (Zhang et al., 2024).

By submitting applications for green financial products, reducing financing costs, and raising financing quotas, financial institutions have aided carbon exchange financing projects and asset management. Government subsidies are one way for businesses to get past their financial obstacles. Government subsidies may support financial or non-financial assets, and they can be given to businesses directly or indirectly. Research and development (R&D) spending is a key factor in the expansion of the knowledge-based economy, which is quickly spreading around the world. According to Browyn H. Hall (2002), business research and development (R&D) efforts are hazardous, have delayed returns, and entail a great deal of information asymmetry since technological innovation is a long-term and ongoing endeavour. As a result, it is crucial to take technological innovation into account when assessing the connection between green capital structure and company performance.

A significant challenge posed by technological innovation is its effect on a firm's ability to raise capital. Typically, firms need to offer tangible assets as collateral when seeking external financing. However, intangible assets, such as patents and developed technologies, are often

excluded from such collateral considerations, thereby limiting the firm's financing capacity. Additionally, the uncertain returns and long lead times associated with technological innovation put added pressure on management decision-making and heighten the risk of financial crises (Weimeng, 2017). As a result, technological innovation often negatively moderates the relationship between corporate debt financing and firm performance, necessitating that firms disclose project-related information to gain investor trust, which can increase the cost of financing and influence the firm's capital structure.

Nonetheless, innovation can positively contribute to the development of green finance and strengthen green leverage. Recent research highlights that innovation can facilitate the adoption of sustainable environmental practices, with companies increasingly integrating green financing into their capital structures to support technological advancements. For example, innovative firms are using green bonds and sustainability-linked loans to finance environmentally friendly projects, aligning their technological progress with green leverage goals (Zhang et al., 2024). By securing green financing, companies can increase their leverage while simultaneously advancing sustainability objectives. This positive relationship between innovation and green leverage demonstrates that companies can achieve both financial and environmental gains through well-planned R&D investments and green finance initiatives. In addition to internal factors like profitability and size, external drivers such as regulatory frameworks, market demand for green products, and investor preferences increasingly shape the adoption of green capital structures. Studies by Hörisch et al. (2022) and Ghosh (2023) illustrate that firms with proactive environmental strategies are more likely to attract investment from green finance markets. Investors are increasingly prioritizing firms that demonstrate a commitment to sustainability, often reflected in lower financing costs and enhanced access to capital. This growing preference underscores the pivotal role of environmental, social, and governance (ESG) factors in modern financial decision-making.

Overall, as green finance continues to evolve, the interaction between firm-specific characteristics, industry dynamics, and regulatory pressures would remain central to the development of a robust green capital structure. The ongoing shift towards sustainable finance highlights the need for firms to align their capital structures with broader environmental objectives, ensuring both financial and ecological resilience in the long term. Capital structure theories such as the Pecking Order Theory and the Trade-off Theory make one think that for the firm having

environmental practices debt financing should be better choice than equity as cost of debt in form of bankruptcy and agency cost would decline with these practices. Firms with better environmental performance can raise investor trust and reduce information asymmetry and agency costs and can have positive impact on financial decision (Cheng et al. 2014; Li et al. 2021). Firm's environment protection activities can serve as bases for credit buildings reduces the risk associated with leverages, we expect that greenness is important factor in capital structure decision and have positive influence on financial leverage of a firm. Firm's optimal capital structure is the ideal ratio of debt to equity with lowest possible cost of capital. Optimal capital structure makes firm more value to share holder by maximizing its wealth by lowering cost of capital.

3.3.7. Study 1's Contribution to the Existing Literature

This study presents a comprehensive analysis of the green capital structure, focusing on its theoretical underpinnings, the factors influencing its selection, and the challenges and opportunities it entails. Drawing on recent empirical research, we identify key determinants influencing corporate environmental financing decisions, with implications for financial management and broader sustainability objectives. Notably, our review highlights the global transition towards sustainable energy, emphasizing the increasing relevance of green capital structures for enterprises worldwide. Additionally, many organizations are likely to face growing pressure to align their financial strategies with environmental goals due to heightened international expectations. Despite these advancements, significant obstacles remain. Limited data availability, varying investor preferences, and the absence of strong legal frameworks and support mechanisms present considerable challenges to the widespread adoption of green financing. Overcoming these barriers is essential for ensuring that green capital structures become an integral part of corporate efforts to meet sustainability targets.

3.4. Hypothesis Formulation: Factors Influencing Green Leverage in AIM

Since every company has a different mix of debt, equity, and retained profits based on its own unique situation and strategic needs, businesses do not all create their capital structures in the same way. But capital structure choices are not decided at random; rather, they are impacted by several factors that help businesses choose the right funding sources. Accordingly, this thesis's main goal is to investigate the financial characteristics of AIM companies and how they influence their capital structure, paying special attention to green leverage. Building on the thorough

literature analysis on capital structure determinants that was provided in Section 3.1, this section methodically compiles and go over pertinent research, concentrating on the specific elements that influence financing choices. The goal is to develop hypotheses that can be empirically tested within the context of this research. By integrating insights from previous studies and identifying key corporate financial characteristics, several hypotheses are proposed to explore the relationship between these characteristics and green leverage decisions.

3.4.1. Internal Financial Resources

Cash flow is an important factor that can influence the financing decisions of firms (D'Amato, 2019; Ozkan, 2001). The relationship between cash flow and green leverage can be supported by multiple theories and empirical evidence from literature. According to pecking order theory, firms with stronger cash flows tend to rely on internal financing before turning to external sources of capital. When it comes to green financing, companies with abundant cash flow are more likely to invest in sustainable projects without needing to raise significant amounts of external debt (Myers & Majluf, 1984). Additionally, cash flow availability allows firms to absorb the higher upfront costs typically associated with green investments while maintaining flexibility in financing decisions (Miller & Modigliani, 1963). In substantial finance cash flow and green leverage is closely related. Studies have shown that positive cash flow facilitates access to green finance markets as lenders and investors perceive firms with stable cash flows as less risky and more capable of meeting debt obligations (Zhang et al., 2021). Furthermore, the dynamic capabilities theory suggests that firms with strong financial performance, indicated by positive cash flows, are better positioned to innovate and adopt green technologies, thereby influencing their leverage structure in a positive manner (Teece, 2007). Overall, firms with solid cash flows are more likely to engage in green leverage, as they possess the financial strength to undertake and support environmentally sustainable initiatives. Positive cash flow help company to invest in green projects by providing necessary capital, while green leverage helps to increase the amount of capital available beyond the company can achieve its own. High level of cash flow leads toward the high level of financial leverage. Zhang and Wang (2021) also suggested that financially strong firms with consistent cash flow should allocate resources towards environmental projects, as they possess the financial capacity to capitalize on available green financing opportunities.

Dividend pay-out refers to the distribution of earnings to shareholders, calculated as

dividends per share divided by net income (Antoniou et al., 2008). This factor significantly influences a firm's capital structure by impacting the firm's retention ratio, particularly by reducing it (Aggarwal & Kyaw, 2010). A lower retention ratio increases the need for external financing, such as debt or equity. Firms that generate sufficient profits to distribute dividends signal strong financial performance and a reduced risk of bankruptcy. As a result, these firms often turn to debt financing to meet external funding needs while benefiting from the tax shield that debt provides. According to Mazur (2007), Tong and Green (2005), Bhaduri (2002), John and Williams (1985), Miller and Rock (1985), and Adedeji (1998), there is a positive correlation between dividend pay-outand leverage, which is consistent with the trade-off theory and pecking order theory.

Most of the literature, however, backs up the opposite position (Antoniou et al., 2008; Bokpin, 2009; Chen & Steiner, 1999; Dang & Garrett, 2015; Frank & Goyal, 2007; Lemmon et al., 2008; Rozeff, 1982). The pecking order theory, put forth by Myers (1984) and Fama and French (2002), states that companies that pay out larger dividends typically have higher levels of profitability and retained earnings. As a result, these businesses are more likely to rely on their own resources rather than outside funding, which reduces leverage. Furthermore, Antoniou et al. (2008) contended that higher dividend payments serve as a signal for anticipated future earnings growth, thereby lowering the cost of equity. Companies that pay out more dividends are therefore more likely to issue equity, which lowers leverage. According to the agency theory, debt and dividends both reduce excess free cash flow within the company and act as tools for management oversight and agency problem mitigation (Jensen, 1986; Jensen & Meckling, 1976). As a result, businesses that use dividends to cut agency costs might require less debt financing (Rozeff, 1982). In summary, Investment and dividend policy are major financing decision that corporate has to make while financing operational activities or project (Asif, Rasool, kamal; 2021). There is a significant relationship between a firm's dividend policy and its green leverage decisions. Firms with higher dividend pay-outs are likely to have lower levels of green leverage, as they prioritize returning profits to shareholders rather than reinvesting in eco-friendly debt instruments. Conversely, firms with lower dividend pay-outs may allocate more resources towards green financing initiatives,

The current study focuses on firms listed in AIM which are rapidly expanding, youthful, small, and medium-sized businesses and preference to allocate more resources towards green financing initiatives, using green bonds or sustainability-linked loans to fund environmental

projects. (Zhang & Wang, 2021).These companies probably have more successful projects that they can reinvest in. The underlying assumption is that dividend policy reflects the firm's financial priorities and may influence the allocation of funds towards green leverage, given the firm's focus on either shareholder returns or sustainability efforts.

H1.1: Firms with stronger internal financial resources—such as higher cash flow and dividend pay-outs—are less likely to adopt green leverage

3.4.2. Structural Characteristics & Firm Financial Profile

Firm characteristics, particularly firm size and firm age and credit worthiness of firm, play a critical role in shaping strategic financing decisions, including the adoption of green leverage. As it affects a company's interaction with external funding sources, firm size has a significant impact on capital structure choices. Bigger businesses often have more access to financing options and benefit that smaller businesses may not have, which gives them a leg up when choosing funding sources. As a driver of capital structure, firm size has been extensively researched and is often quantified by total assets (Sogorb, 2005; Cassar & Holmes, 2003; Hall et al., 2000; Michaelas et al., 1999). The results of the size-leverage connection are still unclear despite a great deal of study, with some studies indicating both positive and negative correlations. The evidence that is currently available, however, indicates that leverage and firm size are positively correlated, with larger firms using more leverage (D'Amato, 2019; Dang & Garrett, 2015; Drobetz et al., 2013; Frank & Goyal, 2009; Antoniou et al., 2008; Gonzalez, 2015; Hall et al., 2000; Guney et al., 2011; Michaelas et al., 1999; Öztekin, 2015; Psillaki & Daskalakis, 2009; Sogorb, 2005; Wald, 1999).

According to Bevan and Danbolt (2002), Rajan and Zingales (1995), and Warner (1977), bigger companies often have stronger debt ratings, more credibility, and better access to loan markets, which explains the positive correlation. According to Graham and Leary (2011), bigger companies are also often more diversified, which lowers their exposure to default and bankruptcy risk. To benefit from tax shelters and advantageous interest rates, bigger businesses are thus more likely to have greater debt levels, especially long-term debt, according to trade-off theory (Daskalakis & Psillaki, 2008). In contrast, research indicating a negative correlation between size and leverage contends that bigger companies are better equipped to handle information asymmetry and transaction costs, which makes them choose equity financing over debt (Fama & Jensen, 1983). Due to increased information asymmetry and financial limitations, smaller businesses have

less access to the capital markets, especially when it comes to long-term loans and equity (Cassar & Holmes, 2003). Due to their tendency to depend more on short-term loans, smaller businesses often have greater total debt ratios than bigger businesses. Research on SMEs typically shows that size and leverage are positively correlated (Bhaird & Lucey, 2010). It may be deduced that their public listing gives them a better market position than non-listed SMEs, given that the sample in this research comprises of AIM-listed businesses, which are generally small to medium-sized organisations. Their improved position makes it easier for them to access the debt market, which lessens funding restrictions. Larger AIM companies are thus probably less likely to go bankrupt, which is in line with trade-off theory and results in a greater leverage ratio.

When applying this reasoning to green leverage, firm size becomes particularly relevant. Larger firms, due to their stronger market position and easier access to capital, are better equipped to engage in green financing initiatives, as they are more likely to attract investors interested in sustainability and are better positioned to bear the costs associated with environmental projects (Zhou et al., 2020). Research by Huang & Kung (2021) supports this notion, demonstrating that larger firms are more inclined to adopt green leverage due to their ability to manage the long-term investments required for green projects. Consequently, the following hypothesis is proposed for further testing in this research. It is hypothesized that Size of the firm has a positive relationship with the leverage ratio.

The age of a firm is a critical determinant in shaping its capital structure, influencing its access to financing options and overall financial behaviour. Older firms tend to have greater profitability, enabling them to rely more on internal resources, thereby reducing the need for external debt financing. This aligns with the hierarchy of financing preferences, where retained earnings are typically prioritized before seeking debt or equity financing. Conversely, older firms, having established their reputation in the debt markets, are often in a favourable position to secure debt at more advantageous terms. As a result, it is reasonable to predict a positive relationship between firm age and leverage, as older firms may seek debt financing despite abundant internal funds, to leverage their established credibility. Harris and Raviv (1991) support this reputational view, positing that firms with longer histories of repaying debt build stronger reputations, leading to lower borrowing costs. These older firms are more likely to opt for safer projects to protect their valuable reputations, while younger firms with limited reputations may engage in riskier ventures in the hopes of surviving without default. If successful, these younger firms may eventually shift

toward safer projects as they mature. Therefore, firms with longer track records experience lower default rates and reduced borrowing costs compared to younger firms.

Despite these theoretical predictions, the empirical evidence regarding the relationship between firm age and leverage is inconclusive. Ramjee and Gwatidzo (2012) highlight that age can serve as a proxy for reputation, suggesting that older firms have acquired sufficient credibility to access debt markets, resulting in a positive relationship between age and leverage. However, they also acknowledge that older, more profitable firms may prefer to rely on internal funds rather than debt, consistent with the pecking order theory, which could lead to a negative relationship between age and leverage. Johnson (1997) finds support for the positive leverage-age relationship, while others, such as Ahmed et al. (2010), Huynh and Petrunia (2010), and Ramjee and Gwatidzo (2012), report a negative association. In the context of green leverage, age could play a pivotal role in determining a firm's ability to access green debt markets. Older firms, having built stronger reputations and financial stability, may be better positioned to take advantage of green financing opportunities, such as green bonds or sustainability-linked loans. Recent studies suggest that firms with longer operational histories are more likely to secure green financing due to their established market presence and commitment to sustainability practices (Bergmann et al., 2020). Therefore, it is hypothesized that firm age would have a positive impact on green leverage, as older firms can leverage their reputations and financial strength to engage in environmentally sustainable financing initiatives. Older firms are better equipped to access green financing options, benefiting from their established reputation and credibility in the market (Bergmann et al., 2020; Harris & Raviv, 1991; Ramjee & Gwatidzo, 2012).

Credit ratings play a pivotal role in shaping firms' financial decisions, particularly during times of financial distress, as highlighted by several studies. They serve as ordinal predictions of a firm's likelihood of default (Orth, 2012) and provide valuable insights into the creditworthiness of firms, influencing their borrowing costs and capital structure decisions (Rogers et al., 2016). The dominance of major rating agencies like Standard & Poor’s and Moody’s, which control the majority of the market share, emphasizes the importance of these ratings in modern financial markets, particularly after the 2008 financial crisis (Duff and Einig, 2009). The primary function of credit rating agencies is to bridge the information asymmetry between debt-issuing firms and investors by evaluating the firms' ability to meet financial obligations. This evaluation not only influences the firms’ access to capital markets but also plays a significant role in determining

borrowing costs, as higher credit ratings often result in lower interest rates and broader access to capital (Kisgen, 2006; Becker and Milbourn, 2011). Regulatory reliance on credit ratings further intensifies their impact across multiple market players, from banks to mutual funds, amplifying the influence of ratings on firms' capital structures (Cantor and Frank, 1994; Kemper and Rao, 2013). Frost (2007) identifies two critical roles of credit ratings: providing timely and accurate information for valuation and facilitating efficient contracting through benchmarking of credit quality. These ratings reduce information asymmetry and can even be considered more significant than a firm's stock market listing (Bosch and Steffen, 2011). Firms with higher ratings tend to rely less on debt issuance due to the lower costs associated with equity issuance compared to debt, as pointed out by Pan et al. (2015).

Capital structure theories such as trade-off and pecking order theories do not fully account for the information provided by credit ratings. Kisgen's (2006) Credit Ratings-Capital Structure (CR-CS) model addresses this gap by empirically demonstrating that credit rating changes significantly influence firms' capital structure decisions. Firms facing potential credit rating changes, especially near the investment grade and speculative grade thresholds, may alter their capital structure by reducing debt issuance to avoid downgrades or to benefit from upgrades. This behavior illustrates the discrete costs and benefits associated with different rating levels, as firms seek to manage their ratings to optimize their access to external financing and minimize costs. While Krichene and Khoufi (2015) found that firms near credit rating thresholds reduce debt issuance, their study also revealed that once firms are upgraded to investment grade, they are more likely to issue additional debt without fearing downgrades. Kemper and Rao's (2013) research corroborated the CR-CS model's application to firms with imminent ratings changes, particularly those with lower credit ratings, though they found that access to debt markets plays a more prominent role in debt reduction than conscious capital structure decisions.

Drawing from these insights, credit ratings can be hypothesized to influence green leverage decisions as well. Firms aiming to improve or maintain high credit ratings might strategically balance their capital structures by incorporating green debt to appeal to environmentally conscious investors while managing their overall leverage. The regulatory and market pressures linked to credit ratings could thus encourage firms to pursue green leverage initiatives as part of their broader financial strategies.

H1.2: Firm structural characteristics, such as size, age, and credit ranking have a significant effect on the adoption of green leverage.

This hypothesis is grounded in the Firm Lifecycle Theory (Mueller, 1972) and empirical capital structure literature (e.g., Frank & Goyal, 2009), which suggest that structural traits such as age and size influence risk preferences, access to capital markets, and willingness to engage in long-horizon investments like green projects.

3.4.3. Firms Growth & Performance

Growth and capital structure formation have a complex relationship that has been thoroughly examined in the literature with differing findings (Benkraiem et al., 2013; D'Amato, 2019; Feng, Ghosh & Sirmans, 2007; Gaud et al., 2005; Hall et al., 2000; Huang, 2006; Michaelas et al., 1999; Palacín-Sánchez et al., 2013; Rajan & Zingales, 1995). According to the pecking order hypothesis (Myers & Majluf, 1984), companies that have plenty of room to develop are often forced to take on additional debt since their retained profits are usually not enough to finance the expansion. Empirical research has shown that in these situations, companies choose debt over stock to minimize the expenses associated with issuing external equity (Michaelas et al., 1999; Palacín-Sánchez et al., 2013; Sogorb-Mira, 2005; Degryse et al., 2012; Tong & Green, 2005; Deesomsak et al., 2004; Awan et al., 2010). According to this viewpoint, expansion and leverage go hand in hand, especially for SMEs, who often have greater difficulty acquiring equity financing.

On the other hand, the trade-off argument points to a negative relationship between leverage and growth. Because their growth assets are intangible and cannot be readily collateralized or used to service debt, firms with significant growth prospects are likely to face significant financial distress and higher agency costs (Arsov & Naumoski, 2016; Billett et al., 2007; Frank & Goyal, 2009; Fosu, 2013; Gaud et al., 2005; Huang, 2006; Kayo & Kimura, 2011; Shah & Khan, 2007). These businesses are more likely to face bankruptcy and have less access to debt funding since intangible assets don't provide much protection from financial difficulties (Titman & Wessels, 1988; Parsons & Titman, 2009). To reduce these risks, it is thus anticipated that businesses with rapid expansion would choose equity over financing (Ahmed & Hanif, 2012). The research mostly supports the pecking order hypothesis in the context of AIM-listed companies, which are rapidly expanding SMEs. Research on SMEs has shown that because of their low retained profits and dependence on outside funding, increased expansion often results in increased

leverage (Cassar & Holmes, 2003; D'Amato, 2019; Forte et al., 2013; Hall et al., 2000; Michaelas et al., 1999). Furthermore, AIM corporations have a special governance structure that includes Nomads, which lessens agency conflicts and excessive risk-taking patterns. Therefore, it is expected that AIM businesses would show a positive correlation between growth and leverage, which is in line with the pecking order hypothesis.

When applying these concepts to the context of green leverage, the relationship between firm growth and green leverage can also be seen as positive. Growing firms are more likely to pursue green financing as part of their expansion strategies, especially in response to increasing regulatory pressures and market demands for sustainability. Green leverage offers an attractive option for firms seeking to align their growth strategies with environmental goals while also benefiting from favourable financing terms related to green bonds and sustainability-linked loans (Huang & Kung, 2021). Hence, firms with significant growth opportunities are expected to exhibit a positive relationship with green leverage, as they seek to finance their sustainable projects while maintaining an optimal capital structure. This leads to the hypothesis that higher growth firms have higher levels of green leverage.

From the perspective of pecking order theory, highly profitable firms are inclined to rely more on internal funds to finance their operations, reducing the need for external debt or equity issuance. Profitability is strongly linked to the availability of internal resources, which suggests that more profitable firms would exhibit lower leverage ratios due to their diminished reliance on external financing (Baker and Wurgler, 2002). Thus, a negative relationship between profitability and leverage is expected. Bartoloni (2013) supports this view, finding that profitable firms are more likely to rely on internal financing, evidenced by the inverse relationship between a firm's debt ratio and its profitability, measured by return on sales. This relationship appears consistent across firms of varying sizes, although larger firms display a lower sensitivity of leverage to profitability fluctuations. These findings are echoed by a wide range of empirical studies (Rajan & Zingales, 1995; Booth et al., 2001; Hovakimian et al., 2001; Faulkender & Petersen, 2006; Antoniou et al., 2008; Frank & Goyal, 2009; Ahmed et al., 2010). On the other hand, trade-off theory suggests a positive relationship between profitability and leverage. According to this view, profitable firms are expected to take on more debt to capitalize on the tax benefits of interest payments and maximize firm value. Hovakimian et al. (2004) argue that greater profitability enhances potential tax savings from debt, reduces the risk of bankruptcy, and mitigates the

likelihood of overinvestment, all of which contribute to a higher target debt ratio. Myers (2001) further contends that firms with higher profitability have more taxable income to shield and are capable of servicing greater levels of debt without increasing financial distress risks. These competing theories can, in fact, complement one another, as suggested by Hovakimian et al. (2004), who posit that profitability likely reflects a mix of pecking order and trade-off considerations. Firms may seek a balance between achieving target leverage ratios while favouring internal funds over external financing when possible. In the context of green leverage, profitability plays a crucial role in enabling firms to take on green debt financing. Recent literature suggests that firms with higher profitability are more likely to pursue green leverage to benefit from favourable financing terms related to sustainability-linked loans and green bonds, while also aligning with their environmental strategies (Huang & Kung, 2021). Thus, a positive association between profitability and green leverage is plausible, as profitable firms are better positioned to utilize green debt as a means to finance eco-friendly projects, enhance their corporate social responsibility, and improve their market standing.

From the standpoint of investors, the Market-to-Book Value (MBV) ratio assesses a company's market value in relation to its book value. This ratio is a key metric in the expensive external financing hypothesis that explains capital structure choices. Companies that have higher MBV ratios are more likely to issue stock since a higher ratio means that financing external equity is less expensive (Myers & Majluf, 1984; Korajczyk & Levy, 2003). The study's use of this variable is relevant as it aims to examine how financial performance affects the capital structure decisions made by NSE-listed companies. Investment advisers, fund managers, and investors use the MBV ratio as a valuation indicator to compare a company's market value (market capitalisation) with its book value (shareholders' equity), according to Marangu and Jagongo (2014). When expressed as a multiple, this ratio helps determine capital structure by indicating the price that shareholders are ready to pay for the company's net assets. Investment possibilities are often represented by MBV, and companies with greater MBV ratios typically expand quickly. The MBV ratio and leverage have an adverse connection since high-leverage companies often pass up good ventures, as stated by Myers (1977) and Stulz (1990). The market timing theory predicts a negative association as well, implying that companies issue or repurchase stocks by taking advantage of favourable equity market circumstances. However, a greater MBV ratio suggests a higher predicted growth rate of the firm's value, according to Merton's (1974) default probability

theory, which suggests a positive link.

The MBV ratio is a key factor in understanding capital structure choices. Firms with higher MBV ratios are more likely to issue equity, driven by the lower external financing costs associated with higher market valuations (Baker & Wurgler, 2002). This rationale forms the foundation of the market timing hypothesis (Obreja, 2013). As firms issue equity in response to favourable market conditions, their leverage ratios deviate from their original targets. This supports the notion that firms prioritize external financing costs over maintaining target leverage ratios (Huang & Ritter, 2005; Mahajan & Tartaroglu, 2008). A negative relationship between the MBV ratio and leverage has been widely documented in capital structure literature (Ogden & Wu, 2013; Frank & Goyal, 2003). Chen and Zhao (2006) examined the roles of MBV and profitability in corporate financing decisions and found evidence favoring the costly external financing theory over the trade-off theory. Their findings suggest that firms with higher MBV ratios issue equity not to adjust their leverage ratios downward but to take advantage of lower external financing costs. Similarly, firms with higher profitability tend to issue debt due to reduced debt financing costs.

Tilehnouei and Shivaraj (2014) studied the relationship between MBV and leverage among firms listed on the National Stock Exchange of India (NSE). Using pooled OLS estimation on data from 139 firms, they found a negative relationship between MBV and leverage in sectors such as FMCG, Consumer Durables, Automobiles, and IT. This relationship, however, was insignificant for other sectors included in their analysis. Hovakimian et al. (2001) also emphasized that stock price changes significantly impact leverage decisions. Firms experiencing stock price increases are more likely to issue equity, leading to lower debt ratios, which aligns with the notion that improved growth opportunities lower a firm's optimal debt ratio (Bhaduri, 2002). While much of the literature highlights a negative relationship between MBV and leverage, Chen and Zhao (2006) argue that the relationship is not always negative. They assert that firms with higher MBV ratios may face lower debt financing costs and, therefore, borrow more. This view challenges the traditional understanding of the negative MBV-leverage relationship, suggesting that the relationship may vary across different firms and industries.

In the context of green leverage, recent research suggests that firms with higher MBV ratios may be better positioned to leverage green financing opportunities. Firms with strong market valuations and growth prospects may find it easier to access green debt markets due to their lower

external financing costs and increased investor confidence in their sustainability initiatives (Fosu, 2013; Margaritis & Psillaki, 2010). As such, a positive relationship between MBV and green leverage is hypothesized, with firms using their favourable market positions to enhance their capital structure through green financing. Firms with higher MBV ratios are better positioned to access green financing opportunities due to their favourable market valuations and lower external financing costs (Fosu, 2013; Margaritis & Psillaki, 2010; Chen & Zhao, 2006).

H1.3: There is positive association between green financial leverage and firm performance and growth

3.4.4. Sustainability Commitment – Firm Green Index

The theoretical background for the influence of a firm's greenness, as measured by a green index, on green leverage is grounded in the increasing role of sustainability in corporate finance. Firms that adopt environmentally responsible practices signal a commitment to long-term sustainability, which enhances their reputation and may lead to preferential access to green financing sources. According to Flammer (2021), firms with higher environmental performance are more likely to access green bonds and loans, as they align with investors' growing preferences for sustainable investments. Furthermore, empirical evidence suggests that firms with robust green credentials experience lower financing costs and are more likely to secure funding at favourable terms due to reduced risks associated with environmental compliance and reputational gains (Cheng et al., 2014). This relationship supports the hypothesis that the greener a firm is, as indicated by a high green index, the higher its ability to leverage green financing, thereby increasing its green leverage**.**

H1.4: There is positive relationship between the firm green index and green leverage.

3.4.5. Innovation & Sustainability

Green patents, encompassing innovations in renewable energy, waste reduction, pollution control, and other sustainable technologies, have been defined by the World Intellectual Property Organization's (WIPO) International Classification List of Green Patents (Wurlod and Noailly, 2018). These patents drive research and development in sustainable fields by granting exclusive rights to innovations, encouraging investments in green technologies (Guo et al., 2018). Additionally, green patents foster knowledge dissemination and technology transfer, enabling

collaboration and the broader adoption of sustainable practices (Nie et al., 2022). Firms holding green patents demonstrate a strong commitment to environmental sustainability and corporate social responsibility, providing tangible evidence of their efforts to develop and implement eco-friendly technologies (Aiello et al., 2021). The existence of such patents not only reflects a firm's proactive approach to mitigating environmental impact but also influences the creation of environmental regulations and sustainable innovation policies (Zhu et al., 2021). Research conducted by D. Li & Shen (2021) showed that green innovation can result in enhancements to a company's environmental performance and have a favourable effect on financial outcomes lead to more green finance requirements that results the development of methods and technology that support trash recycling, pollution reduction, energy efficiency, and the creation of environmentally friendly product designs (Chen, 2008). Firms with higher levels of green patents demonstrate higher green leverage, as they attract increased green financing opportunities by showcasing their innovation and commitment to sustainability. Conversely, firms without such patents may face greater difficulties in accessing green finance, leading to lower green leverage. This is based on the understanding that green patents serve as a signal to investors and regulators regarding the firm’s capacity for innovation and sustainable practices, potentially reducing capital costs and enhancing access to green funding.

The hypothesis that funding in innovation leads to more green finance, particularly green leverage, is supported by a growing body of literature that links innovation financing to enhanced environmental performance and sustainable financial structures. Porter’s Hypothesis posits that strict environmental regulations spur innovation, which can enhance firms' competitiveness and efficiency by adopting more sustainable business practices. As firms invest in green innovation, the development of eco-friendly technologies and processes reduces operational costs, potentially opening access to green financing options like green bonds or green loans, which offer more favourable borrowing terms due to the environmental impact of the projects. Green innovation, being costly, typically requires external funding, and research shows that firms financing such innovation with green leverage can achieve lower capital costs, aligning their financial and environmental goals. Guo et al. (2018) emphasize that green patents, driven by funding for innovation, are a critical component of green leverage because they represent firms’ commitment to sustainability and provide tangible proof of their environmental efforts. This fosters greater confidence among investors, which can translate into better financial conditions for firms

leveraging green assets. (Guo et al., 2018).

Studies on green innovation across different markets reinforce this hypothesis. For instance, Wang et al. (2018) show that in China, green innovation spurred by financial backing, particularly through green leverage mechanisms, results in improved firm performance, both environmentally and financially. In their study, firms that innovated through green financing showed better resilience and adaptability in meeting regulatory and environmental goals. (Wang et al., 2018). Similarly, Albino et al. (2014) found that renewable energy technologies, largely financed through innovation-focused funding, led to significant shifts in the capital structures of firms, favouring more sustainable financing options (Albino et al., 201). Moreover, research by Tolliver et al. (2020) on Asian markets highlights that green leverage not only reduces the cost of financing for green projects but also amplifies firms' capacity to innovate and expand into new eco-friendly markets. Their study reveals that firms utilizing green leverage mechanisms are better positioned to meet global environmental standards and are more likely to attract long-term sustainable financing (Tolliver et al., 2020). In conclusion, the literature strongly suggests that financing innovation through mechanisms like green leverage not only supports firms' sustainability efforts but also enhances their access to green finance, positioning them for long-term financial and environmental success.

H1.5: Firms with higher investment in innovation and greater output in sustainable technologies are more likely to adopt green leverage.

3.4.6. Regulatory & Financial Privileges

The hypothesis that carbon taxes can encourage a transition to green finance and green leverage, as firms seek to avoid the higher costs associated with traditional, carbon-intensive financing, is supported by conventional capital structure theories, particularly the tax shield advantage and Modigliani-Miller propositions. According to the traditional tax shield theory, firms prefer debt financing over equity because interest payments on debt are tax-deductible, lowering the overall cost of capital. In the context of green finance, this theory can be extended to suggest that firms with access to green debt (e.g., green bonds or loans) benefit from tax deductions, while simultaneously avoiding higher costs associated with equity financing (Modigliani & Miller, 1958). As carbon taxes increase, firms that rely on "brown" assets (i.e., fossil fuel-intensive or environmentally harmful activities) face higher tax liabilities due to the environmental penalties

associated with these assets. These taxes increase the overall cost of capital for brown firms, as investors demand higher returns to compensate for the additional tax burden. Conversely, firms that transition to green assets, supported by green financing mechanisms such as green bonds, can reduce their capital costs, benefiting from both lower tax liabilities and favourable financing terms. The theory here aligns with the "trade-off theory" of capital structure, where firms balance the tax advantages of debt with the costs of financial distress (Myers, 1984).

Moreover, the concept of tax shields in green leverage becomes particularly relevant when considering carbon taxes. Firms that issue green bonds or take on green debt are effectively leveraging the tax benefits associated with debt, while simultaneously reducing exposure to carbon taxes. Green leverage allows firms to finance their transition to sustainable practices, thus avoiding the costly equity financing required to restructure towards greener operations. This argument is supported by Tolliver et al. (2020), who found that green bonds not only provide tax advantages but also reduce the financial risks associated with environmental regulations and taxes (Tolliver et al., 2020). Additionally, green debt can be seen as an extension of the pecking order theory, where firms prioritize financing sources based on the least cost. As carbon taxes increase, the cost of equity financing rises for brown firms, making green debt a more attractive option for those seeking to avoid the financial burden of environmental penalties (Myers & Majluf, 1984). The preference for green debt, therefore, is not just a financial strategy but also a means to align with environmental regulations and mitigate the impact of carbon taxes.

Empirical studies support this theoretical framework. For example, Wang et al. (2018) found that firms in carbon-intensive industries that transitioned to green financing instruments were better able to manage the increased costs of capital associated with carbon taxes and other regulatory pressures (Wang et al., 201). Similarly, Guo et al. (2018) emphasized that green leverage through green debt instruments enabled firms to reduce their cost of capital and improve their sustainability profile, further supporting the hypothesis that carbon taxes drive the demand for green financing (Guo et al., 2018) that is consistent with conventional capital structure theories and is further reinforced by empirical evidence from recently studies on green finance and carbon taxation.

Financial privileges including policies and incentives as interest rebate and subsidies given to green firms are the main enablers of green finance. Governments can further support green

investments by providing subsidies, tax credits, and implementing carbon pricing policies (Zhou & Fan, 2023). More interest rebates more demand for debt. that debt financing is preferred over equity due to the tax deductibility of interest payments (Modigliani & Miller, 1958). For green firms, these tax shields are particularly advantageous as they further reduce the cost of financing green projects, incentivizing them to issue more green bonds and other green debt instruments. In addition, as governments offer tax credits specifically targeting green investments, this further enhances the tax shield benefits, making green debt an attractive option for financing sustainable activities. Public measures, such as subsidies and green tax credits, play a crucial role in shaping firms' capital structure decisions. According to Zhou & Fan (2023), government policies that provide direct financial incentives for green investments, such as renewable energy subsidies or subsidies for low-emission technologies, lower the overall costs of these investments. This reduces the effective cost of green debt, encouraging firms to take on more leverage to finance environmentally friendly projects. These financial benefits create an environment where the risk of default is mitigated, making green debt more appealing.

Interest rates are another critical factor that influences capital structure decisions. As noted by Zhou et al. (2020), low-interest rates reduce the cost of borrowing, which encourages firms to finance their operations and investments through debt rather than equity. When governments offer low-interest loans specifically targeted at green initiatives, this further reduces the cost of capital for green projects, promoting the use of green debt. The lower financing costs enable firms to take on more debt to fund environmentally friendly projects, thereby increasing their green leverage. Empirical studies further support the idea that financial privileges drive green debt issuance. For example, Wang et al. (2018) found that firms that benefited from green subsidies and tax credits were more likely to issue green bonds and other green debt instruments, as these financial privileges lowered the overall cost of capital for green investments. Similarly, Zhou et al. (2020) demonstrated that reductions in interest rates encouraged corporations to increase their green debt financing by lowering the cost of credit for environmentally friendly projects.

H1.6: Regulatory and fiscal incentives, such as carbon taxation and green subsidies, have a significant effect on the adoption of green leverage.

3.4.7. Corporate Governance

The proportion of shares held by the largest shareholders is referred to as ownership

concentration. Previous studies have used varying thresholds for this concentration, typically at 5%, 10%, or 20%. Ownership structures can vary widely, either being dispersed among the general public or concentrated in the hands of a few large shareholders. The presence of significant shareholders in a firm's ownership structure can positively influence corporate performance. Such shareholders have the power to influence managerial decisions, including the removal of inefficient managers, thus ensuring that the firm operates more effectively. Agency theory suggests that large shareholders, such as institutional investors, can mitigate agency conflicts by exercising control over management decisions, particularly those related to sustainability and green finance (Jensen & Meckling, 1976). Concentrated ownership, when held by institutions with a focus on ESG, aligns management's interests with long-term environmental goals. This reduces agency costs and encourages the use of green debt as a financing tool for sustainable projects (Hasan & Butt, 2009). In the context of green capital structures, institutional ownership plays a crucial role in steering firms toward environmentally sustainable practices, often through the increased use of green debt. Institutional investors typically have long-term investment horizons and are more focused on environmental, social, and governance (ESG) criteria. These investors encourage firms to adopt green financing strategies, including the issuance of green bonds and other forms of green debt. By concentrating ownership, institutional investors can exert substantial influence over management decisions, ensuring that environmental considerations are prioritized in the firm's capital structure (Zhou et al., 2020). Stakeholder theory further supports this hypothesis by emphasizing that institutional investors, as significant stakeholders, have the power to influence corporate strategy. Their focus on sustainable investments prompts companies to prioritize green financing options, such as green bonds, as part of their capital structure (Freeman, 1984). By advocating for green finance, institutional investors help firms align their financial practices with broader environmental goals.

Board size, representing the number of directors on a company's board, is a critical factor influencing corporate governance and decision-making processes. According to the Cadbury Committee (1992), an optimal board size should range between 8 to 10 members, maintaining a balance between executive (internal) and non-executive (external) directors. Jensen later suggested that a more effective board size is between 7 to 8 members for better governance (Al-Matar et al., 2014). Brown and Caylor (2004) also indicated that a board size between 6 and 15 members can generate optimal outcomes. Lipton and Lorch (1992) argued that smaller boards of around 8 to 9

members are ideal for efficient coordination and timely decision-making, noting that boards with more than 10 members may face challenges in reaching consensus promptly. The size of a board is widely recognized as a significant determinant of corporate governance effectiveness. According to resource dependency theory, larger board sizes can provide benefits by enhancing access to external networks and securing broader resources (Pearce & Zahra, 2007; Tarus & Ayabei, 2016). Multiple studies have demonstrated a positive relationship between board size and firm leverage (Njuguna & Obwogi, 2015), suggesting that larger boards may encourage greater reliance on debt.

However, Tawfeeq, Alabdullah, and Ahmed (2018) found a significant negative relationship between board size and leverage in a study of 100 Jordanian non-financial firms. Their findings suggest that smaller boards tend to adopt higher financial leverage. Conversely, Purag and Abdullah (2016), in their research on Malaysian family-owned companies, reported an insignificant relationship between board size and debt ratio, indicating that the impact of board size on leverage may vary across different contexts. A study by Njuguna and Obwogi (2015) examining East African listed companies revealed that an increase in board size is associated with higher capital leverage. This relationship aligns with the argument that larger boards, by encompassing diverse perspectives and resources, may be more inclined to support financing mechanisms, including green debt, to foster sustainability initiatives. With a larger board, there is a higher likelihood of pushing for environmental governance and aligning corporate strategies with green finance, particularly through green debt financing. Firms that demonstrate strong corporate governance practices are more likely to attract environmentally conscious investors and gain access to financing linked to sustainability. Such firms should have large and independent boards of directors and effective risk control systems, among other governance structures (Zhang et al., 2024). Additionally, institutional investors who prioritize environmental concerns may encourage firms to adopt green capital structures and enhance their environmental performance (Zhou et al., 2020).

The composition of a company's board significantly impacts its operations. Board composition refers to the ratio of inside to outside directors, with the board comprising both executive and non-executive members. Executive directors, also known as dependent directors, are employees of the company, whereas non-executive directors, or independent directors, are external members unaffiliated with the organization. These independent directors provide

oversight and safeguard shareholder interests, while inside directors focus primarily on operational and managerial tasks. The composition of the board plays a crucial role in influencing firm leverage, with a higher proportion of independent directors positively associated with leverage. This is because larger boards, which tend to be less effective, are more likely to be dominated by the CEO. Non-executive directors bring an external perspective to board decisions and are more likely to advocate for sustainable and environmentally responsible business strategies. Their role in monitoring management helps ensure that the company pursues long-term environmental goals rather than short-term profits. As a result, they may encourage the company to finance green initiatives through green leverage—such as issuing green bonds or taking on green debt—to align with environmental goals and improve corporate sustainability performance. According to agency theory, non-executive directors reduce agency conflicts by aligning the interests of management with those of shareholders. Their oversight may lead to the prioritization of green financing mechanisms, as they can hold management accountable for ensuring that the firm meets its environmental targets. This could involve favouring green leverage over traditional forms of debt to support eco-friendly projects (Jensen & Meckling, 1976). Stakeholder theory supports the idea that non-executive directors, representing the interests of broader stakeholders, can push companies towards adopting sustainable practices, including the use of green leverage. These directors often have a responsibility to ensure that the company's actions benefit not only shareholders but also the environment, employees, and the community at large (Freeman, 1984). By influencing the company's governance and financial strategies, non-executive directors can play a crucial role in promoting the use of green debt to fund environmentally sustainable initiatives, thereby enhancing the company's green leverage.

H1.7: Firms with stronger governance, measured through institutional ownership, larger board size, and independent directors, are more likely to adopt green leverage.

Financial sector growth in terms of overall debt size, prevailing interest rate as LIBOR and total emission count by U.K economy are regarded as controlling variables.

3.5. Green Leverage and Stock Price Performance: A Short- and Long-Term Analysis

Following the analysis of the factors influencing the capital structure of AIM companies, the present study looked at the impact of green leverage on stock performance both in short run and long run. The relationship between green leverage—defined as the adoption of

environmentally focused financing instruments, like green bonds and loans—and stock price performance has garnered increasing attention in both academic and financial circles. Green leverage embodies a firm's commitment to environmental responsibility by incorporating sustainable finance options into its capital structure, potentially impacting both its cost of capital and its attractiveness to investors (Flammer, 2021). As firms increasingly align their financial practices with environmental objectives, the influence of green leverage on stock price behaviour has become a critical area of inquiry. This study seeks to explore the short- and long-term price performance implications of green leverage, focusing on how investors perceive and respond to the integration of sustainable finance into corporate strategies. An investor could perceive labelling the green debt as signal of value adding in line with signalling theory. The perception of investor is qualitative measure. This study uses stock price of issuer considered as gauge as investor perception for adding value. This could seem to be a credible signal showing their environmental commitments. Investing in green and sustainable projects, firm wants to send strong and positive signals to market actors toward their commitment and concern for clean and friendly environment and increases the firm's values (Flammer, 2021).

3.5.1. Signalling Theory as a Theoretical Foundation for Analysing Green Leverage Impact on Firm Performance.

Signalling theory, first introduced by Spence (1973), offers insights into how signals mitigate information asymmetry between market participants by transmitting information from those with greater knowledge to those with less. The core of the theory illustrates how the sender of the signal conveys certain information to the receiver, who then uses this information to make decisions. Originally applied to the job market,signalling theory explained how hiring companies often lack insight into candidates' potential productivity. As a result, they rely on certain signals, such as education or experience, to infer future performance. Spence (1973) used education as an example of a signal that the sender can modify, and which holds informational value for the receiver to make informed decisions. Signals may be either intentional or unintentional, but the extent to which the receiver acknowledges the signal depends on its strength and visibility (Ramaswami et al., 2010). The strength of a signal relates to how well it aligns with the underlying information it seeks to convey, enabling the receiver to make accurate judgments. Visibility, on the other hand, determines whether the receiver is able to recognize the signal in the first place. Only when both strength and visibility are present can the sender successfully communicate the

desired attributes (Connelly et al., 2011).

Over time, signalling theory has been applied across various research domains (Connelly et al., 2011). While Spence's initial focus was on job markets, the concept has proven valuable in more complex market structures, such as financial markets (Spence, 2002). Despite assumptions about market efficiency, where investors are expected to incorporate all available information into their decisions, companies inevitably have more insight into their future revenue generation capabilities than investors. As with job applicants knowing more about their skills than prospective employers, companies hold a knowledge advantage over investors regarding their future performance (Ross, 1973). Consequently, investor decisions are often based on perceptions rather than concrete knowledge of a firm's future value. As investors react based on perceptions, signals can convey either positive or negative attributes. Connelly et al. (2011) argue that signals are typically sent with the intent to reduce information asymmetry in favour of the sender, thereby eliciting positive market responses. However, negative signals can also be emitted, often unintentionally, and may impact receiver behaviour. As a result, firms must carefully consider the signals they send to the market when aiming to maximize value.

In recent years, one of the most desirable signals has been a company's commitment to environmental, social, and governance (ESG) practices, particularly its focus on sustainability. Hartzmark and Sussman (2019) demonstrate that sustainability considerations are no longer limited to niche groups of investors but have gained importance across the broader market. Following the introduction of the Morningstar Sustainability Ratings in 2016, a significant reallocation of assets from low-sustainability to high-sustainability funds was observed. Additional research shows that investors respond positively to positive corporate social responsibility (CSR) news (Flammer, 2013) and negatively to adverse CSR events (Krüger, 2015), with a more substantial response to negative CSR-related information. Based on these findings, companies are now increasingly expected to engage in CSR activities (Flammer, 2013). Furthermore, firms with strong CSR profiles not only attract favourable reactions from investors but also build stronger stakeholder relationships, which can generate goodwill from consumers and help attract and retain talented employees (Branco & Rodrigues, 2006).

In the context of green finance, the issuance of green bonds can be viewed as a signal of a company's commitment to sustainability. According to signalling theory, green bond

announcements serve as intentional signals to investors, conveying the firm's alignment with environmental objectives and potentially enhancing its reputation for sustainability. As green bonds signal a commitment to green practices, they may positively impact a firm's share price by attracting investors who prioritize ESG criteria in their investment decisions. Therefore, understanding the signalling effects of green debt, such as green bond issuance, on market performance becomes crucial in analysing its influence on firm value and shareholder returns.

3.5.2. Literature review: Analysing Green Leverage Impact on Firm Performance.

The theoretical foundation for studying the impact of green leverage on stock price performance draws from signalling theory and stakeholder theory. Signalling theory posits that green leverage serves as a signal to the market about a firm's commitment to sustainability, potentially enhancing investor confidence and interest in the firm's stock (Spence, 1973). This signal can attract both institutional and individual investors who prioritize environmental, social, and governance (ESG) factors in their investment decisions, leading to short-term price gains following announcements of green financing initiatives. The positive market response can be attributed to investor perceptions that the firm is likely to benefit from regulatory advantages, cost savings, and reputational gains associated with sustainable practices (Tang & Zhang, 2020). Stakeholder theory further supports the value of green leverage, suggesting that aligning corporate activities with broader environmental goals not only reduces operational risks but also meets the demands of environmentally conscious stakeholders, potentially resulting in a stable and supportive investor base (Freeman, 1984).

Empirical studies have found mixed but often positive associations between green financing and stock performance. For example, Baker, Bergstresser, Serafeim, and Wurgler (2018) report that firms issuing green bonds tend to experience favourable stock price reactions, particularly when these issuances align with stringent environmental standards and reporting requirements. This finding is corroborated by Zerbib (2019), who observes that green bond issuances are often accompanied by lower yields, which could lower a firm's overall cost of debt and create long-term financial benefits. These benefits, in turn, could enhance firm valuation over time as investors incorporate the reduced financial risk and increased reputational capital of green-financed firms into their valuation models. Studies have also suggested that the integration of green debt can influence investor perceptions of a firm's risk profile, especially as regulatory frameworks

become increasingly supportive of green finance. This regulatory support can mitigate perceived risk and contribute to more stable, favourable stock performance (Karpf & Mandel, 2018).

In terms of determinants of stock price, several factors associated with green leverage play a role. Green financing initiatives typically impact firm-specific factors such as leverage ratios, capital structure composition, and cost of equity. A lower cost of debt associated with green bonds, as noted by Tang and Zhang (2020), can make these firms more appealing to investors seeking lower-risk investments, potentially raising stock prices. Additionally, as firms with higher ESG scores often enjoy stronger brand loyalty and customer retention, green leverage can attract environmentally conscious consumers, which further supports firm profitability and, subsequently, stock price stability (Fatemi, Fooladi, & Tehranian, 2015). In addition to firm characteristics, research has also explored what specific aspects of green bonds might contribute to increased firm value. Two main explanations have emerged: the direct economic effects, such as potential reductions in the cost of debt, and the signalling effect of the green label. Baulkaran (2019) argues that risk aversion and the profitability of green projects drive abnormal returns at green bond issuance. Zhou and Cui (2019) and Tamimi and Sebastianelli (2017) support this profitability explanation, noting that green bonds can enhance operational performance, profitability, and long-term growth opportunities through innovation. However, the positive financial effects appear to stem from the underlying green projects rather than the method of financing itself. Conventional bonds, in contrast, often provoke negative investor reactions due to the associated increase in debt (Wolfe, 2009; Roslen et al., 2017).

An alternative explanation for the positive abnormal returns is the additional information that green bond issuances provide to the market. Issuing green bonds requires companies to disclose more details about the projects being financed, enabling investors to better assess the potential profitability of those projects and make more informed evaluations of the firm's future performance (Tang & Zhang, 2020). The type of issuer may also play a role in the market's reaction to green bond issuances. Several studies have differentiated between financial and non-financial (corporate) issuers. Corporate issuers, which use green bonds to finance their own projects, tend to experience larger abnormal returns compared to financial issuers, who use green bonds to finance the projects of others (Lebelle et al., 2020; Wang et al., 2020; Zhou & Cui, 2020). Tang and Zhang (2020) found that corporate issuers saw more significant abnormal returns, particularly for firms where environmental factors had a material impact on financial performance.

Beyond stock market reactions, research has also examined the potential pricing differences between green bonds and conventional bonds, often referred to as the "greenium." While some studies have found evidence of a modest greenium (Zerbib, 2019; Wang et al., 2020), others have found no significant yield difference between the two types of bonds (Flammer, 2021; Tang & Zhang, 2020). However, studies have consistently shown that green bond certification, acting as a signal of legitimacy, enhances the credibility of the green bond and leads to higher abnormal returns (Harjoto & Salas, 2017; Tamimi & Sebastianelli, 2017; Flammer, 2021). Concerns about greenwashing have been raised, but research by Flammer (2021) and Zhou & Cui (2020) suggests that certified green bonds can improve ESG scores and reduce CO2 emissions, further supporting their role as credible signals of environmental commitment. In conclusion, while the greenium's existence remains contested, the signalling power of green bond certification is well-supported, and the positive market reaction to green bond issuance appears to be driven more by the perceived credibility and commitment to environmental initiatives than by direct financial benefits.

3.5.3. Hypothesis Development

From the reviewed literature on stock market reactions to green bond issuances, it can be deduced that investor responses to such announcements are noticeable to some extent. Although there are variations in findings, the prevailing research tends to demonstrate positive abnormal returns surrounding the announcement. This is evident both in the short event windows of 1-3 days (Roslen et al., 2017; Glavas, 2020; Laborda & Sánchez-Guerra, 2021), and more significantly in longer event windows spanning up to 30 days after the announcement (Tang & Zhang, 2020; Wang et al., 2020; Flammer, 2021). Several studies have been conducted to determine the factor that can influence the initial return of stock. Offer price market related variables and firm's own specific characteristics are the major factor documented in literature that influences the initial return. This study is proposed to analyses the firm's green leverage on initial return of stock. We expect as significant impact of green leverage of firm on stock return which means investor perceive this EVENT (announcement issuing of green leverage) as positive activity which mitigate risk of uncertainty therefore lowering initial return.

H2.1: There is significant impact of green leverage on stock return in short run.

From the reviewed literature on stock market reactions to green bond issuances, it can be

deduced that investor responses to such announcements are noticeable to some extent. Although there are variations in findings, the prevailing research tends to demonstrate positive abnormal returns surrounding the announcement. This is evident both in the short event windows of 1-3 days (Roslen et al., 2017; Glavas, 2020; Laborda & Sánchez-Guerra, 2021), and more significantly in longer event windows spanning up to 21 days after the announcement (Tang & Zhang, 2020; Wang et al., 2020; Flammer, 2021). While these studies typically analyse global green bond issuances, many of the samples tend to be predominantly comprised of European bonds. To better understand the market's long-term reaction to green bond issuances, several studies have explored whether investors' responses differ over an extended period. Research suggests that while short-term reactions may show mixed results, long-term effects tend to be more positive. For instance, Tang and Zhang (2020) found that green bonds generally produce positive cumulative abnormal returns (CARs) over longer windows, such as 21 days around the issuance date. Similarly, Wang et al. (2020) demonstrated positive abnormal returns in Chinese markets, extending well beyond the announcement period.

Flammer (2021) reinforced these findings by observing that green bond announcements positively affect long-term stock performance, particularly for firms where environmental factors are material to their financial outcomes. This suggests that investors might assess the long-term benefits of green projects financed by green bonds, leading to sustained positive market reactions. Moreover, long-term positive reactions are often linked to factors like enhanced environmental credibility, improved ESG scores, and reduced CO2 emissions, particularly for certified green bonds. Flammer (2021) emphasized that these certified bonds tend to result in more substantial long-term stock performance, as they signal a stronger commitment to sustainability. This evidence collectively supports the idea that while short-term investor reactions may be uncertain, long-term investor responses to green bonds are generally positive and rooted in the long-term potential of green investments.

From a capital structure perspective, green leverage affects stock market performance through both signalling effects and long-term risk-return trade-offs. Signalling theory (Spence, 1973) suggests that the issuance of green bonds or loans signals a firm’s commitment to sustainability and prudent financial management, which can enhance investor confidence. In the short run, this often results in positive abnormal returns around the announcement date, as evidenced by Laborda and Olmo (2022), Glavas (2020), and Roslen et al. (2017). However, in the

long run, the effects are more nuanced. According to trade-off theory (Kraus & Litzenberger, 1973), the benefits of lower financing costs, enhanced reputation, and reduced regulatory risk may sustain shareholder value only if compliance and monitoring costs remain manageable. Empirical evidence supports this view: Flammer (2021) and Tang & Zhang (2020) find that green bond issuance enhances long-run firm value, while Wang et al. (2020) show that firms integrating sustainability into their leverage structures enjoy more stable investor demand and reduced volatility. Boundary conditions apply in mature markets with strong ESG frameworks, the long-run impact of green leverage is positive due to market trust in certification and disclosure standards. Conversely, in emerging markets, weak governance, high compliance costs, and risks of greenwashing may dilute long-run returns.

H2.2: There is significant impact of green leverage on stock return in long run.

Based on previous research on stock market performance we can conclude that these finding of previous researches support the fact that investors and market participants react positively to event about firm's issuance green bond for short term event announcement (Laborda et al., 2022; Glavas,2020; Roslen et al.,2017) and long term (Flammer,2021;Zhang,2020; Wang et al.,2020).

3.6. Market Reactions to Green Bond Issuance Events: Examining the Pre- and Post-Issuance Impact on Firm Performance

As environmental awareness and sustainable financing practices have gained prominence, green bonds have emerged as a significant tool for firms seeking to signal their commitment to sustainability. Green bonds, designed to fund projects with clear environmental benefits, have become instrumental for companies aiming to attract environmentally conscious investors and gain a reputation for sustainability. This study builds on the growing body of literature that examines the financial impact of green financing mechanisms, specifically focusing on stock market responses to the issuance of green bonds.

3.6.1. Literature Review: Pre- and Post-Issuance Performance in Green Bond Markets

Over the past decade, the issuance of green bonds has surged, driven by incentives for both investors and firms to engage with sustainable financial instruments. This rise has sparked a growing body of research on green bonds. Much of this research focuses on the pricing of green

bonds compared to conventional bonds, commonly referred to as the "Greenium," and the relationship between green bond prices and other financial instruments (Cortellini & Panetta, 2021). A smaller but expanding area of research explores how green bond issuance affects stock prices, particularly examining abnormal stock returns in relation to green bond announcements. The goal is to understand how the market perceives and values green bond issuance and how this translates into tangible impacts on stock market performance (Cortellini & Panetta, 2021). One of the earliest studies on this topic was conducted by Roslen et al. (2017), who used an event study methodology to examine green bond announcements up to 2015. At that time, green bond issuances were still novel, and with a sample of 118 announcements, the authors observed no abnormal returns on the announcement day. However, they did detect significant negative abnormal returns of -1.90% the day before the announcement and a positive abnormal return of 1.17% after the event. The cumulative abnormal returns (CARs) were significant only for a two-day event window of -1 to 0, with a CAR of -2.20%. The authors concluded that while green bonds conveyed some positive information to the market, the increase in debt was still seen negatively by investors.

Subsequent studies have produced mixed results regarding abnormal returns around green bond announcements, often varying by geography and event window length. For example, Zhou and Cui (2020) found positive CARs for financial (0.80%) and non-financial (0.61%) firms in China during a [-1, 1] event window. Similarly, Wang et al. (2020) reported a 0.50% abnormal return for Chinese issuers in a [-3, 3] window. Lebelle et al. (2020) supported Roslen et al.'s (2017) finding of negative abnormal returns, with a CAR of -0.33% during a three-day event window [-1, 1], although most longer event windows showed insignificant results. Conversely, many other studies identified positive abnormal returns over longer event windows. For instance, Baulkaran (2019) found CARs of 1.48% during a 21-day window [-10, 10], and Tang and Zhang (2020) observed abnormal returns of 0.44% for financial firms and 1.88% for non-financial firms in a similar window. These findings suggest that green bond issuances tend to generate positive abnormal returns over longer time periods, though results for shorter windows are less conclusive.

While there is some consensus that green bond issuances tend to lead to positive abnormal returns, the reasons behind this are not entirely clear. Some studies have explored the relationship between firm and bond characteristics and CARs. For example, Baulkaran (2019) found that higher coupons and higher cash flow ratios were associated with negative market reactions, likely due to

expectations that firms with strong cash flows should rely on internal funds before seeking external financing. Similarly, Lebelle et al. (2020) observed a positive correlation between leverage and CARs. Larger firms and those with better growth prospects typically elicit more positive reactions from investors in both studies, despite differences in overall CAR results.

Research on market reactions to green bond issuances has generally shown that such events can enhance firm valuation in the short term, with potential for longer-term benefits as well. For instance, Flammer (2021) finds that the announcement of green bonds tends to yield positive abnormal returns as it signifies a firm's environmental commitment, which is often viewed favourably by investors. This effect aligns with signalling theory, suggesting that green bonds serve as credible indicators of a firm's dedication to environmental, social, and governance (ESG) standards. The immediate reaction often reflects increased demand from investors who prioritize ESG criteria, translating into a short-run boost in stock prices. This price increase can be seen as a reward for the firm's transparency and proactive engagement with sustainable finance (Tang & Zhang, 2020).

However, the literature indicates that the impact of green bonds extends beyond the short term, as investor expectations may be met or adjusted over time based on the actual performance and environmental outcomes of the financed projects. In a study on long-term returns, Zerbib (2019) suggests that green bond issuance can lead to a sustained positive impact on firm valuation. This is partly due to the cost-of-capital advantages that green bonds can offer, as well as the alignment of green bonds with increasing regulatory support for green finance, which fosters investor confidence in a firm's long-term sustainability. Additionally, the enhanced reputational capital gained from green bond issuances often results in lower perceived risk, which can positively influence firm valuation over extended periods (Baker, Bergstresser, Serafeim, & Wurgler, 2018).

Empirical research on market reactions to green bond issuance events demonstrates that these events often lead to positive stock price adjustments. For example, Tang and Zhang (2020) found that green bond issuance announcements generate positive abnormal returns in the days immediately following the announcement, reflecting investor optimism regarding the firm's sustainable financing initiatives. Their findings suggest that green bonds can enhance firm value, particularly when investors view them as a commitment to sustainability rather than a one-time

environmental gesture. Studies by Flammer (2021) and Ehlers and Packer (2017) further reinforce these findings, showing that firms issuing green bonds often experience increased stock prices and improved financial performance. Flammer's research suggests that post-announcement positive abnormal returns are driven by investors' favourable perceptions of the firm's sustainable practices, which align with rising demand for ESG-compliant investments. This view is consistent across both developed and emerging markets, indicating the global significance of green financing as a value-adding strategy. Moreover, studies show that pre-issuance periods may involve market speculation, where stock price fluctuations can occur as investors anticipate the firm's green bond issuance. This speculative effect can influence abnormal returns before the announcement, suggesting that green bond issuance events may have notable impacts on both pre- and post-issuance performance.

3.6.2. Hypothesis Development: Impact of Green Bond Issuance on Firm Performance

Based on signalling theory and empirical evidence from previous studies, this study develops hypotheses to analyse the impact of green bond issuance on firm performance. Specifically, we hypothesize that green bond issuance announcements create significant abnormal returns in both the short term (pre- and post-issuance) and contribute to enhanced firm performance in the long term.

H3.1: The issuance of green bonds has a statistically significant positive impact on firm stock performance immediately following the event date (short-run market reaction).

H3.2: The issuance of green bonds leads to a sustained improvement in stock performance in the long run, as reflected in positive cumulative abnormal returns over an extended post-event window.

CHAPTER 4

RESEARCH METHODOLOGY

4.1. Introduction

In this chapter, the empirical methods used in this thesis are described and discussed. Section 4.3 describes the sample selection procedure and data sources. An explanation of the construction of the variables utilized in the research is given in Section 4.6. To assess the hypotheses presented in Chapter 3, the primary statistical models are discussed in Section 4.4. While the analyses for the final study are covered in Sections 4.4.3 and 4.4.4, the estimate techniques for Studies 1 and 2 are presented in Sections 4.6.1 and 4.6.2, respectively. Furthermore, possible statistical issues like endogeneity and heteroskedasticity that might influence the model results are covered in Section 4.6.5.

4.2. Research Philosophy and Approach

This study adopts a positivist research philosophy, emphasizing objective measurement and empirical testing of hypotheses consistent with Saunders' "Research Onion.". The research approach is deductive, moving from theoretical frameworks to hypothesis testing using quantitative data.

4.3. Research Design

The research design follows a longitudinal quantitative strategy, examining data from AIM-listed firms between 2010 and 2023. The analysis integrates econometric techniques including OLS regression, LASSO for variable selection, and Extreme Bound Analysis (EBA) for robustness checks.

4.4. Data Collection and Sample Selection

The aim of thesis is examining the green capital structure –its enablers and constraints (empirical Study 1) and impact of green leverage on price performance of stocks (empirical Study 2) listed in AIM. The sample of the study included all those AIM firms listed on FTSE 100 over sample period issued green bond over a period 2010 to 2023. AIM market is first market awarded Environmental Finance Bond Award in green, social and sustainability practice in investment, such a sample structure enables to answer the research objectives outlined for the study.

The inclusion of SMEs in this study is justified by both theoretical and empirical grounds. According to the Pecking Order Theory (Myers, 1984), smaller firms with limited financing options often rely on cost-effective debt instruments such as green leverage. SMEs, which dominate the AIM market, represent an important segment for examining financing behavior in less regulated environments.

Recent evidence also suggests that SMEs increasingly adopt green finance mechanisms due to investor demand and policy incentives (Yoshino & Taghizadeh-Hesary, 2022; Boon & Irawan, 2023). Including SMEs thus provides a realistic view of how firm size and financial flexibility influence green leverage decision-insights that are also relevant for markets like the PSX, where small and mid-cap firms prevail.

Furthermore, Purposive sampling was applied to include firms most exposed to sustainability-driven financing. This approach is appropriate for AIM-listed SMEs, which face stricter financing frictions and disclosure trade-offs then segregating this into green and non-green bases on green index. The purpose of my study is to identify enablers and constraints of green leverage and to examine market performance of firms that actually adopt, or have the potential to adopt, green financing tools.Since green leverage is still emerging and not uniformly adopted across all firms, a purposive sample ensures that only relevant firms—those exposed to sustainability reporting, green financing mechanisms, and levered firms—are included. Green leverage—especially green bonds and green loans—is a low-frequency, high-relevance event. Random sampling would risk excluding the firms engaging in green financing. Most sustainability and green finance studies use purposive or criterion-based sampling, such as:selecting firms that disclose ESG data,firms issuing green bonds, or firms in markets with established sustainability frameworks.Thus, purposive sampling is methodologically consistent with established empirical practice.Purposive sampling ensures inclusion of firms experiencing or exposed to green financial decisions and improves statistical power.Although purposive sampling raises representativeness concerns, robustness checks (EBA, LASSO) mitigate potential bias.

The dataset includes both annual and monthly data. Firm-level financials (e.g., leverage, profitability, innovation investment) are collected annually, while stock market data for event study analysis (e.g., returns, market indices) is collected at daily and monthly frequency depending on the study design.

4.5. Conceptual Framework of the Study

The conceptual framework depicts how firm-level, governance, innovation, and policy factors collectively influence the adoption of green leverage and its subsequent impact on stock performance. Integrating capital structure theories—Trade-off, Pecking Order, and Signalling—it positions green leverage (GLEVER) as a mediating construct connecting internal and external determinants with short-term (MAAR) and long-term (BHAR) firm performance, providing a holistic view of sustainable financing decisions and market outcomes.

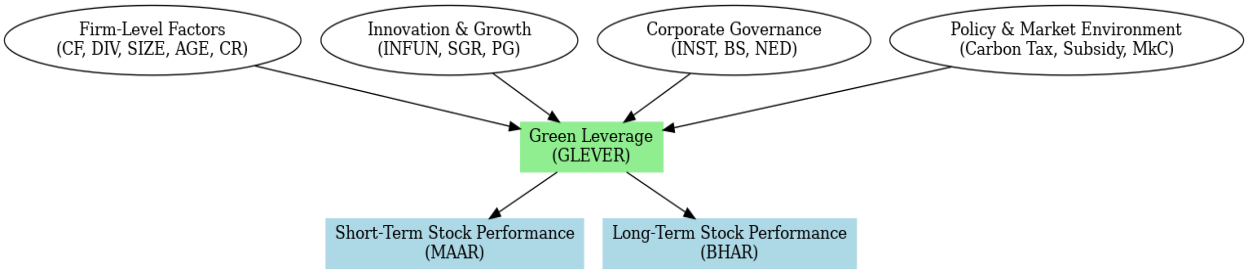


Figure 4.1: Conceptual Framework of Green Leverage

4.6. Measuring the Green Index

By concentrating on investments in green technologies, green debt is a crucial part of green finance for reaching the clean and green environment objective (Mumtaz, 2022). We utilize the green index, created by Mumtaz and Yoshino (2022), to analyse the impact of green leverage on the environment. This index gauges how green a company is. One way to formulate the green index is as follows:

Green Index = [- {percentage of emissions of a firm x weight of CO2 in overall emissions} - {percentage of emissions of a firm x weight of CH4 in overall emissions} - {percentage of emissions of a firm x weight of N2O in overall emissions}]

Where CO2, CH4, and N2O represent the weight of nitrogen oxide, methane, and carbon dioxide emissions, respectively. A company is classified as dirty and non-green if its CO2, CH4, and N2O emissions are greater. -ive symbol denotes emission generation by a linked entity. A higher green index number (-x) indicates a lower degree of greenness for the company, indicating a polluted working environment.

The dataset includes both annual and monthly data. Firm-level financials (e.g., leverage, profitability, innovation investment) are collected annually, while stock market data for event

study analysis (e.g., returns, market indices) is collected at daily and monthly frequency depending on the study design.

4.7. Generalizability and Contextual Relevance

A central contribution of this thesis is to draw lessons for emerging markets, particularly the Pakistan Stock Exchange (PSX). While AIM and PSX differ in regulatory depth and market maturity, both platforms are characterized by small- and medium-sized enterprises (SMEs) with limited access to capital and evolving ESG requirements.

4.8. Variable Measurement

Empirical Study 1: Determinants of Green Leverage

The dependent variable is Green Leverage (GL), measured as the ratio of certified green debt to total assets. Independent variables are grouped into categories (financial resources, governance, firm characteristics, market growth, creditworthiness, and policy environment). Each proxy variable is explicitly defined in formula format to ensure transparency.

Table 4.1

Taxonomy of Enablers and Constraints of Green Leverage

Category	Variables (Proxies)	Expected Relationship	Supporting Theory/Studies
Internal Financial Resources	Cash flow (CF), Dividend pay-out ratio (DIV)	Negative(constraint)	Pecking Order Theory – Myers (1984)
Corporate Governance	Institutional ownership, Board size, Non-executive directors	Positive (enabler)	Agency Theory – Jensen & Meckling (1976)
Firm Characteristics	Firm size, Firm age	Mixed	Trade-off Theory – Kraus & Litzenberger (1973)
Market Position & Growth	Sales growth, Profit growth, Innovation funding	Positive (enabler)	Signalling Theory – Spence (1973)
Creditworthiness	Credit rating	Positive (enabler)	Information Asymmetry – Diamond (1991)
Policy & Regulatory Environment	Carbon tax, Subsidies (financial privileges),	Negative (constraint) / Positive (enabler)	Green Finance Literature – Flammer (2021); Tang & Zhang (2020)

	Compliance costs

Note. Table 3.1 summarizes the enablers and constraints of green leverage, derived from major capital structure and sustainability theories—Pecking Order Theory (Myers, 1984), Agency Theory (Jensen & Meckling, 1976), Trade-off Theory (Kraus & Litzenberger, 1973), Signalling Theory (Spence, 1973), and Information Asymmetry (Diamond, 1991)—and supported by recent green finance evidence (Flammer, 2021; Tang & Zhang, 2020).

To identify the factors that can influence the firm green leverage decision a regression model is constructed with depended on variables of being adaptation of green leverage.

$$GL = \alpha + \beta_1(CF) + \beta_2(DIV) + \beta_3(CR) + \beta_4(INFUN) + \beta_5 PG + \beta_6(SG) + \beta_7(FGI) + \beta_8(BMV) + \beta_9(SIZE) + \beta_{10}(\mathrm{A}ge) + \beta 11(IPs) + \beta_{12}(\mathrm{Debt/BA}) + \beta_{13}(CT) + \beta_{14}(FP) + \beta_{15}(\mathrm{IO}) + \beta_{16}(BSIZE) + \beta_{17}(NOED) + \beta_{18}(IR) + \beta_{19}(CE) + \beta_{20}(FSG) + \varepsilon i$$

The table below is the summary of all the above-explained variables.

Table 4.2

Variables and Their Expected Sign for Hypothesis Development

Variable	Proxy / Measurement	Formula
Green Leverage (GL)	Green debt scaled by total assets	GLEVER = Green Debt / Total Assets
Cash Flow (CF)	Operating cash flow scaled by assets	CF = Operating Cash Flow / Total Assets
Dividend Payout (DIV)	Cash dividends scaled by net income	DIV = Cash Dividends / Net Income
Firm Size (SIZE)	Natural log of total assets	SIZE = ln (Total Assets)
Firm Age (AGE)	Years since incorporation	AGE = Current Year – Incorporation Year
Credit Rating (CR)	Bloomberg long-term issuer rating (scaled 1–10)	CR = Credit Rating Index
Innovation Funding (INFUN)	R&D expenditure scaled by assets	INFUN = R&D Expenditure / Total Assets
Sales Growth (SG)	Annual growth in sales	SGR = (Sales_t – Sales_t-1) / Sales_t-1
Book to Market value (BMV)	by taking book value and dividing to its market value	BMV = $\frac{market\ value}{book\ value}$
Profit Growth (PG)	Annual growth in net income	PG = (Net Income_t – Net Income_t-1) / Net Income_t-1
Institutional Ownership (INST)	Shares held by institutions	INST = Institutional Shares / Total Shares
Board Size (BS)	Number of directors on the board	BS = Count of Directors

Non-Executive Directors (NED)	Number of independent directors	NED = Count of Non-Executive Directors
Carbon Tax (CT)	Dummy: 1 if carbon tax present, 0 otherwise	CT = {1, if carbon tax imposed; 0, otherwise}
Green Subsidy / Financial Privileges (FP)	Dummy: 1 if subsidies exist, 0 otherwise	FP = {1, if subsidies present; 0, otherwise}
Market Activity (MkC)	Dummy: 1 if hot market, 0 otherwise	MkC = {1, if market return > avg; 0, otherwise}

Notes: CF = Cash Flow; DIV = Dividend payout ratio; SIZE = Firm Size; AGE = Firm Age; SG = Sales Growth; PG = Profit Growth; INFUN = Innovation Funding; CR = Credit Rating; CT = Carbon Tax; FP = Financial Privileges/Subsidies; BS = Board Size; NOED = Non-Executive Directors; INST = Institutional Ownership. GLEVER = Green Leverage, measured as Green Debt / Total Assets. Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.10.

Table 4.3

Controlling Variables

Controlling Variables	
C.E	Total emission by U.K economy
Interest rate	LIBOR
Financial Sector Growth	Overall debt size growth

4.8.1. Dependent Variable: Green Leverage

To measure the optimal level of capital structure of green firms, the current study use green financial leverage or green debt. Green Financial leverage can be defined as proportion of total green debt to capital structure. This measure has been employed in a number of studies, such as Frank & Goyal (2009), Oztekin & Flannery (2012), Oztekin (2015) & Belkhir et al. (2016) it means firm asset are acquired by green debt financing. Green leverage=total green debt/ total asset. It can be mathematically described as follows:

$$\text{Green Leverage} = \frac{total\ green\ debt}{total\ assetts}$$

Green leverage = total green debt/ total asset

Total green debt = green loans +green bonds.

4.8.2. Independent Variables: Determinants of Capital Structure

The mathematical computations for each of the explanatory variables in the model are

described in this section, and the expected correlations between these variables and capital structure are given in Section 4.3, as described in the section on hypothesis development.

Cash flow: cash flow defined as the amount of cash that a business has on hand for operating expenses (Mateev et al., 2013) and is measured by dividing operating cash flow through operating cash flow divided by total assets.

$$\text{Cash flow} = \frac{operating\ cash\ flow}{total\ asset}$$

Dividend Pay-out: The terms under which a business pays dividends to its shareholders are reflected in its dividend pay-out policy. In line with previous research, the dividend pay-out ratio (Div. Pay-out) is determined by dividing the dividend per share by the earnings per share, or net income after preferred dividends, and then dividing that figure by the number of outstanding common shares (Adedeji, 1998; Antoniou et al., 2008; Dang & Garrent, 2015; Huang et al., 2010).

$$\text{Dividend Pay-out} = \frac{divedend\ per\ share}{earning\ per\ share}$$

Credit Rating: Credit Ratings are used as assigned by credit rating agencies, the largest of which are Standard & Poor's, Moody's and Fitch Ratings. They use letter designations such as A, B, C. Higher grades are intended to represent a lower probability of default.

$$CR\_it = \text{Credit Rating Index (scaled 1–10)}$$

Innovation funding: Innovation funding as Dummy variable (1=innovation, 0=otherwise)

Profitability: Profit growth is measured as Percentage change in EBIT and is calculated:

$$\text{Profitability} = \frac{\text{EBIT}}{\text{total asset}}$$

Sale Growth: Sales growth is calculated as Percentage change in Sales revenue followed by various studies such as Fan et al. (2012); Flannery & Hankins (2013); Chang et al. (2014); Kieschnick & Moussawi (2018) and Li et al. (2019).

$$\text{SG} = \frac{\Delta\text{SALE}}{SALES}$$

Firm green index: To analyse the effect of green leverage on environment we use green index, developed by Mumtaz and Yoshino (2022) with amendment. This index measures the greenness level of firm. Formulation of green index can be expressed as:

Green Index = [- {percentage of emissions of a firm x weight of CO2 in overall emissions} - {percentage of emissions of a firm x weight of CH4 in overall emissions} - {percentage of emissions of a firm x weight of N2O in overall emissions}]

Where CO2, CH4, and N2O are the weight of emissions of carbon dioxide, methane, and nitrogen oxide respectively. If the emissions of CO2, CH4, and N2O are higher, the firm is considered as polluted and categorized as non-green firm. -ive sign shows production of emission by related firm. More the green index value (-x) means low level of greenness of firm shows firm working is polluting environment.

Market – book value: Market to book value is calculated by taking market value and dividing to its book value.

$$\text{BMV} = \frac{market\ value}{book\ value}$$

SIZE: Firm size is measured using the natural logarithm of a firm's total assets. This approach to measuring firm size is commonly applied in existing literature (e.g., Belkhir et al., 2016; Fan et al., 2012; Flannery & Hankins, 2013; Jõeveer, 2013; Kieschnick & Moussawi, 2018; La Rocca et al., 2010; Lemmon & Zender, 2010; Lucey & Zhang, 2011; Matteva et al., 2013; Oztekin, 2015; Van Hoang et al., 2017).

Size = log (Total Assets)

IPS: No of Invention Prospectus issued in a year.

Debt to book value of assets: Debt to book value of assets is measured by Ratio of total debts to the book value of assets.

DBA= Total debt/ Book value of Assets

Financial privileges: Financial privileges including polices and incentives as interest rebate and subsidies given to green firm.

FP_t = {1, if subsidies present; 0, otherwise}

Institutional ownership: No of shares held by institutions

$$\text{I.O} = \frac{\text{Institutional share}}{\text{total outstanding shares}}$$

Board Size: No of directors

No of Non –Executive Directors (NOED): No of non-executive directors

Carbon Tax (CT): CT_t = {1, if carbon tax imposed; 0, otherwise}

Market Activity (MkC):

MkC_t = {1, if market return > historical average; 0, otherwise}

4.8.3. Controlling Variables

Total Emissions by the U.K. Economy, LIBOR Interest Rate, and Financial Sector Growth are treated as controlling variables to account for external influences that might affect a firm's capital structure and green financing choices. Below is a detailed explanation of each variable along with literature that has employed similar variables in determining leverage and green finance decisions.

4.8.4. Total Emissions by the U.K. Economy (C.E.)

This variable captures the overall environmental footprint of the U.K. economy, reflecting the total greenhouse gas emissions. This measure is relevant as regulatory pressures on firms to reduce carbon emissions are linked to their financing decisions, particularly when it comes to green leverage. As firms are increasingly required to meet environmental standards, their capital structure decisions may shift toward more sustainable and green financing options. Studies such as Hsu, Chen, and Chen (2020) discuss how national environmental policies and emission targets influence corporate financing, pushing firms towards green bonds and other sustainable finance instruments. Furthermore, Delmas and Toffel (2008) highlight that higher national emissions often lead to tighter regulatory frameworks, encouraging firms to adopt green financing strategies to signal compliance and reduce regulatory risks.

4.8.5. LIBOR (Interest Rate)

The London Interbank Offered Rate (LIBOR) represents the benchmark interest rate at which major global banks lend to one another. Interest rates have a direct influence on a firm's debt decisions, including leverage. Firms are likely to adjust their leverage ratios based on the prevailing interest rates. When interest rates are low, firms might find it cheaper to finance through debt, including green debt instruments, leading to higher leverage. Studies like those of Graham and Harvey (2001) and Frank and Goyal (2009) discuss the influence of interest rates on corporate

leverage. In the context of green financing, Zerbib (2019) shows that green bonds can sometimes benefit from lower yields, reflecting lower interest costs, which could make green leverage more attractive during periods of low interest rates.

4.8.6. Financial Sector Growth (Overall Debt Size Growth)

This variable reflects the overall growth of the financial sector, particularly the expansion of debt financing. Growth in the financial sector can lead to increased availability of debt capital, including green finance products, which firms can use to finance environmentally friendly projects. This could result in an increase in the use of green leverage as part of a firm's capital structure. Studies such as Pagano, Panetta, and Zingales (1998) and Rajan and Zingales (1995) explore the relationship between financial sector growth and firm leverage. On the green finance side, researchers like Karpf and Mandel (2018) examine how financial sector innovations, including the rise of green bonds, provide firms with new financing opportunities for sustainable projects, potentially influencing their leverage decisions.

4.9. Event Study

Event studies are a widely employed empirical method in finance and economics to measure the impact of specific events on the value of firms. This methodology aims to quantify the abnormal returns, or deviations from normal returns, that occur around the announcement or occurrence of an event, such as a bond issuance, merger announcement, or earnings report. The foundational theoretical framework for event studies was established by Fama, Fisher, Jensen, and Roll (1969), who introduced the concept of abnormal returns in relation to efficient market theory. Over the years, the event study methodology has evolved and been refined, with significant contributions by researchers like Brown & Warner (1980, 1985) and MacKinlay (1997), who improved the accuracy and robustness of the statistical methods used in event studies.

The core principle behind event studies lies in the semi-strong form of the Efficient Market Hypothesis (EMH), which posits that financial markets quickly incorporate all publicly available information into asset prices. Therefore, when new information, such as the issuance of green bonds, is announced, it is expected to be reflected almost immediately in stock prices. Event studies test this premise by examining whether the stock prices of firms deviate from their expected returns due to the event.

In the context of green finance, event studies have been extensively used to examine the stock market's reaction to announcements of environmentally responsible actions, such as green bond issuances, green investments, and sustainability initiatives. Flammer (2021) conducted an event study to evaluate how the issuance of green bonds affects stock performance, finding that companies issuing green bonds experience positive abnormal returns around the announcement date. Similarly, Tang & Zhang (2020) extended the analysis by examining green bond announcements' effect on both short-term and long-term stock performance, providing additional insights into the market's perception of green financing.

To estimate the abnormal returns associated with green bond issuance, we employ an event study centred on the announcement date. The announcement date, rather than the issuance date, is selected because it is when new information reaches the market. In this study event is considered as issuance of green debt or firm going for green leverage. Event window is the day of announcement.

This study examines antecedents before events to find out factors We use official announcement dates from Eikon to ensure consistency, but in line with previous research (Flammer, 2021; Tang & Zhang, 2020), we also perform the event study with announcement dates sourced from the Bloomberg database for comparability. To calculate abnormal returns around the event, we first need to estimate the normal returns of the firm, following MacKinlay's (1997) guidelines. For this, we rely on historical stock return data and employ the market model:

$$R_{it} = \alpha + \beta R_{mt} + \varepsilon_{it} \quad \text{..... (1)}$$

Where the daily return of stock R_{it} is regressed against the daily return of the relevant market index R_{mt}. The market index is specific to the country where the stock is traded, using all-share indices to reflect the overall market movement. We further conduct an additional event study with MSCI country indices to confirm the robustness of our results under different conditions.

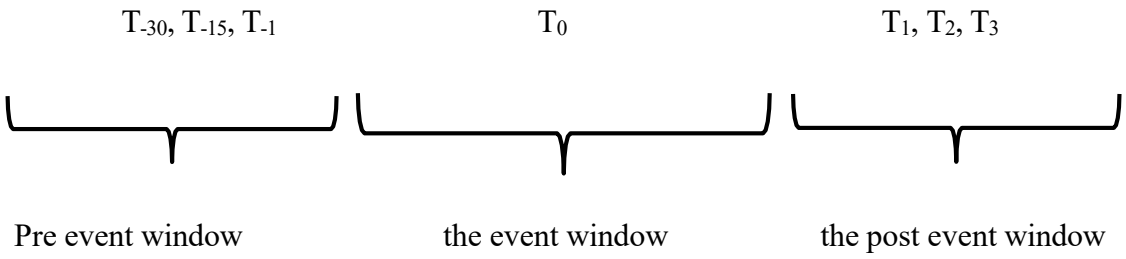
For analysing daily stock returns, the market model has been shown to perform effectively, with no need for multifactor models (Brown & Warner, 1985; MacKinlay, 1997). It is a commonly used method for estimating normal returns in event studies within finance research (Corrado, 2011) and is also frequently used to estimate abnormal returns around green bond issuances (Cortellini & Panetta, 2021). The parameters α and β are estimated using OLS regression, and the abnormal return $ARit$ is derived from the difference between the actual return R_{it} and the expected return

derived from the market model:

$$AR_{it} = R_{it} - (\hat{\alpha} + \beta R_{mt}) \quad \text{..... (2)}$$

Abnormal returns are calculated for each event across every day in the event window(s). Using the announcement date as day 0, we calculate cumulative abnormal returns (AR) for the primary event window [0, 1], [0,15], [0,30] days. For comparability with prior studies, we also examine a period before and after the main event window, [-30, 0], [-15, 0] and [-1, 0]. The AR for each time interval TTT,

4.9.1. Event Study Timeline



- The pre-event window period is T_{-30}, T_{-15}, T_{-1}.
- The event window is T_0
- The post-event window is T_1, T_2, and T_3. It is 3 years after announcement of event.

To find out determinants of green leverage (antecedents) we use 5 years prior to find what are enablers and barriers of firms going for green leverage and post event window is 3 years to find its impact. Market adjusted abnormal returns (MAAR) and Buy- And-Return (BHAR) Abnormal Return is calculated to measure the short and long run performance of green stock respectively. The reason behind this to investigate the impact of green leverage on stock performance.

4.9.2. Market Adjusted Abnormal Returns (MAAR)

To find out the impact of green leverage on post stock performance market adjusted abnormal returns (MAAR) are computed for each firm using FTSE index as a benchmark over first trading month of listing day of an Event. Event is going for green leverage ones. In literature this technique is first adopted by Aggarwal, Leal and Hernandex (1993) to measure the short run performance of firm's stock. Follow by the approach adopted by Boslton et al. (2010) MAAR

(Market adjusted abnormal return) for 1, 15,30th [day] is calculated.

$$MAAR_{it} = \left[\left(\frac{1 + R_{i,1}}{1 + R_{m,1}}\right)\right] \times 100$$

Where is $R_{i,1}$ the stock return which is equal to

$$R_{i,1} = \frac{p_{i,1} - p_{i,o}}{pi, o}$$

and $P_{i,t}$ is price of stock *i* and time at *t* respectively. P_{io} is the offer price of stock *i* $R_{m,,t}$ is the market return at time t, $I_{i,t}$ is the value

Market index at time t of stock *i*, and $I_{i,o}$ is the market index value.(FTSE 100)

4.9.3. Buy-and-hold Abnormal Return (BHAR)

To measure the long run performance of firm's stock buy- And-Return (BHAR) can be used. In long run we would measure the stock price performance for 1, 2 and 3 years over a period of 36 months starting from the closing price on the first day of trading after an event. Buy and hold abnormal return is calculated as:

$$BHAR_{it} = \prod_{t=1}^{\pi}[1 + R_{it}] - 1\} \qquad (3)$$

Firm's BHAR *i* and *t* are adjusted size and time based on firm index is calculated. Positive BHAR of a firm is considered as an indicator of improved performance of stock compared to benchmark return during time period.

4.10. Econometric Technique

4.10.1. Regression Analysis

Ordinary Least Squares (OLS) regression technique is used to test the theories to evaluate the factors that enhance and restricts firm's propensity to go for green leverage (e.g. Beatty et al., 2000; Pukthuanthong -Le, 2008)). OLS is a statistical technique of measuring coefficient of liner regression equation. It commonly describes the relationship between one or more than one dependent quantitates variables on independent variables. In this study we use OLS technique to measure the determinants of green leverage.

$$GL = \alpha + \beta_1(CF) + \beta_2(DIV) + \beta_3(CR) + \beta_4(INFUN) + \beta_5 PG + \beta_6(SG) + \beta_7(BMV) + \beta_8(SIZE) +$$

$$\beta_9(age) + \beta_{10}(GMER) + \beta_{11}(IPs) + \beta_{12}(\text{Debt/BA}) + \beta_{13}(CT) + \beta_{14}(FP) + \beta_{15}(\text{IO}) + \beta_{16}(BOARDSIZE) + \beta_{17}(IR) + \beta_{18}(FSG)+) + \beta_{19}(CE) + \varepsilon_i.$$

This study applies *robust regression* to test the propositions as stated earlier. The objective of employing this method is that other methods do not have ability to adjust outlier. To solve the problems of outlier in statistical techniques, OLS with perception of robust regression is used by many researchers. In the first step, we use the robust regression for determine the potential impact of all variables on the valuation. The primary model for residual function selection is as follows:

$$Huber\ Model = \begin{cases} \dfrac{X^2}{2}, & if\ |X| \le c \\ c|X| - \dfrac{c2}{2}, & otherwise \end{cases}$$

Robust R^2 statistic of robust regression is defined by Maronna & Morgenthaler (1986) as:

$$\frac{\sum^{n}{}_{i}{}^{=1} pc\left(\frac{y_i - \mu}{\delta\omega_i}\right) - \sum^{n}{}_{i}{}^{=1} pc\left(\frac{\tau}{\delta\omega_i}\right)}{\sum^{n}{}_{i=1}\ pc(\tau/(\delta\omega_i))}$$

After analysing abnormal returns in various subsamples through event studies, we intend to further investigate the potential determinants of cumulative abnormal returns (MAARs, BHARs) using an Ordinary Least Squares (OLS) regression. In this model, we incorporate all the variables previously introduced in the data chapter, which have been identified as potential influencers of MAAR based on the literature review. Through this model, our objective is to examine (1) whether investors respond more positively to stronger signals of environmental commitment, and (2) whether the characteristics of the issuer influence investor reactions. The model is formulated as follows:

$$Initial\ \ Return\ = \alpha_0 + \alpha_{1Greenleverage} + \alpha_{2initalreturn} + \alpha_{3Size} + \alpha_{4Risk} + \alpha_{5OSiz} + \alpha_{6Bsize} + \alpha_{7\,io} + \alpha_{8WAAC} + \alpha_{9marketcondition} + \varepsilon_i$$

The MAAR used as a dependent variable in the regression, MAAR calculated for each event *i*, for the primary event window [0,1] [0,15] [0,30], where initial return *i* is market-adjusted returns at the first trading day. Green leverage is measured as green debt issued. $Size_i$ is the size of firm which is natural log of total assets, $Risk_i$ is regarded the aftermarket risk of IPO , calculated as the standard deviation of first 30 trading days post-issue pricing, $FinLev_i$ is calculated as ratio of total debt to total assets, $BoardSize_i$ is the number of Board Directors, Institutional $Ownership_i$

is the no of the IPO firm owned by institutional investors, $OSize_i$ is the logarithm of offer size which is calculated by multiplying offer price with total numbers of shares. WAAC is the weighted average cost. Marketcondition regarded as controlling variable about market condition either the market is hot or cold. Trend of market hot and cold is proxy by 1 and 0.

In next step for sensitivity analysis of explanatory variables and robustness of result in this study we use statistical technique *Extreme Bound Analysis (EBA)* and least absolute shrinkage and selection operator (LASSO). Leamer (1983, 1985) developed EBA technique and Levine and Renelt (1992) applied this method to find out the factor to determine economic growth. The theory does not specify which variables should remain constant when applying any statistical technique or model. Leamer and Leonard (1983, p. 307) suggested that EBA reduces the uncertainty of model. The model is regarded to be robust if the coefficient of estimate remains same and significant having same sign even the change of explanatory variables. Extreme Bound Analysis is applied on simple OLS or liner regression to find the determinants of green financial leverage. We construct the following regression to find the robust predictors (Moosa and Cardak, 2006):

$$\text{Green leverage} = \beta 0 \sum_{xi=1}^{n} \beta c \ X_{ixi} + \mu$$

$$\text{Green leverage} = \beta 0 \sum_{xi=1}^{n} \delta c \ X_{ixi} + \mu + \beta_Q + \sum_{xi=1}^{m} \delta c \ Z_{ixi} + \mu$$

We estimate the coefficient of the variable of interest Q (green leverage) as a sensitivity and robustness indicator. To estimate the coefficient of independent variable robust regression techniques requires many regressions. The dependent variable Q (variable of interest) along set of variables z are selected from predefined pool and fixed variable X are contained within every array of regression.

Moreover, to acquire more precision about model specification and variable robustness, this study used LASSO regression which is extensively used both in variables selection and measure model accuracy. Multicollinearity is a very serious issue in regression analysis. The Ordinary Least Squares (OLS) estimates are obtained by minimizing the residual sum of square (RSS). But the fact is that multicollinearity severely impact on RSS and OLS method does not work properly. Typically, the following two issues occur on OLS model: 1 precision Accuracy and 2. Model interdependently.

Parsimony is an important issue when the number of predictors is high.in case of multicollinearity OLS performs poorly. penalization strategies to improve OLS such as ridge regression but it has the problem although it minimizes RSS but however it can't generate parsimonious model as it still retains all predictors in model (Brieman,1985). Tibshirani (1996) suggested promising method called LASSO. The LASSO is penalized form OLS does both continues shrinking and automatic selection at same time due to the existence of penalty 1. However, as variable selection becomes more important in modern analysis the LASSO is much more appealing due to its spare representation. In this study we use LASSO technique to select factors that determine capital structure or divers of green financial leverage from the above stated variables. We expect LASSO as predetermined technique to identify the sparse set of optimal capital structure. The LASSO estimator is the OLS estimator with an L1 penalty term:

$$\text{GL} = \frac{1}{2m}\sum_{i=1}^{m} y\text{-}\beta_{0+}\sum_{j=1}^{r} xi\ \beta\text{j})^2$$

LASSO, which employs an L1 penalty, reduces some coefficients to zero. The key factor influencing this is λ, which determines the strength of the penalty. When λ = 0, the coefficients are equivalent to those in a simple linear regression, with no shrinkage applied. Conversely, when λ approaches infinity, all coefficients are reduced to zero. For values of λ between 0 and infinity, the coefficients fall within this range, balancing these two extremes. This balance allows LASSO to function as a penalized OLS method, simultaneously shrinking coefficients and performing automatic variable selection due to the penalty term in the linear regression model. As λ increases, more coefficients shrink to zero, resulting in fewer selected variables.

In recent years, LASSO has emerged as a valuable tool for variable selection in finance. Tiene et al. (2015) used the LASSO method to identify key factors related to bankruptcy, finding that it offers better variable selection capabilities compared to methods used in previous studies. Similarly, Nazemi and Fabozzi (2018) demonstrated that certain macroeconomic variables selected using LASSO outperformed other models in predicting recovery rates. In this study, we anticipate that the LASSO method served as an effective variable selection tool for identifying the factors that influence green leverage.

4.10.1.1. Heteroskedasticity

The existing literature provides substantial evidence that the use of panel data can help

alleviate the issue of heteroscedasticity, as demonstrated in works by Baltagi (2005) and Wooldridge (2002). However, when dealing with panel data, several analytical challenges can arise that may influence the outcomes of regression analyses. These challenges include multicollinearity, heteroscedasticity, autocorrelation, and reverse causality. For Ordinary Least Squares (OLS) regression, four key assumptions need to be met, one of which is homoscedasticity, the assumption that the variance of residuals is constant. Heteroscedasticity, which occurs when the variance of residuals is not constant, violates this assumption, potentially leading to inaccurate standard error estimates. To address heteroscedasticity, one widely accepted method is the use of robust standard errors, as suggested by White (1980), which adjusts the standard errors without altering the coefficients. This approach has been utilized by researchers such as Baltagi (2005), Psillaki and Daskalakis (2009), and Wooldridge (2002), to improve their models.

4.10.1.2. Endogeneity statistical issue

While ordinary least squares (OLS) with robust standard errors can address problems such as multicollinearity, heteroscedasticity, and non-normality of error terms, it falls short in eliminating bias caused by endogeneity. Endogeneity arises when an independent variable (Xi) is correlated with the error term (u) in a regression model, as highlighted by Gujarati (2004). This issue typically stems from three main sources: reverse causality, omitted variables, and measurement errors. Reverse causality occurs when the dependent variable (Y) influences the independent variable (X), creating a feedback loop. For example, a firm's capital structure decisions may influence characteristics like profitability or size, which in turn can shape future capital structure choices. One way to address this issue is to use lagged independent variables, as suggested by Rajan and Zingales (1995). This approach ensures that past firm characteristics remain unaffected by current leverage decisions. Omitted variable bias arises when a key variable is excluded from the model, leading to an endogeneity problem due to the correlation between the omitted variable and other explanatory variables. Instrumental variables, as recommended by Wintoki et al. (2012), can address this issue. For an instrument to be effective, it must be correlated with the endogenous variable but uncorrelated with the error term, ensuring unbiased and consistent parameter estimates.

Potential endogeneity issues were addressed through lagged covariates and robustness checks. While GMM/IV methods were considered, the dataset’s structure limited their

applicability. LASSO regression and Extreme Bound Analysis provided alternative strategies, ensuring that results are not sensitive to variable selection bias. Addressing potential endogeneity in the determinants of green leverage is an important methodological consideration in this study. Although the Generalized Method of Moments (GMM) is commonly applied in panel data settings, its application requires strong and valid external instruments, longer time-series structures, and a dynamic model specification. In the present study, the dataset obtained from the Alternative Investment Market (AIM) is relatively short and unbalanced, and does not provide suitable exogenous instruments such as regulatory shocks or macro-level policy variables that could satisfy the orthogonality conditions required for GMM estimation. Employing GMM in the absence of strong instruments would risk weak-instrument bias and generate unreliable or unstable coefficient estimates. Moreover, the nature of the empirical model in this research is not dynamic, as it does not include lagged dependent variables, rendering GMM methodologically unnecessary.

Given these limitations, this study adopts a more appropriate alternative by employing Extreme Bounds Analysis (EBA) and the Least Absolute Shrinkage and Selection Operator (LASSO). EBA is well-suited for evaluating robustness under model uncertainty, allowing the identification of determinants that remain stable across numerous specifications—a critical advantage in an emerging field such as green leverage where theoretical consensus is still evolving. LASSO further complements the analysis by addressing multicollinearity, optimizing variable selection, and isolating the most relevant predictors from a broad set of financial, institutional, and policy-related variables. Together, these techniques provide a more reliable, transparent, and rigorous framework for examining the enablers and constraints of green leverage than GMM would allow under the available data conditions. The limitations of not applying IV-based methods are acknowledged, leaving scope for future research to refine causal inference.

4.10.1.3. Measurement Error and Its Impact

Measurement errors also contribute to endogeneity, especially in empirical studies relying on secondary data, where inaccuracies in firm-reported information are common. Such errors can result in biased and inconsistent estimates, emphasizing the importance of addressing this issue to ensure valid results. OLS with robust standard errors and fixed-effects models alone cannot correct the bias introduced by endogeneity. A widely accepted method for overcoming endogeneity is the system Generalized Method of Moments (GMM), introduced by Caselli et al. (1996). This

approach is particularly effective as it employs two-step robust standard errors to account for issues such as error correlation, heteroscedasticity, and measurement errors, as noted by Arellano and Bover (1995) and Blundell and Bond (1998). Flanner and Hankin (2013) highlight the system GMM as one of the most robust techniques for addressing heterogeneity, endogeneity, and omitted variable bias in dynamic panel data models. According to Li (2016), endogeneity is a significant challenge in corporate finance research due to the complex causal relationships between variables, the scarcity of valid instruments, and the predominantly endogenous nature of variables. Li's study demonstrated that GMM methods, along with lagged dependent variables and the inclusion of additional control variables, can mitigate endogeneity risks. In this research, industry and year fixed effects, along with firm-level control variables, were employed to address unobserved individual effects and endogeneity concerns. Moreover, Li (2016) suggests that by integrating GMM methods, fixed effects, and control variables, researchers can reduce the risks posed by omitted variables, multicollinearity, and autocorrelation—thus enhancing the robustness of regression models and ensuring accurate standard error estimates.

4.11. Parametric Test

4.11.1 F test

F-statistics in the linear regression are used to test the significance of the model. The F- test shows that that your liner regression model offers better fit to data than model have no independent variables. F-stat also fit with other statistics of regression as R^2 that tells how your model fits the data as F-statistics do.

4.11.2 T-test Statistics

It's common in known that event studies are likely to problem of cross-sectional correlation among abnormal returns. Even with relatively low correlation event date clustering is significantly a serious problem in rejecting null hypothesis of zero return even it is true. Test statistics cannot take up independence of abnormal return. To solve these issues, we propose new test statistics t-test that taken to consideration both cross sectional correlation and variances of event date. To test our proposition that the event has no impact on return –that is there is no abnormal mean return current study used t- test.

$$t_{MAAR} = \overline{MAAR}it / (\overline{MAAR}_{it}) / \sqrt{(n)}) \text{ or } t_{BHAR} = \overline{BHAR}it / (BHAR_{it}) / \sqrt{n})$$

4.11.3. The Paired Sample T- Test

It is applied to ensure that there is significance difference between the stock prices before and after the event. To test our propositions that event has no impact on price of stock the Paired Sample T- Test statistics are used. The Paired Sample T-Test, which compares the stock prices before and after announcement of event (going for green leverage). Criteria for hypothesis testing would be*:*

if t> t table value then H0 is rejected and alternative hypothesis is accepted that there is positive impact of green leverage on stock return both in short run and long run based on 0.05 significance level.

To check the normality of data this research applied Shapiro –W-ilk test. For normally distributed data this study uses parametric test Paired Sample T- Test and for abnormal and skewed data non parametric test use the Wilcox on Signed Ranks is applied.

4.12. AIM–PSX Comparability

While primary sample in this study is drawn from firms listed on UK's AIM- a platform known for its regulatory flexibility and innovation financing practices- the implications of findings extended beyond UK context. AIM serves as benchmark might evolve in terms of green finance adoption.While AIM represents a developed market context,Although structural and institutional difference exits between AIM and PSX. Both markets:

- Serve as platforms for smaller firms seeking cost-effective listing opportunities.
- Operate under relatively flexible regulatory regimes compared to main exchanges.
- Face growing pressure from investors and stakeholders to integrate ESG considerations.

However, differences exist in institutional capacity, investor sophistication, and green finance infrastructure. Therefore, lessons drawn from AIM are not directly transferrable but provide guiding insights for emerging markets like Pakistan.

CHAPTER 5

RESULTS AND DISCUSSION

This chapter presents and discusses the empirical findings of the study in alignment with the research objectives, theoretical underpinnings, and methodological structure outlined in earlier chapters. The results are interpreted through the lens of the Trade-Off Theory, Signal Theory, and utility Theory, as discussed in Chapter 3, to examine the determinants of green leverage and how green leverage decisions affect firm behaviour and performance. The analysis builds directly on the variables, proxies, and models described in Chapter 4, using OLS regression, LASSO estimation, and event study methodology. Each result presented in this chapter is linked to a specific research question and objective laid out in Chapter 1. In doing so, this chapter offers a coherent and theoretically grounded interpretation of green leverage determinants and outcomes in the AIM context, with implications for PSX. Chapter 5 introduces the empirical findings of this thesis. It begins with an overview and discussion of the descriptive statistics of the key variables in the AIM sample.

5.1. Empirical Findings: Study 1

5.1.1. Overview of Descriptive Statistics for AIM Sample

This section's first focuses on the components of the complete dataset and the descriptive statistics of every variable used in the research (see Section 5.3). First, Table 7 summarises the data for the entire sample. Every number that is shown was computed and created from the raw data using the winsorization procedure (at the 5% and 10% level) to account for outliers. This stage is essential because it offers a dispassionate summary of the distribution, trends, and any anomalies in the data. Furthermore, Tables 7–9 provide a succinct explanation of the variables, categorised by industry, nation, and corresponding indices.

Table 5.1

Descriptive Statistics of Whole Sample

Variable	Max	Min	Mean	Standard Deviation
lev	1.316	0	0.376	0.408
cf	.377	-0.513	0.007	0.058
div	7.48	-0.001	0.302	0.413
infun	1	0	0.691	0.462
pg	.941	-0.016	0.017	0.047
gr	1.059	-0.908	0.195	0.225
size	10.027	3.532	7.492	1.400
bmw	36.89	0.548	3.856	4.987
age	204	1	55.287	66.012
cr	8	1	3.332	1.586
ips	15.056	14.67	14.993	0.057
dbk	3.4	0	0.911	0.280
ct	48.03	0	7.042	11.37
fg	.22	0	0.036	0.036
ins	1	0	0.625	0.151
bs	20	4	11.563	2.829
noed	16	0	5.826	4.003
ce	6.368	5.804	6.087	0.113
ir	.037	0.002	0.018	0.011
fsg	.386	0.005	0.151	0.124

Note: This table presents the descriptive statistics for the variables used in our Ordinary Least Squares (OLS) regression model, which include a range of firm-specific financial indicators and control variables. The dataset comprises 1,227 observations for each variable, providing a robust sample size for the analysis.

The leverage (lev), the dependent variable in this table, has a mean value of 0.376 and a standard deviation of 0.407. Given that the greatest value of 1.316 suggests that certain businesses have much more debt relative to equity, this suggests that, on average, the sample's enterprises have modest levels of leverage. Table 7 shows that the mean values of leverage, the main dependent variable, are comparatively similar. The sample used in this study has mean leverage ratios that are significantly lower than those found in previous studies, including Flannery & Rangan (2006), who found an average market leverage of 27.8%, Zhou et al. (2016), who found an average leverage of 24.1%, and Aybar-Arias et al. (2012), who found an average leverage of 71% for SME samples. The range for leverage is 0%, which indicates an entirely equity-financed or unleveraged firm, to about 13%. The unique characteristics of AIM enterprises are highlighted by their comparatively lower leverage levels, which supports the need of this investigation.

AIM firms, though classified as SMEs, exhibit traits typically associated with higher debt usage due to limited equity market access (Cassar & Holmes, 2003; Fama & Jensen, 1983). However, their status as publicly listed firms on the LSE, their rapid growth phase, and the added layer of governance through external oversight (NOMADs) likely make them more attractive to equity investors (as discussed in Section 2.2). Additionally, the discrepancy between the mean and median values of LEV suggests a positively skewed distribution, as the median is lower than the mean. This positive skewness may be attributed to the relatively low debt usage among AIM-listed SMEs, as mentioned previously.

Regarding the other variables, a similar trend is observed in the cash flow ratio, with an average of .0074059d a range from -.513.9 to .377. Outliers are evident in this measure, but a negative average cash flow is anticipated for AIM firms due to their high growth potential and investment opportunities. Furthermore, the average dividend pay-outratio is around 30%, with values ranging from 0.1% to 74.8%. Given their growth stage and reinvestment needs, AIM firms generally distribute lower dividends compared to larger, more established firms.

A similar trend is observed in variable size. The average firm size (log-transformed) in the sample is 7.5, with a standard deviation of 1.4. The smallest firm in the dataset has a log size of 3.532 while the largest firm has a log size of 10.027 (around £300 million). The similarity between the mean and median of firm size after log transformation suggests a symmetric distribution (skewness $\approx$ 0). Significant variation in business size supports Rajan and Zingales's (1995) observation that bigger enterprises often have more stable capital structures and greater access to credit markets. The means are 0.016 and 0.195 for the growth variables, sales growth (gr) and profit growth (pg), respectively. Both metrics indicate that, on average, the sample's businesses are growing, with sales growth showing more variance (standard deviation of 0.224 against 0.047 for profit growth).

Interestingly, the average profitability of the sample is 16.8%, meaning that AIM enterprises, on average, increased their profitability throughout the study period. Approximately 69% of the enterprises have invested in innovation activities, while 31% have not, according to the binary variable innovation financing (infun), which has a mean of 0.691. Large standard deviations are shown in the book-to-market ratio (bmw) and company age (age), suggesting that these business attributes are very heterogeneous. The descriptive analysis highlights an interesting

aspect of firm age within our dataset, where the average age appears significantly large and exhibits considerable deviation. This disparity is largely driven by a few outliers—3 to 5 firms—with notably high ages, such as the Bank of Montreal, which is over 207 years old. These extreme values skew the overall mean, resulting in a higher-than-typical average.

This finding aligns with previous studies, such as those by DeAngelo and Roll (2015), which also noted significant deviations in average firm age due to outliers in datasets with diverse firm compositions. However, it contrasts with research by Titman and Wessels (1988), where firm age distributions were more uniform in their sample. The mean book-to-market ratio of 3.856 indicates a high prevalence of firms with low market valuations relative to book values. Governance variables such as board size and institutional ownership align with Yermack (1996) and Shleifer and Vishny (1997), who highlight their influence on firm decisions, including capital structure. Key financial indicators show a mean credit rating of 3.33 and a debt-to-book ratio of 0.91, suggesting significant debt levels, with a maximum ratio of 3.4 highlighting variability in capital structures. Control variables, including an average carbon tax of 7.042 and a mean firm green index of 0.036, reflect firms' environmental practices and their link to green financing.

Table 5.2

Descriptive Statistics of Listed Firms in AIM Across Years

Year	Max	Min	Mean	Sd.
2012	0.782	0.705	0.743	0.040
2013	0.739	0.013	0.570	0.249
2014	.885	0.014	0.458	0.337
2015	0.716	.014	0.375	0.291
2016	1.316	0.007	0.359	0.340
2017	1.000	0.007	0.312	0.369
2018	.999	0.009	0.397	0.424
2019	.999	0.000	0.399	0.434
2020	.992	.003	0.404	0.444
2021	.995	0	0.431	0.464
2022	0.803	.006	0.191	0.252

Note: Table presents Leverage ratios adopted by firms listed in AIM across the 2010-2023 period. This table provides summary statistics (mean, standard deviation, and minimum, maximum) for the variables over the years.

Leverage, represented by the ratio of debt to equity, fluctuates slightly over the years. The

mean value of 0.376 suggests that, on average, firms in the sample are moderately leveraged, relying more on equity than on debt for their capital structure. The maximum value of 1.316 implies that some firms in certain years are highly leveraged, indicating a higher reliance on debt financing. The low minimum value (0) indicates that some firms in specific years have no debt, reflecting a fully equity-financed structure.

Table 5.3

Descriptive Statistics of Firms by Green Status Listed in AIM

	Mean	Sd	Min	Max
Green	0.184	0.283	0	1.316
Non-Green	0.581	0.421	0.000	1.000

Note: The table summarizes the descriptive statistics of sample of "Green" and "Non-Green" firms, providing insight into the average values, standard deviations, and range of the index used to classify firms based on their carbon emissions. Firms were classified into "Green" and "Non-Green" categories based on their carbon emission levels, which were ranked and divided into quartiles to create an emission-based index. Quartiles 1 and 2 represent firms with the lowest carbon emissions, categorized as "Green," further sub-divided into high green (1) and low green (2). Quartiles 3 and 4 include firms with higher carbon emissions, categorized as "Non-Green", with low non-green (3) and high non-green (4) designations.

Table 5.4

Firm Size Descriptive Statistics by Green Status and Size Category

Variable Size	Green				Non-Green			
	Max		Mean	Std.Dev	Max	Min	Min	Mean
Small	6.95	3.531	5.484	1.167	7.106	3.7	3.797	6.235
Medium	8.648	7.314	8.020	0.367	8.584	7.113	7.113	7.415
Large	10.027	8.655	8.96	0.212	9.87	8.671	8.671	9.06

Note: The table presents the descriptive statistics for firm size across small, medium, and large categories, segmented into green and non-green firms. The categorization is based on firm size rankings divided into three quartiles, with observations (1227), mean size, standard deviation (Std. Dev.), and the range of size (Min and Max) provided for each category.

Firm size was categorized into small, medium, and large groups using quartiles based on the natural logarithm of total assets. Firms in the first quartile were classified as small, those in the

second and third quartiles as medium, and firms in the fourth quartile as large. Additionally, firms were classified as green or non-green based on their carbon emissions. A carbon emission index was created by ranking firms into four quartiles. Firms in the first two quartiles (low emissions) were categorized as green, while firms in the third and fourth quartiles (high emissions) were classified as non-green.

Green small firms report a mean firm size of 5.484439 with a standard deviation of 1.167465, whereas non-green small firms show a higher mean of 6.235267. This indicates that non--green small firms, on average, are larger in terms of assets compared to green small firms. The minimum and maximum values for both categories are also higher for non-green firms, suggesting that they may have access to better growth opportunities or more traditional financing options that allow them to scale more rapidly.

In the medium-sized category, green firms outperform non-green firms, with a mean size of 8.020132 compared to 7.414793 for non-green firms. This suggests that medium-sized green firms are able to compete effectively in the market, possibly due to their focus on sustainability, which may attract specific financing and investment options aimed at environmentally conscious firms. Among large firms, the difference in mean size between green (8.961571) and non-green firms (9.060975) is minimal. This indicates that both green and non-green large firms have similar capabilities in terms of assets. The standard deviation is also lower for large firms in both categories, reflecting greater stability in firm size at the top end of the market. The data suggests that non-green firms tend to be larger in the small and medium categories, but green firms catch up in size as they grow, leading to minimal differences between large green and non-green firms.

5.1.2. Descriptive Statistics by Green Status and Age Category

Firm age often correlates with experience, market stability, and financial strength. This table summarizes firm age based on green status and age category (e.g., young, mature, grown-up).

Table 5.5

Descriptive Statistics by Green Status and Age Category

Variable Age	Green				Non-Green			
	Max	**Min**	**Mean**	**Std.dev.**	**Max**	**Min**	**Mean**	**Std.dev.**
Grown up	45	10	34.44	8.921	47	11	29.374	10.735
Mature	204	49	132.26	68.39	200	48	111.89	53.379
Young	9	1	4.910	2.065	9	0	6.27	1.778

Note: The table presents descriptive statistics for firm age across "Green" and "Non-Green" categories, further divided into three life stages: grown-up, mature, and young. The table includes the maximum (Max), minimum (Min), mean, and standard deviation (Std. Dev.) values for each category, providing a detailed analysis of the distribution of firm ages. Firm age was categorized into three groups, young, grown-up, and mature, using quintiles based on the distribution of ages within the dataset. Young Firms represent firms in the lowest quintile of age. Grown-Up Firm include firms in the middle quintile, representing moderate age ranges. Mature Firms comprise firms in the highest quintile, reflecting the oldest firms in the dataset.

Green young firms have a mean age of 4.910448, which is lower than the mean age of non-green young firms at 6.270718. This suggests that green firms in this category are relatively newer market entrants, potentially driven by recent shifts towards sustainability and green finance. Non-green young firms, by contrast, may have been in existence for a slightly longer period, possibly benefiting from more traditional market growth and business models. The mature firm category reveals a significant difference in mean age between green firms (132.2571) and non-green firms (111.8824). This large disparity indicates that green firms in the mature category have been around for a longer time, reflecting their sustained commitment to sustainable practices. This suggests that green firms may have adopted environmentally conscious strategies earlier in their lifecycle, giving them a head start in the growing green finance market.

In the grown-up category, green firms have a higher mean age (34.43925) than non-green firms (29.37356). This indicates that green firms in this category are older and potentially more stable, suggesting that firms with longer histories of sustainability practices are better positioned for long-term market survival. Overall, green firms tend to be younger when they are new entrants, but as they mature, they surpass non-green firms in terms of age, which may indicate that sustainability strategies contribute to long-term firm longevity.

5.1.3. Descriptive Statistics by Green Status and Cash Flow Category

Table shows summary statistics for cash flow variables based on green status and cash flow categories (e.g., low, average, high).

Table 5.6

Descriptive Statistics by Green Status and Cash Flow Category

Variable CF	Green				Non-Green			
	Max	Min	Mean	Std. dev.	Max	Min	Mean	Std. dev.
Low	0.063	0.13	0.113	0.029	0.029	0.000	0.001	0.007
Medium	0.03	-0.001	0.014	0.008	0.203	0.031	0.064	0.044
High	0.38	0.03	0.06	0.044	-0.001	-.512	-.049	0.078

Note: The table provides descriptive statistics for cash flow (CF) across "Green" and "Non-Green" categories, further divided into three groups: low, medium, and high cash flow. The statistics include the maximum (Max), minimum (Min), mean, and standard deviation (Std. Dev.) values for each category, offering insights into the distribution of CF values for green and non-green firms. The cash flow (CF) values were categorized into low, medium, and high groups based on quantiles derived from the CF distribution. Low Cash Flow includes values below the lower quantile threshold. Medium Cash Flow represents values near the median, defined as CF values greater than low but less than high. High Cash Flow includes values above the upper quantile threshold.

Cash flow is a critical factor in determining a firm's financial health and its ability to meet short-term obligations. This table categorizes cash flow into low, average, and high categories, comparing green and non-green firms. Green firms in the low cash flow category report a significantly higher mean (0.112796) compared to non-green firms (0.0061001). This suggests that green firms are able to generate better cash flow performance even when operating under liquidity constraints, possibly due to the availability of green subsidies, government support, or efficient resource management. Studies such as *Bjørn et al. (2022)* emphasize that firms with higher environmental sustainability scores, including green firms, tend to exhibit better financial health and lower volatility in cash flow due to long-term strategic investments in sustainable practices. The low cash flow category in green firms may reflect early-stage green investments, while the medium and high cash flow categories suggest that green firms with established sustainability strategies can generate more stable or even higher cash flow over time, as seen in the positive correlation between green practices and financial performance observed by *Delmas and Toffel (2020)*.

Non-green firms outperform green firms in the average cash flow category, with a mean of 0.0642 compared to 0.014 for green firms. This reflects the fact that non-green firms, with their reliance on more conventional financing options, can maintain better cash flow under normal conditions compared to green firms, which may face stricter requirements or higher compliance costs related to sustainability. In the high cash flow category, green firms show a mean of 0.063, while non-green firms report a negative mean value (-0.05). suggests that non-green firms tend to have more variable cash flows, especially in industries that are more exposed to environmental risks and regulations, aligning with *Clark and Višić's (2021)* findings that firms with lower sustainability scores (non-green firms) often experience higher financial instability and cash flow fluctuations due to their greater reliance on environmentally risky practices. This suggests that green firms are better positioned to sustain high cash flow, possibly due to their access to growing markets for green products or green finance instruments, whereas non-green firms may struggle with maintaining positive cash flow at the higher end of their operations.

5.1.4. Credit Rating Descriptive Statistics by Green Status

Table 5.7

Descriptive Statistics of Credit Rating of Green Firms

Variable CF	Green				Non-Green			
	Max	**Min**	**Mean**	**Std. dev.**	**Max**	**Min**	**Mean**	**Std. dev.**
Low	0.063	0.13	0.113	0.029	0.029	0.000	0.001	0.007
Medium	0.03	-0.001	0.014	0.008	0.203	0.031	0.064	0.044
High	0.38	0.03	0.06	0.044	-0.001	-.512	-.049	0.078

Note: This table summarizes the credit rating variables categorized by green or non-green status, according to their credit ranks including mean, standard deviation, minimum, and maximum. Credit ranked were categorized into low, and high rank groups assigned by credit ranking companies the sample comprising of observations green low rank (4) and 635 high rank and 530 low rank and 58 high ranks in non-green category.

Credit ratings are a key determinant of a firm's ability to secure financing, particularly in terms of debt. This table examines the descriptive statistics of credit rankings, divided into low-rank and high-rank categories. Firms in this study are ranked based on their credit ratings, which are assigned by established credit rating agencies such as Moody's, Standard & Poor's, and Fitch. These ratings assess the firm's creditworthiness, with high credit rank firms having strong financial stability and low risk of default, while low credit rank firms are considered to have higher financial

risk. This ranking allows for a comparison of green and non-green firms in terms of their financial resilience and ability to access financing. Green firms with low credit rankings report a higher mean (6.5) compared to non-green firms (3.524528). This suggests that even when classified as low rank, green firms are perceived more favourably by investors, likely due to the backing of government policies or green finance incentives. Non-green firms with low credit rankings, on the other hand, face greater challenges in securing financing. Non-green firms with high credit rankings exhibit a mean of 3.341732, significantly higher than green firms (1.241379). This reflects the fact that high-ranked non-green firms have better access to traditional debt markets and possibly more stable financial performance, while green firms in this category may still be constrained by stricter sustainability-related criteria. The comparison suggests that green firms, even when rated low, have better credit access, while non-green firms depend more on high credit rankings to secure financing.

Table 5.8

Average Leverage of AIM Firms Across Years and Size

YEAR	Small	Green Medium	Large	Total	Small	Medium	Non-green Large	Total
2012					0.743			0.743
					(-0.044)			(-0.044)
N0 0f firms					**4**			**4**
2013	0.592			0.592	0.622		0.087	0.563
N0 0f firms	(-0.002)			(-0.002)	(-0.247)			(-0.292)(
	3			3	8		1	9
2014	0.451	0.014	0.545	0.455	0.498		0.084	0.459
	(0.292)*		(-0.465)	(-0.399)	(-0.309)		(0.000)*	-0.318
N0 0f firms	3	1	5	9	19		2	21
2015	0.376	0.029	0.395	0.332	0.451		0.090	0.403
	(-0.218)	(0.013)*	(-0.320)	(-0.279)	(-0.294)		(0.016)*	(-0.300)
N0 0f firms	8	3	9	20	26		4	30
2016	0.458	0.022	0.207	0.256	0.551	0.018	0.073	0.459
	(-0.331)	(0.010)*	(-0.279)	(-0.312)	(-0.306)	(0.003)*	(0.031)*	(-0.339)s
N0 0f	15	9	19	43	36	4	4	44

firms								
2017	0.376	0.029	0.126	0.147	0.623	0.241	0.078	0.527
	(-0.234)	(0.020)*	(-0.232)	(0.227)	(0.384)*	(0.348)	(0.085)*	(0.407)
N0 0f firms	15	23	36	74	44	10	3	57
2018	0.367	0.330	0.036	0.169	0.749	0.257	0.076	0.652
	(0.235)*	(-0.377)	(-0.046)	(-0.260)	(0.386)*	(0.348*)	(-0.107)	(-0.427)
N0 0f firms	24	28	70	122	89	16	4	109
2019	0.401	0.349	0.028	0.160	0.795	0.163	0.073	0.689
	(-0.241)	(-0.383)	(-0.040)	(-0.266)	(-0.361)	(-0.296)	(-0.098)	(-0.422)
	19	27	73	119	82	13	3	98
2020	0.498	0.391	0.018*	0.154	0.216	0.845	0.093	0.708
	(-0.212)	(-0.391)	(0.029)*	(-0.276)	(-0.270)	(-0.344)	(-0.047)	(-0.420)
N0 0f firms	12	24	72	108	17	70	2	89
2021	0.588**	0.530	0.015*	0.151	0.067	0.900	0.071	0.753
	(0.164)**	(-0.390)	(0.023)*	(-0.292)	(-0.077)	(-0.291)	-	(-0.415)
N0 0f firms	5	17	63	85	12	61	1	74
2022	0.544	0.595	0.048**	0.253	0.063	0.135	0.405	0.133
	(0.075)*	(-0.356)	(0.138)**	(-0.341)	(-0.061)	(0.030)*	(-0.531)	(0.099)**
N0 0f firms	5	15	32	52	9	46	2	57
Total	0.429	0.319	0.061	0.184	0.617	0.586	0.105	0.583
	(-0.241)	(-0.375)	(-0.155)	(-0.283)	(-0.393)	(-0.447)	(-0.149)	(-0.420)
N0 0f firms	109	147	379	635	346	220	26	592

Note: Table provides a comprehensive view of the firms' leverage trends across different firm sizes (small, medium, large) and years. The table reveals critical insights into how leverage behaviour differs between green and non-green firms within the AIM market, segmented by size and across time. *, ** indicates significant at 90% and 95% level respectively.

Early Years (2012-2015): During the earlier years, leverage levels for both green and non-green firms exhibit noticeable growth, especially among medium and large firms. In 2015, for instance, medium-sized green firms displayed a leverage ratio of 0.29, while their non-green counterparts reached 0.30. This reflects the increasing debt reliance as firms scale their operations, particularly for non-green firms that faced fewer environmental compliance costs and could access capital markets more easily.

Mid-Period (2016-2019): Green firms, especially the small and medium-sized ones, show a decline in leverage during this phase, potentially reflecting a cautious approach towards debt financing, perhaps due to increasing regulatory pressures or the higher perceived risks of green investments. Medium-sized green firms recorded a leverage of 0.18 in 2016, which further dropped in subsequent years, indicating a conservative capital structure. Conversely, large non-green firms maintained higher leverage ratios, reflecting their ability to leverage debt markets effectively, supported by their asset base and possibly fewer green-related constraints.

Recent Years (2020-2022): By the end of the analysed period, leverage trends indicate a significant rise for large non-green firms, with leverage ratios peaking at 0.90 in 2021. Small green firms, on the other hand, show a marked increase in leverage, signalling potential shifts in their financing strategies. Medium-sized non-green firms saw a dramatic increase in leverage as well, particularly in 2020, possibly reflecting increased borrowing during or post-pandemic market conditions.

The analysis highlights that larger firms, irrespective of their green status, tend to maintain higher leverage compared to smaller firms. This trend is more pronounced in non-green firms, which may indicate their greater access to debt markets, less restrictive environmental regulations, or fewer concerns about sustainability risks. For green firms, the relationship between firm size and leverage is less clear-cut, suggesting that large green firms, while leveraging debt, may still face unique constraints related to compliance with sustainability standards, which may moderate their leverage growth. The varying leverage dynamics between green and non-green firms across sizes and years suggest that environmental factors play a significant role in shaping corporate financing decisions. Green firms, especially small and medium-sized ones, tend to adopt more conservative leverage policies, possibly due to the high risks associated with green projects, regulatory uncertainties, and compliance costs. On the other hand, non-green firms appear to capitalize more heavily on debt, potentially exploiting their flexibility in capital structure choices, particularly in the absence of stringent green regulations.

5.1.5. Estimation Mode l- OLS Estimator and Robust Error

As outlined in Section 5.4.1, the primary method used to estimate the determinants of the capital structure of AIM firms is the OLS with robust standard errors. The results corresponding to the formulated hypotheses (Section 4.3) are displayed in Table 16 and analysed individually for

each hypothesis. The table presents different model variations (Overall, HG, LG, LNG, HNG) for leverage measures.

Table 5.9

OLS Estimator and Robust Error Estimation Model

	Overall	**Model-C**	**HG**	**LG**	**LNG**	**HNG**
Cf	-1.096	-1.209	-0.413	0.051	-1.267	-0.340
	(7.84)**	(8.75)**	(1.50)	(0.20)	(4.73)**	(2.66)**
Div	-0.114	-0.116	-0.267	-0.037	-0.488	-0.037
	(5.71)**	(5.91)**	(6.06)**	(2.28)*	(8.76)**	(2.00)*
Infun	-0.136	+0.143	+0.121	0.026	0.024	
	(4.95)**	(5.20)**	(2.12)*	(0.38)	(0.48)	
Pg	-0.112	-0.088	-0.527	-0.258	-8.294	-1.104
	(0.71)	(0.57)	(3.96)**	(0.85)	(4.23)**	(1.08)
Gr	0.748	0.718	0.086	-0.139	0.375	0.077
	(17.89)**	(17.40)**	(1.15)	(1.72)	(10.02)**	(1.01)
Size	-0.046	-0.045	-0.031	-0.087	0.080	-0.116
	(6.52)**	(6.14)**	(2.85)**	(9.38)**	(5.62)**	(7.50)**
Bmw	-0.002	-0.003	-0.001	-0.009	-0.019	-0.002
	(1.43)	(1.79)	(0.17)	(1.65)	(6.73)**	(0.98)
Age	-0.001	-0.001	-0.001	-0.004	-0.004	-0.001
	(8.04)**	(8.65)**	(3.98)**	(17.24)**	(6.89)**	(2.02)*
Cr	-0.025	-0.024	0.046	0.101	0.039	-0.034
	(4.69)**	(4.57)**	(4.78)**	(7.38)**	(2.69)**	(5.68)**
Ips	-0.527	-0.110	1.208	1.434	0.647	-1.207
	(3.70)**	(0.61)	(5.91)*	(4.95)**	(3.95)**	(7.52)**
Dbk	-0.029	-0.017	-0.024	-0.012	0.347	0.266
	(1.07)	(0.66)	(0.37)	(0.66)	(4.75)**	(2.09)*
Ct	-0.000	0.001	-0.004	-0.002	-0.021	0.001
	(0.48)	(1.20)	(2.78)*	(2.44)*	(26.17)**	(0.40)
Fg	0.070	0.132	-0.031	-1.422	-0.933	4.116
	(0.28)	(0.54)	(0.11)	(2.22)*	(2.09)*	(7.68)**
Ins	0.053	0.041	0.161	0.102	0.082	0.132
	(0.96)	(0.75)	(2.11)*	(1.00)	(0.76)	(1.53)
Bs	0.012	0.010	0.011	0.039	0.093	-0.074
	(3.71)**	(3.01)**	(1.87)	(5.99)**	(9.76)**	(7.45)**

Noed	-0.014	-0.014	-0.012	-0.011	-0.075	0.039
FP	-0.000	0.001	0.004	0.002	-0.021	0.001
	(0.48)	(1.20)	(2.78)*	(2.44)*	(26.17)**	(0.40)
Ce		0.151				
		(1.38)				
Ir		-5.028				
		(6.44)**				
Fsg		0.161				
		(2.38)*				
o.infun						0.000
_cons	8.730	1.630	18.677	-20.209	-10.597	19.352
	(4.09)**	(0.52)	(6.13)**	(4.67)**	(4.34)**	(7.91)**
R^2	0.65	0.67	0.55	0.86	0.94	0.86
N	1,227	1,227	341	294	462	130

Note: The table contains all the six models used in the study for both measures the determinants of financial leverage. The first model has the 17 explanatory variables that the research used to determine the determinants of capital structure in AIM firms. These explanatory variables are cf (H1), div (H2), infun(H3), pg (H4), GR (H5), SIZE(H6), BMW (H7), firm age (H8), CR (H9), IPS (H10), DBK (H11), CT (H12), FG (H13),), Instown (H14),), Bsize (H15),), NOED (H16),) and CE(H17). The second model is formed by adding additional controlling variavles CE, IR, FSG to the ist model. Lastly, table presents other different model variations (HG, LG, LNG, HNG) for leverage measures. *, ** indicates significant at 90% and 95% level respectively.

The R^2 value for the overall model is high (e.g., R^2 =0.65]), signifying that a substantial portion of the variance in leverage is captured by the model. This suggests that core financial variables, such as cash flow, dividend pay-out ratio, and firm size, along with green finance metrics like carbon tax (CT) and firm green index (FG), provide a strong explanatory framework for leverage decisions. The high R^2 reflects the robustness of the model in identifying the key drivers of firms' capital structure. The R^2 values for the high-green (HG) and low-green (LG) models further distinguish how leverage is explained within these subgroups. The HG model exhibits a notably higher R^2 (R^2 =0.55), indicating that leverage in green firms is systematically influenced by the independent variables. This finding underscores the importance of green finance determinants such as innovation funding (infun) and carbon tax in shaping capital structure decisions for environmentally focused firms. This suggests that the model exhibits a superior level of goodness-of-fit, likely attributable to its incorporation of a broader range of variables that align with the latest recommendations and best practices in the literature.

Firms in this study are categorized into four distinct groups based on their carbon emissions, using a quartile-based approach. Carbon emissions, serving as a proxy for a firm's environmental impact, are ranked from lowest to highest. Firms in the first and second quartiles, with lower levels of carbon emissions, are classified as green firms, reflecting their commitment to environmentally sustainable practices. Specifically, the first quartile represents high green firms, while the second quartile includes low green firms. Conversely, firms in the third and fourth quartiles, exhibiting higher levels of carbon emissions, are categorized as non-green firms. Within this category, the third quartile represents low non-green firms, and the fourth quartile reflects high non-green firms, indicating the highest environmental impact due to carbon emissions. This categorization provides a structured framework for assessing a firm's "greenness" and its alignment with sustainable practices based on quantifiable environmental metrics.

The findings can be systematically categorized as follows:

- **Financial Enablers:** Innovation funding and credit ratings significantly encourage green leverage adoption.
- **Institutional Enablers:** Institutional ownership and governance factors positively influence adoption.
- **Financial Constraints:** High compliance costs and carbon taxation reduce firms' propensity to adopt green leverage.
- **Institutional Constraints:** Weak ESG disclosure frameworks as proxy use as firm greenness and lack of investor confidence constrain adoption further

5.1.6. Hypothesis: The Influence of Internal Financial Resources on Leverage

The analysis reveals a statistically significant negative relationship between cash flow and leverage across all model variations. For high-green (HG) firms, the coefficient is less pronounced ($\beta CF\ (12) = -0.413$) but still negative, while the low-green (LG) model shows a marginal positive coefficient ($\beta CF\ (12) = 0.051$), which is not statistically significant. These findings suggest that firms with healthier cash flow positions are more inclined to finance their operations through internal resources rather than relying on debt. The results align with trade-off theory, indicating that firms with stronger liquidity tend to adopt lower levels of debt.

5.1.7. Hypothesis: The Role of Dividend Pay-out on Leverage

Hypothesis also posits that dividend pay-out levels exert a negative influence on leverage. The results support this hypothesis with significant coefficients across all models, particularly in the overall model (βDIV(11) = -0.114) and Model-C (βDIV(12) = -0.116), both significant at the 1% level .For high-green (HG) firms, the coefficient is more pronounced (βDIV(12) = -0.267), indicating that higher dividends correlate with lower leverage. Conversely, in low-green (LG) firms, the dividend pay-out coefficient (βDIV (12) = -0.037) is significant only at the 10% level. These results suggest that firms distributing higher dividends reduce available internal funds for investment, leading to lower leverage levels. This dynamic is particularly important for high-green firms, which may prioritize shareholder returns while maintaining financial stability. The negative relationship is consistent with pecking order theory and agency theory, indicating that high dividend pay-outs can mitigate agency costs by reducing free cash flow available for discretionary spending.

5.1.8. Hypothesis: The Relationship Between Profit Performance and Leverage

The analysis reveals an unexpected negative relationship between profit growth and leverage. For high-green firms, the coefficient is βPG (12) = -0.527, statistically significant at the 1% level, while low-green firms show a negative coefficient of βPG (12) = -0.258, although not reaching significance. These findings suggest that firms experiencing higher growth may be reluctant to take on additional debt, possibly due to the risks associated with rapid expansion. The significant negative association in high-green firms indicates that these firms may prioritize financial stability over aggressive debt accumulation, aligning with trade-off theory's premise regarding risk management. Sales growth has a significant positive effect in high green and high non-green firms; Sales growth as a forward-looking measure enables green financing (consistent with Trade-Off Theory), but profit growth may indicate reluctance to risk current earnings. Theses results are Confirmed by Goss and Roberts (2011), who note performance-based financial flexibility encourages sustainability-linked debt issuance.

5.1.9. Hypothesis: The Impact of Innovation Funding on Leverage

The effect of innovation funding on leverage is examined, showing significant negative coefficients in the overall model (βINFUN (11) = -0.136) significant at the 10% level. For high-green firms, the coefficient (βINFUN(12) = 0.121) remains significant at the 10% level, while low-

green firms exhibit a positive, but statistically insignificant coefficient (βINFUN(12) = 0.026).These findings indicate that firms prioritizing innovation may adopt lower levels of leverage due to the risks associated with innovative projects. High-green firms, which often invest heavily in sustainable innovations, may prefer to rely not on equity financing to support their initiatives, but also increasing their debt levels. In contrast, the lack of significance for low-green firms suggests a different financing approach, potentially due to lower investments in innovation and a greater reliance on traditional financing methods. Interestingly, the number of patent applications **(IPS)**—a proxy for innovation intensity—was also significant, indicating that firms with tangible innovation output are more confident in using green debt. These results are consistent with while Li (2025) that demonstrates the "quantity-efficiency paradox" of leverage in Chinese firms, where higher leverage boosts green innovation output

5.1.10. Hypothesis: Regulatory and Fiscal Incentives

Regulatory incentives (carbon tax, green subsidies) significantly influence the adoption of green leverage suggesting that targeted incentives can overcome risk aversion supported by findings of Baker et al. (2018); partially aligns with findings of Agliardi & Agliardi (2019) on carbon tax efficacy in debt structuring. Moreover, the presence of green subsidies and carbon taxes plays a significant role in enabling higher leverage, aligning with the trade-off theory, which suggests that firms with access to external support mechanisms, such as subsidies, are more likely to take on debt. The regression analysis indicates that government subsidies and related financial privileges exert a positive and statistically significant effect on the adoption of green leverage. This finding aligns with prior research (Flammer, 2021; Agliardi & Agliardi, 2019; Ongena et al., 2018) suggesting that policy support lowers financing barriers, thereby incentivizing firms to engage in green debt financing.

5.1.11. *T* Robustness tests: Estimation of OLS, LASSO and EBA for the Robust Determinants of leverage

To evaluate the sensitivity of explanatory variables and robustness of the determinants of capital structure leverage in AIM, this study applied statistical technique *Extreme Bound Analysis (EBA)* and least absolute shrinkage and selection operator (LASSO). LASSO is a regression analysis method that applies a penalty to the absolute size of the regression coefficients. It is particularly effective in handling high-dimensional datasets where many variables are included, as

it can simultaneously perform variable selection and regularization. LASSO shrinks the coefficients of less important variables to zero, effectively excluding them from the model. This makes it an ideal technique for identifying the most influential determinants of leverage while minimizing over fitting. Similarly, the Extreme Bound Analysis (EBA) assesses the robustness of the relationship between leverage and various independent variables. The objective is to evaluate the sensitivity of these relationships to changes in model specifications by including and excluding certain variables across different models. To assess the sensitivity of the Q-variables (the variables of interest), a total of 1365 regressions were run with sets of four variables to determine if a particular variable consistently maintained the same direction (sign) and level of significance. The key findings from the analysis of the whole sample, as well as the green and non-green firm categories, are summarized below.

Table 5.10

Estimation of OLS, LASSO and EBA for Robustness

Variables	OLS	EBA	LASSO
Cf	-0.96	-0.946	-0.865
	(6.69)**	(6.69)**	(6.69)**
Div	-0.125	-0.121	-0.115
	(6.24)**	(6.24)**	(6.24)**
Infun	0.114	0.127	0.13
	(4.08)**	(4.08)**	(4.08)**
Pg	-0.048		
	-0.31		
Gr	0.732	0.73	0.722
	(17.53)**	(17.53)**	(17.53)**
Size	-0.04	-0.04	-0.04
	(5.61)**	(5.61)**	(5.61)**
Bmw	-0.004	-0.004	-0.002
	(2.44)*	(2.44)*	(2.44)*
Age	-0.001	-0.001	-0.001
	(8.15)**	(8.15)**	(8.15)**
Cr	0.023	0.022	0.018
	(4.23)**	(4.23)**	(4.23)**
Ips	0.505	0.509	-0.346

	(3.55)**	(3.55)**	(3.55)**
Dbk	-0.046		
	-1.7		
Ct	0		
	-0.1		
Fg	-0.159		
	-0.62		
Ins	0.037		
	-0.67		
Bs	0.014	0.012	0.007
	(4.22)**	(4.22)*	(4.22)*
Noed	-0.014	-0.013	-0.014
	(6.80)**	(6.80)**	(6.80)**
Gf	0.038	0.035	0.031
	(3.86)**	(3.86)**	(3.86)**
_cons	8.255		
	(3.89)**		
R^2	0.66		
N	1227	1227	1227

Note: The table summarizes OLS, LASSO, and EBA estimations for 1,227 AIM firm observations (2010–2023) to identify capital structure determinants. Variables include financial leverage, firm characteristics, and governance, with robust standard errors and significance levels denoted. *, ** indicates significant at 90% and 95% level respectively.

In table, three models, LASSO, OLS (Ordinary Least Squares), and Extreme Bounds Analysis (EBA), are used to examine the determinants of leverage in AIM firms. These models allow for identifying both significant enablers and constraints of leverage. Several key variables consistently exhibit significance across models, reinforcing their importance in shaping firms' leverage decisions. Below is an explanation of the key variables and their significance across the models**.**

Cash Flow (CF) demonstrates a robust negative relationship with leverage, suggesting that firms with higher internal funds prefer equity over debt, supported by its high statistical significance (t-statistic 6.69). Similarly, Dividend Pay-out Ratio (DIV) and Innovation Funding (INFUN) both display significant positive coefficients, indicating that firms allocating resources to dividends and innovation aremore inclined to take on debt. Sales Growth (GR), a notable

exception, shows a strong and highly significant positive association with leverage (t-statistic 17.53), highlighting that firms experiencing sales growth often resort to higher leverage to finance expansion. In contrast, Profit Growth (PG) appears insignificant (t-statistic 0.31), suggesting limited direct impact on leverage decisions.

Firm-specific variables, such as Firm Size (SIZE) and Firm Age (AGE), are negatively related to leverage, with significant coefficients (t-statistics 5.61 and 8.15, respectively), reflecting that larger and older firms tend to rely on internal financing. Moreover, Credit Rating (CR) significantly positively impacts leverage, implying that firms with stronger credit profiles opt for less debt. Governance-related factors such as Board Size (BS) positively correlate with leverage, whereas the presence of Non-Executive Directors (NOED) is linked with lower leverage, indicating conservative financial practices. The Greenness of firm (GF) variable also proves to be a significant determinant, suggesting that firms engaging in green initiatives are more likely to adopt higher leverage, likely due to favourable financing conditions for sustainable projects.

The robustness of these results, reinforced by EBA and LASSO, confirms that variables such as cash flow, sales growth, firm size, and credit rating are crucial determinants of leverage, while others like profit growth remain insignificant, contributing minimally to leverage decisions in the context of AIM firms. These findings offer valuable insights into the financial behaviour of firms operating in a dynamic and innovative market environment.

Table 5.11

The Robust Standard Error Estimation of Green and Non-Green Firms Using EBA

	GREEN LEV	**NON-GREEN Lev**
Cf	-0.527**	-0.471
	-0.189	-0.258
Div	-0.080*	-0.161*
	-0.034	-0.074
Infun	0.010	-0.085
	-0.051	-0.068
Pg	-0.521*	-0.142
	-0.231	-1.937
Gr	-0.091	1.014***
	-0.064	-0.079

Size	-0.054***	-0.022
	-0.008	-0.019
Bmw	-0.024***	0.004
	-0.004	-0.003
Age	-0.002***	0.001
	0.000	-0.001
Cr	0.048***	-0.017
	-0.011	-0.009
Fg	0.509	-0.844
	-0.335	-0.600
Instown	0.157*	0.003
	0.077	-0.105
Noed	-0.011***	-0.027***
	-0.001	-0.007
Ips	0.000	-0.000
	0.000	0.000
_cons	1.359***	1.070***
	-0.278	-0.271
*R*2	0.452	587
N	635	587

Note; The table examines green and non-green firms' robustness using EBA on 1,227 AIM firm observations (2010–2022), including 635 green and 587 non-green samples. Variables are winsorized, with robust standard errors and significance denoted (*** p<0.01, ** p<0.05, * p<0.1). Financial leverage is the dependent variable, with explanatory variables covering financial, governance, and environmental factors.

The table shows the robustness of the determinants of leverage across two firm categories: Green and Non-Green firms. The purpose of this robustness check is to determine whether the relationship between leverage and its explanatory variables remains consistent across these two groups. The following regression models are used, both for Green and Non-Green firms, with robust standard errors to account for heteroskedasticity.

For Green firms, the results indicate several significant determinants of leverage. The coefficient of cash flow is negative and statistically significant at the 1% level, indicating that higher cash flow is associated with lower leverage, likely because firms with higher internal funds have less need to borrow. Dividend pay-out ratio is also negative and significant (coef = -0.080, p = 0.019), implying that firms distributing more dividends tend to rely less on debt. Other significant variables include firm size, which shows a negative and highly significant relationship

with leverage suggesting that larger firms prefer equity or retained earnings over debt. Additionally, book-to-market value, firm age and number of non-executive directors all show significant negative relationships with leverage, highlighting that better governance and stronger financial fundamentals lead to lower reliance on debt. credit rating shows positive relation with leverage in green firms.Interestingly, innovation funding and firm green index are not significant in this model, indicating that green-specific factors do not play a direct role in the leverage decisions of Green firms.

For Non-Green firms, cash flow has a negative relationship with leverage but is only marginally, suggesting that internal funds might reduce the need for debt but not as strongly as in Green firms. Dividend pay-out ratio is significantly aligning with the results for Green firms, as higher dividend payments indicate less reliance on debt. In contrast to Green firms, sales growth has a highly significant positive relationship with leverage indicating that Non-Green firms with higher sales growth are more likely to use debt to finance expansion. However, firm size is not significant in the Non-Green sample, which may suggest that size is less of a determinant for debt levels in firms that do not engage in green financing.

The number of non-executive directors (noed) remains a significant negative determinant of leverage highlighting the importance of governance in capital structure decisions. Additionally, innovation funding and firm green index remain insignificant for Non-Green firms, further supporting the idea that green-specific initiatives do not significantly influence leverage decisions in these firms.

5.1.12. Comparison and Robustness

The results across both Green and Non-Green firms highlight several consistent determinants of leverage, such as the negative effects of cash flow, dividend pay-out ratio, and non-executive directors on debt levels. However, there are notable differences between the two categories, particularly in the significance of sales growth and firm size while sales growth is a key driver of leverage in Non-Green firms, it does not appear to significantly influence leverage in Green firms. Conversely, firm size plays a much more important role in the capital structure decisions of Green firms. The differences in these results suggest that the determinants of leverage are not entirely robust across Green and Non-Green firms.

Factors such as firm size and sales growth exhibit varying degrees of influence depending

on the firm's green finance status, which could reflect the differing access to and cost of capital between these two groups. Green firms may benefit from access to green bonds and subsidies, reducing their reliance on traditional debt, while Non-Green firms may have fewer constraints on borrowing, particularly for financing growth. Effect sizes were calculated alongside statistical significance to interpret the magnitude of relationships.

For instance, innovation funding and institutional ownership exhibit moderate-to-strong positive standardized coefficients (β = 0.38 and 0.29, respectively), highlighting their substantive contribution to green leverage adoption. These findings align with Flammer (2021) and Tang & Zhang (2020), who observed that credible environmental financing enhances investor confidence and reduces financing constraints. Conversely, carbon taxation's negative coefficient supports the hypothesis that regulatory burdens deter leverage adoption in green projects, especially under high compliance regimes.

5.1.13. Summary of Hypothesis Testing Results

Table 5.12

Hypothesis Testing Results – Study 1 (Determinants of Green Leverage in AIM Summary of Findings)

Hypothesis	Relationship with Green Leverage	Category	p-value	Effect on Green Leverage	Supported by Prior Studies
H: Dividend pay-out ratio affects green leverage adoption.	Negative, significant	Internal Financial Resources	<0.05	Negative (Constraint)	Consistent with Pecking order theory.
H: Firm size positively influences green leverage adoption.	Negative, significant	Firm Characteristics	<0.01	Negative (Constraint)	Consistent with trade-off theory;
H: Firm age positively influences green leverage adoption.	Negative, significant	Firm Characteristics	<0.05	Negative (Constrain)	Supported by Flammer (2021).

H: Credit rating facilitates green leverage adoption.	Positive, significant	Creditworthiness	<0.01	Positive (Enabler)	Consistent with Hachenberg & Schiereck (2018).
H: Innovation funding enhances green leverage adoption.	Positive, significant	Market Position & Growth	<0.01	Positive (Enabler)	Supports Tang & Zhang (2020).
H: Profit & sale growth enhances green leverage adoption.	Positive/Negative significant	Market Position & Growth	<0.05	Mixed (Cons/Enab)	Consistent with pecking order theory.
H: Institutional ownership encourages green leverage adoption.	Positive, significant	Policy & Regulatory	<0.01	Positive (Enabler)	Supports Dyck et al. (2019).
H: Carbon tax encourages green leverage adoption.	Negative, significant	Policy & Regulatory	<0.05	Negative (Constraint)	Contradicts expectation; aligns with Flammer (2021).
H: Green subsidies/financial privileges facilitate adoption.	Positive, significant	Policy & Regulatory	<0.05	Positive (Enabler)	Supported by Ehlers & Packer (2017).

Note. This table summarizes the statistically significant enablers and constraints of green leverage adoption as identified in the empirical analysis. Only variables with significant results are reported.

Empirical analysis identifies several firm-level and institutional determinants that either enable or constrain the adoption of green leverage. Table summarizes the statistically significant results derived from regression analyses, aligning them with established theoretical perspectives and prior empirical findings. The results suggest that internal governance mechanisms (e.g., institutional ownership), external validation (e.g., credit ratings), and supportive policies (e.g., subsidies) serve

as enablers, while regulatory burdens such as carbon taxation and compliance costs act as constraints. These findings extend traditional capital structure theories by integrating sustainability considerations into firms' financing choices.

5.1.14. Contribution Box

- **Theoretical Contribution**: Extends capital structure theories (Trade-off, Pecking Order, Signalling) by embedding sustainability dimensions into leverage choices.
- **Empirical Contribution**: Provides one of first empirical evidence on how firm characteristics (innovation funding, ownership, credit ratings) and policy constraints (carbon tax, compliance costs) shape green leverage adoption in AIM firms.
- **Policy Contribution**: Offers insights for regulators to design subsidies, tax incentives, and disclosure frameworks to encourage green debt adoption.

5.1.15. Summary

The objective of this chapter was to analyse the determinants of green capital structure in AIM-listed firms. Given that AIM firms function within a distinct regulatory framework and conducive market for green finance, compared to other markets, it was essential to explore whether the factors influencing capital structure in green AIM firms align with those affecting firms in other contexts. This chapter focused on a set of variables identified through an extensive review of the existing literature on capital structure determinants. The variables examined providing a comprehensive analysis of their role in shaping capital structure decisions in both green and non-green firms within the AIM market. The findings provide strong empirical support for the theoretical frameworks applied in the study, including the pecking order theory and trade-off theory, which explain how various factors affect capital structure decisions differently for green and non-green firms. For green firms, the study found that innovation funding, credit ratings, and institutional ownership have a significant impact on leverage decisions. These firms tend to incorporate sustainability factors, such as Firm Green Index (FGI) and green market economy rankings (GMER), into their financial strategies. Moreover, the presence of green subsidies and tax incentives plays a significant role in enabling higher leverage, aligning with the trade-off theory, which suggests that firms with access to external support mechanisms, such as subsidies, are more likely to take on debt. The regression analysis indicates that government subsidies and

related financial privileges exert a positive and statistically significant effect on the adoption of green leverage. This finding aligns with prior research (Flammer, 2021; Agliardi & Agliardi, 2019; Ongena et al., 2018) suggesting that policy support lowers financing barriers, thereby incentivizing firms to engage in green debt financing. The results reinforce the role of institutional enablers, particularly in markets like AIM where regulatory alignment and public-private synergy are crucial for sustainable finance evolution." This finding also aligns with earlier studies (e.g., Daskalakis & Psollaki, 2008; Rajan & Zingales, 1995), reinforcing the notion that firms with access to specific financial enablers can balance debt and equity more effectively.

Conversely, the study found that non-green firms rely on more traditional factors like profit growth, sales growth, and firm size, reflecting a conventional approach to capital structure. The negative relationship between liquidity and leverage, in line with the pecking order theory, suggests that these firms prefer to use internal resources to finance their operations rather than seeking external debt. This finding is consistent with prior research (e.g., D'Amato, 2019; Khemiri & Noubbigh, 2018), which highlights the tendency of firms with higher liquidity to minimize debt financing. The risk variable, notably higher for green projects, explains the cautious approach of creditors when dealing with environmentally driven initiatives, leading to a lower debt capacity for high-risk green projects. However, firms with stronger governance structures and market standings are more likely to secure external funding, a finding that parallels earlier studies (e.g., Cassar & Holmes, 2003; Michaelas et al., 1999). This research is unique in its focus on finding on the enablers and constraints of green leverage in the AIM market, which is characterized by a specific regulatory framework for green firms. Unlike previous studies that focused on larger markets or private firms, this research captures the distinct environment of AIM-listed firms, where regulatory considerations, market constraints, and sustainability goals all play pivotal roles in shaping capital structure decisions. The study's findings contribute to the broader understanding of how green and non-green firms navigate financial decision-making within the context of evolving market regulations and environmental imperatives. In conclusion, the determinants of capital structure in the AIM market differ significantly between green and non-green firms, with green firms increasingly leveraging sustainability factors and non-green firms adhering to traditional financial determinants. These findings provide a comprehensive view of capital structure decision-making in the AIM market and offer critical implications for both academics and practitioners in understanding the evolving landscape of green finance.

5.2. Empirical Findings: Study 2

In this part, the research aims to present empirical findings on the impact of green leverage on stock price performance in both the short run and long run. Drawing on signalling theory, the study explores how investors perceive the issuance of green debt as a positive signal of a firm's commitment to environmental sustainability. This perception, while qualitative, is assessed using the firm's stock price as a gauge of investor sentiment and value addition. By issuing green debt, firms aim to convey a credible signal of their dedication to green initiatives, which, in turn, can enhance their market value (Flammer, 2021). The analysis in this chapter applies Mean Adjusted Abnormal Returns (MAAR) and Buy-and-Hold Abnormal Returns (BHAR) to evaluate the stock performance of firms following green debt announcements, providing a comprehensive understanding of both short-term and long-term impacts on stock prices.

5.2.1. Descriptive Statistics

Table 5.13

Short Run Determinants of Price Performance for Sample

	Max	Min	Mean	Std. Dev.
MAAR	63.904	-68.78	-0.957	10.211
Lev	.95	.01	0.238	0.261
Size	8.399	-3.592	5.252	1.872
Risk	3.29	0	0.982	0.619
BS	20	3	12.076	4.212
Instow	84.5	0	15.379	21.68
Os	456.08	0	33.834	76.982
WAAC	1	32.76	6.899	6.915
MKC	1	0	0.970	0.169

Note: This table presents descriptive statistics of 237 observations in sample of firms listed in AIM for various variables that are considered potential determinants of MAAR (Market Adjusted Abnormal Return), which measures market return performance in the short run.

MAAR reflects the short-term abnormal returns of firms compared to the overall market. A negative average value suggests that, on average, firms underperform in the short run. Large variability in returns as s.td (10.21) indicates differences in firm-level factors or market conditions affecting performance. Leverage (lev) represents the extent to which a firm is financed by debt.

The mean leverage value indicates that firms have moderate debt levels. However, the negative minimum value suggests that some firms might have unusual or negative leverage ratios, which could influence their market performance. The range from -3.59 to 8.39 suggests that some firms are either highly leveraged or may be reducing debt.

The mean risk value of 12.08 suggests that firms in the sample are exposed to moderate risk. However, the standard deviation of 4.21 and the range from 3 to 20 indicate considerable variation in risk levels across firms. Higher risk typically correlates with greater potential for both gains and losses in the short run. Mean: 12.0760 indicates an average board size of around 12 members, with firms having between 3 and 20 board members. The moderate standard deviation (4.2119) shows some variation in governance structures. Instown Mean 15.3785 indicates that institutional ownership varies widely across firms, from 0 to 84.5%. The large standard deviation (21.6759) suggests significant diversity in how much a firm is held by institutions. Ownership structures with mean 33.8340 vary significantly, with some firms having highly concentrated ownership (Max: 456.08), while others have none. The high standard deviation (76.9819) shows considerable variability in how ownership is distributed across firms. The average cost of capital for firms, with mean 6.8989 a standard deviation of 6.9147. WAAC values range from 1 to 32.76, indicating that some firms face higher financing costs than other.

Cold Market (0): Represents less active market periods with lower investor engagement and potentially lower returns. Hot Market (1): Represents periods of high market activity, where firms are likely to experience higher returns due to increased trading volume and investor optimism. Average shows that mostly market activity is doing in hot periods. The overall this above table provides insights into the variability of firm characteristics and how they might influence short-term market performance (MAAR). The wide ranges and high standard deviations in some variables, such as MAAR, Ownership Structure, and Institutional Ownership, indicate that firms in the dataset experience diverse market and operational conditions, which could affect their performance differently.

5.2.2. Descriptive Statistics of Green and Non-Green Firms in Short Run

The tables provide descriptive statistics for the variables categorized into Green and Non-Green firms in the short run. The descriptive statistics are divided into four groups based on the classification of firms: High Green (1), Low Green (2), Low Non-Green (3), and High Non-Green

(4) on carbon emission bases. These findings provide insights into the financial and governance characteristics influencing market performance, highlighting the varying dynamics between green and non-green firms in the short run.

Table 5.14

Summary of Descriptive Statistics for High Green Firms in Short-Run Performance

Variable	Max	Min	Mean	Std. Dev.
MAAR	7.339	-32.973	-3.22	8.059
Lev	.95	0.01	0.282	0.288
Size	6.549	2.088	4.623	1.316
Risk	3.29	0	0.921	0.763
Boardsize (BS)	16	4	11.2	3.502
Instown	75.54	0	11.37	21.39
OS	73.96	0	7.692	14.137
WACC	15.75	-0.31	5.552	4.327
MkC	1	0	0.95	0.220

Note: This table provides descriptive statistics of 60 debt instrument issued by firms categorized as high green firms on the bases of carbon emission for the short run.

Table 5.15: Summary of Descriptive Statistics for High Non-Green Firms in Short-Run Performance

Variable	Max	Min	Mean	Std. Dev.
MAAR	41.41	-18.15	1.302	8.288
Lev	.84	.07	.393	0.299
Size	8.39	3.314	5.765	1.153
Risk	2.43	0	1.096	.561
Bsize (BS)	20	4	10.789	3.726
Instown	52.16	0	19.45	18.81
OS	255.93	0	16.98	40.23
WACC	32.76	0.03	9.86	10.89
MkC	1	1	1	0

Note: This tables provides descriptive statistics of 57 debt instrument issued by firms categorized as high non-green firms on the bases of carbon emission for the in the short run.

Table 5.16

Descriptive Statistics for Low Green Firms in Short-Run Performance

Variable	Max	Min	Mean	std
MAAR	63.904	-25	1.578	11.863
Lev	0.617	0.01	0.153	0.189
Size	7.951	1.845	5.504	2.746
Risk	2.37	0	.887	0.362
Bsize	20	3	10.57	3.754
Instown	77.35	0	14.95	24.072
OS	409.91	0	37.89	125.75
WACC	14.36	0.03	6.32	4.635
MkC	1	1	1	0

Note: This table provides descriptive statistics of 63 debt instrument issued by firms categorized as low green firms on the bases of carbon emission for the short run.

Table 5.17

Descriptive Statistics for Low Non-Green Firms in Short-Run Performance

Variable	Max	Mean	Std. Dev.	Min
MAAR	7.321	-3.633	8.288	-18.15
Lev	0.902	0.131	0.299	.07
Size	7.522	5.125	1.153	3.314
Risk	1.84	1.039	.561	0
Bsize	20	15.947	3.726	4
Instown	76.7	15.993	18.81	0
OS	0.71	73.334	40.23	0

WACC	13.94	5.988	10.89	0.03
MkC	1	0.93	0	1

Note: This table provides descriptive statistics of 57 debt instrument issued by firms categorized as low non- green firms on the bases of carbon emission for the short run.

The descriptive statistics of the variables across different categories of green and non-green firms reveal notable patterns in short-term performance and financial characteristics.

High Green firms exhibit a negative mean MAAR (-3.2225), indicating underperformance, with moderate leverage and smaller firm sizes. Conversely, Low Green firms demonstrate positive short-term performance as MAAR 1.302105 with lower leverage and slightly larger firm sizes, suggesting better market adaptation.

In the non-green categories, Low Non-Green firms show significant underperformance with low leverage and highly concentrated ownership, whereas High Non-Green firms exhibit positive MAAR with the highest leverage and larger firm sizes.

The cost of capital (WAAC) is significantly higher in High Non-Green firms, indicating a higher financial burden. Board size and institutional ownership are generally larger in non-green firms, with High Non-Green firms having the highest institutional ownership, suggesting more external monitoring.

Ownership concentration is highest among Low Non-Green firms, pointing to concentrated control, while High Green firms show a more dispersed ownership structure.

Table 5.18

Descriptive Normality Test in Short-Run Performance

Variable	Pr (Skewness)	Pr (Kurtosis)	JB Chi²	JB p-value
MAAR	0.0016	0.0000	59.76	0.0000
Lev	0.0000	0.0184	44.51	. 0.0000
Size	0.0000	0.0000	71.28	0.0000
Risk	0.0000	0.0003	31.87	0.0000
Bsize	0.2295	0.7124	1.59	0.4507
Instown	0.0000	15.993	0.074	0.0000
OS	0.0000	0.0000	-	0.0000
WACC	0.0000	0.0000	-	0.0000
MkC	0.0000	0.0000	-	0.0000

The results of the skewness and kurtosis tests, along with the Jarque-Bera (JB) statistics, provide insight into the distributional properties of the variables used in the regression analysis. These tests are essential for assessing whether the variables meet the assumption of normality, which underpins many classical statistical techniques. The results indicate that several key variables—including MAAR, Leverage, Firm Size, and Risk—significantly deviate from a normal distribution. For each of these, the p-values for both skewness and kurtosis are below the 1% significance level, and their corresponding JB chi-square values are high, with p-values of 0.0000. These findings confirm that the distributions of these variables are non-normal, suggesting the presence of asymmetry and/or heavy tails in the data. In particular, the MAAR variable shows significant non-normality, which is critical because it serves as a primary dependent variable in the performance analysis. Similarly, Leverage, Firm Size, and Risk also display pronounced departures from normality, which may affect the consistency and efficiency of estimators in conventional regression models.

Some variables such as Board Size exhibit relatively normal characteristics, with p-values of 0.2295 (skewness) and 0.7124 (kurtosis), and a JB test statistic that is not statistically significant ($p = 0.4507$). This suggests that the distribution of Board Size is approximately normal. In contrast, variables like Institutional Ownership, offer size (OS), WACC, and Market Capitalization demonstrate extreme deviations from normality, particularly in skewness, with their JB p-values also indicating strong rejection of the null hypothesis of normality. Given these findings, it is methodologically appropriate to apply robust regression techniques, such as heteroskedasticity-robust standard errors and regularization methods like LASSO, to accommodate the presence of non-normal data. These results also justify conducting sensitivity and robustness tests, ensuring that the inferences drawn from the empirical analysis remain valid despite violations of normality assumptions.

5.2.3. Estimation of OLS, LASSO and EBA for the Robust Determinants of MAAR

The OLS regression model is used to examine the direct relationship between key variables (leverage, size, risk, board size, institutional ownership, ownership structure, WAAC, and market activity) and MAAR in the AIM market. Leverage (Lev) shows a negative coefficient of -1.232, indicating an inverse relationship with MAAR, yet this result is statistically insignificant with a standard error of 0.41but it is not statistically significant ($p > 0.05$). This indicates that leverage

has a minimal effect on short-run stock performance, this aligns with findings in the literature suggesting that leverage impacts are more evident in long-term performance. The positive coefficient of firm Size (size) 0.764 implies that larger firms experience a slight increase in MAAR, possibly due to their perceived stability. However, with a standard error of 1.90, this variable is also statistically insignificant, indicating that size alone may not be a strong determinant of short-run performance.

Risk Exhibits a negative coefficient (-2.148) with a standard error of 1.80, suggesting that higher risk could lower MAAR. Though not statistically significant, this aligns with the risk-return trade-off theory, where higher perceived risk may deter investors in the short run**.** Market Activity (MkC)**:** With a positive and significant coefficient (8.222), MkC indicates that a hot market environment positively impacts MAAR. This aligns with the idea that higher trading volumes and increased investor optimism in hot markets contribute to positive short-term performance.

EBA is applied to test the robustness of each variable's impact on MAAR by examining how consistent each coefficient remains across various model specifications. The objective is to evaluate the sensitivity of these relationships to changes in model specifications by including and excluding certain variables across different models. To assess the sensitivity of the Q-variables (the variables of interest), a total of 1365 regressions were run with sets of four variables to determine if a particular variable consistently maintained the same direction (sign) and level of significance. The key findings from the analysis of the whole sample. EBA results indicate leverage with a consistent negative coefficient (-1.439), though insignificantly impacting MAAR. The lack of sensitivity confirms that leverage does not influence short-run stock returns within the AIM market sample, aligning with empirical evidence on the delayed impact of leverage on firm performance**.** Risk Shows a stable, negative relationship with MAAR (-2.127), consistent across models. Although the effect is not statistically significant, this supports theories that higher risk may decrease short-term appeal for investors seeking stability in an alternative market like AIM. EBA confirms the robustness of market capitalization as a positive determinant, with leverage and risk having consistent, albeit statistically insignificant, impacts on MAAR.

Table 5.19

Comparative Analysis and Robustness across Models

	OLS	Lasso	EBA
	(0.41)	(0.41)	(0.41)
Size	0.764	0.752	0.752
	(1.90)	(1.90)	(1.90)
Risk	-2.148	-2.13	-2.127
	(1.80)	(1.80)	(1.80)
BS	-0.253	-0.251	-0.25
	(1.53)	(1.53)	(1.53)
Instow	0.059	0.059	0.059
	(1.66)	(1.66)	(1.66)
Os	-0.007	-0.007	-0.007
	(0.68)	(0.68)	(0.68)
Waac	-0.054	-0.054	-0.054
	(0.51)	(0.51)	(0.51)
Mkc	8.222	8.221	8.221
	(1.83)	(1.83)	(1.83)
Ce	-0.045		
	(0.19)		
_cons	-7.749	-7.768	-7.768
	(1.44)	(1.44)	(1.44)
***R*2**	0.05	0.05	0.047

Note: This table exhibits the sample of 235 firms in the AIM from 2010 to 2023. The table also exhibits the estimation of regressions across all the models. Outcome variable of study is adjusted abnormal returns (MAAR). * $p<0.05$; ** $p<0.01$ represent significance level at the 1, * $p<0.05$; ** $p<0.01$

All models agree on leverage's insignificance in influencing short-run stock performance. This suggests that leverage is a long-term driver of firm stability rather than a short-run determinant, aligning with capital structure theories. Market Activity a consistently significant factor across OLS, LASSO, and EBA, the positive relationship between MkC and MAAR highlights that hot markets drive short-run returns. This is consistent with literature on market sentiment and trading volume, where high activity levels correlate with increased investor confidence.

5.2.4. Short-Run Price Performance (MAAR) for Green and Non-Green Firms

Table 5.20

Determinants of Price Performance in Short Term for Whole Sample

	(GREEN) MAAR	(NON- GREEN) MAAR
Lev	2.250	-3.428
	(0.57)	(-0.86)
Size	-1.020	1.388**
	(-1.51)	(2.65)
Risk	-2.950*	-0.359
	(-1.99)	(-0.15)
BS	0.574*	-0.552*
	(1.99)	(-2.39)
Instow	0.069	0.015
	(1.49)	(0.18)
Os	0.002	-0.012
	(0.08)	(-1.08)
WAAC	0.336	-0.076
	(1.37)	(-0.44)
MkC	19.18**	3.422
	(2.75)	(0.45)
_cons	-21.44*	-2.486
	(-2.55)	(-0.28)

Note: This table exhibits the sample of 235debt instruments including 121 green and 114 non-green in the AIM from 2010 to 2023. The table also exhibits the estimation of regressions across all the models. Outcome variable of study is adjusted abnormal returns (MAAR). * $p<0.05$; ** $p<0.01$ represent significance level at the 1, * $p<0.05$; ** $p<0.01$

The short-run price performance, represented by MAAR (Market Adjusted Abnormal Return), is analysed across green and non-green firms to evaluate if green leverage influences stock performance immediately following market activity. In Green Firms Leverage has a positive coefficient (2.250) with an insignificant effect (t = 0.57), suggesting that leverage in green firms does not significantly impact short-term MAAR. Whereas Leverage in Non-Green Firms shows a negative coefficient (-3.428) but remains statistically insignificant (t = -0.86). This implies that, similar to green firms, leverage does not significantly influence short-run performance in non-green firms rejecting our hypothesis that green leverage has impact on stock performance in short run. Size has a negative coefficient (-1.020) and is statistically insignificant (t = -1.51) in Green Firms, suggesting that size does not affect the short-term performance of green stocks. In Non-Green Firms the positive coefficient (1.388) is statistically significant (t = 2.65, p < 0.05), indicating that larger non-green firms tend to have better short-term performance. This aligns with

studies suggesting that larger firms are perceived as more stable, boosting short-run returns (Fama & French, 1993). Risk in Green firms has a negative and statistically significant impact (-2.950, t = -1.99, $p < 0.05$), indicating that higher risk is associated with lower short-run returns for green firms. This supports the hypothesis that investors in green firms are sensitive to risk and demand a premium for higher perceived uncertainty. In Non-Green the risk coefficient is negative (-0.359) but insignificant, implying that risk does not notably impact short-run performance in non-green firms. In Green firms Board size has a positive, significant effect (0.574, t = 1.99, $p < 0.05$), suggesting that larger boards may contribute to better governance and short-term performance in green firms. In non-green firm Board size has a significant negative impact (-0.552, t = -2.39, $p < 0.05$), indicating that larger boards in non-green firms might reduce efficiency, which can adversely impact short-run performance. Market activity (MkC) shows a significant positive relationship (19.18, t = 2.75, $p < 0.01$), suggesting that higher market capitalization in green firms correlates with better short-run returns.in Non-Green Firms: The effect is positive (3.422) but insignificant, suggesting that market condition has a lesser impact on short-run performance in non-green firms.

5.2.5. Descriptive Stat of Variables Green and Non-Green Categories in Longs Run

The descriptive statistics provided offer insight into the determinants of long-term stock price performance for different categories of firms, distinguished by their level of green involvement. Sample firms are categorized into four categories as High Green, Low Green, Low Non -Green, High Non- Green on the bases of green index.

Table 5.21

Descriptive Statistics for High Green Firms in Long-Run Performance

Variable	Max	Mean	Std. Dev.	Min
BHAR	83.009	14.048	45.876	5.08
Lev	0.95	0.225	0.256	0.020
Size	6.898	4.624	1.392	1.842
Risk	1.16	0.754	0.807	-0.6
Boardsize (BS)	16	11.2	28.589	4
Instown	97.38	15.683	28.589	0
OS	121.18	11.804	25.072	0

WACC	18.23	6.28	4.092	1.26
MkC	1	0.767	0.427	0

Note: This tables provides descriptive statistics of 60 debt instrument issued by firms categorized as high green firms on the bases of carbon emission for the in the long run.

Table 5.22

Descriptive Statistics for High Non-Green Firms in Long-Run Performance

Variable	Max	Min	Mean	Std. Dev.
BHAR	166.51	-85.06	5.871	49.424
Lev	0.83	0.01	0.373	0.325
Size	9.234	3.389	6.079	1.191
Risk	2.43	0	1.101	0.504
Boardsize(BS)	20	4	11.07	3.45
Instown	66.68	0	22.514	19.936
OS	108.64	0	18.26	29.763
WACC	32.76	0.94	9.06	7.870
MkC	1	0	0.895	0.309

Note: This tables provides descriptive statistics of 57debt instrument issued by firms categorized as high non- green firms on the bases of carbon emission for the in the long run.

Table 5.23

Descriptive Statistics for Low Green Firms in Long-Run Performance

Variable	Max	Min	Mean	Std. Dev.
BHAR	186.46	-99.75	-6.124	45.525
Lev	1.28	.01	0.184	0.303
Size	8.490	1.925	5.583	1.701
Risk	2.29	0	0.754	0.707
Bsize	20	3	10.571	3.499
Instown	72.64	0	19.492	26.505
OS	500.96	0	48.373	80.937
WACC	20.9	.94	7.759	5.041
MkC	1	0	0.825	0.383

Note: This tables provides descriptive statistics of 63 debt instrument issued by firms categorized as low green firms on the bases of carbon emission for the in the long run.

Table 5.24

Descriptive Statistics for Low Non-Green Firms in Long-Run Performance

Variable	Max	Min	Mean	Std. Dev.
BHAR	128.899	-76.8	-0.649	37.181
Lev	0.52	0.01	0.111	0. 1012
Size	7.622	0.872	5.828	1.494
Risk	7.622	0.45	1.048	0.321
Instown	63.8	0	8.178	14.038
OS	418.3	.28	56.782	99.483
WACC	16.66	5.01	9.117	3.741
MkC	1	0	0. 86	0.350

Note: This tables provides descriptive statistics of 57 debt instrument issued by firms categorized as low non-green firms on the bases of carbon emission for the in the long run.

High Green Firms exhibit a mean BHAR of 14.05 with a significant standard deviation of 45.88, implying these firms tend to outperform in the long run. This outperformance aligns with the increasing market demand for sustainable investment, where investors value firms adopting green practices due to the long-term benefits of sustainability (Lins, Servaes, & Tamayo, 2017). High Non-Green Firms (-5.87) and Low Green Firms (-6.12) both show negative BHAR values, suggesting these firms underperform in the long run. Non-green firms, especially, are exposed to increasing regulatory pressures, shifting investor preferences, and potentially higher future costs related to carbon emissions and environmental compliance (Grewal, Hauptmann, & Serafeim, 2020). Low Non-Green Firms have a BHAR close to zero (-0.65), reflecting more stable but modest performance. Possibly reflecting higher risk aversion in non-green sectors.

The significant positive BHAR for High Green Firms can be attributed to the growing emphasis on ESG (Environmental, Social, and Governance) factors in investment decisions. Green firms that align with investor preferences for sustainable and socially responsible investment tend to benefit from enhanced valuation over time. Leverage, measured as the debt-to-equity ratio, varies significantly across categories: High Green Firms have an average leverage of 0.23, while High Non-Green Firms show a higher leverage ratio (0.37). This disparity suggests that non-green firms are more reliant on debt financing. Higher leverage increases financial risk, especially in industries that face regulatory risks or volatile cash flows (Miller, 1977). Low Green Firms and Low Non-Green Firms have lower leverage (0.18 and 0.11, respectively), which may reflect a

more conservative approach to capital structure, particularly for firms transitioning toward or away from green initiatives.

High Non-Green Firms are the largest, with an average size of 6.08, suggesting that these firms, despite being non-green, maintain significant market presence. High Green Firms are smaller (mean size of 4.62), reflecting that firms investing in sustainability may not always be the largest in the market but are growing due to increasing investor interest in sustainable practices. Risk, as measured by the variability of stock returns, shows interesting patterns: High Non-Green Firms have the highest risk (1.10), indicating they face greater volatility, possibly due to increasing regulatory uncertainties and investor concerns about future sustainability. High Green Firms exhibit lower risk (0.75), which may be attributed to the stable, long-term growth prospects associated with green investments. Board size varies moderately across the firms, with Low Non-Green Firms having the largest boards (mean 15.95), while High Green Firms have slightly smaller boards (11.20). Larger boards in non-green firms may reflect a more complex governance structure, which can slow decision-making, particularly in response to environmental challenges (Yermack, 1996).

Smaller boards in green firms may facilitate faster, more agile decision-making, crucial in industries that need to adapt to rapidly changing regulatory and market environments. High Non-Green Firms show higher institutional ownership (22.51%) than High Green Firms (15.68%). Ownership structure indicates the concentration of ownership in firms: Low Green Firms display significant variability in ownership structure (mean 48.37%), A lower WAAC for green firms suggests that their cost of capital is reduced due to favourable financing terms associated with sustainable projects (Hsu, 2018). High Green Firms have the lowest WAAC (6.28), reflecting access to cheaper financing options such as green bonds and government subsidies. High Non-Green Firms have a higher WAAC (9.06), likely due to higher financial risks and limited access to green financing. Market conditions significantly influence stock performance, especially in the long run. Firms in hot markets are more likely to experience higher valuations and liquidity, while those in cold markets may face challenges in raising capital and maintaining investor interest (Baker & Wurgler, 2006). The data sample shows that on average firms in a sample are preforming their operation in hot market.

5.2.6. Summary Statistics for Determinants of Long-Term Performance of Overall Sample

Table 5.25

Descriptive Statistics for Determinants of Long-Term Performance of Overall

	Max	Min	Mean	Std. Dev.
BHAAR	186.45	-99.75	0.360	45.242
Lev	1.28	.01	0.225	0.280
Size	9.234	0.871	5.519	1.554
Risk	3.1	-.6	0.908	0.636
BS	20	3	12.143	4.137
Instow	97.31	0	16.533	23.622
Os	500.96	0	33.896	69.299
WAAC	32.76	.94	8.023	5.498
MKC	1	0	0.835	0.372

Note: The table presents the summary statistics of 237 observation in sample for determinants of long-term performance of overall performance of firms in AIM market in long run., which include leverage (lev)**,** firm size (size)**,** risk**,** board size (BS)**,** institutional ownership (Instow)**,** ownership structure (Os)**,** Weighted Average Cost of Capital (WAAC)**,** and Market Capitalization (MkC)**.**

The BHAR (Buy and Hold Return) shows considerable variation with a high standard deviation, indicating substantial fluctuations in long-term stock performance across the sample. The mean BHAR is relatively small compared to the wide range of values, which suggests that while some firms experience strong positive returns, others face significant losses. On average, firms have a leverage ratio of 22.5%, with the values ranging from 1% to 128%. The standard deviation indicates moderate variability in leverage levels across firms, suggesting different capital structures within the sample. Firm size, likely measured on a logarithmic scale, shows a mean of 5.52, with a relatively broad distribution. The minimum size is 0.87, while the largest firm has a size of 9.23, indicating considerable differences in firm scales within the sample. Risk levels across the firms show some variability, with a mean of 0.91. The standard deviation of 0.64 indicates that firms have differing risk profiles, ranging from -0.60 (possibly indicating risk-reducing factors) to 3.10 (high-risk firms). Institutional ownership varies significantly across firms, with a mean of 16.53%. The wide range (from 0 to nearly 100%) and large standard deviation reflect a substantial difference in the involvement of institutional investors across the firms. Ownership structure, likely representing ownership concentration, shows a mean of 33.9%, with an extremely high

standard deviation. This indicates that some firms have highly concentrated ownership, while others have dispersed ownership. WAAC averages at 8.02%, with variability across firms (standard deviation of 5.50). The wide range suggests differences in firms' cost of capital due to varying capital structures and market conditions. Market activity, likely coded as a dummy variable (0 = cold activity, 1 = hot activity), shows an average of 0.835, suggesting that most market activity in the sample is hot. Overall, the dataset shows significant variability in key financial metrics such as BHAR, leverage, risk, and ownership structure, indicating that the sample includes a diverse set of firms in terms of capital structure, risk exposure, and market performance. This variability likely play a crucial role in determining how leverage impacts stock performance in the long run.

Table 5.26

Descriptive Normality Test

	Pr(Skewness	Pr(Kurtosis)	JB Chi²	JB p-value
BHAAR	0.0000	-0.0001	33.16	0.0000
Lev	0.0000	0.0000	72.09	0.0000
Size	0.0001	0.9223	13.46	0.0012
Risk	0.1071	0.0884	5.48	0.0646
BS	0.1690	0.9375	1.91	0.3840
Instow	0.0000	0.0026	50.48	0.0000
Os	0.0000	0.0000	-	0.0000
WAAC	0.0000	0.0000	61.58	0.0000
MKC	0.0000	0.0035	57.59	0.0000

The results of the skewness, kurtosis, and Jarque-Bera (JB) tests provide important insights into the distributional characteristics of the variables used in the analysis. Several key explanatory and outcome variables—such as BHAR, Leverage (LEV), WAAC, Institutional Ownership (Instow), and Market Capitalization (MkC)—exhibit statistically significant skewness and/or kurtosis, with p-values well below the 1% threshold. The corresponding JB test statistics for these variables also indicate a strong rejection of the null hypothesis of normality. This non-normality suggests that the data distributions are either skewed, heavy-tailed, or both, which may violate the assumptions of Ordinary Least Squares (OLS) regression. In contrast, variables such as Risk, Board Size (BS), and Firm Size display more symmetric distributions, with higher p-values

suggesting a closer approximation to normality. These findings validate the methodological decision to apply robust statistical techniques in this study. The use of robust standard errors, LASSO regression, and event study models mitigates the potential bias and inefficiency arising from non-normal error terms. Additionally, the results support the relevance of conducting further sensitivity analyses to ensure the robustness of the findings across different model specifications.

5.2.7. Estimation of OLS, LASSO and EBA for the Robust Determinants of BHAR

In table, column 1 posts the OLS model that assesses the direct relationship between selected variables (leverage, size, risk, board size, institutional ownership, ownership structure, WAAC, and market activity) and long-term stock performance, measured by BHAAR. The findings show that leverage (lev) with a strong negative coefficient (-41.081) and a standard error of 3.34, indicating a significant impact ($p < 0.01$) on BHAAR. This suggests that higher leverage is associated with lower long-term performance. This aligns with theories suggesting that high debt levels can lead to financial constraints, reducing long-term growth potential and returns.

Firm Size (Size) displays a positive coefficient of 2.807, with a standard error of 1.18. However, this effect is statistically insignificant ($p > 0.05$), suggesting that size alone may not drive long-term performance in the AIM market. Risk Exhibits a negative coefficient (-1.422) with a standard error of 0.26, although statistically insignificant. This suggests that higher risk does not substantially impact long-term stock performance, even though the negative coefficient aligns with general investor preferences for lower-risk, stable returns. WAAC Shows a negative coefficient (-1.533) and is statistically significant ($p < 0.05$), indicating that a higher cost of capital adversely affects long-term performance. This finding supports theories in finance that emphasize the drag effect of high financing costs on profitability and long-term growth. Market activity (MkC) presents a negative coefficient of -12.124, but without significance, indicating that market capitalization does not notably influence long-term stock performance within the AIM market in this sample. Overall the OLS model highlights leverage and WAAC as significant factors negatively impacting long-term performance, while variables like firm size and risk remain statistically insignificant.

In second column LASSO regression is used where focus on variables with the most substantial and consistent impact on BHAAR by shrinking the coefficients of insignificant variables towards zero. Table 28 displays that leverage (lev) has an even stronger negative

coefficient of -41.87, maintaining high statistical significance ($p < 0.001$). This reinforces leverage as a detrimental factor to long-term performance, where higher debt burdens reduce growth potential. WAAC Shows a negative coefficient of -1.5243 with statistical significance ($p < 0.05$), consistent with OLS findings. This significance underscores the role of financing costs in diminishing long-term returns, as high WAAC reflects costly capital sources that can drain firm resources. LASSO also retains positive and negative coefficients, respectively, for these variables. However, neither shows statistical significance, echoing OLS results indicating that size and risk do not drive long-term stock performance. In short LASSO affirms leverage and WAAC as key negative determinants of BHAAR, while deemphasizing other variables such as firm size and risk that remain insignificant.

EBA tests the robustness of variable impacts on BHAAR by assessing whether the significance and direction of effects hold under multiple model specifications. Findings reveal Leverage (Lev) with a coefficient of -41.87, leverage remains a robust negative determinant of long-term performance, indicating its consistent detrimental impact on BHAAR. This result supports the argument that high leverage can impose constraints that reduce long-term growth and profitability. EBA confirms the negative effect of WAAC (-1.524) with statistical significance, consistent with findings in OLS and LASSO. This robustness signifies that high costs of capital are a reliable indicator of lower long-term returns, as elevated financing costs may deter profitability. Other Variables such as Firm size, risk, and market capitalization remain statistically insignificant, suggesting that these factors do not consistently influence BHAAR over the long term in the AIM market.

Table 5.27

Comparative Analysis and Robustness across Models

	OLS	LASSO	EBA
Lev	-41.081	-41.87***	-41.87***
	(3.34)**	(3.34)**	-11.97
Size	2.807	2.689	2.689
	-1.18	-1.18	-2.329
Risk	-1.422	-1.334	-1.334
	-0.26	-0.26	-5.404
Size(BS)	-0.258	-0.218	-0.218

	-0.34	-0.34	-0.75
Instow	0.021	0.023	0.023
	-0.15	-0.15	-0.134
Os	-0.096	-0.096	-0.096
	-1.91	-1.91	-0.05
Waac	-1.533	-1.5243**	-1.524**
	(2.66)**	(2.66)**	-0.575
Mkc	-12.124	-12.35	-12.35
	-1.49	-1.49	-1.49
Ce	-0.355		
	-0.28		
_cons	23.249	23.19	23.19
	-1.56	-1.56	-14.91
R2	0.09	0.087	0.055
N	231	231	231

Note: This table exhibits the sample of 231 firms in the AIM from 2010 to 2023. The table also exhibits the estimation of regressions across all the models. Outcome variable of study is Buy and Hold abnormal returns (BHAR). * $p<0.05$; ** $p<0.01$ represent significance level at the 1, * $p<0.05$; ** $p<0.01$

All three models (OLS, LASSO, and EBA) identify leverage as a significant negative factor for BHAAR, underscoring that high debt levels constrain long-term growth. This finding aligns with financial theories emphasizing that excessive leverage can lead to financial distress, curbing the ability to generate sustainable returns. Consistently negative and significant across OLS, LASSO, and EBA, WAAC proves to be a reliable predictor of lower BHAAR. This suggests that firms with higher financing costs face reduced profitability and growth prospects, aligning with corporate finance theories on the cost of capital's impact on net returns. All models agree that these factors such as size, Risk and market activity do not significantly impact long-term performance, indicating that these attributes might not be primary considerations for investors focused on sustainable returns in the AIM market.

5.2.8. Long-Term Price Performance (BHAR) for Green and Non-Green Firms

Table 5.28

Price Performance (BHAR) for Green and Non-Green Firms in Long Run

	(GREEN) BHAR	(Non- GREEN) BHAR
Lev	-13.46	-33.91*
	(-0.80)	(-2.06)
Size	-3.590	6.930*
	(-1.25)	(2.11)
Risk	-14.05*	23.13*
	(-2.13)	(2.25)
BS	5.755***	-3.556***
	(4.85)	(-3.88)
Instow	0.292	-0.594*
	(1.79)	(-2.50)
Os	-0.163*	-0.066
	(-2.11)	(-1.07)
WAAC	0.796	-0.690
	(0.77)	(-0.93)
MkC	-4.431	-11.77
	(-0.46)	(-0.93)
_cons	-29.41	14.12
	(-1.40)	(0.57)

Note: This table exhibits the sample of 231debt instruments including 123 green and 104 non-green in the AIM from 2010 to 2023. The table also exhibits the estimation of regressions across all the models. Outcome variable of study is bought and hold abnormal returns (BHAR). * p<0.05; ** p<0.01 represent significance level at the 1, * p<0.05; ** p<0.01

Regression results shows that Green Firms Leverage has a negative coefficient (-13.46) but is statistically insignificant (t=-0.80), suggesting minimal influence on the long-term performance of green firms. Where as in Non-Green Firms Leverage is significantly negative (-33.91, t = -2.06, p < 0.05), indicating that higher leverage in non-green firms leads to reduced long-term performance. Size has a negative coefficient (-3.590) and remains statistically insignificant, indicating that size does not significantly impact the long-term returns of green firm. Size is positively associated with BHAAR (6.930, t = 2.11, p < 0.05), in non- green suggesting that larger non-green firms achieve better long-term performance. This may be due to increased stability and

resource availability, which supports sustainable growth.

Risk has a significant negative coefficient (-14.05, $t = -2.13$, $p < 0.05$), supporting the idea that higher risk diminishes long-term returns in green firms. In Non-Green Firms Risk has a significant positive impact (23.13, $t = 2.25$, $p < 0.05$), suggesting that non-green firms with higher risk potentially attract investors willing to take on greater risk for higher long-term rewards. In Green Firms Board size is positively significant (5.755, $t = 4.85$, $p < 0.001$), indicating that larger boards in green firms support long-term performance, possibly due to improved oversight and strategic planning. Board size has a negative effect (-3.556, $t = -3.88$, $p < 0.001$), which might reflect inefficiencies in governance among larger boards.

Institutional Ownership in Green Firms, positive coefficient (0.292) with marginal significance, suggesting a potential but weak impact on long-term performance. A significant negative coefficient (-0.594, $t = -2.50$, $p < 0.05$) suggests that higher institutional ownership may constrain long-term growth in non-green firms, possibly due to conservative policies or investor pressure. Overall results reveals that for green firms, leverage does not significantly impact long-term performance.

Conversely, green firms' negative leverage impact is present but less pronounced, potentially due to the growing investor preference for sustainable companies, which aligns with studies suggesting lower capital costs for green-oriented firms over time. This indicates that leverage alone may not be a strong enough factor to influence the long-term performance of Green firms, suggesting that other factors might play a more important role. However, for non-green firms, the significant negative relationship between leverage and BHAAR supports the alternative hypothesis (H1), indicating that high leverage in non-green firms is detrimental to long-term performance.

5.2.9. Summary of Hypothesis Testing Results.

Table 5.29

Hypothesis Testing Results – Study 2 (Green Leverage and Stock Performance: Short vs Long Run)

Hypothesis	Statement	Result	Support
H2.1	Green leverage adoption improves short-run stock performance (MAAR).	Partially Supported	Modest abnormal returns in 1–30 days window.
H2.2	Green leverage adoption improves long-run stock performance (BHAR).	Not Supported	Weak or insignificant effect.

Note. This table presents the results of empirical analysis. Significance levels are indicated, and hypotheses are accepted or rejected accordingly. The findings are contextualized with prior literature where applicable.

5.2.7. Contribution Box

- **Theoretical Contribution:** Links capital structure choice (green leverage) with firm value and stock market reactions, expanding trade-off theorem within sustainable finance.
- **Empirical Contribution:** Demonstrates modest positive impacts of green leverage in the short run, but weak or insignificant long-run effects.
- **Policy Contribution:** Highlights need for stable government policies and incentives to sustain investor confidence in green projects.

5.3. Empirical Findings: Study 3

In this part, the research aims to present empirical findings on the impact of stock price responses to green bond issuance events using event study methodology. The focus would be on determining if and how the market reacts to announcements of green bond issuances and the significance of these reactions in terms of abnormal returns.

5.3.1. Descriptive Statistics

The descriptive statistics of the Pre-Market Adjusted Abnormal Returns (Pre-MAAR): table reveals insightful trends in the data across various classifications of firms (Green and Non-Green) over different time intervals. For Green firms, the Pre-MAAR is analysed across three intervals: before the 1st day of trading, 15 days prior, and 30 days prior to trading. The minimum Pre-MAAR values indicate significant negative fluctuations, with the most substantial decline of

-7.027 occurring in the 15-day period. Conversely, the maximum value of Pre-MAAR in Green firms during this interval reaches 4.990, suggesting a high level of variability in abnormal returns in the lead-up to trading. The mean Pre-MAAR for Green firms fluctuates near zero, with values of -0.0175 before the 1st day, -0.1579 for the 15-day interval, and 0.1082 for the 30-day interval. These values imply relatively balanced returns overall, with minor negative and positive biases over shorter and longer periods, respectively. The standard deviation is also informative; it increases with the length of the pre-trading period, peaking at 3.342 by the 30th day. This progression suggests that the farther in advance of trading, the more dispersed and volatile the returns become for green firms, which may imply sensitivity to broader market and regulatory expectations tied to environmental considerations.

Non-Green firms, in contrast, show somewhat different trends in Pre-MAAR behaviour. The minimum values remain comparable to green firms, with a value of -7.027 observed in the 15-day period, and the maximum for this category reaches 6.188 in the 30-day period. Notably, non-green firms exhibit a mean Pre-MAAR of -0.1897 before the 1st day of trading, which is marginally more negative than that of green firms (-0.0175). This difference in mean returns could be indicative of market sentiment toward non-green firms, where anticipated returns might face slight downward adjustments, potentially in response to environmental scrutiny or lower market expectations. Interestingly, in the 30-day pre-trading period, non-green firms demonstrate a positive mean Pre-MAAR of 0.4777, marking a distinct shift from prior intervals. This shift, accompanied by a standard deviation of 2.2699, suggests that non-green firms may experience positive anticipation in the longer lead-up to trading, potentially due to investor re-assessment of short-term risks or firm-specific factors outside environmental performance.

Analysing the entire sample provides a broader perspective on Pre-MAAR trends irrespective of environmental classification. In the full sample, the minimum Pre-MAAR remains at -7.027, seen in the 15-day interval, while the maximum peaks at 4.990 in both the 15- and 30-day intervals. The overall mean Pre-MAAR values hover close to zero across all intervals, with -0.0971 before the 1st day, -0.2232 in the 15-day interval, and 0.2791 in the 30-day period, pointing to the absence of extreme positive or negative biases across all firms in the pre-trading periods. The standard deviation trends in the overall sample align with those observed in individual categories, increasing over longer pre-trading periods. This trend supports the notion that abnormal returns tend to disperse over time, with the 30-day interval exhibiting the greatest variability

(standard deviation of 2.8846). This increase may reflect an accumulation of external market factors that influence all firms as trading day approaches.

Table 5.30

Descriptive Statistics of the Pre-Market Adjusted Abnormal Returns (Pre-MAAR)

Green Status	Pre-MAAR	Maximum	Minimum	Mean	Deviation
	Before 1st Day of Trading	4.842	-4.007	-0.017	2.348
Green	fifteen Day of Trading	4.990	-7.027	-0.158	2.621
	thirty Day of Trading	6.757	-6.096	0.108	3.342
	1st Day of Trading	4.842	-6.267	-0.190	2.451
Non-Green	fifteen Day of Trading	4.990	-7.027	-0.299	2.631
	thirty Day of Trading	6.188	-2.95	0.478	2.270
	1st Day of Trading	4.842	-6.267	-0.097	2.382
Overall Sample	fifteen Day of Trading	4.990	-7.027	-0.223	2.610
	thirty Day of Trading	4.990	4.990	0.279	2.885

Note: This table exhibits MAAR for 30 days before event for overall sample of 235 which includes green non-green respectively listed on the AIM from 2010 to 2023. T-test is used to test the significance of abnormal return and *, ** indicates significant at 95% and 99% level respectively.

5.3.2. Descriptive Statistics of the Post-Market Adjusted Abnormal Returns (Pre-MAAR)

Table31 shows that green firms in 1st day of trading show a modest mean MAAR of 0.11% with a range from -6.19% to 7.77% and a standard deviation of 2.82, indicating moderate volatility. At *Fifteen Days of trading* the mean MAAR increases slightly to 0.15%, with a wider range from -9.63% to 14.67% and a higher standard deviation of 5.89, suggesting increased variability over the two-week period. The mean MAAR at 30th day of trading shifts to -1.80%, indicating a slight decline, with a significant range (-27.09% to 16.09%) and a standard deviation of 10.44. This indicates that longer trading periods introduce more variability and potential losses for green firms.

At1st Day of Trading Non-green firms exhibit a mean MAAR of -0.61% with a range from -9.63% to 13.66% and a standard deviation of 4.05, suggesting a slightly more negative reaction on the first trading day. The mean MAAR improves slightly to -0.07%, on 15th day with similar variability (SD = 4.79) and a range comparable to green firms. At *Thirty Days of Trading the* mean MAAR is -1.11%, with a broader range (-27.09% to 16.09%) and a higher standard deviation of 8.58, indicating greater long-term variability but still an overall downward trend. In overall sample

mean is -0.22%, showing minimal net movement across green and non-green firms, with a standard deviation of 3.44 at Ist day of trading. At *Fifteen Days of Trading* the mean is positive at 0.05% with increased variability (SD = 5.38), showing mixed performance across the sample. The mean drops to -1.48% with significant variability (SD = 9.57) on *Thirty Days of Trading*, indicating increased losses and variability over time for both groups.

Table 5.31

Descriptive Statistics of the Post-Market Adjusted Abnormal Returns (Pre-MAAR)

Green Status	MAAR	Maximum	Minimum	Mean	Deviation
	1st Day of Trading	7.767	-6.19	0.108	2.817
Green	fifteen Day of Trading	14.674	-9.631	0.151	5.894
	Thirty Day of Trading	16.090	-27.089	-1.800	10.443
	1st Day of Trading	13.66	-9.631	-0.605	4.053
Non-Green	Fifteen Day of Trading	14.674	-9.631	-0.069	4.789
	Thirty Day of Trading	16.090	-27.089	-1.107	8.580
	1st Day of Trading	13.66	-9.631	-0.222	3.440
Overall Sample	Fifteen Day of Trading	14.674	-9.631	0.050	5.379
	Thirty Day of Trading	4.990	-27.089	-1.480	9.573

Note: This table exhibits MAAR for 30 days after the event for overall sample of 235 which includes green non-green respectively listed on the AIM from 2010 to 2023. T-test is used to test the significance of abnormal return and *, ** indicates significant at 90% and 95% level respectively.

To detect outliers, we applied the split sample outlier deduction technique introduced by Adil (2010) and later utilized by Zubair Mumtaz et al. (2016) and abdul wahid (2019). This method was further refined in the work of Abdul Wahid (2019). The process is as follows:

First, we determined the data's upper and lower boundaries. The initial step involves dividing the dataset into four quartiles using the following formulae:

$$Q_1 \text{ Left} = 12.5\text{th Percentile}$$

$$Q_1 \text{ Right} = 62.5\text{th Percentile}$$

$$Q_3 \text{ Left} = 37.5\text{th Percentile}$$

$$Q_3 \text{ Right} = 87.5\text{th Percentile}$$

Next, we calculated the interquartile range (IQR) to identify the spread within the middle 50% of data:

$$IQR_{Left} = Q_{3L} - Q_{1L} = 37.5h \text{ percentile} - 12.5^{th} \text{ percentile}$$

$$IQR_{Right} = Q_{3R} - Q_{1R} = 87.5h \text{ percentile} - 62.5^{th} \text{ percentile}$$

Then upper and lower boundaries are calculated as:

$$LCV = Q_{1L} - (1.5 \times IQR_{Left}) \text{ and } UCV = Q_{3R} + (105 \times IQR_{Right})$$

Observations below the lower boundary (LCV) or above the upper boundary (UCV) were classified as outliers. Following this method, we identified 19 outliers across the entire sample; after removing these outliers, we recalculated the abnormal returns to ensure data accuracy and reliability.

5.3.3. Summary Statistics: Mean, Sd, Min, Max By Size) For Green Firms

Table depicts the summary statistics of green firm according to size. Across all trading windows, small green firms exhibit consistent mean MAAR values of 3.57%, with a standard deviation of 1.22, minimum of 1.84, and maximum of 7.19. This reflects stable performance with moderate variability. Medium green firms show a higher mean MAAR of 5.67% across all periods, with lower variability (SD = 0.47) and a narrower range (4.38 to 6.18). This indicates stable, favourable returns for medium-sized green firms. Large green firms have a mean MAAR of 6.51% across all periods, with very low variability (SD = 0.15) and a narrow range (6.26 to 6.62). This reflects highly consistent performance and possibly market confidence in large green firms. Across all sizes, the overall mean MAAR for green firms is 4.93% with moderate variability (SD = 1.51), showing steady performance across the size categories.

Table 5.32

Summary Statistics: Mean Sd Min Max by Size) For Green Firms

		Max	Min	Mean	SD
Small	1st Day of Trading	7.189	1.844	3.568	1.223
	fifteen Day of Trading	7.189	1.844	3.568	1.223
	thirty Day of Trading	7.189	1.845	3.568	. 1.223
Medium	1st Day of Trading	6.18	4.383	5.668	0.474
	fifteen Day of Trading	6.18	4.384	5.668	0.474
	thirty Day of Trading	6.18	4.384	5.668	0.474
Large	1st Day of Trading	6.62	6.258	6.511	0.151
	fifteen Day of Trading	6.62	6.258	6.511	0.151

	thirty Day of Trading	6.62	6.258	6.511	0.151
Total	1st Day of Trading	7.189	1.844	4.925	1.506
	fifteen Day of Trading	7.189	1.844	4.925	1.506
	thirty Day of Trading	7.189	1.844	4.925	1.506

Note: This table exhibits MAAR for ist, 15th and 30th day after event for small medium and large green firms listed on the AIM from 2010 to 2023

5.3.4. Summary Statistics: Mean Sd Min Max by Size) For Non-Green Firms

Table 5.33

Summary Statistics: (Mean, SD Min Max By Size) for Non-Green Firms

		Max	Min	Mean	SD
Small	1st Day of Trading	5.116	1.005	3.401	1.632
	fifteen Day of Trading	5.116	1.005	3.401	1.632
	thirty Day of Trading	5.116	1.005	3.401	1.632
Medium	1st Day of Trading	6.18	5.281	5.704	0.367
	fifteen Day of Trading	6.18	5.281	5.704	0.367
	thirty Day of Trading	6.18	5.281	5.704	0.367
Large	1st Day of Trading	6.619	6.258	6.36	0.131
	fifteen Day of Trading	6.619	6.258	6.36	0.131
	thirty Day of Trading	6.619	6.258	6.36	0.131
Total	1st Day of Trading	6.619	1.004	5.44	1.468
	fifteen Day of Trading	6.619	1.004	5.44	1.468
	thirty Day of Trading	6.619	1.004	5.44	1.468

Note: This table exhibits MAAR for ist, 15th and 30th day after event for small medium and large non- green firms listed on the AIM from 2010 to 2023.

Table show that Small non-green firms have a mean MAAR of 3.40% with higher variability (SD = 1.63), indicating greater performance fluctuations with a range from 1.01 to 5.12. Medium non-green firms exhibit a mean MAAR of 5.70% across all windows with low variability (SD = 0.37) and a narrow range (5.28 to 6.18), suggesting stable and favourable returns similar to their green counterparts. On another hand Large non-green firms show a mean MAAR of 6.36%, with minimal variability (SD = 0.13) and a range from 6.26 to 6.62, reflecting stability and potentially strong investor confidence. Across all sizes, non-green firms have a mean MAAR of 5.44%, with variability (SD = 1.47) similar to green firms. The overall range for non-green firms (1.00 to 6.62) shows that larger non-green firms maintain consistent positive performance.

5.3.5. *Estimation of OLS for the determinants of MAAR*

Table depicts the result of OLS for the determinants of pricing performance of green and Non-Green on 1ist, 5th and 30th day of trading. For green firms, financial leverage has a negative but statistically insignificant effect on MAAR across all time windows (-2.649 for MAAR at the event day, 0.426 for MAAR over 15 days, and -5.419 for MAAR over 30 days). This implies that, in the short term, leverage may not significantly impact green firms' abnormal returns. For non-green firms, financial leverage also shows an insignificant positive effect on MAAR on the event day (2.022) and over 15 days (0.576), with a slightly stronger positive but still insignificant effect over 30 days (8.437). Firm size shows a positive and statistically significant effect for non-green firms in the short term, with coefficients of 1.036* for MAAR at the event day and 1.063* over 15 days ($p < 0.05$). This indicates that larger non-green firms tend to experience higher MAAR over these windows, possibly reflecting market confidence in established non-green firms. However, for green firms, the effect of size becomes negative over the 30-day period (-2.836**), suggesting that larger green firms may face diminishing abnormal returns in extended windows, potentially due to investor focus on newer, smaller green ventures.

Risk has a negative effect on MAAR, for Green firms with significance over the 15-day window (-4.471*, $p < 0.05$) and the 30-day window (-5.870*). This suggests that higher-risk green firms see reduced MAAR in the short term, possibly due to the heightened sensitivity of green investments to perceived volatility. Non-green firms display a negative but insignificant relationship with MAAR across all periods, which may indicate a less pronounced impact of risk on their short-term returns compared to green firms.

For non-green firms, board size has a significant negative effect at the event day (-0.406**), but this effect diminishes over time. This may imply that larger boards in non-green firms are viewed as less efficient or less aligned with shareholder interests in immediate events. For green firms, board size shows a positive, though insignificant, effect on MAAR, which could indicate a perceived alignment of larger boards with green goals, though not to a significant extent. Institutional ownership does not show significant effects for either green or non-green firms across all windows, suggesting that institutional backing alone may not be a strong short-term driver for abnormal returns in both green and non-green contexts. Ownership structure has a significant negative effect only for non-green firms over the 30-day period (-0.0869*, $p < 0.05$). This may

indicate that complex ownership structures in non-green firms are perceived negatively by investors, impacting long-window abnormal returns.

Similarly, WACC does not exhibit significant effects on MAAR for either green or non-green firms across all windows, suggesting that short-term abnormal returns in both categories are relatively unaffected by changes in capital cost. Meanwhile carbon count for Non-Green shows a significant negative impact over the 30-day window (-0.971, $p < 0.05$), possibly reflecting negative investor sentiment associated with carbon-heavy companies.

Table 5.34

OLS Result for Short Term Performance

	(GREEN)	**(NON-GREEN)**	**(GREEN)**	**(NON-GREEN)**	**GREEN**	**NON-GREEN**
	MAARist	***MAARIST***	***MAAR15***	***MAAR15***	***MAAR30***	***MAAR30***
FLEV	-2.649	2.022	0.426	-5.419	8.437	1.031
	(-1.25)	-0.58	-0.11	0.576	-1.43	-0.17
Size	0.816	1.036*	-0.139	1.063*	-2.836**	2.438**
	-1.97	-2.25	(-0.19)	0.577	(-2.95)	-2.77
Risk	-1.171	-1.363	-4.471*	-2.481	-5.870*	-2.322
	(-1.27)	(-0.68)	(-2.62)	2.748	(-2.39)	(-0.57)
Boardsize	0.146	-0.406**	0.544	0.219	0.852	-0.638
	-0.98	(-2.37)	-2	0.227	-1.99	(-1.86)
InstOwn	0.012	0.015	0.015	0.051	0.069	-0.108
	-0.65	-0.2	-0.2	0.094	-1.28	(-1.41)
OSIZE	-0.035	-0.039	-0.02	-0.018	0.076	-0.0869*
	(-1.30)	(-1.10))	(-0.69)	0.022	-1.81	(-2.13)
WACC	-0.003	-0.087	0.382	-0.129	0.473	-0.026
	(-0.02)	(-0.47)	-1.67	0.232	-1.55	(-0.10)
MktActivity	0	0.842	0	5.388	10.65	0
	(.)	-0.14	(.)	0.11	-1.97	(.)
Carboncount	0.356	-0.365	0.727	-9.549	45.40*	-0.971
	-1.22	-0.365	-1.37	8.215	-2.34	(-1.97)
_cons	-3.703	1.469	-4.452	-9.549	-12.93	3.809
	(-1.46)	-0.22	(-0.97)	-8.215	(-1.68)	-0.46
N	42	37	42	37	42	37

Note: t statistics in parentheses* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5.3.6. Event-Based Paired T-Test Results: Pre and Post Comparison for Hypothesis Testing in Short Run

This analysis examines the event's impact on short-term term price performance within three distinct event windows for both Green and Non-Green firms. Paired t-tests were conducted to assess whether there were significant changes in performance around the event dates**.**

Table 5.35

Paired Test for Short Term Performance

Group	Event Window	Mean (Pre)	Mean (Post)	Difference	Std. Dev.	T	p-value
Green	(-1, 0), (0, 1)	-.0808(.3609)	.1226(.4397)	0.9306	3.785	-0.348	0.729
	(-15, 0), (0, 15)	-.280.389	-0.195	0.086	5.87	-0.095	0.924
	(-30, 0) , (0, 30)	-.299(.4325)	-.0687(.7873)	0.2303	5.284	-0.265	0.792
Non-Green	(-1, 0) , (0, 1)	-.1897(.403)	-.605(.666)	-0.4153	4.67	0.541	0.592
	(-15, 0), (0, 15)	-.2991(.4325)	-.0687(.7873)	-0.388	5.284	-0.265	0.792
	(-30, 0) , (0, 30)	.478(.3732)	-1.107(1.411)	-1.585	8.919	1.081	0.287

Note: Mean values and differences are in percentages. $p < .05$ indicates statistical significance.

Table shows that for Green firms in event window (-1, 0) to (0, 1) Pre-event mean is -0.0808, and post-event mean is 0.1226, resulting in a mean difference of 0.906 with a standard deviation of 3.785. For Event Window (-15, 0) to (0, 15) Pre-event mean is -0.280, and post-event mean is 0.086, yielding a difference of -0.194 with a standard deviation of 5.87. Similarly pre-event mean is -0.299, and post-event mean is -0.0687 for Event Window (-30, 0) to (0, 30), resulting in a difference of 0.2303 with a standard deviation of 5.284. The result shows across all three event windows, the p-values (0.7294, 0.924, and 0.7924) exceed the 0.05 threshold, indicating that none of the differences are statistically significant. The negative differences suggest a slight post-event reduction in performance, but these changes lack statistical strength. This result implies that for Green firms, the event does not produce a measurable short-term impact on market

performance.

For Non-Green firms Event Window (-1, 0) to (0, 1) having Pre-event mean -0.1897, and post-event mean -0.605, giving a positive mean difference of-0.4153 with a standard deviation of 4.67. Similarly in Event Window (-15, 0) to (0, 15) Pre-event mean is -0.2991, and post-event mean is -0.0388, yielding a mean difference of -0.2303 with a standard deviation of 5.284. And for Event Window (-30, 0) to (0, 30) Pre-event mean is 0.478, and post-event mean is -1.107, resulting in a mean difference of -1.585 with a standard deviation of 8.919. Similarly, for Non-Green firms, p-values across the three windows (0.5916, 0.7924, and 0.2870) also fail to meet the 5% significance level.Overall, Non-Green firms also show no statistically significant short-term impact from the event.The absence of significant findings in the short-term windows aligns with the literature suggesting that sustainability-linked announcements might not immediately affect stock returns, especially in emerging markets where green finance is still evolving (e.g., Eccles et al., 2014).

The results suggest that stock markets does not significantly reward for announcing green debt in short term. This align with Zerbib(2019) and Giantfrate and Peri(2019), who argue that green bond announcements generate natural to mild investor reaction unless paired with strong ESG signalling. According to signalling theory, the issuance of green debt may not serves as a credible signal unless accomplished by third part verification and robust ESG alignment The results could also reflect investor skepticism toward immediate financial gains from green initiatives, given the complex nature and long-term focus of sustainable financing.

5.3.7. Descriptive Statistics of Variables Green and Non Green Categories in Longs Run

The descriptive statistics provided offer insight into the determinants of long-term stock price performance for different categories of firms, distinguished by their level of green involvement. Sample firms are categorized into Green and Non-Green on the bases of green index.

Table 5.36

Descriptive Statistics for Firms in Long-Run Performance

	Green			Non-Green			Overall Sample		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation	N	Mean	Std. Deviation

BHAR1	43	7.227	38.74	37	-8.92	35.35	80	-0.243	37.86
BHAR2	43	8.515	48.32	37	-1.660	42.39	80	3.80	45.68
BHAR3	43	2.213	47.57	37	-1.881	42.10	80	0.319	44.89

Note: This table exhibits long term performance of overall sample of 80 consisting green (43) and non- green (37) on the AIM from 2010 to 2023.

Over 1 year Green firms Show a positive mean of 7.23% with a high standard deviation (SD) of 38.74, indicating considerable variability in returns. *Non-Green Firms* display a negative mean of -8.92% and a slightly lower variability (SD = 35.35), suggesting a trend toward negative returns over one year. In 2nd year *green* firms have a mean of 8.52% with increased variability (SD = 48.32), reflecting a continuing trend of positive returns but with more dispersion. Whereas Non-*Green Firms* show a mean of -1.66% and a standard deviation of 42.39, indicating fewer negative returns than in the 1-year period but still below green firms. *Overall*: The sample mean is 3.80%, and the standard deviation is 45.68, showing slightly positive performance on average. *Green Firms* at 3rd year exhibit a positive mean of 2.21%, though lower than previous years, with a standard deviation of 47.57. *Non-Green Firms*: Continue with a negative mean of -1.88%, with similar variability (SD = 42.10). Overall, the sample mean is approximately 0.32%, with a standard deviation of 44.89, suggesting mixed performance across the total sample. Small firms show consistently positive mean BHAR values across all periods, with the highest mean of 10.84% in the 1-year window (SD = 38.7), indicating that smaller green firms tend to achieve higher abnormal returns. Medium Firms Report positive BHARs with moderate variability, achieving the highest mean (19.63%) in the 2-year window (SD = 34.43), suggesting stable performance. Large green firms exhibit a negative trend, with a mean of -1.02% in BHAR1 and dropping further in subsequent years (e.g., -12.0% in BHAR3). This could indicate less long-term growth potential for larger green firms.

Table 5.37

Long Term Performance of Green Firms According to Size

SIZE	BHAR1				BHAR2				BHAR3			
	MAX	MIN	MEAN	STD	MAX	MIN	MEAN	STD	MAX	MIN	MEAN	STD
Small	107.79	-23.85	10.84	38.7	125	-78.23	12.15	50.99	100.71	-83.01	2.81	54.19
Medium	83.36	-39.23	9.069	39.5	73.22	-47.86	19.63	34.43	100.63	-21.47	12.64	28.32
Large	-1.024	40.2	-35.06	107.8	-11.57	56.59	-78.23	132.81	-12.0	55.62	-92.15	100.71

Note: This table exhibits long term performance of small medium and large green firms listed on the AIM from 2010 to 2023.

5.3.8. Long term price performance of Non- Green firm according to size

Small Firms Show mixed results with a positive mean of 7.58% in BHAR1 but turning negative in later years, reaching -0.064% in BHAR3. This indicates higher short-term gains that may not sustain in the long run. Medium Firms Exhibit consistently negative BHARs across all periods, with the lowest mean in BHAR1 at -20.38% (SD = 39.98). This trend indicates potential underperformance in mid-sized non-green firms. Large Firms show slight improvements over time, with near-neutral mean BHARs (e.g., -0.32% in BHAR2 and -0.37% in BHAR3), suggesting a stabilization of returns for large non-green firms in the long run.

Table 5.38

Long Term Price Performance of Non- Green Firm According to Size

SIZE	BHAR1				BHAR2				BHAR3			
	MAX	MIN	MEAN	STD	MAX	MIN	MEAN	STD	MAX	MIN	MEAN	STD
Small	1.15	-36.05	.58	0.23	5.96	-76.8	-3.76	8.09	00.72	-85.06	-.064	67.88
Medium	3.74	-68.26	-20.38	9.98	8.95	-61.12	-1.42	9.78	55.21	-46.84	-3.82	25.39
Large	2.29	-44.57	-4.72	6.86	32.81	-34.27	-0.32	5.63	100.72	-43.98	-0.37	40.64

Note: This table exhibits long term performance of small medium and large non-green firms listed on the AIM from 2010 to 2023.

Overall, the results highlight that green firms, especially smaller ones, tend to outperform non-green firms in terms of long-run BHAR, particularly over the first two years. Larger green firms show more variability and weaker performance compared to smaller and medium-sized counterparts. For non-green firms, the results suggest underperformance, especially for medium-sized firms, with larger firms showing stabilization in returns over time. This variability suggests that firm size plays a critical role in long-term performance, particularly for green firms in a growing sustainable investment market.

5.3.9. Estimation of OLS for the Determinants of BHAR

Table 5.39

OLS Result for Long Term Performance

	(GREEN) BHAR1	(NON-GREEN) BHAR1	(GREEN) BHAR2	(NON-GREEN) BHAR2	GREEN BHAR3	NON-GREEN BHAR3
	3.53	4.457	-34.77	-32.95	-3.701	-61.23
	-0.11	-0.23	(-1.23)	(-1.40)	(-0.12)	(-1.68)
Size	-4.714	-0.636	0.65	16.93*	0.593	19.38*
	(-1.12)	(-0.13)	-0.13	-2.74	-0.12	-2.73
Risk	-9.952	15.71	-13.39	13.78	-25.35	4.06
	(-1.00)	-1.24	(-1.23)	-0.86	(-2.00)	-0.2
Board size	2.321	-6.072***	6.912**	-3.437*	6.173**	-5.167*
	-1.29	(-4.55)	-3.44	(-2.36)	-3.04	(-2.51)
InstOwn	0.009	-0.493	0.087	-1.648***	0.829*	-0.05
	-0.04	(-1.82)	-0.39	(-3.74)	-2.58	(-0.10)
OSIZE	-0.185	0.341	-0.502*	-0.265	-0.404	-0.3
	(-0.87)	-1.92	(-2.26)	(-1.21)	(-1.98)	(-1.35)
WACC	0.369	-1.5	1.692	0.061	2.347	-2.363
	-0.19	(-1.46)	-0.92	-0.03	-1.64	(-1.75)
Mkt Activity	-37.75	-12.52	-22.52	12.28	-4.514	8.699
	(-1.86)	(-0.48)	(-1.20)	-0.62	(-0.31)	-0.43
Carbon count	-11.42	-5.371**	7.444	-2.716	-1.557	-4.52
	(-1.25)	(-2.91)	-0.75	(-1.31)	(-0.16)	(-1.53)
_cons	49.39	91.71*	-38.54	-39.4	-70.41*	1.541
	-1.28	-2.74	(-1.11)	(-0.84)	(-2.32)	-0.04
N	42	37	42	37	42	37

Note: Depicts the result of OLS for the determinants of pricing performance of green and Non-Green on 1, 2 and 3 years. t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Financial leverage is insignificant across all windows for green firms, with a negative effect in Year 3 (-3.701) and a notably large negative effect for non-green firms in Year 3 (-61.23, though not statistically significant). This suggests that over extended periods, high leverage may detract from non-green firms' BHAR, likely due to increased debt burdens. For non-green firms, firm size positively impacts BHAR significantly over the 2-year (16.93*, $p < 0.05$) and 3-year (19.38*, $p < 0.05$) periods, indicating that larger non-green firms tend to perform well in the long term. For green firms, firm size does not have a significant impact on BHAR across all periods, indicating that long-term abnormal returns in green firms may be less influenced by firm size.

Risk has a significant negative impact on 3-year BHAR for green firms (-25.35, $p < 0.05$), implying that higher risk in green firms leads to lower abnormal returns over extended periods. Non-green firms show no significant relationship between risk and BHAR, suggesting that long-term investors may tolerate risk differently in non-green investments. Board size positively impacts BHAR for green firms, with significant effects over the 2-year (6.912**, $p < 0.01$) and 3-year (6.173**, $p < 0.01$) periods. This suggests that larger boards in green firms may be associated with governance practices valued by long-term investors. In contrast, non-green firms display a significant negative impact of board size on BHAR, particularly at the event date (-6.072***, $p < 0.001$) and in the 3-year window (-5.167*, $p < 0.05$). This may reflect investor concerns regarding large boards in non-green contexts. Likewise Institutional ownership has a positive and significant effect for green firms in the 3-year period (0.829*, $p < 0.05$), suggesting that institutional backing contributes to green firms' BHAR over the long term. For non-green firms, the relationship remains insignificant, indicating limited long-term influence. Ownership structure negatively affects BHAR for green firms in the 2-year window (-0.502*, $p < 0.05$), suggesting that complex ownership arrangements may detract from long-term returns. However, non-green firms show no significant effect, potentially due to different investor perceptions of ownership complexity.

WACC has a positive but insignificant effect on BHAR for green firms in the 3-year period (2.347), suggesting that while higher capital costs might align with sustainable investments, this factor alone does not drive long-term abnormal returns. Similarly, Market activity shows no significant impact across all periods. However, for non-green firms, carbon count has a significant negative effect in the 2-year period (-5.371**, $p < 0.01$), suggesting that high-carbon activities may reduce long-term abnormal returns for non-green firms. In sum-up these findings suggest that green and non-green firms exhibit distinct patterns in short- and long-term abnormal returns.

Factors like firm size, risk, and board size significantly impact performance, often aligning with investor expectations regarding sustainability and governance. The different responses in MAAR and BHAR highlight the importance of ESG factors in investor sentiment and long-term value for green firms, particularly in high-impact research and sustainable finance fields.

5.3.10. Event-Based Paired T-Test Results: Pre and Post Comparison for Hypothesis Testing in Long Run

This analysis examines the event's impact on long term price performance within three distinct event windows for both Green and Non-Green firms. Paired t-tests were conducted to assess whether there were significant changes in performance around the event dates.

Table 5.40

Paired Sample T-Test for Long Term Performance

Group	Event Period	Mean	Std. Dev.	T	p-value
Green	Year 1	4.8324 (5.532)	35.85	0.855	0.398
	Year 2	*5.555 (6.911)*	*44.79*	*0.792*	*0.433*
	Year 3	*2.213 (7.031)*	*7.031*	*-0.036*	*0.971*
Non-Green	Year 1	*-8.923 (5.811)*	*35.35*	*-1.448*	*0.156*
	Year 2	*-1.661 (6.97)*	*4.053*	*-0.155*	*0.878*
	Year 3	*-1.88 (6.92)*	*42.10*	*-0.189*	*0.851*

Note: Mean values and differences are in percentages. $p < .05$ indicates statistical significance.

Table depicts for Green firms Year 1, 2, 3 Mean performance is 4.8324, 5.555, 2.213 with standard deviation of 5.532, 6.911and 7.031 respectively. Across the three years, p-values (0.3975, 0.4330, and 0.9712) indicate no statistically significant results. This lack of significance suggests that, despite positive mean values in Years 1 and 2, any impact of the event on Green firms' performance diminishes over time, with a near-zero mean in Year 3. Thus, Green firms experience neither a short-term nor sustained long-term performance improvement related to the event. For Non-Green Firms Year 1, 2, 3 Mean performance is -8.923, -1.661, -1.88 with standard deviation

of 5.811, 6.97 and 6.92respectively. For Non-Green firms, p-values across the three years (0.1563, 0.8777, and 0.8513) also show no significance, indicating no measurable long-term impact. The negative mean performance suggests a trend of decreased returns for Non-Green firms post-event, though this effect is statistically insignificant. Such results imply that non-green initiatives lack the robustness needed for substantial market advantage over time.

The absence of statistically significant long-term results may highlight limitations in the appeal of both green and non-green capital initiatives within the observed market environment. This aligns with findings from previous studies suggesting that the benefits of sustainable finance, if present, often emerge slowly due to market adjustments, regulatory acceptance, and gradual shifts in investor preferences (Friede, Busch, & Bassen, 2015). The minimal long-term gains for Green firms could indicate that while green finance is favourable in theory, immediate financial rewards remain uncertain, echoing views on the paradox between sustainability and profitability (Porter & Kramer, 2006).

5.3.11. Summary of Hypothesis Testing Results

Table 5.41

Hypothesis Testing Results – Study 3 (Event Study of Green Bond Issuance

Hypothesis	Statement	Result	Support
H3.1	Green bond issuance generates positive abnormal returns around event date.	Not Supported	No significant abnormal return observed.
H3.2	Green bond issuance generates positive abnormal returns around event date.	Not Supported	No significant abnormal return observed.

5.3.12. Contribution Box

- **Theoretical Contribution**: Applies signalling theory to test whether green bond announcements transmit credible sustainability signals to markets.
- **Empirical Contribution**: Finds no significant abnormal returns in AIM around issuance events, suggesting signalling is not always effective.
- **Policy Contribution**: Calls for stronger transparency, certification, and reporting standards to

enhance investor trust in green financial instruments.

In sum up, the event does not exert a statistically significant effect on the short-term or long-term performance of either Green or Non-Green firms. These results contribute to the broader debate on the effectiveness of green finance as a lever for enhanced stock performance, particularly in emerging markets where the green economy is still gaining traction. Future research could explore alternative measures or market contexts to further elucidate the nuanced relationship between green initiatives and financial performance.

CHAPTER 6

DISCUSSION AND CONCLUSION

6.1. Introduction

The purpose of this chapter is to synthesize and interpret the study's findings within the broader context of green finance and leverage theory, offering insights into the determinants of green leverage and the subsequent impact on stock price performance. The analysis integrates both short- and long-term effects, examining implications for markets and investors. The findings carry profound implications, especially for markets like the PSX, as they provide evidence-based recommendations to drive sustainable growth and facilitate the adoption of green financing mechanisms.

6.2. Summary of Key Findings

This research primarily explored three domains: (1) the determinants of green leverage, identifying enablers and constraints influencing its adoption, (2) the impact of green leverage on short- and long-term stock performance (measured through MAAR and BHAAR, respectively) and (3) Market reactions to events(Green Bond Issuance)- examining the Pre- and Post-Issuance impact on firm performance through a comprehensive examination of AIM-listed firms, the study provides empirical evidence on the viability and market impacts of green leverage. The determinants analysis highlighted that factors such as innovation funding, institutional ownership, and credit rating serve as strong determinants of green leverage, while Government policy instruments, Financial Privileges (FP**)**—which include subsidies—also positively influence the adoption of green leverage, suggesting that targeted incentives can overcome risk aversion.The negative relationship between carbon tax and green leverage highlights the unintended effect of environmental regulation on financing costs. Firms view carbon tax as an additional burden, reducing incentives to adopt green debt instruments. This finding complements prior evidence on regulatory frictions in green finance (Kölbel & Lambillon, 2022). Furthermore, the study revealed that green leverage has a relatively modest but positive effect on short-run stock performance but shows muted weaker impact in the long run, suggesting that sustainable financing practices offer substantial advantages initially but over extended periods investor reassess the financial ability of firms supporting previous studies i-e Flammer (2021) and Tang and Zhang (2020), who found that

green bonds positively influence firm valuation and performance in the long run, as they signal strong corporate governance and environmental responsibility and confirms that firms with green financing frameworks experience higher levels of investor trust and improved stock performance over time, as they are perceived as lower-risk investments with greater resilience to regulatory and environmental risks.

6.3. Discussion of Findings

The following sections discuss the implications of these findings within the context of green finance literature, considering both theoretical contributions and practical applications.

6.3.1 Determinants of Green Leverage: Enablers and Constraints

The identification of enablers and constraints influencing green leverage provides a nuanced understanding of the dynamics driving sustainable finance decisions. These findings align with research by Flammer (2021), who asserts that innovation funding and supportive policies catalyse green investments by lowering the financial barriers associated with sustainability projects. This study confirms the positive role of innovation funding, which not only boosts green investment but also encourages firms to allocate resources toward environmental objectives, aligning with the sustainability targets of many institutional investors. Similarly while Li (2025) demonstrates the "quantity-efficiency paradox" of leverage in Chinese firms, where higher leverage boosts green innovation output..

The positive influence of institutional ownership on green leverage adoption is consistent with findings by Clark et al. (2015), who note that institutional investors increasingly favour firms with clear environmental and social governance (ESG) commitments. Institutional investors, who often have longer investment horizons, prefer the resilience and risk mitigation that ESG-aligned firms provide, which substantiates their positive impact on green leverage.

Carbon and high compliance costs emerged as primary constraints, discouraging firms from adopting green financing practices. This supports the findings of Weber and ElAlfy (2019), who argue that compliance costs and stringent regulations are major impediments in emerging markets, where the financial burden of adhering to environmental standards can be prohibitive. The implication is that policymakers must develop frameworks that balance environmental standards with feasible compliance requirements, especially for firms new to sustainable finance.

6.3.2 Impact of Green Leverage on Stock Performance: Short and Long Run

The effects of green leverage on short- and long-term stock performance indicate a time-dependent impact, with limited influence in the short term but a significant positive effect over the long term.

- **Short-Run Effects**

In the short run, the market-adjusted abnormal returns (MAAR) for green-leveraged firms were neutral to slightly positive. This limited short-run impact may stem from the delayed realization of benefits from green investments, as noted by Hachenberg and Schiereck (2018), who highlight that the financial returns from sustainable investments often lag due to the initial costs of green projects and the longer horizon required for them to impact profitability. This aligns with green finance theories which posit that sustainable investments, while beneficial, are less likely to produce immediate returns (Clarkson et al., 2020).Theoretically, these results align with Signalling Theory, In the short run, investors respond positively because green financing signals a firm's commitment to sustainability and corporate responsibility. This positive signal creates short-term optimism in the market, even if the effect is not statistically strong.

- **Long-Run Effects**

In examining long-term performance, leverage shows a substantial negative impact on BHAAR for both green and non-green firms, with a higher magnitude for non-green firms. This significant negative coefficient for non-green firms supports the hypothesis that higher debt levels introduce risks detrimental to long-term performance. Conversely, green firms' negative leverage impact is present but less pronounced, potentially due to the growing investor preference for sustainable companies, which aligns with studies suggesting lower capital costs for green-oriented firms over time which supports theories by Bocken et al. (2014) suggesting that firms adopting sustainable practices gain a competitive advantage and attract a loyal investor base over time. By reducing operational risks associated with environmental volatility, green-leveraged firms are able to stabilize their cash flows and benefit from higher valuation multiples. This is supported by Flammer (2021), who found that green bonds positively influence firm valuation and performance in the long run, as they signal strong corporate governance and environmental responsibility.

Theoretically, these results align with, the Trade-Off Theory in the long run, explains the gradual decline — as firms face compliance costs, certification expenses, and delayed financial returns from green projects. Despite this, green firms remain relatively more stable than non-green ones, reflecting their stronger governance and reputational advantages.

6.3.3. Market Reactions to Green Bond Issuance Events: Examining the Pre- and Post-Issuance Impact on Firm Performance

- **Short-Term Performance**

The lack of statistically significant differences in short-term abnormal returns across both green and non-green firms suggests that green bond issuance events may not strongly impact stock price performance in emerging markets. This could reflect investor caution regarding immediate financial gains from green initiatives or scepticism about their direct economic benefits.

- **Long-Term Performance**

Over the 1-year, 2-year, and 3-year windows, neither green nor non-green firms exhibit significant performance changes post-event. Green firms show a declining trend in performance by Year 3, while non-green firms consistently show negative mean values. This result reinforces the idea that market adjustments to green finance initiatives may unfold gradually and that initial market reactions may not translate into long-term gains. These findings echo the work of Friede, Busch, and Bassen (2015), who emphasized the long-term nature of sustainable finance impacts, and Porter and Kramer (2006), who discussed the potential tension between sustainability and immediate profitability.

How This Study Addresses and Helps Resolve the Green Leverage Paradox

The Green Leverage Paradox refers to the tension between firms' increasing commitment to environmental responsibility and the practical difficulties involved in financing green initiatives. While sustainable investment is becoming an economic necessity, green projects often involve higher procedural costs, certification requirements, and longer payback periods. This study addresses this paradox by identifying the conditions under which green leverage becomes a feasible, attractive, and rational financing choice for firms.

First, the study provides empirical evidence on the financial enablers that reduce the cost–

risk barrier associated with green investments. Internal financial resources—such as cash flow and dividend capacity—play a critical role in lowering reliance on external capital, consistent with Pecking Order Theory. Innovation funding and higher credit ratings further reduce financing frictions and borrowing costs. These findings demonstrate that green leverage adoption increases when firms possess strong financial fundamentals, thereby reducing uncertainty and resolving part of the paradox relating to cost and risk sensitivity.

Second, the study highlights the institutional and governance mechanisms that encourage firms to adopt green leverage. Institutional ownership, board size, and the presence of non-executive directors strengthen managerial monitoring and reduce agency inefficiencies. According to Agency Theory and Signalling Theory, such governance structures align managerial incentives with long-term sustainability goals and enhance the credibility of green financing commitments. As a result, governance quality emerges as an important determinant that helps firms transition from intention to actual adoption of green leverage.

Third, the study identifies the key constraints that explain why the adoption of green leverage remains limited across firms despite global interest in sustainability. Policy-related factors, such as carbon taxation, verification and certification costs, and environmental compliance burdens, act as significant barriers. By empirically isolating these constraints, the study offers insights into the institutional reforms needed to lower the regulatory and procedural cost pressures that intensify the paradox.

Fourth, the research examines short- and long-run market responses to green financing decisions. Evidence from event study analyses reveals modest and statistically insignificant short-run abnormal returns for green debt issuances, and weak or negative long-run performance patterns. These results reflect investor caution and the evolving maturity of green financial instruments, particularly in emerging markets. By clarifying market reactions, the study contributes to understanding the demand-side challenges that influence firms' willingness to adopt green leverage.

Finally, the study provides a contextual comparison between the UK's Alternative Investment Market (AIM) and Pakistan's capital market environment. AIM operates within a mature sustainability ecosystem characterized by innovation funding, ESG-aligned investors, and credible certification structures, making it possible to observe market-driven adoption of green

financing. In contrast, the Pakistan Stock Exchange (PSX) continues to face structural constraints such as limited green debt issuance, concentrated bank financing, low investor awareness, and weak sustainability infrastructure. By drawing lessons from AIM, the study demonstrates how emerging markets can strategically strengthen their institutional frameworks to reduce financing frictions and address the paradox in practice.

Taken together, these findings show that the Green Leverage Paradox can be partially resolved by improving financial capacity, strengthening governance structures, reducing regulatory burdens, and enhancing market infrastructure. This research thus extends traditional capital structure theories into the sustainability domain and offers a comprehensive explanation of when and why firms adopt green leverage, providing actionable insights for policymakers, investors, and firm managers.

- **Broader Implications**

The minimal impact observed in this study supports the view that green finance may require stronger regulatory frameworks, investor education, and time for meaningful market acceptance. These findings contribute to the ongoing debate on green finance efficacy in promoting enhanced stock performance and underscore the need for sustained support to foster investor confidence in green financial instruments in emerging markets.

- **Policy Implications**

The findings contribute directly to SDGs 7 (Affordable and Clean Energy), 12 (Responsible Consumption and Production), and 13 (Climate Action). Policymakers should design incentives, such as subsidies, tax relief, and standardized reporting frameworks, to mitigate compliance costs and foster wider adoption of green leverage in both developed and emerging markets. Overall, the results extend capital structure theories by incorporating sustainability-oriented financing. Consistent with signalling theory, green leverage sends positive signals to the market, though impacts on long-term performance remain muted. Utility and Trade-off theory are supported, as firms adopt green leverage only when reputational and regulatory benefits outweigh compliance costs.

6.4.Guiding Insight for PSX

The findings of this study provide several context-specific practical guidelines for the Pakistan Stock Exchange (PSX), where the green finance ecosystem is still developing. Unlike AIM—where institutional participation, innovation funding, and a supportive regulatory environment facilitate the use of green leverage—PSX faces structural and market-level constraints that hinder widespread adoption.Therefore, lessons drawn from AIM are not directly transferrable but provide guiding insights for emerging markets like Pakistan.The results of this research highlight the following targeted implications:

- **Strengthening institutional and governance mechanisms.**The empirical evidence demonstrates that institutional ownership and board structure act as significant enablers of green leverage adoption. For PSX, this implies the need to strengthen corporate governance practices, promote institutional investor participation, and encourage the entry of ESG-oriented investment institutions. A stronger governance environment would reduce agency conflicts and support long-term sustainability-driven financing decisions.
- **Enhancing access to innovation financing.** Innovation funding emerged as a significant determinant of green leverage in this study. PSX-listed firms often lack dedicated financing instruments for R&D and green innovation, limiting their ability to qualify for or benefit from green debt. Policymakers and financial institutions should introduce innovation grants, concessional green credit lines, and sustainability-linked lending programs to support innovation-driven sustainability investments.
- **Reducing compliance and certification burdens.**The study identified carbon taxation, verification requirements, and green certification costs as major constraints limiting green leverage adoption. For PSX, simplifying compliance procedures, improving the transparency of certification standards, and lowering verification costs are critical steps to reduce barriers to entry for firms considering green financing options.
- **Improving ESG disclosure standards.** The modest or insignificant market reaction observed in both the short and long run suggests weak investor confidence in green announcements. This underscores the need for PSX to strengthen ESG disclosure frameworks. Clearer reporting guidelines, standardized sustainability metrics, and the introduction of a national green taxonomy would enhance transparency and credibility and reduce information asymmetry.

- **Building investor awareness and market confidence**. The results from Study 2 and Study 3 indicate muted investor responses, implying limited understanding of green instruments among market participants. Investor awareness programs, workshops, and sensitization campaigns are necessary to improve knowledge about green bonds, sustainability-linked loans, and the economic value of green financing instruments.
- **Developing a more supportive secondary market for green debt.** Long-run performance outcomes were statistically insignificant and slightly negative, suggesting that investors perceive green debt as relatively high-risk or low-return in emerging markets. Developing a liquid secondary market for green bonds and introducing credit enhancement mechanisms can improve price discovery, reduce perceived risk, and attract long-term institutional investors.
- **Overall Contribution to PSX.** By aligning the empirical findings with the structural realities of PSX, this study highlights the need for coordinated efforts between regulators, policymakers, investors, and listed firms. The implications underscore that enabling environmental sustainability within Pakistan's capital market requires improvements in governance, regulatory capacity, investor education, and market infrastructure. These targeted insights provide a practical roadmap for strengthening Pakistan's green financing ecosystem and accelerating its transition toward sustainability-oriented capital markets.

6.6. Policy Implications and SDGs

The findings of this research have direct implications for achieving global sustainability targets. Specifically:

- **SDG 7 – Affordable and Clean Energy:** Green leverage enables firms to finance renewable energy and clean infrastructure projects.
- **SDG 12 – Responsible Consumption and Production:** By adopting green debt, firms demonstrate sustainable investment practices that contribute to resource efficiency.
- **SDG 13 – Climate Action:** Green leverage adoption signals corporate commitment to reducing carbon emissions, aligning financial strategies with climate action.

These contributions illustrate that green leverage is not only a financing mechanism but also a strategic tool for aligning corporate capital structures with the United Nations' sustainability agenda.

6.7. Limitations

Despite the contributions of this study, several limitations should be acknowledged to ensure a and Future Research.

- First, the dataset is restricted to firms listed on the Alternative Investment Market (AIM), which limits direct generalizability to emerging markets such as the Pakistan Stock Exchange (PSX). The exclusion of PSX firms is due to the immaturity of its green finance ecosystem, characterized by de-capitalization, limited listings, and lack of green-specific instruments.
- Second, the study focuses exclusively on green leverage (green bonds and loans), without considering alternative instruments like green equity or carbon credits.
- Third, reliance on secondary data constrains the scope of firm-level insights, particularly managerial perspectives on financing decisions. These limitations, however, create opportunities for targeted future research.

6.8. Future Research Directions

Future research Future research should build upon these limitations by:

1. **Comparative Analysis** – Conducting cross-country studies to contrast developed (e.g., AIM) and emerging markets (e.g., PSX), thereby identifying institutional and regulatory differences in green leverage adoption.
2. **Integration of ESG Disclosure Data** – Utilizing standardized ESG reporting frameworks to assess how disclosure quality shapes investor confidence, cost of capital, and firms' access to green debt.
3. **Mixed-Methods Approaches** – Combining econometric models with qualitative evidence (e.g., interviews with managers, regulators, investors) to provide deeper insights into motivations and barriers to green leverage.
4. **Expanding Financial Instruments** – Extending inquiry to other green financing mechanisms (e.g., green equity, sustainability-linked loans) to understand complementarities within the broader capital structure.
5. **Investor Behaviour** – Investigating market sentiment and behavioural finance dimensions,

particularly how institutional versus retail investors price green instruments differently.

6.9. Implications for Policymakers and Regulators

Together, the results indicate that green leverage adoption is possible but constrained by institutional and market inefficiencies. For Pakistan, this means developing a supportive regulatory environment that reduces barriers (high compliance costs) while amplifying enablers (institutional ownership, creditworthiness, and innovation incentives).

Implications for Firms and Investors

Firms should recognize that while green leverage may not yield strong immediate returns, it serves as a strategic investment in long-term sustainability, reputation, and access to global capital markets. Investors, meanwhile, must incorporate non-financial indicators such as ESG disclosures and innovation capacity into their valuation models when assessing green debt instruments.

6.10. Conclusion

This thesis advances the understanding of green leverage as a novel dimension of capital structure decisions, exploring both its enablers and constraints and its performance implications, with evidence drawn from firms listed on the Alternative Investment Market (AIM). The study demonstrates that internal financial resources, and corporate governance features (institutional ownership, board size), innovation funding and credit rating encourage adoption of green leverage, while policy-related factors such as carbon taxation and compliance costs act as significant constraints.These findings extend the pecking order and trade-off theories into the sustainability domain, showing that firms prioritize internal and cost-efficient financing but remain sensitive to additional compliance burdens. The results suggest that capital structure choices are shaped not only by financial logic but also by institutional and environmental pressures. Short-term market reactions to green financing remain modest, and long-term effects on performance appear muted, reflecting both investor caution and the evolving maturity of green financial instruments. These findings extend capital structure theories by embedding sustainability considerations into traditional trade-off and signalling frameworks, suggesting that firms pursue green leverage when reputational and regulatory benefits outweigh additional costs. This suggests that, unlike developed markets where green bonds often generate positive investor sentiment (Flammer, 2021),

AIM investors remain cautious. The muted reactions could reflect information asymmetry, investor skepticism about green commitments, or limited awareness of certification standards. This reinforces the importance of signalling theory: if the credibility of green claims is uncertain, markets would not reward firms with positive abnormal returns. These results extend classical capital structure theories into the sustainability domain. Signalling theory is supported, as green leverage sends positive environmental and financial signals to investors, reflected in short-term market reactions. Trade-off theory is also validated, with firms weighing the reputational and regulatory benefits of adopting green leverage against its additional compliance and certification costs. At the same time, the muted long-run effects highlight boundaries to these theories, suggesting that sustainability-driven financing decisions may not always translate into enduring financial returns without broader market and institutional support. From a policy standpoint, the findings underscore the need to reduce compliance costs, improve transparency of green certification, and expand subsidies for innovation. For firms, the results underscore the strategic importance of adopting green leverage not merely for financial returns but as a means to strengthen legitimacy, reputation, and long-term resilience. For investors, the thesis emphasizes the necessity of incorporating ESG disclosures, innovation capacity, and governance quality into green investment decisions. By drawing lessons from AIM and applying them to the Pakistan Stock Exchange (PSX), the thesis contributes original insights into how emerging markets might design supportive ecosystems for green finance. It shows that while PSX lags in infrastructure, policy, and investor readiness, the AIM experience offers a roadmap for overcoming constraints and leveraging enablers. In conclusion, green leverage has the potential to reshape corporate capital structures by aligning financial strategies with sustainability goals. However, its adoption remains constrained by institutional inefficiencies, regulatory burdens, and uncertain payoffs. Future success will depend on how firms, regulators, and investors collectively address these challenges, ensuring that green leverage evolves from a niche financing tool into a mainstream instrument for sustainable growth.

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