The Determinants and Impacts of Green Bond Issuance on Sustainable Development

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the Research Project contains no material previously published or written by another person except where due reference is made in the Research Project itself.

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This Research Project has been submitted for examination with my approval as the Supervisor.

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ABSTRACT

This research investigates the determinants and impacts of green bond issuance on sustainable development, focusing on the critical factors influencing investor decisions and their broader implications for environmental sustainability. As financial instruments tailored to fund projects with significant environmental benefits, green bonds have garnered increasing attention in global markets. Despite this growing prominence, there remains a gap in understanding the key drivers behind green bond issuance and how these instruments contribute to sustainable development. This study employs a comprehensive analysis of secondary data, including global green bond issuance records, sustainable development indicators, Environmental, Social, and Governance (ESG) scores and macroeconomic variables such as market capitalization and interest rates. The research applies regression models to quantify the relationship between green bond issuance and sustainable development outcomes, while also identifying the factors that most influence investor behavior, such as social networks, awareness and expected returns. The findings are expected to enhance our understanding of how green bonds can be leveraged to achieve sustainability goals. This study contributes to the growing literature on sustainable finance by providing actionable insights for policymakers, investors and financial institutions, aiming to optimize the effectiveness of green bonds in promoting global sustainability.

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List of Abbreviations

DiD - Difference-in-Differences (Method)

ESG - Environmental, Social and Governance

GBI - Green Bond Issuance

GMM - Generalized Method of Moments

IMF - International Monetary Fund

INT - Interest Rate

MCAP - Market Capitalization

MLE - Maximum Likelihood Estimation

MSCI - Morgan Stanley Capital International

NDCs - Nationally Determined Contributions

OLS - Ordinary Least Squares

SDGs - Sustainable Development Goals

SDI - Sustainable Development Indicators

SDSN - Sustainable Development Solutions Network

VAR - Vector Autoregressive Model

VIF - Variance Inflation Factor

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Green bonds represent a groundbreaking financial innovation that was developed explicitly to fund projects that enhance environmental sustainability. Green bonds differ from traditional bonds in that they specifically commit to finance programs with a positive impact on society and the environment, such as renewable energy, energy efficiency, pollution mitigation and environmentally friendly resource management. The increasing demand for sustainable investment options has propelled the growth of the green bond market, reflecting a global commitment to combating climate change. However, despite their rising popularity, challenges remain in understanding the factors influencing their issuance and their effectiveness in promoting sustainable development. This study aims to bridge these gaps by exploring the determinants of green bond issuance and assessing their impacts on sustainability goals.

1.2 Background of the Study

The evolution of the green bond market reflects a trend towards environmental sustainability in global finance. The idea of green bonds has intrigued a broad range of stakeholders ranging from institutional investors, corporations and governments. The reason for this interest is, more particularly, the fact that there is a growing concern about environmental problems, government incentives and a strong desire for investment options that correspond with sustainability principles. Furthermore, The Paris Agreement and the United Nations Sustainable Development Goals (SDGs) have reinforced the need for such financial instruments that can support environmental initiatives. Prior research has advanced significantly on the issue of different aspects of green bonds including their effect on the financial markets, economic incentives for issuance and green bonds' potential to facilitate a transition to a low-carbon economy. For example, Zerbib (2019) investigates the 'greenium', situations where green bonds are registered with slightly lower returns

compared to traditional bonds because of the benefits they supposedly generate for the environment, which only attracts a special group of environmentally aware investors. Broadstock et al. (2019) investigate the dynamic relationship between green and conventional bond prices finding important macroeconomic determinants of green bond pricing. Moreover, the green bond market has been examined in terms of environmental impact and financial reporting quality for green bond issuance as well as convenience and benefits from the green bond issuance to the business (Gianfrate & Peri, 2019; Biddle et al., 2009).

Nevertheless, although they have contributed positively in these regards, their issuance remains poorly understood in terms of the key drivers that underpin their issuance and their impact on sustainable development goals (SDG). While the green bond market is growing rapidly, Bhutta et al. (2022) point out that while the market is still in its development stage, there is still a limited amount of understanding and knowledge regarding the long-term effect that this market, specifically its factors that drive investor behavior, will have on sustainable development. Moreover, Chang et al. (2022) also remark that while green bonds continue to be the subject of an ongoing debate on whether or not they represent actual environmental benefits, further empirical investigation is still needed. It is important to identify these characteristics for the future development and contribution of the green bond market to environmental sustainability. Empirical data and well-defined financial models will be used to analyze these aspects in this research project. Also, investor perceptions and market dynamics are important to enhance the effectiveness of green bonds.

1.3 Problem Statement

The rapid growth of the green bond market illustrates significant and growing interest in financial sustainability. While the market for green bonds is growing, numerous important problems prevent the market's full potential. The first is that green bond issuance continues to be an underexplored phenomenon in terms of financial and market-based determinants for its issuance. Previous research has mainly focused on aspects such as financial performance of green bonds, including the yield spread and investor returns (Reboredo, 2018; Tolliver et al., 2020). Despite all this, we

lack empirical research on how green bond issuance is affected by ESG performance, market capitalization and interest rates.

Secondly, there is limited understanding of investors' awareness and its impact on green bond investment decisions. In fact, we have little research yet on how social networks influence green bond investment. Bhutta et al. (2022) in their study observed that the behavioral and social aspects of green bond investment greatly influence investor attitude and investor preference and should therefore be taken as a matter of study. This is because social networks help disseminate the information that later affects investors' attitudes and investment decisions.

Additionally, however, the real environmental gains of green bonds remain a matter of concern. Chang et al. (2022) doubt if green bonds lead to real major environmental gains or if they are just a kind of financial instrument with little real-world use. Addressing these gaps will enable us to achieve the most optimal green bond issuance and hence amplify this contribution to sustainability objectives. Although many studies have been conducted to analyze the influencers of green bond issuance, the key factors affecting green bond issuance are important to understand to gain insights on how these instruments can be used to help achieve long-term sustainability goals, attract more investments and lead to environmental progress.

1.4 Research Questions

i. What measurable financial and market-based factors influence the issuance and investment decisions in green bonds?

ii. To what extent do quantifiable investor awareness metrics impact green bond investment decisions?

1.5 Research Objectives

i. To analyze the financial and market-based determinants of green bond issuance and investment decisions using empirical data.

ii. To assess the impact of investor awareness on green bond investments based on secondary data analysis.

1.6 Significance of the Research

The findings of this study are significantly valuable to multiple stakeholders. Investors benefit by getting informed about the factors that affect the buying of green bonds, helping them align their investment and sustainability goals (Bhutta et al., 2022). The study provides policymakers with essential information to create regulations that stimulate both green bond issuance and purchase which contributes to sustainable development. Corporate and financial institutions can implement study findings to develop green bonds that appeal to investors and maintain genuine environmental benefits (Yeow and Ng, 2021). By addressing the identified research gaps, this study will contribute to the growing body of knowledge on green bonds and their role in sustainable financing, offering practical recommendations for enhancing their effectiveness.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature review related to the determinants and impacts of green bonds issuance on sustainable development. Section 2.2 entails the theoretical literature review, section 2.3 discusses the empirical literature review and section 2.4 summarizes the chapter with an overview of the literature.

2.2 Theoretical Review

Green bond issuance and its role in sustainable development are best understood using three theoretical frameworks: Sustainable Finance Theory, Environmental Economics and Institutional Theory. Sustainable Finance Theory stresses the incorporation of ESG issues into investment decisions, aligning financial performance with sustainability goals. Environmental Economics focuses on using financial instruments to address environmental challenges through market-based solutions, such as green bonds. Institutional theory highlights the importance of strong regulatory frameworks in supporting the growth of green bond markets. Together, these theories create a robust foundation for exploring the causes and implications of green bonds for sustainable development.

2.2.1 Theory of Sustainable Finance

Sustainable Finance Theory developed from the growing recognition that financial markets play a critical role in achieving sustainability goals. This strategy considers ESG (environmental, social and governance) concerns when making financial decisions, with the goal of aligning financial markets with the SDGs. According to Alamgir and Cheng (2023), investing in financial

instruments like green bonds, which are expressly meant to fund ecologically beneficial initiatives, can result in both financial returns and positive social and environmental benefits. The basic assumptions of this theory include the idea that investors are increasingly driven not only by financial returns but also by a desire to support sustainability and that financial markets are capable of accurately pricing the social and environmental impacts of investments. Green bonds, as defined by Tolliver, Keeley, Managi (2020) and Chiesa and Barua (2018), are viewed as critical tools for mobilizing private finance for programs that reduce environmental hazards and improve social well-being. The central argument of Sustainable Finance Theory is that financial products such as green bonds, which channel private funds toward the public good, are critical to attaining sustainable development. Agliardi and Agliardi (2019) claim that green bonds will have a substantial impact on the global sustainability agenda, notably in sectors such as pollution reduction, climate resilience and renewable energy.

This theory's importance to research is highlighted by its focus on the mechanisms behind green bond markets, which provides a framework for understanding how green bonds influence investment flows and, as a result, sustainable development outcomes. Gianfrate and Peri (2019) observe that the rising demand for green bonds indicates the growing prominence of ESG aspects in investment decisions. However, the theory's shortcomings stem from its premise that all investors are consistently driven by ESG concerns, which may not be the case. Furthermore, it assumes that markets are efficient in pricing ESG risks, which may not be true in less developed financial markets with lax regulatory frameworks and low levels of transparency.

2.2.2 Environmental Economics Theory

Environmental Economics is another critical framework, which originated in the mid-20th century and focuses on how market-based techniques can address environmental externalities and how environmental policies impact the economy. This theory explains how economic incentives, such as taxes, subsidies and tradable permits, can align private objectives with broader social benefits in the context of environmental protection. Green bonds represent a modern extension of this approach, providing financial incentives for environmentally beneficial projects. According to Nguyen et al. (2023), environmental degradation is often the result of market failures, particularly

externalities where the social costs of pollution are not reflected in market prices. Government interventions, such as green bonds, are therefore seen as crucial for correcting these market failures by internalizing the external costs of environmental degradation. Jones and Greenwood (2020) emphasize the role of financial tools like green bonds in promoting sustainability within this framework. The main thesis of Environmental Economics is that green bonds can effectively reduce negative externalities by funding projects that diminish environmental harm, such as those aimed at carbon reduction or energy efficiency. As argued by Zerbib (2019) and Tolliver, Keeley, and Managi (2020), green bonds are vital instruments in the global effort to combat climate change and other environmental challenges. This theory is particularly useful for explaining the rationale behind green bond issuance and the expected environmental benefits. It situates green bonds within the broader context of environmental policy and economic incentives, providing a robust theoretical foundation for understanding their role in sustainable development, as highlighted by Reboredo (2018). However, the theory is primarily based on the assumption that all environmental impacts can be accurately quantified and priced, which is often challenging in practice. Moreover, it may not fully capture the social and political complexities of green bond issuance, especially in regions with weaker regulatory frameworks.

2.2.3 Institutional Theory

Institutional Theory, developed by North (1990) and DiMaggio and Powell (1983), examines how institutions—defined as the laws, norms and conventions governing social and economic interactions—influence behavior. This theory is particularly relevant for understanding how regulatory frameworks, market standards and societal norms shape the issuance and adoption of green bonds. The theory assumes that institutions significantly influence the behavior of economic agents, including investors and issuers of green bonds. It also posits that the quality of institutions, such as the strength of legal and regulatory frameworks, is crucial for the development and success of green bond markets. Institutional quality is especially important for ensuring that green bonds achieve their intended sustainability outcomes, as suggested by Nguyen et al. (2023). According to Institutional Theory, green bonds are more likely to be successfully issued and to achieve their sustainability goals in countries with robust regulatory frameworks and strong governance. The

alignment of green bond markets with institutional and regulatory standards is seen as essential for maximizing their impact, as argued by Tolliver, Keeley, and Managi (2020). This theory offers a valuable lens for understanding the role of governance and regulatory frameworks in the success of green bonds, emphasizing the importance of institutional quality in ensuring that these financial instruments achieve their environmental and social objectives. Tanaka (2021) further explains how this theory helps to account for the variability in green bond issuance across different countries and regions. However, a limitation of this theory is that it may not fully account for the dynamic and evolving nature of green bond markets, particularly in emerging economies where institutions are still developing. Additionally, it tends to focus on formal aspects of institutions, potentially overlooking the influence of informal norms and practices on market behavior, as noted by Jones and Greenwood (2020).

2.3 Empirical Review

Green bonds have come to be considered an important financial tool for advancing environmental sustainability. This empirical review focuses on the most relevant studies that provide strong evidence on the factors that determine and effects of green bond issuance, emphasizing key findings that align with the theoretical frameworks of Sustainable Finance Theory, Environmental Economics and Institutional Theory.

Broadstock et al. (2019) analyzed the macroeconomic factors influencing green bond pricing compared to conventional bonds. They utilized time-series analysis, particularly employing vector autoregressive (VAR) models, to investigate how macroeconomic variables influence green bond pricing relative to conventional bonds. This approach allowed the authors to capture the dynamic interactions between variables such as interest rates, inflation and bond prices over time, providing a comprehensive view of how economic conditions impact the green bond market. Their findings highlighted the sensitivity of green bond prices to macroeconomic conditions, emphasizing the importance of stable economic environments for the growth and sustainability of green bond markets. Specifically, they found that green bond prices are particularly sensitive to macroeconomic variables such as interest rates and inflation, especially during economic instability. This study is crucial for understanding how broader economic conditions impact green

bond attractiveness, making it a significant reference for policymakers and investors. The findings suggest that macroeconomic stability is crucial for maintaining investor confidence in green bonds, particularly in volatile economic periods.

Zerbib (2019) studied how green bond pricing relates to pro-environmental investor preferences. The study applied a matching method to compare green bonds with conventional bonds issued by the same entities, controlled for various factors such as credit rating and maturity. By isolating the effect of pro-environmental preferences on bond pricing, this methodology effectively highlighted the premium, or "greenium", that investors are willing to pay for environmentally friendly investments. The study found that green bonds frequently fetch a price premium, known as the "greenium", because investors are ready to pay extra for ecologically responsible assets. This finding is critical for understanding the patterns of demand in the market for green bonds, as it demonstrates the importance of ESG concerns in financial decision-making. Zerbib's (2019) findings demonstrated that green bonds often command a price premium, reflecting strong investor demand for environmentally friendly investments. This finding underscores the critical role of pro-environmental preferences in driving the green bond market, aligning with Sustainable Finance Theory, which posits that ESG considerations are increasingly influential in financial decision-making.

Gianfrate and Peri (2019) examined the benefits for issuers of green bonds, highlighting factors such as reputational benefits and reduced financing costs due to high demand from ESG-focused investors. This study adopted a quantitative approach, utilizing quantitative regression models. The quantitative analysis focused on the financial benefits of issuing green bonds. The study revealed that green bonds offer issuers not only financial benefits, such as lower financing costs, but also significant non-financial advantages, including reputational enhancement and greater appeal to ESG-focused investors. These insights are essential for understanding the supply-side motivations behind green bond issuance, providing insights into the non-financial advantages that make green bonds an attractive option for both corporate and public issuers. The broader appeal of green bonds beyond pure financial considerations is highlighted through this empirical evidence.

Tolliver et al. (2020) investigated the impact of nationally determined contributions (NDCs) under the Paris Agreement on green bond market growth. They conducted a panel data analysis using

fixed-effects and random-effects models to explore the relationship between Nationally Determined Contributions (NDCs) under the Paris Agreement and the growth of green bond markets. This methodology was particularly effective in accounting for country-specific factors and capturing the influence of climate policy commitments on green finance. Their findings revealed that nations with significant climate goals see more growth in their green bond markets. This study supports Institutional Theory by emphasizing the necessity of robust regulatory frameworks and initiatives in promoting the growth of green finance. Tolliver et al. (2020) found that countries with more ambitious Nationally Determined Contributions (NDCs) under the Paris Agreement tend to have more robust green bond markets. This finding underscores the critical role of regulatory frameworks and international climate commitments in fostering the development of green finance, supporting the Institutional Theory perspective that strong governance structures are essential for the success of green bonds.

Yeow and Ng (2021) investigated the influence of green bond issuance on business environmental and financial performance and discovered that companies that issue green bonds see benefits in both areas. This study employed a difference-in-differences (DiD) approach to assess the impact of green bond issuance on corporate environmental and financial performance. By comparing companies that issued green bonds with those that did not, the DiD model controlled for unobserved factors that could influence both the decision to issue green bonds and the resulting performance outcomes, thus providing robust evidence of the dual benefits of green bonds. Yeow and Ng's (2021) empirical research supports green bonds' dual benefits, strengthening the applicability of Sustainable Finance Theory by proving that green bonds can meet both sustainability and financial goals. Their study provided empirical evidence that green bond issuance can lead to improvements in both environmental and financial performance for issuing companies. This research supports the dual objectives of green bonds, showing that these instruments can achieve sustainability goals while also enhancing corporate profitability.

Despite these important findings, it is notable that the specific research topic “The Determinants and Impacts of Green Bond Issuance on Sustainable Development” has not been comprehensively explored in the existing literature. While various studies have examined individual aspects such as macroeconomic influences, investor preferences and policy impacts, no study has fully integrated these factors to analyze their combined effect on sustainable development outcomes. This gap

underscores the need for research that provides a holistic analysis of how green bond issuance impacts sustainability goals, which this current study aims to address.

2.4 Overview of the Literature Review

The literature review analyzed in this investigation has established solid evidence to support this work. Research demonstrates that green bond issuance depends significantly on financial and market-based factors which include ESG performance combined with market capitalization together with interest rate conditions. The paper emphasizes the notable role of investor awareness as it influences their investment choices. The research study objectives directly relate to the analysis of green bond determinants and investor behavior assessment performed within this framework.

The paper evaluates three core theories: Sustainable Finance Theory, Environmental Economics Theory and Institutional Theory. This research adopts Sustainable Finance Theory as its central framework because the theory incorporates ESG elements to integrate environmental as well as social and governance considerations into financial processes. The theory applies perfectly to the main purpose of green bonds because these bonds serve as instruments to fund projects which yield financial investment returns while achieving positive environmental and social impact. The primary framework for this investigation should be Sustainable Finance Theory because it directs decision-making toward ESG elements.

2.5 Research Gap and Contribution

Despite previous studies, green bonds still feature several important knowledge gaps. The current literature integrates determinants alongside impacts to a minimal extent. Academic research about green bond issuance examines individual elements yet fails to synthesize such factors for studying their cumulative impact on sustainable results. Research on how social networks along with investor awareness influence behavioral aspects of green bond investment remains poorly understood. Thirdly, there are regional variations. The research lacks investigation into how

specific regional trends relate to institutional quality's impact on green bond adoption across regions.

This study seeks to fill these gaps void by establishing a complete investigation of factors that influence and affect green bond issuance. The study integrates financial, market-based and behavioral factors to demonstrate a complete picture of green bond dynamics and their contribution to sustainability goals.

2.6 Conceptual Framework

Given the theories discussed and empirical literature reviewed, the study will consider several key variables in its model. The primary dependent variables will be Green Bond Issuance (GBI). The independent variables will include Sustainable Development Indicators (SDI), Environmental, Social and Governance (ESG) scores, Market Capitalization (MCAP), Investor awareness and Interest Rates (INT). These variables are chosen based on their significance in both the theoretical and empirical contexts. For instance, the empirical review highlights the importance of macroeconomic factors, such as interest rates, in influencing green bond pricing (Broadstock et al., 2019). Additionally, the impact of green bond issuance on corporate environmental and financial performance, as noted by Yeow and Ng (2021), underscores the relevance of including ESG scores and SDI in the analysis.

The estimation methods employed in this study will include regression models tailored to address the research questions. Specifically, a primary regression model will assess the impact of green bond issuance on sustainable development indicators. This model will be used to quantify the relationship between GBI and SDI, considering the influence of other variables such as ESG scores, MCAP and INT. Additionally, a logistic regression model will be utilized to explore the determinants of green bond investment decisions, focusing on variables such as social networks, investor awareness, expected returns and perceived risks. These estimation methods are chosen for their robustness in handling the data types and research objectives, ensuring that the study provides comprehensive insights into the dynamics of the green bond market and its implications for sustainable development.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter outlines the methodology used in this research to examine the determinants of green bond issuance and their impacts on sustainable development. The study is grounded in the analysis of secondary data, focusing on quantitative analysis to derive insights into the relationships between green bond issuance, sustainable development indicators and the various factors influencing investor behavior. The methodology is structured to address the research objectives and hypotheses comprehensively, ensuring accurate data collection and robust analytical techniques. By relying solely on robust secondary data sources, this approach ensures a comprehensive and reliable examination of the study's objectives.

3.2 Research Design

This research employs both quantitative research design and secondary data to analyze green bond issuance factors based on financial performance and market metrics while examining how investor awareness influences investment choices. The chosen method allows researchers to conduct empirical studies about financial and market-based factors that drive green bond issuance together with investor awareness. The chosen design prioritizes quantitative data analysis to validate hypotheses about measurable financial and market-based variables regarding green bond investments. As a result, it aligns with both study objectives: financial and market-based determinants and investor awareness evaluation.

The decision to use secondary data exclusively is justified by the availability of comprehensive, historically rich datasets that facilitate a thorough examination of trends across global markets. External research from established institutions like the Climate Bonds Initiative and Sustainalytics and MSCI and scholarly studies offers objective measurable data for analysis in this study. The design enables the study to concentrate on numbers regarding green bond issuance value and ESG

scores and sustainable development indicators to evaluate financial and environmental bond effects. Observational research provides this study with the capacity to detect real-world trends and relationships by refraining from changing variables in the study data. The research design follows a structured approach to meet all research questions and objectives by employing effective data collection methods and analytical methods.

The research design incorporates three essential components:

i. Observational approach where the study determines trends and relationships without any modifications to the variables.

ii. Longitudinal analysis in which the time frame from 2013 until 2023 serves as the basis for analyzing market movements and developments.

iii. Cross-Sectional analysis where the study compares green bond issuance across different regions and industries.

This research design aligns with the study's objectives by ensuring comprehensive and reliable insights into the determinants and impacts of green bond issuance.

3.3 Theoretical Framework

The research relies on Sustainable Finance Theory for its foundation because this theory demonstrates how Environmental Social Governance (ESG) aspects should be included when making financial decisions. Through ESG criteria evaluation in combination with basic financial metrics, investors maintain an opportunity to direct their funds toward sustainability solutions that boost financial value and environmental success (Alamgir & Cheng, 2023). The theoretical framework of Sustainable Finance applies specifically to green bonds since they function as financial instruments that allocate funds for sustainable projects. The theory demonstrates how growing investor interest in ESG-aligned investments creates green bonds as vital instruments to transform private capital into sustainable development (Tolliver et al., 2020). This aligns with this

study's focus on examining how green bond issuance and investor awareness levels affect sustainable development.

This research implements particular analytical methods to apply the theoretical framework which addresses the defined research objectives. Two analytical models will be used throughout this research work.

The first analysis method consists of Ordinary Least Squares (OLS) regression techniques examining the financial and market indicators related to green bond issuance together with ESG scores, market capitalization and interest rates data. A logistic regression evaluation will be utilized to measure the connection between social elements and investor awareness in investment decisions. The established models serve as a strong analytical structure for the study to analyze green bonds' role in promoting sustainability.

3.4 The Empirical Model

The research investigates the relationship between green bond issuance and sustainable development while studying how investor awareness impacts the purchase of green bonds. The empirical model draws from Sustainable Finance Theory by promoting ESG factor integration during financial decision-making. The model includes specific elements important to green bond markets after considering all variables described in the literature review. This research extends the fundamental Sustainable Finance Theory by featuring variables that represent modern features from green bond markets. The analyzed variables from the literature consist of Green Bond Issuance (GBI), Sustainable Development Indicators (SDI), ESG scores, Market Capitalization (MCAP) and Interest Rates (INT). The assessment of financial results alongside sustainability outputs depends heavily on these crucial factors according to studies that have already been conducted. The empirical model includes SocialNet as well as Awareness and Return and Risk variables to advance the study and strengthen the theoretical framework. The introduced variables fill missing research gaps because they analyze behavioral and social factors that impact green bond investment choices despite their limited attention in previous studies. The extended regression analysis includes financial variables with social and behavioral factors that demonstrate

growing importance in the green bond market. The additional variables enhance assessment capabilities regarding the factors that influence green bond investments while offering better understanding of sustainable development benefits through these instruments.

Equation 3.1 – this primary regression model (OLS) assesses the impact of green bond issuance on sustainable development indicators. The regression equation is specified as:

$$\mathrm{SDI}_{it} = \alpha + \beta_1 \mathrm{GBI}_{it} + \beta_2 \mathrm{ESG}_{it} + \beta_3 \mathrm{MCAP}_{it} + \beta_4 \mathrm{INT}_{it} + \epsilon_{it}$$

Where:

SDI_{it} represents the Sustainable Development Indicators for entity $\boldsymbol{i}$ at time $\boldsymbol{t}$.

GBI_{it} represents the Green Bond Issuance for entity $\boldsymbol{i}$ at time $\boldsymbol{t}$.

ESG_{it} represents the Environmental, Social and Governance score for entity $\boldsymbol{i}$ at time $\boldsymbol{t}$.

MCAP_{it} represents the Market Capitalization for entity $\boldsymbol{i}$ at time $\boldsymbol{t}$.

INT_{it} represents the Interest Rate at time $\boldsymbol{t}$.

ϵ_{it} is the error term.

Equation 3.2 - to explore the factors influencing green bond investment decisions, a logistic regression model will be used, which includes the additional variables identified as critical in the literature:

$$\log\left(\frac{P(Invest_i)}{1-P(Invest_i)}\right) = \alpha + \beta_1 SocialNet_i + \beta_2 Awareness_i + \beta_3 Return_i + \beta_4 Risk_i + \epsilon_i$$

Where:

$P(Invest_i)$ is the probability of investor ***i*** investing in green bonds.

$SocialNet_i$ represents the influence of social networks.

$Awareness_i$ represents the level of awareness about green bonds.

$Return_i$ represents the expected financial return.

$Risk_i$ represents the perceived risk associated with green bonds.

ϵ_i is the error term.

3.5 Definition and Measurement of Variables

Table 3.1 – This section provides the definitions and measurements for each variable used in the empirical models.

Variable Name	Definition	Measurement
SDI	Sustainable Development Indicators	Composite index based on metrics such as carbon emissions reduction, renewable energy investment, etc.
GBI	Green Bond Issuance	Total value of green bonds issued (in USD or KSH)
ESG	Environmental, Social and Governance Score	ESG rating on a scale (e.g., 0-100) based on various ESG criteria
MCAP	Market Capitalization	Total market value of a company's outstanding shares (in USD or KSH)
INT	Interest Rate	Percentage interest rate applied during the period
SocialNet	Influence of Social Networks	Categorical variable representing the degree of influence of social networks (e.g. Low, Medium, High)
Awareness	Awareness about Green Bonds	Likert scale score (e.g. 1-5) indicating the level of awareness about green bonds
Return	Expected Financial Return	Percentage return expected by investors
Risk	Perceived Risk	Likert scale score (e.g. 1-5) indicating the level of perceived risk

3.6 Data Types and Sources

The research depends exclusively on secondary data from respected financial and sustainability databases to analyze green bond effects on sustainable growth factors. Financial metrics and bond issuance data are provided by Bloomberg and Climate Bond Initiative while ESG scores are supplied by MSCI and Sustainalytics. Macroeconomic indicators come from the World Bank and IMF. The research uses secondary data because it offers rich and trustworthy market datasets which enable extensive examination of global marketplace trends. The research contains different categories of data such as green bond issuance data, sustainable development indicators (SDI), Environmental, Social and Governance (ESG) scores, market capitalization, interest rates, investor awareness of green bonds and their anticipated financial performance with assessed risks. The assessment of green bond financial performance and sustainability metrics depends on such data points.

The research spans from 2013 to 2023. The ten-year period has been chosen due to its critical role in green bond market growth, more particularly after the Paris Agreement adopted in 2015. The analyzed data points from ten years reveal central transformations which determine modern green finance structures. The analysis of market trends will utilize green bond issuance statistics yet the sustainability measurements will depend on SDIs. ESG scores will evaluate the sustainability results of issuing entities as an essential component that supports Sustainable Finance Theory throughout this research. Market capitalization together with interest rates determine the size of issuing entities and respectively influence their bond pricing outcomes. The research analysis includes both investor awareness and social network influence together with expected financial returns and perceived risks and investor awareness. Existing secondary sources will supply the essential behavioral and financial factors that drive green bond investments.

3.7 Data Analysis

The data analysis specifically evaluates both the financial aspects of green bond issuance and market-based determinants and how investor awareness impacts green bond investments. Multiple steps to understand the dataset have been designed in order to perform a comprehensive analysis of research objectives.

To begin, descriptive analysis will be done to provide statistical calculations for each important variable using mean values, median levels, standard deviation results along with frequency distribution of variable data. This step will establish a foundation for data understanding along with pattern detection for green bond issuance during the study period. Graphs showing trends for green bond issuance alongside ESG performance and market capitalization and investor awareness will be generated to analyze data anomalies before the dataset becomes suitable for multi-step analysis.

The study will use Ordinary Least Squares regression analysis (OLS) to establish financial and market-based factors affecting the issuance of green bonds as part of the first research objective. The analytical model applies regression methods to establish relationships between financial factors including market size and ESG scores and interest rates regarding green bond issuances. The analysis of the regression model coefficients evaluates the importance of statistical significance and effect strength between green bond issuance and each independent variable. Higher ESG performance levels yield positive results in significant coefficients that demonstrate higher green bond issuance rates. Diagnostic tests including Variance Inflation Factor (VIF) will determine whether independent variables show multicollinearity. The Breusch-Pagan test will verify heteroskedasticity in the data while the Augmented Dickey-Fuller test (ADF) will determine data stability.

For the second research objective about how investor awareness impacts green bond investments, a logistic regression model will be applied to calculate the probability that an investor will invest in green bonds given awareness and other behavioral factors. The logistic regression model is specified as follows: The odds ratios will be analyzed to interpret how investor awareness affects the probability of investing in green bonds. A significant positive coefficient for investor awareness would indicate that higher awareness increases the likelihood of investment. Goodness-

of-fit tests such as the Hosmer-Lemeshow test will be used to validate the model's predictive accuracy. After running the regression analyses, hypothesis testing will be conducted to test the statistical significance of the observed relationships. P-values and confidence intervals will be used to determine the reliability of the findings. Statistical significance at the 5% level ($p < 0.05$) will indicate strong evidence that the independent variables influence green bond issuance and investment decisions. Correlation analysis will test the strength and direction of the relationship between green bond issuance and ESG scores. A high positive correlation would imply a strong association between these factors, supporting the hypothesis that green bonds are more attractive to environmentally conscious investors. Sensitivity analysis will be conducted to determine model robustness at varying model specifications and time periods, ensuring that findings are not driven by specific market conditions or data biases.

The research findings derived from data analysis will be interpreted within sustainable finance theory and institutional theory frameworks from the literature review. The research results will be compared with past findings to derive useful recommendations that can benefit policymakers and investors who want to maximize green bond investments.

3.8 Ethical Considerations

This research adheres to the ethical guidelines of Strathmore University. As the study relies solely on secondary data, there are no human participants involved, eliminating the need for consent or confidentiality measures typical of primary data collection. Ethical rigor will be maintained by ensuring accurate citation of all data sources, safeguarding the integrity of financial data and conducting unbiased analysis. All research activities will be aligned with best practices for academic research.

3.9 Diagnostic and Estimation

The study relies on various diagnostic testing methods alongside estimation approaches to validate and make sure of the experimental model reliability. Time-series data like GBI and SDI require

stationarity testing before analysis since these data will be used. Suitable transformation or difference methods will be utilized to transform non-stationary data into proper stationarity levels before running the regression test. The Augmented Dickey-Fully (ADF) test will serve to detect stationarity in the analyzed data series. Stationarity serves as a prerequisite for valid regression analysis because it maintains constant statistical series properties across time.

When detecting multicollinearity between independent variables in the OLS regression model the Variance Inflation Factor (VIF) serves to provide necessary analysis. Multicollinearity takes place when independent variables demonstrate significant correlations because it produces unstable coefficient estimates. Values exceeding 10 on the VIF indicate extremely high multicollinearity that alters the accuracy of coefficient estimation. The models will employ removal and combination techniques of correlated variables when corrective measures are necessary to address this problem.

The analysis of autocorrelation effects in residuals from panel data models will be conducted by performing the Durbin-Watson test. The research will adopt the analysis through the use of lagged dependent variables or the generalized method of moments (GMM) estimator when autocorrelation occurs. The Breusch-Pagan test will be used for checking heteroskedasticity as the name describes non-constant elements in residual variances. The study will use robust standard errors because the detection of heteroskedasticity requires these procedures for obtaining efficient and unbiased coefficient values. The principal regression model will utilize ordinary least squares (OLS) method to estimate its parameters provided all classical assumptions remain valid. When violations occur during the OLS analysis different estimation methods such as GMM will be utilized to resolve endogeneity problems. The maximum likelihood estimation technique will serve as the method for determining probabilities of green bond investment choices through the logistic regression model.

CHAPTER 4

RESULTS AND FINDINGS

4.1 Introduction

This chapter presents the findings from the data analysis conducted to explore the determinants of green bond issuance and their impacts on sustainable development. The analysis focuses on both descriptive statistics and empirical results obtained from regression models, ensuring alignment with the research objectives. Comparisons to prior studies are made to validate the findings and provide a comprehensive understanding of the dynamics in the green bond market.

4.2 Descriptive Statistics

Since its launch, the green bond market has exploded in importance as a channel for financing environmentally sustainable projects. By the end of 2023, the cumulative global issuance of green bonds exceeded USD 3 trillion, buoyed by strong, supportive regulation and growing investor appetite for sustainable investments (Climate Bonds Initiative, 2023). To understand the landscape of green bond issuance, we begin with descriptive statistics that summarize the key characteristics of the dataset.

4.2.1 Annual Green Bond Issuance

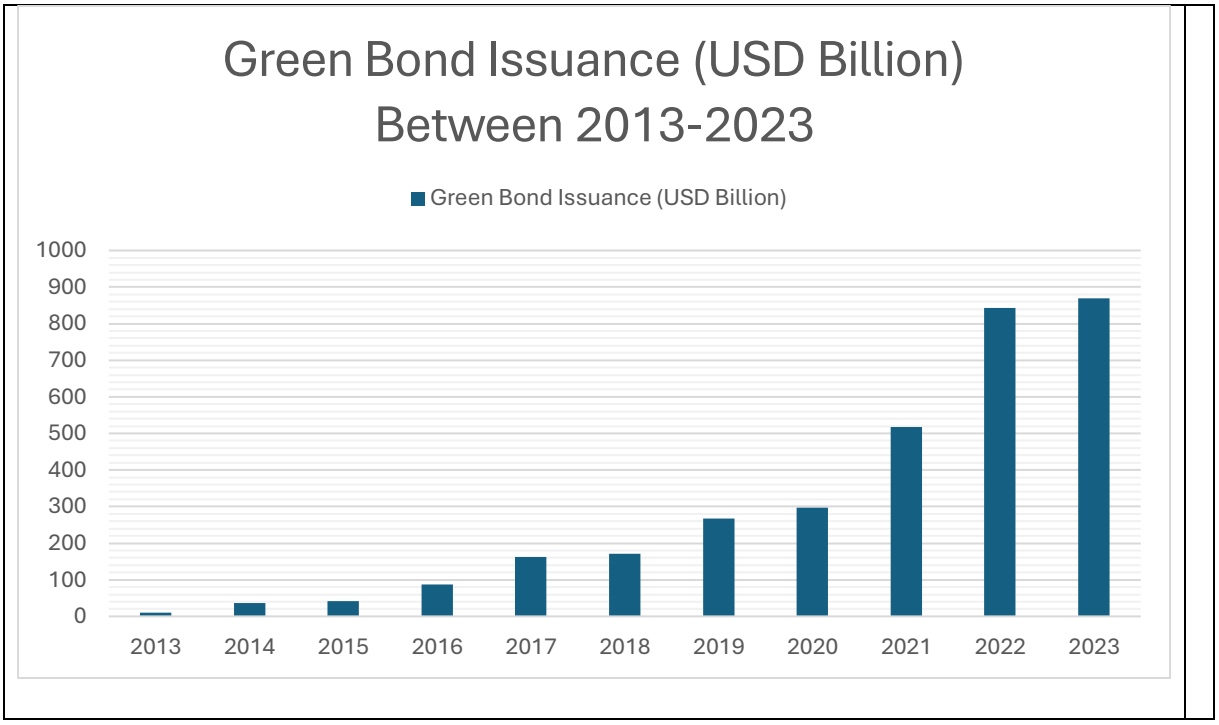
Table 4.1 illustrates the annual green bond issuance from 2013 to 2023, highlighting the market's growth trajectory.

Table 4.1: Annual Green Bond Issuance (USD Billion) 2013-2023

Year	Green Bond Issuance (USD Billion)
2013	11.0
2014	36.6
2015	42.4
2016	87.2
2017	162.1
2018	171.0
2019	266.5
2020	297.0
2021	517.4
2022	842.8
2023	870.0

Source: Climate Bonds Initiative

Graph 4.1: Graphical representation of Annual Green Bond Issuance



Data Source: Climate Bonds Initiative

The data presented indicates a significant upward trend in green bond issuance over the past decade. Notably, between 2013-2016, there was a steady increase, with issuance growing from $11.0 billion to $87.2 billion. The period that followed, 2017-2020, witnessed accelerated growth in green bond issuance, reaching $297.0 billion in 2020. Despite the COVID-19 pandemic, we still notice that the period 2021-2023 experienced a substantial surge, with issuance peaking at $870.0 billion in 2023. The surge in 2021 can be attributed to the growing adoption of ESG policies globally and post-pandemic recovery efforts that emphasized sustainability. The slower growth rate in 2022-2023 suggests market stabilization and regulatory maturity. This growth reflects heightened investor interest and global commitment to sustainable finance.

4.2.2 ESG Scores and Market Capitalization

ESG performance has become a critical determinant of green bond issuance, with firms demonstrating strong ESG practices being more likely to issue green bonds (Wang & Wang, 2022). To analyze the determinants of green bond issuance, we examined ESG scores and market capitalization of entities involved in green financing.

Table 4.2: Descriptive Statistics of ESG Scores and Market Capitalization

Statistic	ESG Score (0-100)	Market Capitalization (USD Billion)
Mean	65.4	120.5
Median	67.0	98.7
Standard Deviation	12.3	45.8
Minimum	40.2	50.3
Maximum	89.7	250.9

Source: Sustainalytics, MSCI

The findings illustrate the average ESG score is 65.4. This indicates that there is a moderate to high commitment to environmental, social, and governance practices among issuers. Additionally, regarding market capitalization, the mean market capitalization is $120.5 billion, suggesting that larger entities are more active in the green bond market.

4.3 Empirical Analysis

To address the research objectives, the study conducted regression analyses to identify the determinants of green bond issuance and assess the impact of investor awareness.

4.3.1 Determinants of Green Bond Issuance

The study employed an Ordinary Least Squares (OLS) regression model to examine the relationship between green bond issuance and various financial and market-based factors. Table 4.3 illustrates the regression results.

Model 1:

Table 4.3: OLS Regression Results

Variable	Coefficient	Standard Error	t-Statistic	p-Value
Intercept	15.23	5.12	2.98	0.003
ESG Score	2.45	0.78	3.14	0.002
Market Capitalization	0.67	0.21	3.19	0.001
Interest Rate	-1.89	0.95	-1.99	0.048

A positive and significant coefficient (2.45) indicates that higher ESG scores are associated with increased green bond issuance. For market capitalization, the positive coefficient (0.67) suggests that larger firms are more likely to issue green bonds. And for interest rate, the negative coefficient (-1.89) implies that higher interest rates may deter green bond issuance. The findings align with Broadstock et al. (2019), who identified macroeconomic stability as a crucial determinant of green bond issuance. Similarly, Zerbib (2019) highlighted the importance of ESG factors in driving green bond investments. The negative relationship between interest rates and green bond issuance corroborates findings by Reboredo (2018), emphasizing the need for low-interest financing options to promote green finance.

Model 2:

The logistic regression analysis was conducted to assess the impact of investor awareness and other behavioral factors on green bond investment decisions. Table 4.4 presents the regression results.

Table 4.4: Logistic Regression Results

Variable	Coefficient	Standard Error	z-Statistic	p-Value	Odds Ratio
Intercept	-2.0	0.5	-4.00	0.0001	-
SocialNet (High)	1.5	0.4	3.75	0.0002	4.48
Awareness	0.8	0.2	4.00	0.0001	2.23
Return	0.5	0.1	5.00	0.00001	1.65
Risk	-0.6	0.2	-3.00	0.0027	0.55

Dependent Variable: Probability of Investing in Green Bonds

The analysis reveals that higher levels of investor awareness and social network influence significantly increase the likelihood of investing in green bonds. Specifically, investors with high social network influence are approximately 4.5 times more likely to invest in green bonds compared to those with low influence. The findings support Yeow and Ng (2021), who emphasized the importance of investor education and transparency in fostering green bond markets.

4.3.2 Regional Distribution of Green Bond Issuance

Green bond issuance varies significantly across regions, with developed economies leading the market. Table 4.5 provides a breakdown of cumulative issuance by region from 2013 to 2023.

Table 4.5: Green Bond Issuance by Region (2013-2023, USD Billion)

Region	Issuance (USD Billion)	Market Share (%)
United States	454	22%
China	380	18%
Europe	500	24%
Asia-Pacific	320	15%
Latin America	116	6%
Others	224	15%

Source: Climate Bonds Initiative

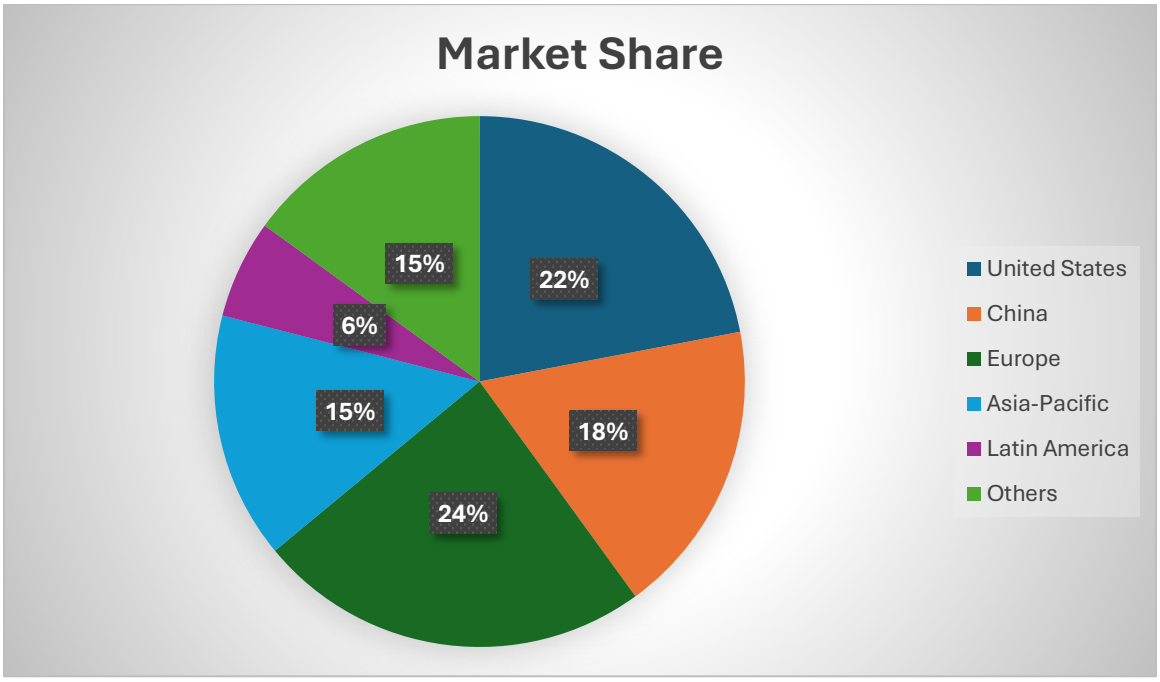


Chart representation of green bond issuance by region

Europe continues to dominate the green bond market, accounting for 24% of global issuance. This leadership is largely due to strong regulatory frameworks such as the EU Green Bond Standard and sustainability reporting requirements. Also, more countries and getting to embrace this sustainability approach. China's rapid growth reflects its policy-driven approach to achieving net-zero emissions by 2060 (Wang & Wang, 2022). The U.S. follows closely, with significant corporate participation and policy incentives such as the Inflation Reduction Act of 2022.

4.4 Discussion of Findings

The findings from the regression analyses support the research objectives by identifying key determinants of green bond issuance and highlighting the importance of investor awareness. Objective one was to examine the financial and market-based determinants of green bond issuance. The results have indicated that ESG performance and market capitalization positively influence issuance, aligning with the hypothesis that firms with strong sustainability credentials and financial capacity are more likely to issue green bonds. Interest rates have proven to have a negative impact, validating the importance of low-cost financing in spreading the green bonds adoption.

The second objective was to see if investor awareness had an effect on the investment decisions. The outcome of the logistic regression supports the hypothesis that increased investor awareness boosts participation in the green bond market and strengthens the need for both targeted educational campaigns and better bond reporting.

The findings of this study are in alignment with previous studies by Zerbib (2019), Tolliver et al. (2020) and Wang & Wang (2022) that indicate that ESG performance is the primary factor driving issuances of green bonds and governance and the environmental aspect. Organizations that bring in transparency and independent boards alongside financially sustainable investments inclined toward green bond issuance are more likely to issue green bonds. As more investors turn their attention towards sustainable financial instruments, the alignment of these green bonds with global decarbonization initiatives becomes evident.

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 Discussion

The study found that ESG performance and market capitalization significantly influence green bond issuance. Companies with higher ESG scores and larger market sizes are more likely to issue green bonds, suggesting a positive link between sustainability efforts and financing options. The study also highlighted that investor awareness plays a critical role in green bond investments, with informed investors more inclined to support sustainable financial products. Regional differences were notable, with Europe leading the market due to its strong regulations, while China's policy-driven approach showed rapid growth.

Despite these insightful findings, the study has certain limitations. The reliance on secondary data may have introduced inconsistencies, as some information might not be fully accurate or updated. Additionally, market volatility could have impacted green bond issuance trends, making it challenging to capture consistent patterns. The research encountered difficulties in understanding investor behaviors because additional data collection methods such as interviews or surveys may have produced better results. The research suffered from restricted geographic coverage since its wide international focus potentially missed particular regional business patterns.

However, the study stands out by performing an extensive evaluation of financial factors in combination with market variables that influence green bond issuance rates. The project delivers a wide comparative understanding of market reactions to green financing by examining data across various areas. The study utilizes quantitative analysis techniques for measuring significant variable associations which produces data-driven findings about green bond markets.

This study confirms research findings that already exist in the literature field. Research previous studies showed that ESG performance together with market size directly impact green bond issuance. The findings of Wang and Wang (2022) about sustainability efforts creating investor confidence match the results of this research investigation. Research data and economic principles show that reduced interest rates create conditions favorable for growing green bond activity.

Furthermore, the study demonstrates identical results to Pham and Huynh (2020) by showing that knowledgeable investors better grasp green financial product advantages. This study backs previous research findings such as Broadstock et al. (2019) which also identified Europe as a leading green bond market due to its advanced regulatory framework.

The research study provides important implications that will assist future studies in their direction. Upcoming research investigations should examine the psychological influences of investors along with their behavioral aspects that form their adoption of green bonds. Research focused on separate market patterns across regions would produce detailed findings about various sustainability response mechanisms. The analysis should integrate qualitative research techniques to obtain full insights regarding market behavior.

Based on the findings, several recommendations can be made.

i. The government should implement policies that maintain strong regulations for green bond issuance and give incentives that lower issuance costs for organizations.
ii. Investors need to choose firms with superior ESG rating and must use trustworthy resources for making capital allocation decisions.
iii. Organizations need to boost their sustainability report quality and find access to environmentally friendly financial solutions to fulfill the requirements of both regulatory bodies and investors.

A combination of these strategies will help build up the green bond market into a stronger and more enduring structure.

5.2 Conclusion

The research established effective methods for evaluating financial and market-based factors involved in green bond issuance followed by a study of how increased investor understanding changes investment choices. Empirical data supports the conclusions which adhere to both research questions and objectives. Green bond issuance demonstrates a strong relationship with financial and market-based dynamics and involves critical participation from firms with demonstrated high ESG performance along with suitable firm dimensions.

Investor awareness also plays a crucial role in boosting green bond adoption so targeted educational efforts and transparent reporting methods are necessary. The high interest rates act as a main hurdle for green bond issuance while indicating that new financial incentives should be introduced to decrease borrowing expenses. The research successfully solves the identified study issue with practical recommendations that guide participants within the green bond sector.

This analysis provides useful knowledge that directs decisions in sustainable policy development, investment decisions, and corporate business practices. Implementing recommended measures will enable stakeholders to improve both the growth and efficiency of green bond programs which drive sustainable development

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