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The Impact of Green Bond Issuance on Stock Market Performance

The Role of ESG and Financial Crises – Evidence from the US and European Markets

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ABSTRACT:

This study investigates the impact of green bond issuance on the stock market reaction of issuing firms, highlighting the moderating effects of Environmental, Social, and Governance (ESG) performance and financial crises. This study used an event study methodology to study 426 green bond announcements from listed non-financial firms in the United States and European markets from January,2014 to September,2025, aiming to evaluate short-term abnormal stock returns. Furthermore, regression analyses based on a sub-sample of 407 firms explore whether ESG performance and crisis conditions, particularly during the COVID-19 pandemic, affect these reactions.

The findings show that investor reactions depend on timing and issuer experience. Before the crisis, green bond announcements often led to positive stock market responses, especially for first-time issuers, as investors saw them as strong signals of sustainability. During the crisis, reactions became more cautious and often negative, especially for new issuers without a solid ESG framework. In contrast, repeat issuers with strong ESG performance received stable or even positive responses. This means that the impact of green bond announcements fluctuates among firms, depending upon market conditions, ESG reputation, and whether the issuer is experienced or new. These findings strengthen the literature on sustainable finance and provide practical insights for businesses, investors, and policymakers aiming to better understand how green financing interacts with market behavior and crisis dynamics.

KEYWORDS: Green Bonds, ESG, Event Study, Cumulative Abnormal Return (CAR), Stock Market Reaction, Financial Crisis, COVID-19, Sustainable Finance, Corporate Social Responsibility (CSR), Signalling Theory

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Abbreviations

ABS – Asset-Backed Securities

BIS – Bank for International Settlements

CAPM – Capital Asset Pricing Model

CAR – Cumulative Abnormal Return

CETS – Carbon Emission Trading System

COP – Conference of the Parties

COVID – Coronavirus Disease

CRS – Congressional Research Service

CSR – Corporate Social Responsibility

DDM – Dividend Discount Model

EMH – Efficient Market Hypothesis

ESG – Environmental, Social, and Governance

GBP – Green Bond Principles

GDP – Gross Domestic Product

GRI – Global Reporting Initiative

GSS – Green, Social, and Sustainability Bonds

ICMA – International Capital Market Association

IPO – Initial Public Offering

ISBN – International Standard Book Number

ISO – International Organization for Standardization

IT – Information Technology

PA – Paris Agreement

PRI – Principles for Responsible Investment

SBG – Sustainability Bond Guidelines

SBP – Social Bond Principles

SLBP – Sustainability-Linked Bond Principles

SPV – Special Purpose Vehicle

SR – Social Responsibility

UN – United Nations

UNEP – United Nations Environment Programme

UNFCCC – United Nations Framework Convention on Climate Change

UN SDGs – United Nations Sustainable Development Goals

YMCA – Young Men’s Christian Association

1 Introduction

1.1 Background and Motivation

Nowadays, carbon emissions and global warming caused by human activities and the use of fossil fuels have become controversial subjects. In this context, pursuing restrictive regulations for companies has become unavoidable, leading to uncertainties such as carbon-emission risk. In other words, by enforcing such rules and policies, high-emission companies have to align their consumption patterns with carbon-emission allowances (CEAs) (Liu, 2025).

According to Bolton & Kacperczyk (2021) prior to the Paris Agreement in 2015, investors showed limited reaction to firms with poor ESG scores, especially firms with poor environmental performance. However, since the treaty encouraged nations to pursue voluntary climate goals, concerns around carbon risk have increased. Companies with high levels of emissions are now exposed to stricter rules, possible carbon taxes, and international supervision. As a result, environmental factors have become an inseparable component of stock-market valuation, quickly shaping abnormal share price reactions to climate-related corporate news.

The urgent and rising pace of climate change and global sustainability challenges have created broad interest in financial instruments that directly support environmental goals. Among them, green bonds (GBs) have emerged as a pivotal tool enabling firms and governments to fund environmentally responsible projects. These securities share the basic structure of conventional bonds but earmark proceeds for initiatives such as renewable energy, energy efficiency, sustainable agriculture, and pollution prevention (Fatica & Panzica, 2021; Jin et al., 2020) ; hence the announcement of such issues provides a visible signal to equity markets.

Moreover, while Jin et al. (2020) find a strong relationship between green bonds and the carbon market in terms of returns and volatility, they also introduce the green-bond index as one of the cheapest and most effective tools for hedging carbon risk and emphasize the outstanding role of green bonds in carbon-risk management, particularly for firms in high-emission industries. They further argue that the emergence of green bonds signals a new tendency in leading economies toward low-carbon technologies. These favorable features are increasing the popularity of green bonds among companies seeking financing and investors looking for sustainable opportunities. According to Fatica and Panzica (2021), despite the dramatic growth of the green-bond market since its debut in 2007, it is still tiny; Europe alone needs to invest about €180 billion per year to fulfil the 2030 targets of the 2015 Paris Agreement. Therefore, there are still a lot of chances to expand the green bond market in the coming years.

Before the green bond expansion, much evidence showed that CSR activities by corporates lead to financial performance improvement (Cheng et al., 2023; Kim et al., 2018; Li et al., 2009; Margolis & Walsh, 2003). Thereafter, environmental, social and governance (ESG) factors increasingly play a determinant role in investment decisions, as a key index for estimating companies' efforts in the CSR area (Cheng et al., 2023). Nowadays, investors and stakeholders seek more than financial returns. They expect transparency, responsibility and sustainability. These expectations usually are reflected on the share price within a few days, as has been seen in abnormal returns of the stock markets in reaction to credible sustainability signals (Serafeim & Yoon, 2023). Firms with strong ESG reputations have more social capital (Amiraslani et al., 2023), lower perceived risk (Hoepner et al., 2024), and better long term prospects.

As Serafeim and Yoon (2023) mention, the chaotic pace of growth in the publication of ESG reports by public companies since the 1990s showcases the materiality of ESG to the asset-management industry. They also mentioned that the importance of the subject is reflected in the substantial inflows into the "United Nations Principles for Responsible Investment (PRI)", whose signatories' assets under management exceeded $100 trillion

by 2020. They also discovered the direct relationship between ESG news and market reaction.

These developments have resulted in the mainstreaming of sustainable finance, where green bonds and ESG strategies intersect. Therefore, green bonds are recognised not only as a funding instrument but also as a means of simultaneously influencing share prices through that public commitment, validated by third-party certification.

Nevertheless, further academic work is needed to understand how sustainable instruments affect corporate outcomes. Assessing the impact of green-bond issues on issuer companies' stock-market performance (short-term abnormal returns) is particularly important, because the post-2019 surge in issuance has outpaced the existing literature, as also mentioned explicitly in many previous studies (Fatica & Panzica, 2021; Flammer, 2021; Gronwald & Wadud, 2025).

We aimed to investigate the impact of green-bond issuance on the long-term financial performance of the issuer companies, but we found the green-bond market too new to capture long-term effects. So, according to the research needs of this area and following recent studies (such as Berdiev (2025), Yu et al. (2025), Ahmed et al. (2024), Flammer (2021), Tang & Zhang (2020), etc), we aim to focus on short-term effects of this emerging financial tool.

Although some studies have addressed the impact of green bond issuance on short term equity market reactions, they cover this effect mostly with data before 2019. For instance, Flammer (2021) finds a positive relationship between green-bond issuance and investors' reactions by examining data from 2013-2018, and Tang and Zhang (2020) document a positive impact of green-bond issuance on stock prices using international datasets during 2007-2017. Wang et al. (2020) also assess how green-bond announcements influence debt and stock markets simultaneously, focusing on China's market and using data from 2016-2019, and they find positive reactions from both markets, and so

forth. Amongst these, there are also some studies with opposite results. For example, Yu et al. (2025), whose research is one of the newest in this field, find a negative stock-market reaction after green-bond issuance, using a sample of cases between 2014-2021.

Given the sample-period concentration of former studies and the existence of some conflicts in their results, we can conclude that the current literature on green bonds is still immature and various dimensions of this phenomenon have not been addressed completely. In the early stages, studies mainly focused on comparing green bonds with conventional bonds to identify structural differences, investors' tendency to pay a premium, and benefits such as a reduction in the cost of capital (Gianfrate & Peri, 2019; Nanayakkara & Colombage, 2019; Zerbib, 2019). However, From the end of 2019 and the beginning of 2020, studies' focus has moved to assessing the relationship between green bonds, the equity market, and the short-term performance of the issuer firms (Ahmed et al., 2024; Baulkaran, 2019; Berdiev, 2025; Flammer, 2021; Tang & Zhang, 2020; Yu et al., 2025). What is more, some recent studies, like Karim et al. (2024) and Gronwald & Wadud (2025), have measured new dimensions of green bonds by assessing crisis periods and market information efficiency, and have found these bonds to be a safe haven. Despite this progress, some important gaps still remain in the understanding of the short-term impact of green bonds on the stock market, particularly in linking them with sustainability criteria such as ESG scores and the role of crises.

Therefore, the target of this thesis is to fill these gaps by exploiting three complementary approaches. First, to assess the short-term impact of green bond issuance on the stock market reaction. Second, to analyze the relationship between this effect and the ESG rating of the issuer firms. And third, to examine the supporting role of green bond issuance during the COVID-19 pandemic, with an emphasis on the effects of social capital and corporate social responsibility (CSR). The pandemic is considered as an exogenous shock that disrupted supply chains, changed consumer behavior, and increased risk. It also emphasized the importance of sustainability and resilience by providing a unique term to examine the interaction between green bond issuance experience, crisis, and

company outcomes. Accordingly, the present research contributes to expanding the scientific understanding of the link between sustainable finance, corporate performance, and sustainability in times of crisis by focusing on the immediate and behavioural reactions of the market to green bond issuance.

1.2 Previous main Studies and Contribution of this Thesis

In recent years, there have been several Studies investigating the impact of climate change-related financial instruments and organizational sustainability on financial markets. In particular, green bonds are considered novel financial tools that can play an important role in both financing environmental projects and influencing equity markets. Some studies examine the impact of green bond issuance on both financial and non-financial corporate performance. For instance, Flammer (2021) finds that green bonds reinforce the market value of issuers through both short-term and long-term effects, while it also improves Environmental, Social, and Governance (ESG) ratings. Tang and Zhang (2020) reveal positive abnormal returns following green bond announcements, which lead to better stock performance due to changes in investor base and interest. In contrast, however, Yu et al. (2025) report a negative stock market reaction to green bond issuance announcements.

On the other hand, some prior studies show that companies' social capital may lead to more sustainable performance during crises, as the advantages of social capital become more prominent when public trust declines. In fact, one of the clear consequences of any crisis is the weakening of social trust. In this regard, Lins et al. (2017) suggest that companies with high levels of Corporate Social Responsibility (CSR) experience higher returns during crisis periods compared to those with lower CSR levels; however, this effect is not observed under normal conditions. Similarly, Amiraslani et al. (2023) state that the social capital generated through Environmental and Social (E&S) performance acts like insurance against trust deterioration and market stress, and, notably, contributes to a reduction in the cost of capital.

In addition, a few studies have investigated the impact of green bond issuance during crises. For instance, Jin and Zhang (2023) consider green bond issuance as a proxy for social capital in crisis periods, which allows issuers to receive positive responses from the market. Moreover, Gronwald and Wadud (2025) highlight the sustainability of the green bond market even during economic distress, focusing specifically on the duration of the crisis.

Therefore, given the literature, it can be expected that there is a positive relationship between green bond issuance and both the increase of corporate social responsibility (CSR) and the social capital of issuer companies. In this way, green bonds can be considered a form of insurance for companies during crises.

Other studies, such as Cheng et al. (2023), also demonstrate that strong ESG performance significantly increases the probability of green bond issuance, particularly when brand reputation is also strong. Their findings indicate that prior ESG performance not only influences the likelihood of green bond issuance but may also moderate the intensity of the market reaction. In line with this, Pedersen et al. (2021) show that incorporating ESG factors into investment decisions can improve the Sharpe ratio, providing an ESG-efficient frontier framework, which highlights the positive role of ESG in risk reduction and return enhancement. On the other hand, Serafeim and Yoon (2023) assert that high ESG performance decreases the stock market's reaction to positive news, as ESG precedence reduces the novelty of such news for the market.

There are some studies, such as Broadstock et al. (2021) and Gronwald and Wadud (2025), that provide evidence of the higher sustainability of companies with stronger ESG performance. In particular, during the COVID-19 crisis, companies with high ESG ratings not only achieved better returns but also experienced lower risk. Additionally, the green bond market maintained its relative sustainability and informational efficiency during this period. These findings suggest that green bonds, especially in times of crisis, may serve as a tool to promote social capital and market trust. In contrast, Abedifar et

al. (2023) argue that high environmental and social (E&S) performance alone is not necessarily a guarantee of protection or additional rewards during crises.

Despite this progress, there are still important gaps in the literature. First, past studies have mostly focused on limited data and time periods prior to the widespread growth of the green bond market (i.e., before 2019). Second, the interaction between green bond issuance, companies' ESG performance, and crises has been less assessed in a simultaneous and comprehensive manner. Third, differences in market reactions to green bond issuance by firms with varying levels of ESG performance, especially in the context of exogenous shocks like the COVID-19 pandemic, still require more precise empirical evidence. Finally, the existence of conflicting results in some studies further proves the need for more research in this area.

Therefore, this study aims to address the gaps in previous literature by applying the Event Study methodology and more recent data related to the period from 2015 to 2024. The theoretical contribution of the research is the integration of three important dimensions such as green bonds, ESG performance, and financial shocks, such as COVID-19 pandemic, in a unique coherent framework. Furthermore, focusing on the moderating role of ESG on the market reaction to bond announcements and examining the impact of crises on the intensity of these reactions is taken into account as some other initiatives of the investigation.

From a practical point of view, the findings of the study can be used by financial managers of companies in making strategic green financing decisions. From the perspective of investors, they can also play a role in optimizing ESG-oriented portfolios by identifying market reactions to sustainability signals and assessing the roles of trust and company reputation. Finally, policymakers and financial regulators can also utilize the research findings to design clearer and more credible frameworks for sustainable financial markets.

1.3 Purpose of the Study and Research Questions

As mentioned before, due to the dramatic growth in the importance of sustainability in financial markets and the increasing focus of researchers on green financial instruments, investigating the impact of green bond issuance on the stock market performance of issuing companies has become one of the pivotal topics in recent financial studies. Studies such as Flammer (2021) and Tang and Zhang (2020) provide evidence of equity market reactions to green bond issuance announcements. In contrast, Yu et al. (2025) report different results. Nevertheless, most of these studies focus on data prior to 2019, and a clear understanding of market reactions in more recent years has not yet been established. Therefore, the current study aims to address the question, using more updated data: Does issuing corporate green bonds lead to a surge in the cumulative abnormal return (CAR) of their share prices?

Meanwhile, existing literature strongly emphasizes the role of Environmental, Social, and Governance (ESG) factors in improving corporate performance and reducing risk (Broadstock et al., 2021; Hoepner et al., 2024; Khan et al., 2016). Some research shows that investors are becoming more sensitive to the sustainable performance of companies, and companies with high ESG scores can gain more credit and trust in the market (Amiraslani et al., 2023; Lins et al., 2017). On the other hand, some findings indicate that the market may react less to positive sustainability signals, such as the announcement of green bond issuance, by companies with a strong ESG background, as such companies have already met market expectations in this regard (Serafeim & Yoon, 2023). In other words, issuing green bonds can be seen as a kind of positive news in the field of green investment and sustainability commitment, to which the market reaction may depend on the prior level of the company's ESG performance. Therefore, the study also addresses the question of whether the ESG level of companies can moderate the intensity of the stock market reaction to green bond issuance.

Moreover, crises like the COVID-19 pandemic provide an opportunity to assess the role of social capital, corporate social responsibility (CSR), and green financial instruments

more precisely during times of fluctuation. Many studies have stated that companies with a high level of social capital perform better in times of crisis, as previously earned trust acts as a form of insurance against instability (Amiraslani et al., 2023; Lins et al., 2017). According to some studies, the issuance of green bonds can be seen as a proxy for CSR (Jin & Zhang, 2023). This raises the question of whether the impact of issuing such bonds on market returns is reinforced under crisis conditions such as COVID-19. thus, this becomes another question that the current study seeks to answer.

Therefore, the final target of this study is to present a novel and comprehensive insight into the impact of green bond issuance on the equity market reaction of issuer companies, considering the moderating role of ESG performance and crisis conditions such as the COVID-19 pandemic; a subject that has not yet received sufficient simultaneous and seamless attention.

1.4 Data and Market Context Overview

The study focuses on green bond announcements issued by publicly listed non- financial companies in the United States and European markets between January 2014 and September 8, 2025. This timeframe was selected to capture both stable and crisis market conditions, including the COVID-19 pandemic. To address the research objectives, this thesis applies two empirical methods: event study analysis and regression modeling. The event study uses 426 green bond announcement events to examine short-term stock market reactions over seven event periods. These events were selected based on the availability of precise announcement dates and daily stock price data. An adjusted sample of 407 firm-level data was used for the regression analysis. This dataset comprises simply the firms that have comprehensive ESG scores, financial indicators, and control variables. The same sample was used in two regression models: one studying whether the ESG performance of firms determines the market reaction to green bond issuance, and the other assessing whether these reactions become stronger during crisis periods, specifically the COVID-19 pandemic.

The data for this study were compiled from reliable resources. Data on green bond issuance was sourced from Bloomberg. Stock price data and ESG ratings were obtained from Refinitiv, assuring consistency in financial and sustainability indicators. Additional firm-level variables, including market capitalization and industry classification, were used to adjust for structural differences among firms and improve the reliability of the regression models. Both authors of this thesis have contributed equally to the progress of the project.

This section provides the empirical foundation for the thesis. The detailed methodology, sample construction, and variable definitions are presented in Chapters 5 and 6, where the event study and regression results are discussed in depth.

1.5 Structure of the Study

This thesis is divided into seven main parts. Part 1 introduces the study. It explains the background, previous research, purpose, research questions, data sources, market context, and how the thesis is organized. Part 2 discusses financial instruments and environmental concerns, with a focus on how green bonds fit into sustainable finance. Part 3 provides the study's theoretical background related to the study, including key concepts and frameworks. Part 4 reviews past literature on green bonds, ESG performance, and financial crises. It also introduces research hypotheses. Part 5 describes the research design. It explains how the sample was selected, how the variables were built, and how the regression models were structured. It also includes descriptive statistics. Part 6 shows the results of the event study and regression analysis, comparing findings between the U.S. and European markets. Part 7 summarizes the main findings, discusses the purpose and research gaps, highlights general implications and limitations, and suggests ideas for future research.

2 Financial Instruments and Environmental Concerns

2.1 From CSR to ESG: The Evolution

Several definitions have been presented for CSR by scholars and organizations. Despite overlaps, one of the oldest and most powerful was proposed by Carroll (1979): “The social responsibility of business encompasses the economic, legal, ethical, and discretionary expectations that society has of organizations at a given point in time.” (p. 500)

Though in a more extensive dimension, we are faced with a more comprehensive definition of social responsibility in the documents of the international standards (ISO). The standard, in fact, does not see social responsibility (SR) limited to corporations in ISO 26000 (2010). Meanwhile, referring to the popularity of the term CSR in the document, it emphasizes Social Responsibility (SR) and considers it beyond commercial companies and defines it as follows:

> *“responsibility of an organization for the impacts of its decisions and activities on society and the environment, through transparent and ethical behaviour that*
> — *contributes to sustainable development, including health and the welfare of society;*
> — *takes into account the expectations of stakeholders;*
> — *is in compliance with applicable law and consistent with international norms of behaviour; and*
> — *is integrated throughout the organization and practised in its relationships”*
> (ISO, 2010, Clause 2.18)

increase in global temperature can put all creatures’ and humans’ lives in danger. This potential danger is accompanied by a lot of financial risks and consequences. Estimates indicate that increasing the earth’s temperature by 3.2 degrees Celsius can eradicate 18 % of global economic GDP by 2050 (Cheng et al., 2023, p.570; Marchant, 2021). Hence, particular attention has been paid to the environment as a missing link in the welfare chain of human society since the 1950s, initiating concerns about growing climate change. Actually, the environment was taken seriously as the basic pillar of human life alongside other CSR factors. In the following, the need to identify active and passive

reasons for environmental destruction and ways to prevent it was felt more than ever. Therefore, studies and research began to combat this phenomenon.

Social and environmental concerns were the beginning of the formation of concepts such as CSR and sustainable business in the 1950s. During this period, Howard Bowen introduced the idea that corporate duties extend beyond profit-making. In the 1960s, with the growth of environmental and civil movements, social pressure forced companies to acknowledge the consequences of their activities. The 1980s marked a milestone, when CSR shifted from donation-oriented activities to business strategies, accompanied by important theories such as the stakeholder theory. In the 1990s, globalization and the exposure of labor exploitation in poor countries led to enhanced reporting and transparency, and the role of companies was formalized in the 1992 Earth Summit. In the 2000s, ESG and frameworks such as GRI and PRI were created as quantitative measures of corporate responsibility. After the 2008 financial crisis and the emergence of the UN SDGs, ESG became the main criterion in investment decision-making. In the 2020s, following challenges such as climate change and the pandemic, the concept of “ESG 2.0” emerged, in which corporate responsibility became embedded in organizational culture and linked to management compensation systems and technologies such as blockchain (Passas, 2024).

Eccles & Viviers (2011), as cited in Cheng et al. (2023), state that, in fact, there has been a substantial need to inspect the CSR performance of corporates, which has led to the formation of a firm linkage between ESG and CSR (Eccles & Viviers, 2011, as cited in Cheng et al., 2023, p. 572). Actually, CSR is considered an internal factor for reforming internal structure and organizational culture, the results of which are interpreted by a quantitative index named ESG (Cheng et al., 2023). This index was ratified for the first time by the United Nations in the Principles for Responsible Investment, which was published in the “Who Cares Wins” report to shed light on the path of those who seek the impact of ESG factors on investment and business decisions. It was Goldman Sachs that literally created the current meaning of ESG by integrating environmental factors with

other investor-regarded factors such as governance and social responsibility (S. Chen et al., 2023). Therefore, the quantitative assessment process of corporate social responsibility, as the name ESG suggests, includes three general factor, environmental, social, and corporate governance, each of which has several sub-factors. Each dimension of ESG is scored separately for the assessed company, and the average of these three scores is the final ESG rating, which is reported by authorized assessment institutions.

2.2 Carbon Emission Concerns

In recent years, global concerns regarding global warming, climate change, and rising greenhouse-gas levels, particularly carbon dioxide, have imposed new rules and social pressures on companies. These pressures significantly affect polluting industries with high carbon emissions and oblige firms to align their energy-consumption pat-terns with climate policies. In this regard, policies such as Carbon Emission Allowances (CEAs) have been introduced to moderate the behaviour of fossil-fuel-consuming companies (Liu, 2025).

Along these lines, European Union exploit the first Carbon Emission Trading System (CETS) in 2005 (J. Chen et al., 2023; Etienne & Yu, 2017); subsequently, many countries have launched their own systems. A CETS provides a platform in which the right to emit carbon is traded as a good while preventing total emissions from exceeding a predetermined level. According to studies, implementing such mechanisms has been effective in reducing carbon emissions (J. Chen et al., 2023; Dong et al., 2022; Yan et al., 2020).

The most important international action in recent years is the Paris Agreement (PA), adopted on 12 December 2015 at the 21st Conference of the Parties (COP 21) by 195 members of the United Nations Framework Convention on Climate Change (UN-FCCC). Based on the 1992 Convention and the 1997 Kyoto Protocol, the PA aims to prevent dangerous global warming. It came into force once at least 55 countries, ac-counting for 55% of total emissions, had ratified it. Under the PA, each country must submit and follow its

nationally determined contribution every five years and report on emissions and adaptation. Wealthy countries must also provide technical and financial support to developing ones. The collective goal is to keep global tempera-ture rise well below 2 °C and pursue efforts to limit it to 1.5 °C, with commitments becoming stricter every five years (Leggett & Lattanzio, 2017).

Although no direct fines are foreseen in the Paris Agreement (PA), its transparency system and international review create political “name-and-shame” pressure on potentially culpable parties. Consequently, the Agreement has established a binding global procedural framework that compels countries to plan, report, and cooperate on emission reduction and adaptation. Accordingly, member states will have to introduce domestic limits on carbon-emitting factors in order to implement their commitments. Therefore, carbon risks are significant not only environmentally but also financially, as they may lead to fines, market-value losses, and investor pessimism. These risks are not limited to highly polluting industries but can affect all companies. The equity market reflects regulatory and technological risks related to carbon limits in share prices; hence, carbon emissions should be considered a risk factor in stock-pricing models (Bolton & Kacperczyk, 2021).

2.3 Corporate finance, green finance and sustainable finance

Corporate finance and its management can easily be proved to be an existence requirement for any business by a glance at the financial reports and operational activities of the company. Financing is, in fact, like blood in the veins of the organization and guarantees the continuation of its life. A company needs to possess real assets to commence any business. Thereafter, it should also have various investments to survive and achieve growth and development. It is obvious that these assets are never obtained for free and their possession requires funds and financing. The important inquiry is: from what sources and in which combination should the budget be provided? Undoubtedly, the answer to this question is a comprehensive academic-scale subject which occupies many chapters of a book in corporate finance literature. In general, a company confronts four

main sources to finance, including: 1) reissuance of shares, 2) borrowing, 3) reinvestment of earnings, 4) sale of surplus assets. What is clear is that there are particular implications and costs for any choice of the options. Therefore, corporate finance is a field of specialization whose target is selecting the optimal combination of the sources to maximize the company's value, while considering corporate governance incentives and possible opportunity costs. Among these, borrowing, due to the variety in tools and the tax-shield advantage, can be an attractive option. However, provided that default risk or financial crisis do not neutralize its advantages, it is still a viable solution. In the case of limited debt capacity, reissuance of shares can be considered the last solution, because it has the definite cost of dividends and a possible negative reaction from the equity market. This, in fact, can be perceived as a lack of liquidity and may impact negatively on the share price (Brealey et al., 2009, pp. 4–5, 419, 443, 445).

Following the subjects discussed in previous parts regarding corporate social responsibility and environmental concerns, corporate finance can be applied as an instrument in this regard. This is exactly where topics such as green finance and sustainable finance come into play. According to UNEP (2016), several definitions of Green Finance and Sustainable Finance have been presented by credible organizations and authorities, which are listed in this report (United Nations Environment Programme, 2016, p. 5). However, in another UNEP document published in (2017), green finance is considered a subsidiary of sustainable finance, with the difference that green finance focuses on the environmental dimension, whereas sustainable finance concentrates on all three economic, social, and environmental dimensions simultaneously. In this document, there are two separate definitions for these two concepts as follows:

> *"Green finance aims to deliver environmental benefits, tackling issues such as air pollution, biodiversity loss, climate change, resource efficiency, sustainable agriculture and forestry, as well as waste and water management. It is often used to describe the environmental character of particular assets (such as green bonds)."* (United Nations Environment Programme; Corporate Knights, 2017, p. 12)
>
> *"Sustainable finance takes a comprehensive approach to the management of the economic, social and environmental dimensions of finance to enable broad-based progress to sustainable development. It is often used to describe the desired*

> *performance and impact of financial institutions (eg Principles for Sustainable Insurance).”* (United Nations Environment Programme; Corporate Knights, 2017, p. 12)

Environmental concerns nowadays are taken into account as a factor in corporate insurance calculations, and the growing acceptance of climate change has become a main driver of Green Finance. Thus, innovative tools such as green bonds have been very popular in the current decade. The growth and development of green bonds have also led to the emergence and development of other green-finance tools since their first issuance in 2007. For instance, “Green Asset-backed Securities (ABS)” are a tool in which illiquid green assets are collected, based on a traditional scheme, to become a “Special Purpose Vehicle (SPV)” so that they can be exchanged like an easily accessible and negotiable security. Other financing tools in the green area include “Green Loans”, “Green Funds”, etc. Since the inherent and main target of green finance is to create a sustainable and environment-protecting economy, these innovative instruments should also follow this target and positively influence both climate change and environmental protection (Migliorelli & Dessertine, 2019).

2.4 Bonds and Green Bonds

As a matter of fact, when it comes to leverage and corporate debt financing, some concepts become more prominent, such as “capital structure,” its influential concepts like the “tax shield effect” and the Modigliani–Miller theory, and the results of precedent investigations which are conducted based on the impact of debt on the agency problem in companies. In other words, a company's leverage determines the amount of corporate financing from debt relative to equity, which, in fact, forms the firm's capital structure. According to the Modigliani–Miller theory, debt financing can increase the value of the company by creating a tax-shield effect. Since interest expenses reduce taxable income, the cost of capital is consequently lowered (Brealey et al., 2009, pp. 440–442).

Previous studies have also demonstrated additional advantages of corporate debt financing. For instance, Jensen (1986) argues, in support of Agency Theory, that when an

enterprise has too much surplus cash flow, its managers may expend more on personal and unnecessary projects. Therefore, corporate debt financing obliges directors to pay the interest and principal on the debt. Consequently, it decreases agency costs for the company.

Meanwhile, one of the most important and popular instruments for corporate financing in the debt market is the bond. From an investor's perspective, a bond is generally considered a low-risk and attractive fixed-income investment, and a suitable tool for risk management and for hedging portfolios. From the issuer's perspective, it is also a rapid financing instrument that can be issued by various governmental and non-governmental organizations and private companies.

The cornerstone of a bond, in fact, is the agreement between borrower and lender, which is recognized as the indenture. One of the main pillars of the agreement is the term to maturity of the issued bond, which determines the duration and the due date of principal repayment. This date is important for determining various aspects such as return calculation, term of validity, number of the coupons, expiry or extension date, and sensitivity to the market. As a result, there are various kinds of bonds based on the main pillars of the issuer, rate, due date, particular conditions, and the target of the issuance. The rate divides bonds into three kinds: fixed-rate, floating-rate, and zero-coupon bonds. Based on due date, they are divided into three sorts: short-term, medium-term, and long-term bonds. But some bonds can come with particular conditions and include specific kinds of bonds such as callable, puttable, convertible, and exchangeable bonds (Fabozzi et al., 2021, pp. 26–29).

In the target classification of bonds, "Green Bonds" can be considered one of the obvious examples. As mentioned before, one effective way to decrease environmental concerns is corporate financing for environmentally friendly projects. Since bonds are debt-financing tools, green bonds are also created for this purpose. Green bonds, in fact, are exactly the same as conventional bonds in terms of their performance mechanism. They can

also be issued by various organizations and can consist of various kinds in terms of due dates, rates, and particular conditions. These kinds of bonds include various types of green bonds based on their issuance goals.

A unique and obligatory standard cannot be found for the issuance of green bonds. However, the "Green Bond Principles (GBP)" were created as a voluntary framework in the green-bond arena, with the goal of directing debt-market funds toward green projects. The standard sits alongside the "Social Bond Principles (SBP)", the "Sustainability Bond Guidelines (SBG)", and the "Sustainability-Linked Bond Principles (SLBP)", and presents these principles as a discretionary framework (International Capital Market Association (ICMA), 2021).

ICMA (2021)defines "Green Bonds" in its GBP document as follows:

> *"Green Bonds are any type of bond instrument where the proceeds or an equivalent amount will be exclusively applied to finance or re-finance, in part or in full, new and/or existing eligible Green Projects (see Use of Proceeds section below) and which are aligned with the four core components of the GBP"* (P. 4).

The issuance of the first green bond, named the "Climate Awareness Bond," took place in 2007 by the "European Investment Bank." The GBP standard, which was previously discussed in detail, has also been a turning point in the rapid growth of these bonds. This standard and its framework began with their creation by the "International Capital Market Association (ICMA)" in 2014 (Ehlers & Packer, 2017).

The growing trend of green bond issuance has continued since 2014. According to the latest updates on the Bloomberg website, the total amount issued in 2023 reached more than $575 billion. Based on Bloomberg data, the issuance trend for green bonds during 2014-2023 is as follows:

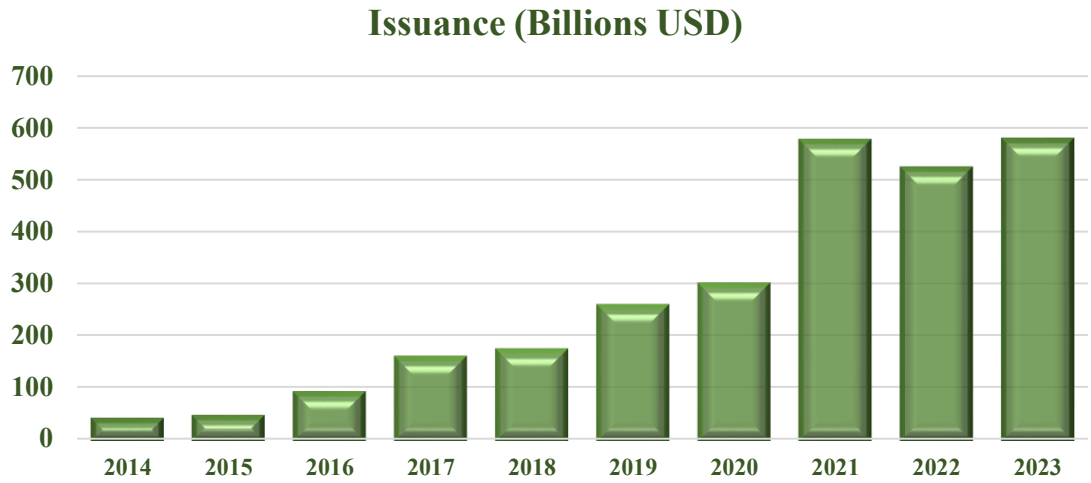

Figure 1. Annual green bond issuance (2014–2023), data comes from Bloomberg (Adapted from Gardiner & Freke, 2024).

As the historical development in figure above shows, there is a growing trend by the end of 2023 based on Bloomberg data. According to the Climate Bonds Initiative (2025), the growing trend continues in 2024 and culminates in a new historical record. Green bond issuance has also expanded to 98 countries worldwide. The charts and statistical details of the report are provided in Appendix 1 and Appendix 2 (Climate Bonds Initiative, 2025).

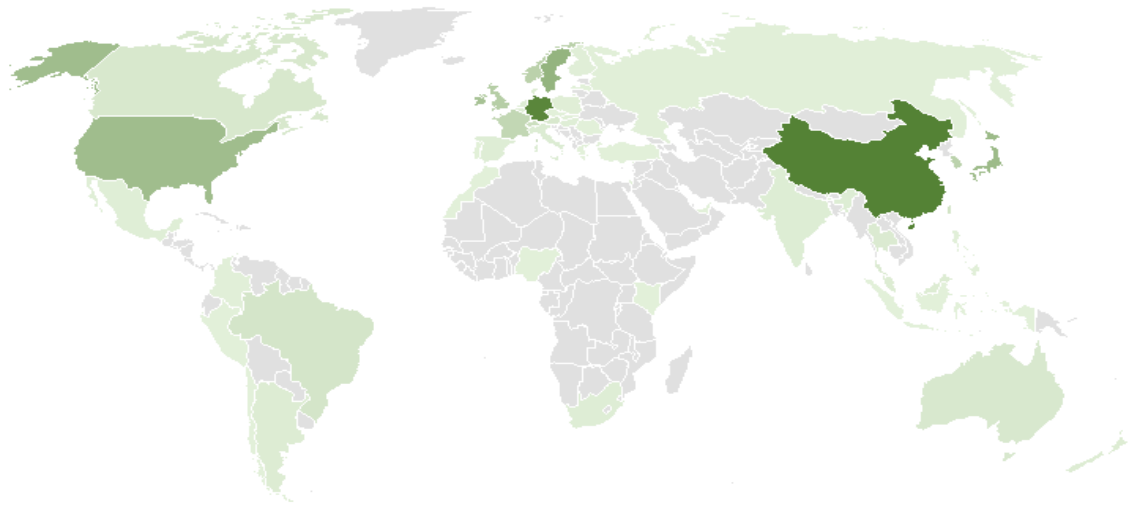

Figure 2. Map Chart of Green Bond Globalization 2025 (Adapted from Tang & Zhang, 2020)

The figure above, which is inspired by Tang & Zhang (2020), shows a schematic expansion of green bond issuance throughout the world. The figure is provided by "Microsoft Map Chart" based on extracted data from Refinitiv Workspace (Eikon) in 2025. According to the data, the highest issuance of green bonds has occurred in the three countries of China, Germany, and Luxembourg respectively, as of the date of the report. The details are provided in Appendix 3.

2.5 Greenwashing and Market Skepticism

There has always been a concern about setting misleading goals in the Mergers and Acquisitions (M&A) process instead of pursuing practical operational improvement and the main objectives of the company, but rather to pursue other incentives. In fact, this action occasionally acts as a cover for concealing the buyer's weaknesses. In these cases, parent companies usually misuse the reputation and credit of their subsidiaries in specific fields. For instance, some companies, due to either the nature of their activities and the industries they are in or due to their negligence, are not able to achieve good results in the field of ESG, especially in environmental indices. Therefore, they might attempt to recoup this deficit by acquiring and owning a company with a top-tier position in social capital and CSV activities. In this line, a green bond is considered a much cheaper tool to exploit reputational advantages relative to the acquisition of a subsidiary on sustainability and social capital grounds. This advantage may provide sufficient motivation for some companies to issue green bonds merely to gain false fame or to achieve short-term goals. These companies are not committed to the main objective of this financial instrument, namely directing cash flows to green projects and environmental protection.

The importance of this matter arises from the increasing environmental awareness in society. Consumers have become more sensitive to the environmental effects of products than before. Companies also attempt to showcase their products as greener than those of their rivals to attract customers. Such actions can be seen as examples of the "Greenwashing" concept. Despite much research, there is not yet a comprehensive and widely accepted definition of Greenwashing. (Spaniol et al., 2024) articulate, after

reviewing 79 scientific definitions, that greenwashing occurs when a company makes an environmental claim in marketing a service or product that is not verifiable, is made with the intent to mislead, and pursues the objective of gaining a competitive advantage. If all these conditions exist simultaneously, the greenwashing claim is valid.

Flammer (2021) also deals with this subject and states that the deceitful use of green bonds is still costly for companies, because it leads to some financial limitations and some extra expenses such as third-party certification. She shows that the environmental performance of the companies improves after the green bond issuance. Long-term and green investors' ownership also increases at such companies, and the market reacts positively to the news of the bonds' issuance. Therefore, she rejects the hypothesis that green bonds are used as a greenwashing instrument.

2.6 Crisis Effects

Providing guidelines and solutions to increase the entities' resilience is the target of many studies in the field of finance. Thus, the results of this research, in addition to guiding firms in improving their performance under normal economic conditions, should also ensure companies' resistance and sustainability during unusual and crisis conditions. This information is invaluable for other stakeholders, such as investors, as well. Investors can effectively insure their capital by identifying resilient companies in market turbulence and adjusting the risk and return of their portfolio to an optimal level even during crisis periods. That is why, separating crisis periods and comparing them with normal conditions is a common practice among many previous studies and is even sometimes considered essential. This issue has either been a main objective in some investigations or has been used as a robustness test in other cases.

In the 21st century, the 2008–2009 financial crisis is one of the most obvious examples of an exogenous shock, formed after the bursting of the United States housing-price bubble, caused by imprudence in the banking system and the indiscriminate use of credit instruments such as CDSs. This crisis caused serious damage to public trust in the global

financial system by increasing the default risk of mortgages. It was also followed by an unprecedented recession. Thereafter, we can recall COVID-19 as another important exogenous factor that imposed an expanded crisis condition on the global financial system (Bodie et al., 2021, pp. 17–25; Bossman et al., 2025).

Baker et al. (2020) argue that Coronavirus-related news confronted the equity market with an intense fall and unprecedented turbulence. In particular, the intensity of market volatility in the USA in 2020 has been inimitable with respect to comparable historical examples. The news of the virus's fatality and its spread made governments impose wide economic and social restrictions. It also imposed unanticipated costs on the global economy. The spread of COVID-19 is considered a milestone in the financial and economic literature, because it is the first time that an infectious disease is recognized as a common factor threatening mankind's health and the financial system simultaneously. Other findings of this study demonstrate that in the historical record (from 1900 onwards), pandemics such as Influenza in 1918 and 1957 were not able to cause a financial crisis.

The emergence of COVID-19 has provided a worthwhile research opportunity despite its entirely negative implications. The recorded data and experiences from this period (2020–2022) can provide a strong basis for scientific research and make the results more authentic and generalizable across various economic conditions. This study also takes advantage of this opportunity to examine the effects of this financial crisis in the corporate green bond area, an area whose serious debut in practice dates back to 2014.

3 Theoretical Background

3.1 CSR Theories

3.1.1 The Shareholder theory vs. the Stakeholder perspective

Perhaps Friedman's shareholder theory (1970) and Freeman's stakeholder theory (1984), along with their conflict, can be seen as the most important theoretical events in the area of CSR. This argument is considered one of the main milestones in the evolution of corporate social responsibility. Although the idea of CSR had emerged before these two theories, this stakeholder/shareholder duality sheds light on the field's path.

Approximately two decades after the emergence of concepts like corporate social responsibility, Milton Friedman presented one of the most controversial official points of view in an explicit criticism of CSR. He presents a transparent form of corporate shareholders' priority, which is famed as the shareholder theory. Friedman (1970) brings forward a mechanism in which an economic enterprise is not considered an independent moral actor, but rather it is an agency institution that gains meaningful only through its shareholders. That is, any management decision outside maximizing profit is considered a sort of allocating private resources to public ones. Therefore, provided these decisions are made within the framework of law and free competition, they should be dealt with in the domain of public policymaking and the tax regime rather than in the board of directors' chamber. In his perspective, profit maximization is not only not a sign of greed, but also represents the efficiency and responsibility of the market to consumers' priorities. If the market faces failure for any reason, it is the duty of the legislator to mend it, not by the moral engineering of corporate managers.

All in all, Friedman insists on this point, separating individual from institutional responsibility, that economic liberty, private possession, and democratic responsibility should stay hand in hand together. If a society seeks a goal beyond earning profits, it should pursue it in a transparent line of public policy rather than imposing a vague duty on

corporate shoulders. He explicitly articulates that directors are employees and agents of the owners and that they are responsible for their interests in the corporation (Friedman, 1970).

About one decade later, Robert Edward Freeman presented a theory in his strategic management book that challenges the shareholders' approach. The notion of stakeholders, in fact, suggests a responsible perspective toward all beneficiaries of an enterprise. Freeman's stakeholder theory states that a firm is a network of intertwined relationships and its sustainable success depends on the benefit of various groups, from employees and shareholders to customers, suppliers, society, and even the environment. In Freeman's belief, a manager cannot separate economic issues from social implications; because any business decision acts through political, economic, and social forces, and there is a close connection between them. Therefore, the management task is to consider these forces seamlessly and to build a trustworthy and sustainable relationship between stakeholders by creating shared value. Otherwise, theories and instruments that consider only one dimension are not able to interpret and predict the complex reality of the business world correctly (Freeman, 1984).

3.1.2 Legitimacy theory

Legitimacy theory defines how firms seek to operate their actions with societal expectations in order to maintain trust, credibility, and continued access to resources. This study explains why firms engage in ESG practices and issue green bonds under sustainable finance, not just for financial gains but also to reinforce their social license to operate.

Recent studies suggest the significant growth of ESG metrics in global investment management is not solely driven by economic gain. Clark and Dixon (2024) argue that the adoption of ESG has emerged as a strategic response to reputational challenges and perceived shortcomings in the integrity of the financial industry. By adopting ESG

frameworks and sustainability-linked instruments, firms seek to redefine their societal role and regain legitimacy among stakeholders.

Baah et al. (2021) further suggest that the ”green legitimacy", a legitimacy derived from environmental accountability can significantly influence company behavior. Their findings show that firms motivated by legitimacy concerns are more likely to carry out environmental and social responsibility initiatives, which ultimately affect both environmental and financial performance. This is particularly important in emerging economies, where regulatory stakeholder expectations and legitimacy limitations significantly influence CSR strategies.

In this context, legitimacy theory provides a conceptual framework to clarify how green bond issuance functions as a strategic signal. Firms with poor ESG profiles may utilize green bonds as a corrective strategy to boost their legitimacy and attract investor trust. For firms with strong ESG performance, the issuance of green bonds could boost current perceptions of responsibility; however, the market reaction may be limited due to established credibility.

Furthermore, legitimacy-seeking behavior becomes especially apparent during periods of crisis. Bani-Khaled et al. (2025) highlight that ESG engagement can boost firm resilience and trust among investors during financial crises. This study examines the impact of green bond announcements made during the COVID-19 pandemic to see if legitimacy-driven signals are intensified in situations of increased uncertainty.

Overall, legitimacy theory supports the hypothesis that green bond issuance is not merely a financial decision but a strategic act of alignment with societal values. This describes the varying intensity of financial reactions depending upon prior ESG performance and crisis conditions, offering a solid theoretical framework to consider investor behavior in sustainable finance.

3.1.3 Agency theory in CSR

Agency theory provides a fundamental framework for understanding the interaction between corporate managers (agents) and shareholders (principals), particularly in instances where management discretion may conflict with shareholder interests. In the field of corporate social responsibility (CSR) and environmental, social, and governance (ESG) practices, agency theory has been increasingly used to explain how governance operations, transparency, and accountability can mitigate agency costs and enhance firm value.

The role of ESG initiatives as strategic tools for reducing information asymmetry and aligning managerial behavior with long-term shareholder objectives. Flammer (2021) shows that the issuance of green bonds operates as a commitment device, constraining managerial decisions by incorporating externally visible environmental objectives into firm financing. This method indicates a long-term strategic focus and enhances confidence among shareholders by strengthening managerial accountability.

Yu et al. (2025), in their extensive review of the literature on ESG and firm value, find agency theory as the main explanatory framework. Their findings indicate that ESG engagement, especially when associated with credible disclosure and strong governance oversight can reduce opportunistic behavior and enhance market value. ESG practices are not only ethical or reputational tools; they serve as governance-enhancing strategies that manage principal–agent conflicts.

In this setting, agency theory provides theoretical support for all three possibilities. Initially, companies exhibiting strong ESG performance are likely to be regarded as better governed, therefore moderating the market reaction to green bond announcements. Additionally, during periods of crisis, green bond issuance may serve as a trustworthy indicator of managerial discipline and strategic resilience, enhancing investor reaction. Lastly, the relationship between ESG performance and crisis circumstances might strengthen the signaling effect, as investors seek assurance of governance quality and

commitment under increased uncertainty. It reinforces the argument that CSR and ESG practices are not only socially desirable but also strategically valuable in enhancing transparency, reducing agency costs, and supporting sustainable value creation.

3.1.4 CSR & Social Capital as Insurance

Corporate Social Responsibility (CSR) supports businesses execute the correct ethical thing and remain in business for a long time, and it also helps build social capital, which can be an armory in times of crisis. Social capital, which is generally defined as the trust, goodwill, and cooperative relationships that a business builds with its stakeholders, makes the business more resilient and makes stakeholders more loyal when things are uncertain (Lins et al., 2017). Companies that regularly invest in social responsibility initiatives tend to establish up credibility and trust from stakeholders, which can help them deal with adverse outcomes. Companies with a lot of social capital are more likely to keep investors' trust, get loans, and experience less severe drops in stock performance during times of economic trouble or systemic disruption, like the COVID-19 pandemic. The idea behind this protective effect is that stakeholders see socially responsible companies as more trustworthy and dedicated to creating long-term value.

Lins et al. (2017) presents empirical evidence from the 2008–2009 financial crisis, demonstrating that companies with superior CSR scores outperformed their counterparts by 4–7% in stock returns and enjoyed more favorable financing conditions. These results support the perspective that CSR-driven social capital operates as a non-financial asset that eliminates risk and improves firm performance in challenging circumstances.

CSR is not merely a reputational tool but a strategic resource that strengthens stakeholder relationships and reinforces firm stability. The insurance-like role of social capital becomes particularly relevant in the analysis of green bond issuance during crisis periods, where investor reactions may be shaped by perceptions of corporate responsibility and long-term commitment to sustainability.

3.2 Market Reaction Theories

3.2.1 Efficient Market Hypothesis (EMH)

Fama (1970) introduced the Efficient Market Hypothesis (EMH), which asserts that financial markets are informationally efficient and asset prices fully reflect all available information. In such markets, investors cannot consistently earn abnormal returns based on public disclosures. This principle underpins the use of event study methodology to assess stock price reactions to green bond announcements. Under this framework, investors cannot consistently earn abnormal returns through either technical or fundamental analysis, as new information is rapidly incorporated into market prices. EMH has since become a foundational theory in financial economics and underpins the use of event study methodology to evaluate market reactions to corporate disclosures.

In its semi-strong form, EMH asserts that publicly available information—such as earnings reports, policy announcements, or sustainability-related disclosures—is immediately reflected in stock prices. This form is particularly relevant for analyzing green bond issuance, which represents a strategic and publicly observable signal of a firm's environmental commitment and financing structure. If markets are semi-strong efficient, any value-relevant information embedded in the announcement should be promptly priced in, resulting in observable abnormal returns around the event date.

Several empirical studies support this application of EMH in the context of green finance. Flammer (2021) finds that green bond announcements are associated with positive abnormal returns, suggesting that investors interpret them as credible sustainability signals. Tang and Zhang (2020) report stronger market reactions for firms with lower prior ESG reputations, while Wang et al. (2020) highlight regional differences in investor response. These findings reinforce the relevance of EMH in assessing how financial markets process sustainability-related information and justify its use as a theoretical foundation for this thesis.

3.2.2 Signaling Theory

Spence (1973) explains how parties with private information convey credible signals to reduce information asymmetry in markets. In corporate finance, signaling has become a central framework for understanding as how firms communicate intangible qualities such as managerial intent, long-term orientation, or sustainability commitment through observable actions. Connelly et al. (2025) provide a comprehensive synthesis of signaling theory in strategic management, emphasizing that effective signals must be visible, costly, and difficult to imitate to ensure credibility and differentiation.

In the context of green finance, the issuance of a labeled green bond serves as a strategic signal of environmental responsibility. Because green bonds often require third-party certification, adherence to the Green Bond Principles, and transparent use-of-proceeds reporting, they meet the criteria for credible signaling. This is particularly relevant for firms operating in markets where sustainability performance is not directly observable or where ESG reputations are still developing. By issuing green bonds, firms can signal their commitment to long-term environmental goals and attract ESG-oriented investors.

Empirical studies support the signaling role of green bond issuance. Tang and Zhang (2020) find that green bond announcements generate positive abnormal returns, especially for firms with weaker prior ESG reputations, suggesting that the signal is more impactful when it conveys new or incremental information. Flammer (2021) similarly shows that green bonds are interpreted by investors as credible sustainability signals, leading to favorable market reactions. These findings align with signaling theory's core premise: the strength and impact of a signal depend not only on its content but also on the context in which it is received. In this thesis, signaling theory complements the Efficient Market Hypothesis by explaining why certain green bond announcements elicit stronger investor responses, particularly during periods of heightened uncertainty or reputational transition.

3.2.3 Behavioral Theories (Overreaction / Underreaction)

While traditional finance theories such as the Efficient Market Hypothesis (Fama, 1970) assume rational investor behavior and immediate price adjustment to new information, behavioral finance challenges this view by emphasizing psychological biases and cognitive limitations in decision-making. Behavioral theories suggest that investors may either overreact or underreact to corporate announcements, leading to temporary mispricing and delayed market corrections (Barberis et al., 1998; De Bondt & Thaler, 1985).

Overreaction occurs when investors respond excessively to new information, causing stock prices to deviate from fundamental values. This may be driven by optimism, herd behavior, or framing effects, particularly when announcements are perceived as novel or emotionally salient. Conversely, underreaction reflects a sluggish or muted response, often due to conservatism bias or limited attention, where investors fail to fully incorporate the implications of new disclosures into prices.

In the context of green bond issuance, behavioral responses may influence short-term stock price movements. For instance, firms with strong ESG reputations may experience underreaction, as investors perceive the announcement as expected or redundant. On the other hand, firms with weaker sustainability profiles may trigger overreaction, as the issuance is interpreted as a strategic shift or reputational upgrade. Studies such as Krüger (2015) and Flammer (2021) highlight that investor responses to CSR and sustainability signals are not uniform, and may be shaped by prior expectations, firm visibility, and market sentiment.

By incorporating behavioral theories, this thesis acknowledges that abnormal returns following green bond announcements may not solely reflect informational efficiency, but also cognitive biases and perception-driven dynamics. This perspective complements EMH and signaling theory by offering a more nuanced understanding of investor behavior in sustainability-oriented capital markets.

3.3 Stock Pricing Theories

Each company's stock has two kinds of value: Intrinsic Value and Market Value. The difference between these two prices is considered the basis of investors' decision-making for estimating the expected return on the related stock. Professional investors are able to identify mispriced shares by calculating the Intrinsic Value and comparing it with the market price. Therefore, they are also able to buy underpriced shares and sell those that are overpriced.

3.3.1 Dividend Discount Model (DDM)

According to Bodie et al. (2021), the intrinsic value of a stock is equal to the present value of its future cash flows, including dividends and the capital gain from the sale of the share. The concept is articulated in the Dividend Discount Model (DDM), for which the formula is as follows:

$$P_0 = \sum_{t=1}^{T} \frac{D_t}{(1+r)^t} + \frac{p_t}{(1+r)^t} \quad (1)$$

Where P_0 is the current share price, r is the discount rate, and D_t represents the dividend in year t. The "Gordon Growth Model" applies when the time of sale is unspecified, and the cash dividend grows every year at a fixed rate. In this case, the formula is as follows (Bodie et al., 2021, pp. 571–575):

$$P_0 = \frac{D_1}{r-g} \quad (2)$$

DDM, in fact, estimates the fair value of a stock. However, market pricing models, as illustrated by some examples below, explain how the market, in practice, prices share with regard to risk and various economic factors.

3.3.2 Capital Asset Pricing Model (CAPM)

"Modern Portfolio Theory (MPT)" has introduced by Markowitz (1952), and is considered the initiator of modern finance. The following key concepts are discussed in this theory:

- **Portfolio Selection:** Investors should consider "average return" and "variance" simultaneously in their portfolio selection.
- **Diversification:** The combination of various assets can reduce total risk, especially when there is a low correlation among them.
- **Efficient Frontier:** indicates the efficient frontier of the portfolios, that is, the combinations that yield the maximum return for a specific level of risk.

Following this, the CAPM was developed by Sharpe (1964), Lintner (1965) and Mossin (1966), and was actually an expansion of the Markowitz Model. The model assumes that systematic risk is the only determining factor in the expected return of an asset, a risk that is not removed by diversification. Below is the CAPM formula:

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f) \quad (3)$$

Where $E(R_i)$ is the expected return of asset i, R_f is the risk-free rate, $E(R_m)$ is the expected return of the market portfolio, and β is the asset's sensitivity to market changes. In other words, CAPM provides a framework for calculating the expected return based on market sensitivity (Bodie et al., 2021, pp. 275–286).

3.3.3 Market Model

The Market Model, in fact, is considered a simplified version of the CAPM. It is one of the most popular and common methods for event studies, due to its simplicity in calculations and high flexibility. This model establishes a linear relationship between the stock return and the market index return, defined by two factors "α" and "β". Specifically, "β" represents the market factor, and "α" represents the firm-specific factor.

According to MacKinlay's (1997) definition, the market model is a statistical model that relates each stock's return to the market portfolio return as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (4)$$

Where R_{it} is the return of stock i during period t, α_i is equal to the expected return of the stock when the market return is zero (the intercept of the equation), β_i is the sensitivity of the return with respect to the market return (the slope of the equation), R_{mt} is the market return in period t, and ε_{it} represents the abnormal return of the stock, whose expected value equals zero ($E(\varepsilon) = 0$). This abnormal return and its cumulative abnormal return (CAR) actually are the main pillars of the Event Study method.

3.3.4 Multifactor Models

Ross (1976) introduced "Arbitrage Pricing Theory (APT)" as a flexible substitute for CAPM. This model is based on the no-arbitrage principle and, in contrast to the CAPM, which considers the market as the only factor, takes into account several systematic risks. APT is articulated as follows:

$$E(R_i) = R_f + \lambda_1 b_{i1} + \lambda_2 b_{i2} + \cdots + \lambda_j b_{ij} \quad (5)$$

Where, b_{ij} is defined as the sensitivity of asset i to factor j, and λ_j is the risk premium corresponding to that factor; thus, APT presents a multifactor perspective in determining returns (Bodie et al., 2021, pp. 310–318).

In the development of multifactor models, Fama and French (1996) introduced their three-factor model, which considers two additional factors in addition to the CAPM market factor:

- **Small Minus Big (SMB):** the difference between the portfolio returns of small and big companies.

- **High Minus Low (HML):** the difference between portfolio returns of companies with high book-to-market value ratios and those with low ratios.

The formula of this model is as follows:

$$E(R_i) = R_f + \beta_{im}\big(E(R_m) - R_f\big) + \beta_{iSMB}SMB + \beta_{iHML}HML + e_{it} \qquad (6)$$

(Bodie et al., 2021, pp. 321–322)

4 Literature Review and Hypotheses

In this chapter, we review the literature of previous research in relation to our main variables' relationship, in line with the general structure of the thesis. We first go through the papers which assess the impact of Green Bond issuance news on the CAAR of the issuer's stock, similar to our first research question. Following this, we turn to articles which can help us estimate the second research question. That is, examining the effect of ESG Orientation of the issuer companies on their stock market reaction. Eventually, we review the results of studies that have assessed the relationship between Green Bond, CSR, and crisis. This section has a specific importance in that we consider Green Bond issuance as a proxy for CSR and the Social Capital of the company in the end. Through this process, we can provide the required theoretical support for our third research question as well. That is, the influence of prior Green Bond issuance experience on the equity market's reaction to the news of its reissuance during the crisis. In the end, we formulate our hypotheses based on the research background.

4.1 Green Bonds and Equity Market

Nowadays, attention to environmental issues has become a key concept in economic and financial decisions. Considering the CSR status of companies is also recognized as an important and determining factor in investment returns. As Bolton & Kacperczyk (2021) point out, after the Paris Agreement, investors have pursued a premium to compensate for the risk arising from high carbon emissions in their portfolios.

This issue has also affected the cost of capital for such corporations. The paper also concludes that the market reflects regulatory risks and technological shocks related to carbon restrictions in stock prices. Therefore, all sectors, not only energy suppliers, are exposed to this risk. Even the unexpected withdrawal of the United States from the Paris Agreement could not mitigate this effect. On the contrary, this exit acted as a catalyst and led other countries to reinforce their regulations by prioritizing environmental sustainability.

From this perspective, a question arises: whether any observable actions in carbon risk reduction, such as Green Bond issuance, can act as a positive signal to the stock market of the issuing company?

Although studies in this regard are restricted, reviewing them reveals various insights and results. Many investigations consider Green Bond issuance as positive news for the equity market, despite their issuing costs, such as expenditures caused by third-party approval and financial constraints to fulfill environmental commitments.

For instance, Baulkaran (2019) demonstrates that Green Bond issuance leads to a significant and positive Cumulative Average Abnormal Return (CAAR) around the announcement date of issuing such bonds, by using the Event Study method and examining 54 firms during 2013-2016. Flammer (2021) also assesses this effect based on three perspectives:

1- Signaling Argument, which considers the issuance of the bonds as a signal of environmental commitment and the credibility of the company.
2- Greenwashing Argument, which interprets the bond issuance as a misleading practice.
3- Cost of Capital Argument, which regards the bond as merely an instrument to reduce the cost of capital.

The results of her examination of 1189 Corporate Green Bonds during the period 2013-2018 show a significant and positive CAAR. The findings of the paper confirm that these bonds are mainly an authentic instrument for signaling environmental commitment to the market, rather than being merely a cheap financing tool or an act of greenwashing. That is why the effect of the first issuance is reported to be stronger and more significant. Tang & Zhang (2020) also capture a positive and significant reaction of the stock market to the issuance announcement of Green Bonds by examining 1510 corporate Green Bonds belonging to 132 public companies during 2007-2017. They also report a stronger effect for the first issuance, similar to the aforementioned study, and attribute this

reaction to signaling theory. Wang et al. (2020) likewise record positive CAAR around the event date of Green Bond announcements by analyzing 48 issuance announcements of corporate green bonds in China during 2016-2019. Ahmed et al. (2024), in a similar study, also show a positive market reaction by recording positive and significant CAAR around announcement dates by studying 225 green bonds across various American industries during 2013-2018. They also mention that abnormal reactions of the market during COVID-19 prevented them from capturing significant results for this period. However, they extended the sample to 2018-2022 and estimated a positive (though not significant) market reaction using simpler models such as the Market Model.

In the other hand, some papers in this literature have obtained different results. For example, Yu et al. (2025)**,** which is one of the newest studies in this area. This research addresses market behavior with respect to the green bond issuance in the framework of two theories:

1- Signaling Theory, according to which studies believe that green bond issuance leads to an increase in stock price.
2- Agency theory, according to which some studies consider issuing green bonds a losing action, particularly when the company does not manage to prove its environmental intention and incurs high costs.

The research findings on 595 international green bonds issued between 2014-2021 show that market reaction to this news is negative and significant, especially for the first issues and for companies with weak environmental performance. Lebelle et al. (2020) also conclude that CAAR is significantly negative in the initial days of the issuance announcement, assessing 475 green bonds issued by 145 firms between 2009-2018. In this study, market behavior is interpreted as being similar to its reaction to conventional bonds.

A definite and significant reaction of the stock market to green bond issuance is the consensus result of prior studies in this field. However, the intensity and direction of this reaction depend on various factors such as the geography of the studied market, the period of the study, and its prevailing conditions.

4.2 ESG orientation and Equity Market

Since the second question of the current study is related to the effect of the companies' ESG rating on the intensity of the possible stock market reaction to green bond issuance news, in this section we review the literature and go through those studies that either directly examine this subject or provide indirect evidence regarding the moderating role of ESG.

As mentioned in the previous section, one of the main factors behind the possible negative market reaction to green bond issuance is greenwashing concerns, which arise from a lack of sufficient trust and transparency (Yu et al., 2025). In addition, the emergent nature of the green bond market and the lack of a coherent framework and standards make the issue more serious (Flammer, 2021). Thus, any factor that can make investors believe more strongly in the reality of the company's green actions plays a moderating role, either in reducing negative reaction or even reinforcing positive reaction. For instance, receiving third-party certification or a label has been demonstrated in many studies to enhance the positive and direct impacts of green actions, due to the increase in creditability and market trust (Ehlers & Packer, 2017; Fatica & Panzica, 2021; Flammer, 2021).

In this line, ESG rating, which is recognized as the first qualified measure to verify CSR activities and green proceeds, can play a significant role in absorbing market trust. Study evidences also confirm this assumption. For instance, Cheng et al. (2023) show that companies need to have strong performance in the ESG area, in addition to improving their brands, in order to fully exploit the advantages of green investments. In fact, it is the way by which they can increase market trust and facilitate access to green capital. Yu et al. (2025) also suggest that companies with either a pre-issuance background in green bonds or a good ESG rating do not receive negative market reactions to their green bond issuance. What is more, stock liquidity improves for companies with strong environmental performance. The article showcases that ESG, and in particular the E factor, plays an important role in green bond adoption. For a firm with no ESG credentials, green bond

issuance can be considered greenwashing. Moreover, Berdiev (2025) states that firms with high ESG scores receive a positive and significant reaction from the equity market at the time of green bond issuance, while those with lower or without ESG rating do not see any market reaction. These findings suggest the importance of the role of trust in this regard, particularly considering the fact that the green bond market is still immature, especially in terms of legal and institutional structure.

With a more accurate assessment of literature, we can observe that there are several studies whose results show a positive effect of ESG on both short-term and long-term performance of companies. For example, Servaes & Tamayo (2013) and Eccles et al. (2014), both published in Management Science journal, are among the first studies to examine the correlation between corporate sustainability and financial performance. Servaes & Tamayo (2013) show that CSR positively and significantly influences Tobin's q in companies with a high level of advertising. They also conclude that CSR, if accompanied by customer awareness and positive reputation, can act as a value-creating strategy. Similarly, Eccles et al. (2014) show that companies with high levels of ESG perform better than their peers in stock market and accounting indices. In other words, sustainability is not only an extra cost, but it can also be considered a competitive advantage.

In another study, Galema & Gerritsen (2025), which assesses the long-term and short-term effects of ESG on American companies' stock returns simultaneously during 2013–2019, show that changes in ESG ratings do not have any effect on share prices in the short term. However, changes in ESG ratings, in particular in the environmental dimension, are important for long-term investors and influence their decisions. S. Chen et al. (2023) also prove that high ESG generally has a positive effect on the financial performance of companies, and the effect is more prominent in big corporates, high-risk and environment-sensitive industries. This study also states that ESG can reduce the cost of capital and lead to an increase in reputation and trust.

In contrast, some studies have provided different results. For instance, Serafeim & Yoon (2023) demonstrate that ESG ratings can be an appropriate signal for forming market expectations by assessing the ESG rating 's predicting power on future ESG news and equity market reaction. Findings suggest that the market reaction to positive ESG news is generally positive and negative to negative news. Nevertheless, the intensity of the positive reaction is less for firms with higher ESG, since an important part of this effect has already been reflected in the share price. In another study, Tang & Zhang (2020), in their robustness tests, show that issuing green bonds has a greater effect on the shares of companies with lower ESG scores. In other words, these companies benefit more from green bond issuance, because issuing such bonds can attract investors' attention and trust to a greater extent.

In conclusion, in the current literature review, Berdiev (2025) can be considered the only study that directly examines the effect of ESG on the stock market reaction to green bond issuance. Its results show a positive and significant relationship between these two variables. Other studies have indirectly emphasized that ESG can strengthen the positive reaction of the market by creating positive fame, improving financial performance, and increasing trust in green proceeds. Flammer (2021) shows that issuing green bonds leads to an increase in ESG rating itself as well. Therefore, it is expected that a high level of ESG not only conveys a positive environmental message, but also represents a set of bilateral messages for the market.

Another important point is that the impact of ESG is often not reflected in the market immediately, hence, in the analysis it is essential to use the ratings recorded before the event date. Besides, the results of previous studies show that the size of the company and the industry also play a relevant role in the intensity of ESG's influence on the equity market reaction.

4.3 The Pandemic as a Financial Crisis

As this study coincides with the COVID-19 crisis, considering the anomalous and abnormal conditions of the market during this period is inevitable to achieve real results. Moreover, the existence of this crisis provides special conditions and, in fact, an opportunity to design the third research question; that is, assessing whether the crisis affects the market reaction to the green bond issuance announcement.

4.3.1 Crisis and Green Bonds

Few studies have investigated the impact of crises on the various dimensions of green bonds. Among them, Cicchiello et al. (2022) show that green bonds had less resilience and faced higher risk during COVID-19 by studying the credit spread of green bonds compared to conventional ones in Europe during this period. However, after the publication of positive news, such as the effectiveness of vaccination, they returned to favorable conditions and recorded better returns. These results clearly show that the occurrence of an unusual condition like COVID-19 can inversely and unexpectedly influence the effects of green bond issuance.

In contrast, some studies, like Karim et al. (2024), by assessing the effects of various kinds of crises, such as COVID-19, on various financial markets, although confirm that the green bond market is affected by crisis conditions, they still identify it as one of the most sustainable financial markets. Based on their interpretation, green bonds play the role of a safe haven in investment during crisis periods. Similarly, Gronwald et al. (2025), by comparing the efficiency of the green bond market with other traditional markets, concluded that green bonds reacted more resiliently and more gently in crisis situations.

In another research, Ahmed et al. (2024) examine the impact of green bond issuance on the USA stock market reaction separately during the COVID-19 period as an additional study. They explain COVID as an external imposed shock to the market, which causes an unusual and rare condition with anomalies and abnormalities in the market. However,

recording significant results was not possible, especially when using classic asset pricing models such as CAPM and Fama & French. Even with simpler models like the Market Model, they could not achieve strong and significant effects on CAAR.

From the other side, Jin & Zhang (2023), by considering a short period of COVID-19 , analyzed the stock market reaction of China to the green bond issuance. Although they obtained various results from various asset pricing models, their findings show that the issuance of green bonds by non-financial companies can gain investors' trust and generate higher returns, while this effect has not been seen in financial companies. This article considers green bonds as a proxy for CSR and social capital of firms, since they lead to the creation of public trust.

The conclusion of this part of the literature demonstrates that although the green bond market has higher resilience in crisis times compared to other financial markets (Gronwald & Wadud, 2025; Karim et al., 2024), it is less sustainable than the conventional bond market (Cicchiello et al., 2022). Since the target of this research is pursuing how the signal of green bond issuance influences the equity market during crises, the emergence of unusual behavior is possible. This is because, although the relative resilience of the green bond market can be an effective factor in moderating the stock market reaction during crises, it is ultimately the stock market reaction that determines the results of this research. On the other hand, those studies that estimated the direct effect of this relationship during crises have not reported any conclusive results. Hence, after reviewing the literature on green bonds, we refer to studies in the fields of ESG, CSR, and Social Capital to provide reliable support for formulating our third hypothesis.

4.3.2 Sustainability in Crisis Markets

Aloui et al. (2023) have assessed the impact of green policies of the European Central Bank on the stock market in two situations: ordinary and COVID-19. Their results confirm once again the unusual reaction of the equity market to green news. The findings show that the market reaction to these policies is positive and strong under normal conditions,

but reversed during crisis situations. They interpret their findings as follows: in crisis conditions, investors seek more security, and fear of the high cost and risk of these kinds of investments leads to an extreme reduction in acceptance.

Nevertheless, the immediate and short-term market reactions to CSR and ESG activities should be distinguished from their long-term effects. In this line, although the requirement for a long-term perspective on CSR activities was first proposed by Davis in 1960 (Davis, 1960), Lins et al. (2017) were the pioneers in examining the long-term effects of CSR in empirical tests by introducing the Social Capital theory. They state that the social capital of companies can protect them during crisis situations. In this article, CSR (or ESG) has been identified as a proxy for social capital. Their findings, based on the assessment of the abnormal returns of 1,673 corporations during the 2008–2009 crisis and related accounting metrics, show that firms with higher levels of CSR achieved greater returns and efficiency during this period, while such an effect was not observed under normal conditions. Therefore, the social capital gained from CSR acts as a form of insurance, the value of which becomes apparent when market trust reaches its lowest level.

Similarly, Amiraslani et al. (2023), who use environmental and social scores to measure the social capital of corporates, show that social capital leads to a reduction in the cost of debt and financial improvement during crisis periods. They also describe social capital as a form of insurance against trust erosion and market volatility.

The results of the literature imply that the instant reaction of the equity market to green bond issuance during crisis periods can be unusual and even opposite to ordinary conditions. This is because during such periods, investors' priorities change, and fear and the search for security dominate their decision-making. Moreover, the decline in the level of trust may lead investors to perceive green activities as opportunism or even greenwashing. However, the social capital of corporations can change the rules of the game, as it helps rebuild trust and reduce investors' fear. Thus, any factors that help strengthen this

intangible asset may save companies in times of crisis. Typically, having issued green bonds before a crisis can be considered a proxy for a gain in social capital.

4.4 Hypothese Development

With the review of the literature in section 4.1 of the current chapter, it is indicated that issuing green bonds can have different effects on the stock market of the issuer company. In accordance with the findings, hypotheses, and the results of previous studies, we can conclude that the issuance of green bonds may convey a positive message from the issuer firm based on the Signaling Theory; a message which conveys signals the real commitment of the company to environmental targets and responsibilities and leads to an increase in trust and the attraction of ESG-supporting investors.

In contrast, some studies have suggested a possible negative perception among investors of green bond issuance and have attributed this reaction to several related theories. A group believes that issuing green bonds sends a negative signal to the market, as it imposes higher costs, either pecuniary or non-pecuniary, which may lead to a higher cost of capital and consequently a negative market reaction. In addition, if the issuer is not able to demonstrate its sincerity regarding environmental goals, it may end up facing a negative market reaction.

Some studies have analyzed this phenomenon within the Agency Theory framework. They state that CSR may manifest as a Moral Hazard; i.e., those executives who separate their own goals from those of the investors may utilize CSR to increase their personal reputation, rather than to truly fulfill the social responsibility of the firm (Yu et al., 2025). Other groups also attribute the negative reaction of the market to the Greenwashing theory. They believe that issuing green bonds, like other types of green activities, might not be done honestly. In other words, there might be some opportunistic or misleading intentions behind that (Flammer, 2021).

In overall, findings of these studies show that the stock market's reaction to green bond issuance has been significant yet different across various periods, geographic areas, and market conditions. Therefore, the first hypothesis of this investigation is stated as follows:

H_1: Green bond issuance has a significant effect on the stock market's CAAR.

Our conclusion from this part of the literature is that trust plays a crucial role in the field of green activities in determining the kind of reaction of the equity market. Under normal economic conditions, the possibility of a positive market reaction to green bond news increases when the level of trust is high and investors' sensitivity is lower. In this case, the signaling theory also functions properly. According to this, the initial formulation of the first hypothesis can be stated as follows:

H_{1a}: Green bond issuance has a positive and significant effect on stock markets' CAAR.

Contrary to this, in conditions where the trust level in the market has decreased and the investment risk has increased, either the fear of Greenwashing or the concerns arising from the increase in the cost of capital can lead to a negative reaction from the market. Thus, the second formulation of the first hypothesis is explained as below:

H_{1b}: Green bond issuance has a negative and significant effect on stock markets' CAAR.

The literature review in Section 4.2 also provides the theoretical foundation for the development of the second hypothesis of this research. The second research question aims to examine the impact of ESG on the equity market's reaction to green bond issuance announcements. Most studies in this domain have reported a positive effect of ESG on market reactions. ESG activities are recognized as a reinforcing factor of market trust, and the increased level of trust ultimately leads to improved corporate financial performance. Therefore, a high ESG score conveys a positive and multifaceted message to the stock market. Based on this, the second hypothesis is formulated as follows:

H_2: The CAAR around green bond announcements is higher for corporations with high pre-issuance ESG scores than for those with low ESG scores.

As aforementioned, we believe that the market's trust in the issuer company's honesty and the authenticity of the news is the determinant factor of the stock market's behavior toward green bond issuance. The materiality of this factor doubles when the trust is dramatically damaged or is at its lowest level and risk aversion is at its highest degree. The rendered literature review in section 4.3 steers us to the perspective that social capital can act as a kind of insurance (Amiraslani et al., 2023; Lins et al., 2017). Based on this idea, green bond issuance also can be considered as a proxy for CSR.

In the results, we argue that those companies with previous experience in green bond issuance receive a more favorable reaction from the stock market, thanks to the social capital gained from their former green activities. Hence, this time we hypothesize the following:

H_3: Companies with prior experience in green bond issuance receive a more positive stock market reaction to their reissuance during crises.

5 Data & Methodology

5.1 Research Design

This chapter presents the empirical methods used in the analysis. First, an event study framework is applied to measure whether green bond announcements generate abnormal stock market reactions. We use the market model to determine cumulative abnormal returns (CAR) across multiple event windows and estimating expected returns. Second, using ordinary least squares (OLS) regression models to find out the impact of firm-level ESG orientation on the size of the market response to green bond issuance is studied. Lastly, the regression framework has been extended to incorporate crisis-period indicators specifically, the timing of COVID-19 and previous experience with green bonds to evaluate whether external shocks influence the market's reaction to green bond issuance. This approach helps to carefully examine both the existence and the underlying causes of abnormal stock market reactions to sustainable financing signals.

5.1.1 Event Study Approach

In this study, we use the event study methodology to see how the stock markets react when firms announce green bonds. Wai Kong Cheung (2011) explains that event studies are commonly used to determine how financial markets react to corporate announcements by tracking changes in stock prices around the event date. This method is especially important for sustainability-related announcements which may signal environmental commitment and influence investor sentiment (Flammer, 2021; Lebelle et al., 2020; Tang & Zhang, 2020; Wang et al., 2020).

The event date (Day 0) is the day that the green bond issuance is officially announced when the issuer offers bond publicly and used to measure abnormal returns. Previous research consistently applies the announcement date as the event date in the analysis of market reactions to green bond issuance (Krüger, 2015; Wang et al., 2020).

Expected returns are estimated using the market model:

$$E(R_{i,t}) = \alpha_i + \beta_i R_{m,t} \quad (7)$$

Where $R_{i,t}$ is the return of firm *i* on day *t*, $R_{m,t}$ is the market return, and α_i, β_i are firm-specific parameters estimated over a 250-days estimation window, ranging from day -300 to day -50 relative to the event date.

Actual daily returns also are estimated as follows :

$$R_{i,t} = Ln(\frac{P_t}{P_{t-1}}) \quad (8)$$

Where $R_{i,t}$ is the return of firm *i* on day *t*, P is the price of the stock on day t

Abnormal returns (ARs) are calculated as:

$$AR_{i,t} = R_{i,t} - E(R_{i,t}) \quad (9)$$

which can be written as:

$$AR_{i,t} = R_{i,t} - (\alpha_i + \beta_i R_{m,t}) \quad (10)$$

Cumulative Abnormal Returns (CARs) are computed by summing ARs over selected event windows:

$$CAR_i = \sum_{t=t_1}^{t_2} AR_{i,t} \quad (11)$$

To assess overall market reaction, Cumulative Average Abnormal Returns (CAARs) are the average CARs of N firms in the same event window, and typically provide an over-view of the outcomes for every firm:

$$CAAR = \frac{1}{N}\sum_{i=1}^{N} CAR_i \quad (12)$$

The market's response to the announcement of the green bond issue may be examined by considering the sign and significance of CAARs in various event windows. Statistical significance is tested using a cross-sectional t-test, with p-values reported for each window.

$$t_{CAAR} = \sqrt{N}\frac{CAAR}{S_{CAAR}} \quad (13)$$

Where t_{CAAR} is *t-statistic* for the Cumulative Average Abnormal Return, N is Number of firms or events in the sample, $CAAR$ is Cumulative Average Abnormal Return and S_{CAAR} is Standard deviation of the CAAR across the sample.

5.1.2 Estimation and Event Windows

Krüger (2015), Flammer (2021) and Tang and Zhang (2020) use event windows that begin before the event date to account for information spillage. Addition to include previous days for some information leakage before the event, days after the event should be included for staggered response of the event. And to ensure a robust estimation of expected returns, we prefer to use an estimation period of 300 days before the event, ending 50 days before the announcement date.

In this study, we focus [–10, +10] and [–1, +1] as two primary event windows, both of which are commonly used in green bond event studies to capture both extended and immediate market reactions. The [–10, +10] window helps us to detect early price movements before the announcement (information leakage) and delayed investor responses after the event. The [–1, +1] window shows the short-term reaction surrounding the announcement date.

We also include [–5, +10], [–5, +5], [0, +1], [+1, +5], and [+1, +10] windows to test the robustness of results as these windows help us to assess whether the market reaction is concentrated or spread over time. As Flammer (2021) and Tang and Zhang (2020),

highlight the importance of using multiple windows to capture diverse investor behavior and enhance comparability across research findings, we will keep up with the method.

5.2 Variables and Regression Model

In this thesis, we apply two regression models to analyse the factors that influence cumulative abnormal returns (CAR) around green bond announcements. The first model analyses firm-level ESG performance, whereas the second model studies the impact of macroeconomic crises. Both models have been developed based on the research questions and the most common methods used in previous studies. Using ordinary least squares (OLS) regression to examine the effects of various factors on CAAR has been considered a commonly used approach in the literature., including Flammer (2021), Tang and Zhang (2020), and Wu et al. (2025), Berdiev (2025), Capelle-Blancard & Petit (2019) Lebelle et al. (2020) which highlight the significance of sustainability signals and contextual factors in influencing investor responses.

5.2.1 ESG Regression Model

The first regression model investigates the relationship between firm-level ESG performance and the stock market reaction to green bond announcements. Specifically, the model tests whether firms with higher ESG scores experience more favourable cumulative abnormal returns (CAR) during the event window. This approach builds on prior literature that emphasizes the signalling value of sustainability commitments. Flammer (2021) highlights that the credibility of green bond issuance is strengthened when firms show strong ESG performance, especially in contexts where greenwashing concerns are significant. This corresponds with extensive research indicating that transparency in ESG matters and third-party validation can bolster investor confidence (Ehlers & Packer, 2017; Fatica & Panzica, 2021). Wu et al. (2025) further support this by showing that the quality and transparency of ESG are positively correlated with market valuation, particularly in environmentally sensitive firms. Tang and Zhang (2020) suggest that firms with lower ESG scores may get additional benefits from green bond issuance, as the announcement

might act as a signal that attracts investor interest. The mixed findings emphasize that projected ESG credibility via ratings, external evaluations, or issuance history moderates stock market reactions to green bond announcements, as discussed in section 4.2.

we test whether a company's sustainability performance influences how the stock market reacts when it announces a green bond. We use a regression model, the dependent variable is the cumulative abnormal return (CAR_i) for firm i which is calculated over a specific event window surrounding the announcement and key independent variable is ESG_i, which represents the firm's overall environmental, social, and governance score at the time of the announcement. This score reflects how the firm operates responsibly and manages sustainability risks. The Control variables is $Size_i$ which is measured as the logarithm of total assets to account for differences in firm scale, and $Industry_i$ which is a set of dummy variables to control for sector-specific effects. We use the model is estimated using the Ordinary Least Squares (OLS) method. As mentioned before we were inspired by some articles to use OLS to capture this effect, especially those that use the same way to assess the impacts of various variables on CAR (e.g. Berdiev, 2025; Capelle-Blancard & Petit, 2019)

The regression equation is specified as follows:

$$CAR_i = \beta_0 + \beta_1 ESG_i + \beta_2 Size_i + \beta_4 Industry_i + \varepsilon_i \qquad (14)$$

The purpose of this model is to test Hypothesis 2 (H_2) as the firms with higher ESG scores experience more positive abnormal returns following green bond announcements. It reflects that If the coefficient for ESG_i is positive and statistically significant, it would suggest that investors reward firms with strong sustainability profiles, confirming that ESG credibility plays a role in shaping market reactions.

5.2.2 Crisis Regression Model

To examine this dynamic, we developed our model based on the framework of Lins et al. (2017) and were inspired by the method they used to record the effect of social capital

on abnormal returns during the crisis. We also considered those articles that used a cross-sectional regression approach in addition to the event study method (e.g. Berdiev, 2025; Capelle-Blancard & Petit, 2019; Flammer, 2021; Lebelle et al., 2020; Tang & Zhang, 2020).

We run a second regression model to test if cumulative abnormal returns (CAR_i) differ for firms with prior green bond experience during crisis periods. The model includes a dummy variable $Crisis_i$, which is set to 1 if the green bond announcement occurred between February 2020 and June 2023 (as defined by the World Health Organization), and 0 otherwise. Our models include the variable GB_Pre_i, a dummy variable that indicate whether the issuing firm has prior experience in green bond issuance. The interaction term $Crisis_i \times GB\_Pre_i$ to capture whether prior green bond experience affects investor response during crises periods. $Controls_i$ represents a set of firm specific and industry-level control variables. The model is using the Ordinary Least Squares (OLS) method and is given below:

$$CAR_i = \delta_0 + \delta_1 Crisis_i + \delta_2 GB\_Pre_i + \delta_3 (Crisis_i \times GB\_Pre_i) + \delta_4 Controls_i + \varepsilon_i \quad (15)$$

This model tests Hypothesis 3 (H_3) as the firms with prior green bond experience receive more favourable abnormal returns during crisis periods compared to first-time issuers. A positive and statistically significant coefficient for the interaction term (δ_3) would suggest that prior issuance acts as a credibility signal that investors value more during uncertain times. Lins et al. (2017), who find that firms with higher social capital proxied by CSR intensity outperformed their peers during the 2008–2009 financial crisis. Their study shows that when overall market confidence drops, companies having better history of responsible behaviour are more trusted by investor this reinforcing the idea that green bond experience can serve as a trust-based buffer during systemic shocks. In this study, we include a crisis variable to reflect economic uncertainty period. This variable shows whether a green bond announcement was made during the COVID-19 pandemic.

The Crisis variable is expected to reflect changes in investor sentiment, risk aversion, and valuation dynamics that might remain overlooked during stable periods. Also, looking at pre-crisis and crisis-period CAARs in subsamples of event study method gives us more information about how market reactions changed in response to different macroeconomic conditions.

5.2.3 Control Variables

The regression model incorporates a series of firm-level control variables frequently utilized in event study literature to delineate the impacts of ESG performance and crisis timing on abnormal returns. These variables take into account observable traits that might affect how investors react to green bond announcements:

- Firm Size: Determined by the natural logarithm of total assets. Larger companies may see different market reactions as they are more visible, liquid, or stable.
- Industry Dummies: To account for differences in how investors feel about different industries, fixed effects for each sector are included. This takes into account differences in ESG relevance, regulatory exposure, and environmental impact.

These control variables help make sure that the estimated coefficients for ESG and Crisis show how they each contribute to abnormal returns on their own, instead of being mixed up with factors that are specific to the firm or the market as a whole. To make it easier to understand and compare, all continuous variables are standardized before regression. Since we have limited samples, adding more control variables may make the model unstable and may reduce the accuracy of the results. On the other hand, it may also have the risk of a reduction in samples due to the lack of access to the data. Therefore, we keep these two regression models simple, having two main control variables: size and industry. Although we believe adding more variables may not cause significant differences in the results, we include this as a recommendation for future studies in the last chapter.

5.3 Robustness Checks

To make sure that our results are reliable and consistent , we conduct robustness check for both event study and regression analysis In the event study, our two main event windows are [–10, +10] and [–1, +1], as they capture both broad and immediate market reactions to green bond announcements. To test the sensitivity of cumulative abnormal return (CAR) estimates, we apply six additional windows as robustness checks. They are [–5, +10], [–5, +5], [0, +1], [+1, +5], and [+1, +10]. These alternative windows help to verify whether the observed market reaction remains consistent across shorter, asymmetric, and post-announcement periods.

In addition to testing different event windows, we also check the robustness of our results by dividing the sample based on time (before and during the crisis) which helps us to understand whether investor reactions vary depending on local market conditions or broader economic uncertainty. By comparing time periods, especially around the COVID-19 crisis, we test whether green bond announcements still influence investors during crisis. We find that green bonds had positive effects before the crisis, but during the crisis, reactions turned negative especially for first-time issuers. These extra checks confirm that our findings are reliable and show whether ESG signals depend on context and credibility.

5.4 Data

The section explains how the data was collected. In the beginning, we discussed the sample selection criteria and data sources used in the event study which includes bond-level data, stock price information, and relevant market indices. Then, this describe the ESG metrics and firm-level financial variables incorporated into the analysis. Finally, it presents descriptive statistics to summarize the characteristics of the sample and the green bond issuances examined in this study.

5.4.1 Sample Selection and Sources

The dataset used in this study was primarily obtained from Refinitiv, provided by the University of Vaasa, and supplemented with announcement dates extracted from the Bloomberg Terminal. Refinitiv's fixed income database provided us a rich information on corporate green bond issuances across both European and U.S. markets. Despite the initial intention of the study was exclusive focus on European issuers, the COVID-19 period limited the availability of green bond data. Therefore, we expanded the sample to include U.S. corporate issuers to ensure sufficient sample size and analytical robustness.

Up to now, green bond has been issued approximately 12,055 globally. This study focuses on a sample data of green bond announced from January 2014 to September 8, 2025, retrieved from Refinitiv Eikon and compiled by the University of Vaasa. We use a series of selection criteria to construct a relevant and focused sample. These included geographic scope (United States and Europe), issuer type (corporate), and listing status (publicly traded firms). After applying these criteria, we use the initial sample consisted of 468 green bond observations from 176 companies. Specifically, the U.S. market contributed 260 observations from 91 firms, while the European market accounted for 208 observations from 85 firms.

We collected daily adjusted closing prices for each stock which were obtained from Refinitiv Eikon to calculate the daily return series which is used in event study. Adjusted prices were used instead of raw closing prices as they reflect company events such as dividends, stock splits, and rights offers which guarantees that return reflect actual investor gains or losses over time. We used the S&P 500 Composite Index to represent the US market and the MSCI Europe Index for European firms for market benchmark returns. These indexes were chosen due to their broad coverage, liquidity, and wide acceptance in the empirical finance literature as reliable measure of regional market performance. To maintain consistency, we have taken both benchmark series from Refinitiv Eikon.

To ensure the reliability of the event study analysis, a further screening process was conducted to exclude firms whose stocks exhibited limited market liquidity or lacked sufficient daily return data. We exclude certain entries to maintain the accuracy of abnormal return calculations and to ensure the results reflect genuine market reactions. For extended analysis, we select a subsample of 407 observations which is based on the availability of firm-level data such as ESG ratings, total assets, and other financial indicators. ESG scores were obtained from Refinitiv and reflect company performance.

For extended analysis, a refined subsample of 407 observations was selected based on the availability of firm-level data such as ESG ratings, total assets, and other financial indicators. ESG scores were obtained from Refinitiv and reflect company performance. For each bond, detailed attributes were collected, including ISIN code, issuer name, ticker, announcement and issue dates, maturity date, currency, market, and issuer type.

This final dataset provides a robust foundation for analysing the stock-market impact of green bond announcements, with particular attention to firm characteristics, sustainability performance, and market conditions during the study period.

5.4.2 Descriptive Statistics

This section provides an overview of the distributional characteristics of cumulative abnormal returns (CAR) surrounding green bond announcements. We looked at descriptive statistics across seven event windows to see how stock prices moved before and after the announcement. As we already mention above, the two main windows used for analysis are [–10, +10] and [–1, +1], while other windows were used to check robustness. We used basic statistical measures like mean, median, standard deviation, t-statistics, and P-value to explore how cumulative abnormal returns (CAR) were distributed across the sample. This summary provides foundation for interpreting market reactions and supports the validity of subsequent regression analysis.

Table 1. CAR Summary

Event Window	[-5,+10]	[-5,+5]	[-10,+10]	[-1,+1]	[0,+1]	[+1,+5]	[+1,+10]
No. of Obs.	407	407	407	407	407	407	407
Mean	-0.057	-0.021	-0.053	-0.013	-0.009	-0.018	-0.054
Median	-0.017	-0.018	-0.02	-0.01	-0.011	-0.003	-0.013
Maximum	0.244	0.352	0.3	0.098	0.062	0.208	0.189
Minimum	-0.397	-0.396	-0.48	-0.377	-0.193	-0.344	-0.276
Std. Dev.	0.128	0.094	0.129	0.042	0.028	0.062	0.108
t-statistic	-9.028	-4.545	-8.242	-6.463	-6.628	-6.001	-10.199
P- value	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: Dependent variable Across Event Windows

As shown in Table 1, the mean CAR is negative across all event windows, indicating that green bond announcements are generally followed by a decline in stock prices. The largest noticeable average declines in stock returns appear in the [–5, +10] and [+1, +10] windows, suggesting that the market reaction may be delayed or sustained over time. In addition, longer windows like [–10, +10] and [–5, +10] show higher standard deviations, pointing to increase volatility around the announcement period. Some event windows show unusual patterns in the distribution of cumulative abnormal returns. The t-statistics indicates that the mean CAR values for all event windows are significantly different from zero. All p-values are less than 0.001, indicating strong statistical significance. This suggests that green bond announcements are consistently followed by negative abnormal returns, that are unlikely to be a result of random variation.

Table 2. Independent Variables

Variable	Obs.	Mean	Median	Maximum	Minimum	Std. Dev.
Crisis	407	0.44	0	1	0	0.50
ESG_E	407	57.07	58.55	97.43	0.8	23.04
ESG_T	407	54.29	59.46	89.04	7.78	21.38
Crisis × GB_Pre	407	0.19	0	1	0	0.39
GB_Pre	407	0.60	1	1	0	0.49

Note: Crisis, GB_Pre, and Crisis × GB_Pre are dummy variables coded as 0 or 1. ESG_E and ESG_T represent environmental and total ESG scores, respectively. All statistics are based on 407 firm-level observations.

Table 2 shows descriptive statistics for the independent variables used in the regression analysis. The variable Crisis shows whether a green bond announcement occurred during a crisis period, with a mean of 0.44 based on 407 observations. The ESG ratings, ESG_E (environmental) and ESG_T (total), have average values of 57.07 and 54.29, indicating variance in firm sustainability performance. The variable GB_Pre, with a mean of 0.60, indicates whether a firm issued green bonds prior to the current announcement. The interaction term Crisis × GB_Pre identifies firms that issued green bonds during the crisis, with a mean of 0.19. These statistics provide an overview of the sample characteristics and support selection of variables for the regression model.

6 Empirical Results

This chapter presents the empirical findings of the study. The results are divided into three sections, each addressing a specific research question using appropriate analytical methods. First, the outcomes of the event study, which examines how stock prices respond to green bond announcements. The analysis is based on the Market Model, and cumulative abnormal returns (CARs) are calculated across seven event windows to capture both short-term and extended market reactions. Second, the role of ESG performance using ordinary least squares (OLS) regression. The aim is to test whether firms with higher ESG scores experience stronger abnormal returns following green bond announcements. Third, the moderating effect of the COVID-19 crisis and pre-issuance experience. Another OLS regression is conducted, introducing a crisis dummy variable to compare market reactions before and during the pandemic, and a dummy variable to distinguish firms with previous experience in green bond issuance, along with the interaction term of these two dummies to capture the simultaneous effect.

6.1 Market Reaction to Green Bond Announcements

This section presents the results of the event study conducted to examine how stock prices respond to green bond announcements. Using the Market Model, cumulative abnormal returns (CARs) are calculated across seven event windows to capture both short-term and extended market reactions. The analysis is performed across multiple sub-samples, including first-time and repeat issuances, pre- COVID and COVID periods for Europe and the USA. The results are summarized in tables and interpreted based on the direction, magnitude, and statistical significance of the CAR values.

Table 3 presents the cumulative average abnormal returns (CAAR) for green bond announcements among firms in Europe and the USA, divided into three groups: the full sample, first-time issuers, and other-time (repeat) issuers.

The full sample of 426 observations show statistically significant negative CAARs market reactions in several windows. The [–1,+1] (–0.54%), [–10,+10] (–1.28%), and [–5,+10] (–1.16%) windows are statistically significant at the 5% level which indicates both short-term and extended negative impacts. The insignificant results for the [–5,+5] and [+1,+5] windows suggest that price fluctuations during these periods may be random or less influenced by the announcements. These findings are consistent with prior literature. Lebelle et al. (2020) and Yu et al. (2025), find modest or negative reactions around the green bond issuances.

For first-time issuers, the results are stronger and more significant market reaction. All the [–10,+10] (–2.41%), [–1,+1] (–1.11%), and [0,+1] (–1.22%) windows are statistically significant at the 1% level which indicates a strong investor reaction to first green bond announcements. This pattern signifies that first issuances are considered as an indication of strategy alignment or financial exposure to sustainability commitments by investors. However, the insignificance of the [–5,+5] and [+1,+5] windows suggests that the influence is likely concentrated on the immediate event period. These results align with Flammer (2021) and Tang & Zhang (2020), who reported that first-time green bond issuances attract more intense investor attention and reaction.

In contrast, other-time issuers show weak and statistically insignificant reactions in all event windows. The CAAR values are small and close to zero, i.e –0.95% in [–5,+10] and +0.13% in [0,+1] with no significance at the 10% level. This suggests that repeat green bond issuances are largely anticipated by the market and do not convey new information about firm value. The muted response implies that once firms are recognized as consistent green bond issuers, subsequent announcements no longer carry the same signaling power as the first issuance.

Table 3. CAAR Results – Europe and USA Green Bond Issuers

Issuer Type	N	[–5,+10]	[–5,+5]	[–10,+10]	[–1,+1]	[0,+1]	[+1,+5]	[+1,+10]
Full Sample	426	–1.16**	–0.59	–1.28**	–0.54**	–0.42**	–0.16	–0.74**
		(–2.51)	(–1.37)	(–2.30)	(–2.31)	(–2.22)	(–0.55)	(–2.22)
First-Time Issuers	174	–1.47**	–0.80	–2.41***	–1.11***	–1.22***	–0.51	–1.19**
		(–2.06)	(–1.24)	(–2.86)	(–2.72)	(–3.63)	(–1.22)	(–2.37)
Other-Time Issuers	252	–0.95	–0.44	–0.49	–0.15	0.13	0.08	–0.43
		(–1.56)	(–0.77)	(–0.67)	(–0.54)	(0.58)	(0.21)	(–0.96)

Note: CAAR values are expressed in percentage terms, are reported on top and rounded to two decimal places for presentation. t-values are shown in parentheses. Significance levels: p < 0.10 (*), p < 0.05 (**), p < 0.01 (***).N represents the number of observations.

Table 4 presents the empirical results of cumulative average abnormal returns (CAAR) for green bond announcements before and during the COVID-19 period across different event windows. The Pre-COVID results show a positive and statistically significant market reaction to green bond announcements. All event windows show positive CAARs where the strongest effects in the [–10,+10] and [+1,+5] windows, both significant at the 1% level. Short-term windows such as [–1,+1] and [0,+1] are also positive and significant which suggesting that investors reacted favorably to sustainability-related financing announcements during this period. The finding is parallel to Flammer (2021), Tang & Zhang (2020), Ahmed et al. (2024), Wang et al. (2020) and Baulkaran (2019) who report positive investor responses to green bond issuance during non-crisis periods.

In contrast, the COVID-period (N = 124) reveals a sharp reversal in investor sentiment. CAAR values are negative and statistically significant across all windows along with the [–10,+10] window showing a decline of –4.16% (t = –4.90). When further segmented by issuer experience, first-time issuers (N = 118) during COVID still experienced strong negative reactions though slightly less severe than repeat issuers. Other-time issuers (N = 96) recorded the most pronounced declines along with CAARs as low as –4.88% in [–

10,+10] and –3.31% in [–5,+5] showing both significant at the 1% level. These results suggest that, during crisis period, green bond announcements may be interpreted with skepticism particularly when issued by firms with prior issuance history. The adverse reactions suggest that other time issuances are expected and could lack the signaling strength of initial announcements. Ahmed et al. (2024), highlight the role of market conditions and issuer credibility, in shaping investor responses to sustainable finance instruments during crisis periods.

Table 4. CAAR Results – Pre-COVID and COVID-Period

Issuer Type	N	[–5,+10]	[–5,+5]	[–10,+10]	[–1,+1]	[0,+1]	[+1,+5]	[+1,+10]
Pre-COVID	133	+1.24* (1.82)	+1.43** (2.6)	+2.12*** (2.74)	+0.56** (2.54)	+0.72*** (3.49)	+1.11*** (3.02)	+0.92* (1.84)
COVID-Total	124	–3.18*** (–4.77)	–2.31*** (–3.65)	–4.16*** (–4.90)	–1.26*** (–3.38)	–1.06*** (–3.65)	–0.85* (–1.87)	–1.71*** (–3.33)
COVID-First Time	118	–2.43** (–2.51)	–1.49* (–1.87)	–3.57*** (–3.16)	–1.45*** (–2.70)	–1.45*** (–3.33)	–0.08* (–1.66)	–1.73*** (–2.66)
COVID-Other Time	96	–4.11*** (–3.93)	–3.31*** (–3.27)	–4.88*** (–3.81)	–1.03** (–2.03)	–0.06 (–1.61)	–0.09 (–1.12)	–1.73** (–2.06)

Note: CAAR values are expressed in percentage terms, are reported on top and rounded to two decimal places for presentation. t-values are shown in parentheses. Significance levels: p < 0.10 (*), p < 0.05 (**), p < 0.01 (***).N represents the number of observations.

6.2 Results of ESG Regression Model

Table 5 presents the regression results examining the relationship between total ESG scores (ESG_T) and cumulative average abnormal returns (CAAR) surrounding green bond announcements across multiple event windows. The analysis is based on 407 observations from green bond issuers in the USA and Europe between 2014 and 2025. The dependent variable in each model is the CAAR over a specific event window, while the key

independent variable is the total ESG score (ESG_T). Control variables include firm size (proxied by the logarithm of total assets) and industry fixed effects.

The results indicate a generally positive relationship between ESG_T and CAAR, with varying levels of statistical significance across event windows. In the extended windows [–5, +10], [+1, +5], and [+1, +10], the ESG_T coefficient is positive and statistically significant at the 5% or 1% level. Notably, the [+1, +10] window shows the strongest effect, with a coefficient of 0.14% (t = 5.63), significant at the 1% level, suggesting that firms with higher ESG scores experience more favourable post-announcement abnormal returns. Similarly, the [–5, +10] window yields a coefficient of 0.09% (t = 2.54), significant at the 5% level, indicating that ESG performance influences investor sentiment both before and after the announcement.

In contrast, the [–5, +5] and [–10, +10] windows show weaker or statistically insignificant ESG_T effects, with coefficients of –0.003% (t = –0.09) and 0.04% (t = 1.05), respectively. The [–1, +1] window yields a marginally significant coefficient of 0.03% (t = 1.73), significant at the 10% level, while the [0, +1] and [+1, +5] windows show stronger significance at the 1% level, with coefficients of 0.03% (t = 2.71) and 0.05% (t = 2.65), respectively. These findings suggest that ESG performance has a more pronounced effect on investor reactions in the immediate aftermath of green bond announcements and in the days following the event.

Firm size is consistently positively associated with CAAR across most windows, with statistically significant coefficients in all but the [–1, +1] window. This implies that larger firms tend to experience more favourable abnormal returns, potentially due to greater market visibility, investor familiarity, or perceived financial stability. The intercepts are negative and significant in broader windows, reflecting a baseline expectation of negative abnormal returns in the absence of strong ESG performance or firm size advantages.

The models exhibit moderate explanatory power, with R-squared values ranging from 0.16 to 0.64, and the highest explanatory strength observed in the [+1, +10] window. The F-statistics across all models are statistically significant, confirming the joint explanatory power of the included variables.

In summary, the results support the hypothesis that higher total ESG scores are associated with more favourable market reactions to green bond announcements, particularly in post-announcement and extended event windows.

Table 5. Regression Results – ESG_T and CAAR (USA & Europe, 2014–2025, N = 407)

Variable	**[–5,+10]**	**[–5,+5]**	**[–10,+10]**	**[–1,+1]**	**[0,+1]**	**[+1,+5]**	**[+1,+10]**
Intercept	–34.74***	–9.90*	–32.37***	–2.96	–5.48***	–8.03**	–32.86***
	(–5.54)	(–1.75)	(–4.49)	(–1.08)	(–3.03)	(–2.31)	(–7.21)
ESG_T	0.09**	–0.003	0.04	0.03*	0.03***	0.05***	0.14***
	(2.54)	(–0.09)	(1.05)	(1.73)	(2.71)	(2.65)	(5.63)
Size	1.65***	0.84**	1.78***	0.20	0.24**	0.46**	1.27***
	(4.45)	(2.52)	(4.18)	(1.25)	(2.24)	(2.21)	(4.70)
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	407	407	407	407	407	407	407
R-squared	0.52	0.28	0.38	0.16	0.17	0.37	0.64
F-statistic	35.29***	12.79***	19.94***	6.07***	6.87***	19.28***	58.66***

Note: All regression coefficients are expressed in percentage terms. values are rounded to two decimal places for presentation. t-values are shown in parentheses. Significance levels: p < 0.10 (*), p < 0.05 (**), p < 0.01 (***).

We re-examined the ESG model using the environmental factor (E) and have reported the results in Appendix 4. In general, the findings have captured the same and more significant results. The findings, in fact, confirm again that the higher ESG ratings receive

a more positive reaction from the market, especially for those firms that have better performance in environmental activities.

6.3 Results of Crisis Regression Model

The COVID-19 pandemic introduced unprecedented uncertainty into global financial markets, prompting investors to reassess risk, credibility, and sustainability signals. In this section, the analysis investigates whether the stock market reaction to green bond announcements is moderated by the presence of a crisis period. Specifically, it tests Hypothesis 3, which posits that firms with prior green bond issuance may experience more favourable abnormal returns during crisis conditions due to enhanced investor trust and perceived resilience. To evaluate this, interaction terms between the crisis dummy and pre-announcement indicators are included across multiple event windows.

Table 6 presents the regression results testing Hypothesis 3, which examines whether the impact of green bond announcements on stock returns is moderated by crisis periods. The dependent variable is cumulative abnormal return (CAR) across seven event windows ranging from short-term ([–1,+1], [0,+1]) to medium ([+1,+5]) and long-term ([–5,+10], [+1,+10], [–10,+10]). Key independent variables include the crisis dummy, green bond pre-announcement indicator (GB_Pre), and their interaction term (Crisis × GB_Pre), along with firm size and industry fixed effects.

The results show that the interaction term (Crisis × GB_Pre) is statistically significant in several windows, particularly [+1,+5] and [+1,+10], suggesting that firms with prior green bond issuance experience more favourable investor reactions during crisis periods. The GB_Pre variable is consistently negative and significant, indicating that green bond announcements are generally associated with lower abnormal returns in repetitive issuance which confirms results of previous studies (Such as Flammer, 2021; Tang & Zhang, 2020), but this effect is mitigated when interacted with crisis conditions. Firm size is positively significant across all windows, and the models demonstrate strong explanatory power, with R^2 values ranging from 0.16 to 0.65.

Table 6. Regression Analysis of Crisis Moderation Effects on CAR Following Green Bond Announcements

Variable	[–5,+10]	[–5,+5]	[–10,+10]	[–1,+1]	[0,+1]	[+1,+5]	[+1,+10]
Intercept	–39.36*** (–7.14)	–14.75*** (–2.91)	–36.88*** (–5.73)	–7.80*** (–3.17)	–8.02*** (–4.89)	–11.89*** (–3.81)	–36.50*** (–9.01)
Crisis	+1.19 (0.80)	+0.47 (0.35)	+0.50 (0.29)	+1.11 (1.69)	–0.28 (–0.64)	–1.56* (–1.87)	–0.85 (–0.78)
GB_Pre	–4.30*** (–3.03)	–1.41 (–1.08)	–3.27** (–1.98)	+0.82 (1.29)	+0.31 (0.74)	–2.70*** (–3.37)	–5.59*** (–5.36)
Crisis × GB_Pre	+4.57** (2.35)	+2.01 (1.13)	+3.90* (1.72)	–0.91 (–1.05)	–0.51 (–0.88)	+2.97*** (2.70)	+5.52*** (3.87)
Size	+2.24*** (7.23)	+0.82*** (2.90)	+2.07*** (5.72)	+0.34** (2.48)	+0.40*** (4.37)	+0.80*** (4.54)	+2.21*** (9.71)
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	407	407	407	407	407	407	407
R-squared	0.54	0.29	0.39	0.16	0.17	0.38	0.65
F-statistic	33.23***	11.41***	18.14***	5.19***	5.65***	17.00***	52.48***

Note: All regression coefficients are expressed in percentage terms. values are rounded to two decimal places for presentation. t-values are shown in parentheses. Significance levels: p < 0.10 (*), p < 0.05 (**), p < 0.01 (***).

6.4 Discussion

This section examines the empirical findings of the study in relation to the theoretical frameworks and prior research discussed in Chapters 3 and 4. The discussion is categorized into three main dimensions: the market reaction to the green bond

announcements, the moderating role of ESG performance, and the impact of crisis conditions and prior issuance experience.

6.4.1 Green Bond Announcements and Market Reaction

The literature provides mixed information on how equity markets respond to green bond announcements. Baulkaran (2019), Flammer (2021), Tang & Zhang (2020), Wang et al. (2020), and Ahmed et al. (2024) report positive and significant CAARs, especially for first-time issuers, supporting Signaling Theory. In contrast, Yu et al. (2025) and Lebelle et al. (2020) find negative reactions, particularly during crises or from firms with weak ESG pro-files, aligning with Agency Theory. These mixed findings suggest that market response depends on issuer credibility, timing, and economic context.

In the crisis period from 2020 to 2023, first-time and repeat green bond issuers experience negative market reactions; however the intensity and significance of those reations differed. First-time issuers showed consistently negative and statistically significant cumulative average abnormal returns (CAARs) across nearly all-time windows, including [−10,+10] at −3.57% ($p = 0.002$) and [0,+1] at −1.45% ($p = 0.0012$). In contrast, repeat issuers showed negative cumulative average abnormal returns (CAARs), though the effects were less consistent, as particular windows such as [0,+1] and [+1,+5] showed insignificant results. The [0,+1] window for repeat issuers achieved a return of −0.06% ($p = 0.11$), showing an insufficient investor response.

The findings support Agency Theory, showing that investors show greater skeptical behavior towards first-time issuers during uncertain period. The relatively weak reaction to repeat issuers is consistent with Legitimacy Theory, suggesting that previous experiences with green bonds can improve investor confidence, despite fluctuations. This study indicates that, according to earlier research, there are strong positive reactions for first-time issuers (e.g. Flammer, 2021; Tang & Zhang, 2020), should the economy be in its usual condition. The effectiveness of green bond signaling is not consistent in all situations. In reliable periods, investors displayed positive reactions, especially for first-time issuers.

During the crisis period (2020–2023), market reactions turned negative, though repeat issuers showed greater resilience. This indicates that issuer credibility and timing are critical; green bonds are most successful when trust and stability are present.

6.4.2 ESG Performance and Moderating Effect

Table 5 shows the results of the regression analysis that examines the relationship between ESG performance (ESG_T) and cumulative average abnormal returns (CAAR) over several event windows. The findings show that the coefficients of ESG_T are positive and statistically significant in several event windows i.e. in [+1,+5] (+0.05%) and [+1,+10] (+0.14%). This suggests that firms with higher ESG ratings experience stronger positive stock market reactions following green bond announcements This effect is more evident in the period after the announcement, which means investors prefer to respond once the information becomes public rather than anticipating it earlier. The variable Size is also positive and significant across most windows, indicating that larger companies receive stronger reactions. This may be given that they are more transparent, well-known to investors, with a lower information asymmetry.

These findings are consistent with previous research indicating that credible sustainability performance increases investor trust and market confidence. According to Flammer (2021) and Ehlers and Packer (2017), transparent and verified green financing mechanisms show genuine environmental commitment, resulting in positive market reactions. Similarly, Cheng et al. (2023) and Berdiev (2025) show that high ESG performance reduces information asymmetry by serving as a proxy for reputation and managerial reliability. Companies with low ESG credibility or insufficient transparency risk being seen as "greenwashing," resulting in weaker or even negative market reactions (Yu et al., 2025). These findings demonstrate the importance of ESG reputation in determining how investor's view sustainability-related announcements.

Overall, the regression results support Hypothesis 2, indicating that ESG performance strengthens market reaction to green bond issuance. Firms with strong ESG profiles

seem more authentic and trustworthy, and investors reward them when they announce new green bond. Larger and established companies benefit from this effect as well, due to higher visibility and better information availability. This finding aligns with Signaling Theory, which states that credible and costly acts, such as issuing certified green bonds, deliver a positive message to the market about a company's long-term commitment to sustainability. As a result, high environmental, social, and governance (ESG) performance and company size improve the credibility of green bond announcements and lead to more positive stock-market responses across industries. Findings of reexamination of the model, using environmental scores (E) as the independent variable, give us stronger and more significant results (Appendix 4).

6.4.3 Crisis Context and Prior Issuance Experience

This section discusses how crisis conditions and prior green bond issuance experience influence investor reactions to green bond announcements. The study is based on Hypothesis 3, which argues that firms with prior issuance history may experience more favorable abnormal returns during crisis periods due to enhanced investor trust and perceived stability.

The regression results presented in Table 6 support this hypothesis. The interaction term between the crisis dummy and prior issuance indicator (Crisis × GB_Pre) is statistically significant in several event windows, particularly [+1, +5] and [+1, +10]. This suggests that firms with prior green bond issuance are better positioned to maintain investor confidence during periods of heightened uncertainty. In contrast, the GB_Pre variable alone is consistently negative and significant, indicating that green bond announcements are generally associated with lower abnormal returns. However, this negative effect is mitigated when the announcement occurs during a crisis, and the firm has prior issuance experience.

Lins et al. (2017) address the concept of social capital that firms with a history of credible sustainability engagement are more resilient in times of crisis. Prior issuances act as a

reputational asset, boosting the firm's credibility concerning its environmental commitment and reducing investor suspicion. This is especially crucial during crises, when market confidence is unstable and investors are more sensitive to perceived risk and authenticity.

In conclusion, the results indicate that investor responses to green bond announcements are significantly influenced by both the crisis context and prior issuance experience. Firms that have a history of issuing green bonds are more successful at maintaining investor trust and legitimacy during periods of uncertainty. These findings enhance our understanding of the way in which contextual factors interact with sustainability signaling in financial markets and emphasize the significance of long-term credibility in generating a favorable investor response.

7 Conclusion

In the final chapter of this thesis, firstly, a summary of the existing gap in the literature and the scientific contribution and purposes of the investigation are presented. Thereafter, conclusions of the main findings and a brief summary of the key results are provided as the essence of the research. Subsequently, the general conclusion along with the research implications are outlined. Finally, the limitations of the thesis and some suggestions for future studies are presented.

7.1 Summary of the Gaps, Purposes and Findings

In recent decades, consideration of social and environmental issues, alongside the traditional goals of business, has occupied a major part of academic research. On the other hand, the necessity of considering environmental dimensions in financial affairs has become a challenging and inevitable subject that has attracted a wide range of practitioners' attention. Especially after the Paris Agreement, the concept of carbon risk has gained a specific place among financial decisions and has become increasingly material following the implementation of environmental restrictions and policies.

As a result, with the rapid growth of green bonds as one of the most innovative and successful financial instruments in the field of sustainability, related research has increasingly come into the spotlight, particularly studies examining the spillover effects of green bond issuance on other financial markets such as the stock market.

Assessing the stock market reaction to green bond issuance has been one of the pivotal subjects in this field over the last decade. Hence, the main goal of this thesis is to analyze the market reaction to announcements of green bond issuances. Although there are a few studies in this regard, their results have been somewhat conflicting. On the other hand, limited data, especially in early studies, as well as the emerging nature of the green bond market, have created significant opportunities for further research.

This thesis contributes to the expansion of the literature by using a relatively richer and more diverse set of sample data. Access to a larger dataset has enabled us to reexamine the findings of previous studies and assess their generalizability by focusing on non-financial corporate green bonds, comparing the results with the U.S. and European markets in particular, and taking into account various economic conditions.

To achieve these goals, data have been extracted from the most important datasets such as Bloomberg and Refinitiv. Thereafter, the hypotheses have been examined by applying Event Study and OLS Regression as statistical methods. All tests have been replicated across seven event windows and smaller subsamples as robustness checks. Furthermore, the crisis period has been excluded and analyzed separately to capture the effects of COVID-19. The findings from the pre-COVID subsamples have been used as a comparison criterion with the results of previous studies.

In addition, In the examinations of the second and third hypotheses, using OLS regression, various kinds of CARs for different event windows have been applied as dependent variables. Moreover, the total ESG score and the environmental (E) factor scores of the companies have been used as dependent variables in the second model. All in all, 14 regression models have been estimated for the second hypothesis and 7 models for the third.

The findings of the Event Study method (first hypothesis) show that, at the level of the total sample, the stock market reaction to green bond issuance is negative and significant. This result is in the same direction as the H_{1b} hypothesis and the findings of some previous studies (Lebelle et al., 2020; e.g. Yu et al., 2025). For instance, an average decrease of 0.54 percent in CAR is observed in the event window of [-1, +1] with a t-statistic of -2.31. Moreover, it is indicated that the first issuance of the bond triggers a more negative reaction (on average, a -1.11% decrease in CAR is recorded in the [-1, +1] window with a t-statistic of -2.72).

But the pre-COVID data analysis (before 2019) demonstrates that the market reaction is positive and significant. This result is also consistent with the H_{1a} hypothesis and the findings of most previous studies (Such as Ahmed et al., 2024; Flammer, 2021; Tang & Zhang, 2020; Wang et al., 2020). Moreover, several studies (Including Ahmed et al., 2024) have emphasized the necessity of analyzing the COVID period separately as a time of crisis in order to obtain more accurate results.

In the second hypothesis model, the OLS regression results show that the higher the ESG score, the more positive the market reaction to green bond issuance is; especially when the company's environmental factor (E) is at a higher level. This finding confirms the H_2 hypothesis.

In the third hypothesis model, the findings also show that the pre-issuance experience of green bonds has a positive and significant effect on the equity market reaction during the crisis. The result supports and confirms H_3. Furthermore, the findings show that green bond reissuance receives a weaker market reaction, which is in compliance with the Event Study findings and previous studies. The Crisis variable did not record significant results, except in one model where the effect was negative. The combination of these results indicates the negative impact of the crisis on the market reaction.

7.2 General Conclusion

As a whole, we can conclude that under normal conditions, the stock market reaction to green bond announcements is positive and significant. However, during crises or unusual conditions, it may move in the opposite (negative) direction due to changes in market priorities, increased risk aversion, and decreased investor trust.

What is more, the findings suggest that the first issuance of green bonds elicits a more intensive market reaction, as the signal is new. Additionally, corporate experience in ESG ratings plays a determining role in the intensity and direction of the market reaction. In

other words, the higher the ESG performance of the firm, the more positive the reaction it receives.

The findings of this thesis show that prior experience of firms in issuing green bonds may act as a type of market trust insurance, such that in crisis situations, this experience helps rebuild investors' trust and leads to a more positive reaction from the market.

7.3 Implications

This thesis contributes to the development and expansion of knowledge in this research field by addressing the stock market reaction to green bond announcements during the COVID-19 crisis, and by analyzing the role of ESG in this context, focusing on the U.S. and European markets.

The research results are useful for various stakeholder groups:

- For investors to adopt optimal strategies under different market conditions.
- For researchers and practitioners as a guide to expand future research in this field.
- For regulators and policymakers to develop encouraging and supportive policies in the green bond area.
- For corporates to select appropriate financing methods and improve their brand image.

and ultimately enhance public trust in sustainable financial instruments.

7.4 Limitations

The sample size is still limited due to the recent adoption of green bonds as a standard financing tool. Despite a substantial increase in green bond issuance since 2014, the total number of corporate issuers remains limited in comparison to traditional bonds. This study depends on foreign data, which may result in discrepancies in ESG rating methodology, and regulatory frameworks among nations. This global perspective provides extensive knowledge but constrains the capacity to derive country-specific conclusions.

Only a few markets, such as China, Europe and America, currently have enough issuers to support national-level studies. Third, the analysis uses the standard event study methodology, presuming market efficiency and that abnormal returns can be attributed directly to green bond announcements. Nevertheless, in real scenarios, other factors—such as macroeconomic conditions, market sentiment, and firm-specific information—may obscure these results. Ultimately, though the study considers COVID-19 an external shock, its effects differed significantly between industries and regions. This diversity may influence the generalizability of findings concerning market reactions during crises.

7.5 Future Research

Some limitation of this thesis may smooth the rout for the future researches. It, in fact, can facilitate complementary studies in this field. For instance, re-examination of this thesis results is still quite justifiable if there are more data in various economic conditions at future.

As well as, applying other models in asset pricing, such as Fama & French, CAPM, and similar approaches, it may provide new research incentives and help a deeper understanding of market reaction dynamics.

Regarding ESG, examining other factors such as Social and Governance dimensions, and evaluating their impacts on market reaction in the presence of other control variables, such as accounting indicators like ROA and ROE, could represent a promising direction for future research in this area.

Besides, in the line of the third research model development, the interaction term of the Size variable and the Crisis dummy variable could be assessed. This combination can be considered as a foundation for new studies aimed at a more precise analysis of market reactions during crisis periods.

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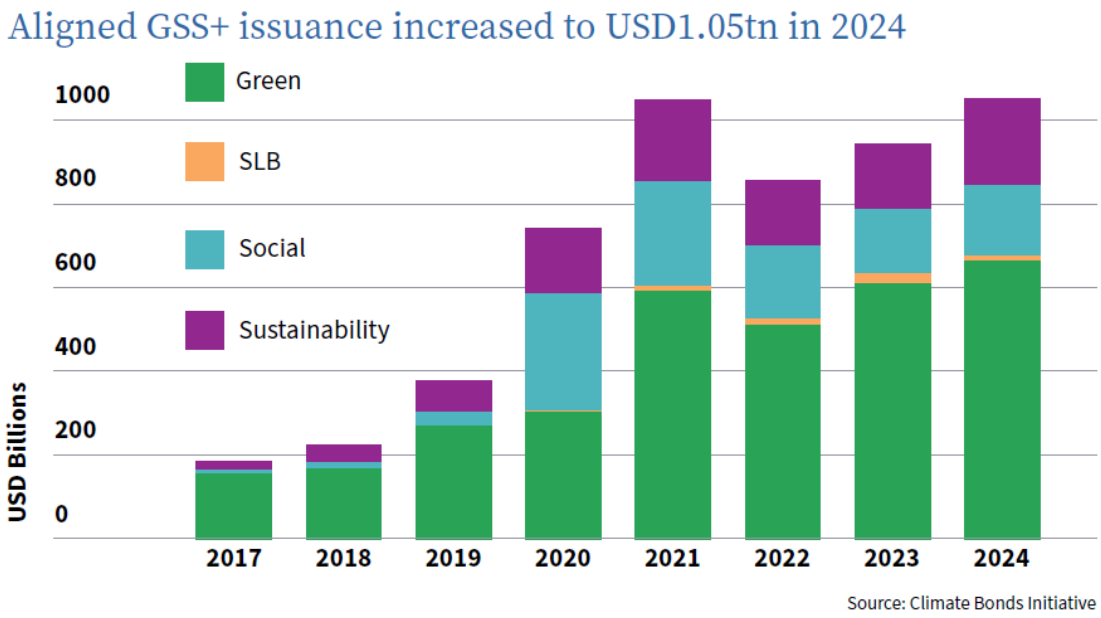
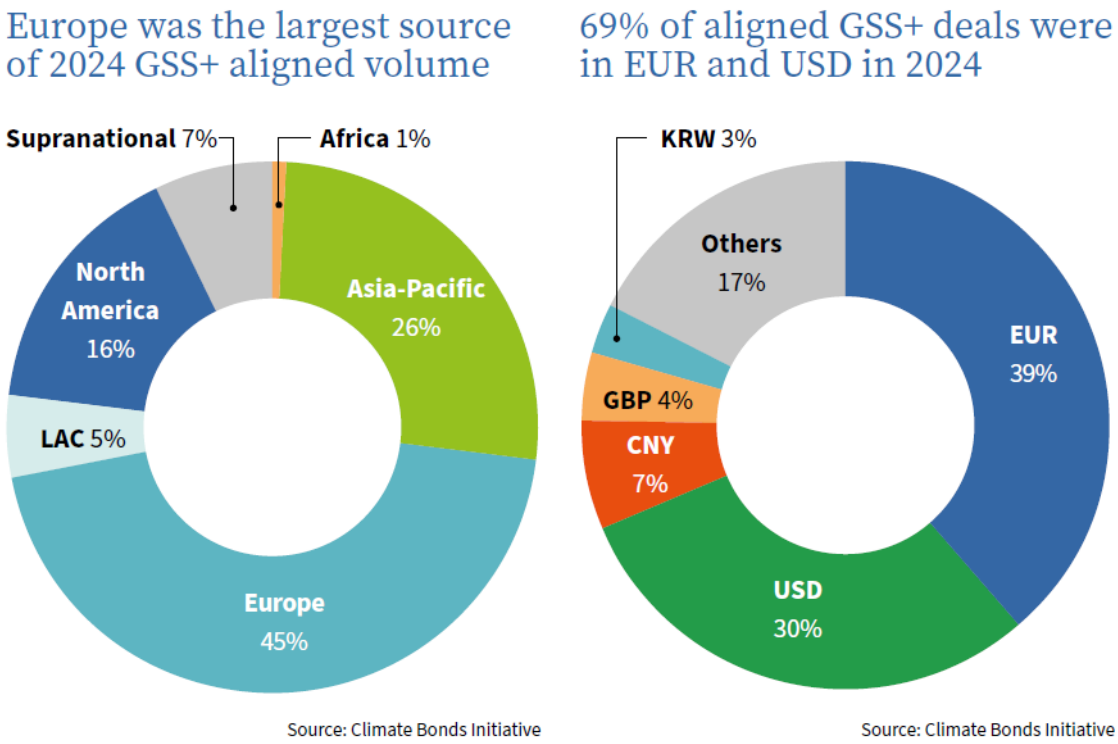
Appendices

Appendix 1. Aligned GSS+ issuance increased to USD1.05tn in 2024 (Climate Bonds Initiative, 2025, p. 3)



Appendix 2. Europe was the largest source of 2024 GSS+ aligned volume (Climate Bonds Initiative, 2025, p. 3)



Appendix 3. Green Bond Issuance by country 2007-2025 (Refinitiv Report, August 12, 2025)

Country	Total_Count	Country	Total_Count	Country	Total_Count	Country	Total_Count
Argentina	58	Greece	4	Morocco	4	South Korea	428
Australia	109	Hong Kong	355	Netherlands	40	Spain	44
Austria	113	Hungary	29	New Zealand	54	Sweden	860
Belgium	38	India	51	Nigeria	3	Switzerland	247
Brazil	155	Indonesia	1	Norway	438	Taiwan	179
Canada	116	Ireland	655	Peru	4	Thailand	80
Chile	5	Israel	2	Philippines	12	Turkey	2
China	1,574	Italy	63	Poland	25	United Arab Emirate	3
Colombia	13	Japan	765	Portugal	6	United Kingdom	491
Czech Republic	2	Kenya	1	Romania	3	United States	729
Denmark	46	Latvia	8	Russia	14	International	1,045
Finland	23	Luxembourg	922	Singapore	225	**Total**	**12055**
France	354	Malaysia	57	Slovakia	13		
Germany	1,513	Mexico	31	South Africa	43		

Appendix 4. Regression Results – ESG_E and CAAR (USA & Europe, 2014–2025, N = 407)

Variable	[–5,+10]	[–5,+5]	[–10,+10]	[–1,+1]	[0,+1]	[+1,+5]	[+1,+10]
Intercept	–31.42***	–7.28	–28.59***	–1.82	–4.77**	–7.85**	–31.99***
	(–5.08)	(–1.29)	(–3.99)	(–0.67)	(–2.65)	(–2.23)	(–6.93)
ESG_E	0.13***	0.06**	0.11***	0.04***	0.03***	0.03**	0.10***
	(4.86)	(2.46)	(3.68)	(3.60)	(4.20)	(2.23)	(5.21)
Size	1.34***	0.44	1.30***	0.08	0.19	0.54**	1.44***
	(3.84)	(1.38)	(3.23)	(0.55)	(1.88)	(2.72)	(5.52)
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	407	407	407	407	407	407	407
R-squared	0.54	0.29	0.40	0.18	0.19	0.37	0.64
F-statistic	38.21***	13.50***	21.60***	7.05***	7.89***	19.02***	57.66***

*Note: All regression coefficients are expressed in percentage terms. values are rounded to two decimal places for presentation. ***, ** and * indicate statistical significance on a 1%, 5% and 10% level.*