Chathuri Mahishika Thalagahawatta

Reaction of Share Prices to Announcement of Green Bond Issuance in Europe

A study analysing the impact of financial leverage

School of Accounting and Finance
Accounting and Finance
Master's Degree Programme in Finance

Vaasa 2026

UNIVERSITY OF VAASA
School of Accounting and Finance
Author: Chathuri Mahishika Thalagahawatta
Title of the thesis: Reaction of Share Prices to Announcement of Green Bond Issuance in Europe A study analysing the impact of financial leverage
Degree: Master of Science in Economics and Business Administration
Degree Programme: Master's Degree Programme in Finance
Supervisor: Vanja Piljak
Year: 2026 **Pages:** 81

ABSTRACT:
Green bonds is a concept with immense popularity in present business context, given the increased need for the corporates to operate in an environmental friendly manner, in order to ensure long term survival in the market. When analysing the previous studies conducted on the same arena, it was understood that most of the studies were done at a global level. Accordingly, given the significant position Europe holds in terms of green bonds, a research gap was identified due to limited number of studies focusing on the Europe region. Therefore, this thesis primarily aims at understanding the share price reaction to green bond issuance announcements in Europe, while focusing on evaluating whether the financial leverage of corporates accounts for any impact on this stock price reaction. This reaction was evaluated using a sample of 93 green bond issuance announcements in Europe for the period from year 2014 to year 2024.

The event study methodology was used in the thesis to evaluate this relationship between the stock price reaction and the green bond issuance announcements, while calculating the cumulative abnormal returns across an array of event windows selected for the study. The Wilcoxon signed rank test was used to evaluate the significance of the results derived from the event study methodology and the regression analysis was also conducted to understand whether any company or bond specific characteristics have an impact over this stock price reaction to green bond issuance announcements.

The results derived from the event study were not statistically significant across all the event windows identified, suggesting that the stock market does not necessarily reacts to the green bond issuance announcements by publicly listed non-financial corporates in Europe. The regression analysis conducted also generated insignificant results showcasing that the independent variables, which includes the company and bond specific characteristics do not hold a material impact on the reaction of stock prices to green bond issuance announcements. These results can be interpreted with the prominent position Europe holds in the green bond market making green bond issuance mostly a routine task or a norm in the market.

The findings of this study, contribute to the literature while facilitating the understanding on how the markets in which being environmental friendly has been a part of its daily tasks, react to these eco-friendly events such as green bond issuance announcements. Also, this facilitates the company managers in incorporating the understanding on stock market reaction to green bond issuance announcements to day to day corporate decision making, while exploring innovative ways through which the corporates can be more favourable towards the environment and community.

KEYWORDS: green bonds, sustainable finance, event study, Europe, market reaction, leverage

Contents

Tables

1 Introduction

With the ever increasing negative consequences on the natural environment from factors such as green-house gas emission and increasing carbon foot print, a majority of individuals and organisations are currently more inclined towards ways and means through which these negative consequences can be mitigated while ensuring sustainable environmental practices. From year 1990 to year 2021 the growth in global greenhouse gas emission was a 51%, with this increasing emissions leading to negative consequences such as global warming, storms, floods, fires, and heatwaves (Ge et al., 2024). In year 2019, the outdoor air pollution was estimated to have resulted in 4.2 million premature deaths worldwide (World Health Organization, 2024). By the first quarter of 2025 the European Union (EU) greenhouse gas emissions were estimated to have a 3.4% increase from the same quarter of 2024, with the two economic sectors namely, electricity, gas, steam and air conditioning supply (+13.6%) and households (+5.6%) showcasing the most significant year on year increases (Eurostat, 2025). Increases in greenhouse gas emissions were estimated for twenty EU countries, with the remaining seven EU countries were estimated for a decrease, by the first quarter of 2025 compared to the same quarter of 2024. From the twenty countries, Bulgaria, Czechia, Cyprus, Poland, Hungary, and Greece were estimated to have more than 5% emission increments, whereas for Malta (-6.2%), Finland (-4.4%), and Denmark (-4.3%), the largest reductions in the greenhouse gas emissions were estimated (Eurostat, 2025).

Driven by this increasing emission of carbon dioxide gasses to the natural environment, several initiatives such as the Paris Agreement and Sustainable Development Goals came into effect requiring the companies to change its business practices and shift towards more climate and environment friendly projects that would have a favourable impact on the natural environment (Bhutta et al., 2022). Accordingly, in order to finance these environment friendly projects, the Green Bonds came into light. Green Bonds are similar to conventional bonds in every aspects except for the fact that the proceeds from green bonds will be used for projects resulting in benefits over the environment (Agliardi & Agliardi, 2021).

1.1 Background and Motivation

Driven by the growing concern towards the environmental and social problems, the businesses started incorporating the Environmental, Social, and Governance aspects to its corporate policies, since the end of the 20th century (Bhutta et al., 2022). Accordingly, the concept of Green Bonds also started to get its prominence, since the proceeds from these financial instruments will be utilized to finance green projects which create a favourable impact over the environment, such as reducing the carbon dioxide emission and preventing pollution (Tang & Zhang, 2020).

The world's first green bond was issued by the European Investment Bank in year 2007 and this was called a "climate awareness bond" (Tang & Zhang, 2020). Followed by this, the World Bank issued its first green bond in year 2008 (Climate Aligned, 2025). In the year 2013 the first corporate green bond was issued by a French electricity generating firm, with the aim of raising funds for a technologically advanced climate friendly project (Bhutta et al., 2022). The green bond market witnessed an immense growth since 2015, with annual issuance volumes surging from USD40 billion in year 2015 to USD500 billion in year 2021 (Climate Aligned, 2025). During this period the corporate participation also started to get broadened across sectors from automotive to telecommunication (Climate Aligned, 2025). As per ICMA (2025), in year 2024 from the total sustainable bond issuance per category, the Green category holds the highest percentage of 57.54%. Accordingly, it is understood that this growing popularity of green bonds concept makes it a valuable area to conduct a study upon.

According to ICMA (2025), when the green bond issuance is considered in terms of the regions, in year 2024 out of the total green bond issuance, 56.97% of the issuance was from the Europe region and this was followed by Asia (17.23%), North America (12.70%), Supranational (9.22%), Oceania (2.81%), and South America (0.95%), respectively. From these figures it is evident that the Europe region holds a significant position in terms of the green bond issuance, being the region with the highest issuance percentage against the rest of the regions.

Accordingly, the motivation of this study is to understand the reaction of share prices to the green bond issuance announcement in the region of Europe, while understanding if the leverage of the respective corporates accounts for any impact over this relationship. When a company issues a green bond, a positive signal is sent to the stock market on the company's commitment towards the environment and accordingly the stock market reacts positively to this signal in return (Flammer, 2021).

1.2 Purpose of the Thesis

This thesis aims at understanding the reaction of share prices to the announcement of green bond issuance by the corporates in the Europe region, while understanding if the financial leverage of the corporates holds any impact over this relationship.

The green bonds market size globally is expected at USD699.11 billion in year 2026 with a cumulative annual growth rate of 3.86% to reach a figure of USD844.61 billion by year 2031 (Mordor Intelligence, 2026). Given this growth trajectory of the green bonds market, conducting an analysis on share price reaction to green bond issuance announcement by corporates will be value adding both in the present and future business contexts. Understanding whether the existing shareholders of the green bond issuing firms can benefit from the issuance is of utmost importance, since this information will be valuable for the further development of green bond market and impact investing (Tang & Zhang, 2020).

Moreover, this study is concentrated to the Europe region, given the significant position the region holds in terms of green bonds. According to European Environment Agency (2025), by year 2024, the green bonds reached 6.9% of the total bonds issued by corporates and governments in the European Union and this is an uptick from the 5.3% in year 2023. Also, by year 2024 Europe holds the highest share (56.97%) of green bond issuance per region (ICMA, 2025). This suggests the prominence Europe holds in terms of green bonds market.

Further, for this analysis the green bonds issued by all the publicly listed non-financial corporates in Europe are considered, given the present world's increasing inclination towards the corporate green bonds. The total amount of corporate green bonds issued increased from USD5 billion in year 2013 to USD95.7 billion in year 2018, showcasing a significant growth, and this trend is expected to continue driven by the popularity of sustainable finance (Flammer, 2021).

1.3 Research Hypotheses

This thesis primarily focuses on understanding the share price reaction to green bond issuance announcement by corporates in the Europe region while analysing whether the leverage of the respective corporates has any impact on this relationship.

Though several value adding studies have been conducted in past on understanding the reaction of share prices to green bond issuance announcements by corporates, most of those studies were covering green bond issuance globally, creating a gap in the studies conducted focusing on the Europe region. By using a comprehensive dataset covering the total corporate green bond issuance worldwide, the results showed that the issuing companies' stock prices increase predominantly around the announcement of green bond issuance (Tang & Zhang, 2020). As per ICMA (2025), region wise, Europe accounts for 56.97% of green bond issuance in year 2024. Given this significant position Europe holds in terms of the green bonds, this thesis focuses on the Europe region, thereby addressing the gap of fewer studies existing concentrating on the European region.

Further, the previous studies conducted analysing how the stock market reacts to the corporate green bond issuance announcement have generated mixed results with some studies concluding that there is a positive reaction in the share prices around the green bond issuance announcement (Flammer, 2021), whereas some other studies suggesting

that there is a negative reaction of the share prices to the green bond issuance announcement (Lebelle et al., 2020). Accordingly, this thesis aims at understanding whether this reaction of share prices to green bond issuance announcement would be a positive, a negative, or a neutral in terms of the European region. Also, this thesis expects to analyse whether the green bonds issuing companies' financial leverage aspect will have a considerable impact over the share price reaction to the green bond issuance announcement.

Accordingly, to understand the reaction of share prices to green bond issuance announcement in Europe the below research hypotheses are tested.

H_0: The value of the share does not react to the announcement of the green bond issuance in Europe.

If the null hypothesis holds, it means that the share price does not react at all to the green bond issuance announcement in Europe. However, as per the previous studies conducted on this same arena, the results have communicated that, there is a share price reaction to the green bond issuance announcement. Therefore, the main research hypothesis is as below:

H_1: The value of the share reacts to the announcement of the green bond issuance in Europe.

In order to further evaluate the main research hypothesis, the potential share price reactions are divided into below listed first two hypotheses, with the third hypothesis listed below aiming at testing the financial leverage impact on these share price reactions:

H_2a: The value of the share reacts positively to the announcement of green bond issuance in Europe.

H_2b: The value of the share reacts negatively to the announcement of green bond issuance in Europe.
H_2c: The financial leverage of the corporate has an impact on the reaction of the value of the share to the announcement of green bond issuance in Europe.

H_2a hypothesis aims at understanding whether the green bond issuance announcement creates shareholder value with increasing share prices. The cumulative abnormal returns are calculated with this regard around the green bond issuance announcement. This hypothesis is driven by the assumption that the green bond issuance by a corporate generates a signal to the stock market on the corporate's commitment towards the environment and as a result the stock market reacts positively to this signal (Flammer, 2021).

H_2b hypothesis aims at understanding whether the green bond issuance announcement diminishes the shareholder value with decreasing share prices, in terms of negative cumulative abnormal returns around the announcement date. This is driven by the assumption that when the green bond issuance announcement was made by the company, investors may sometimes incorporate this announcement with increased levels of uncertainty since they are not fully certain on whether this new business model will remain as profitable as it has been so far (Lebelle et al., 2020).

The H_2c hypothesis aims at understanding whether the financial leverage of companies holds an impact over the stock price reaction to green bond issuance announcements. According to Lebelle et al. (2020), positive impact from leverage on stock market reaction to green bond issuance announcements has been realised, while stating that higher leverage indicates relatively lower financial constraints for the company with better debt market access.

1.4 Contribution of thesis

When previous researches conducted on the same area are concerned, a majority of those were focusing on the green bond issuance at a global level (Flammer, 2021; Tang & Zhang, 2020). Given the significant position the Europe region holds in terms of green bonds, this study focuses on understanding the stock market reaction to the green bond issuance announcement in Europe. During the period from year 2013 to year 2018, corporate green bonds were mostly prevalent in China, the United States (US), and Europe, with the Netherlands, France, and Germany dominating as the larger issuers in dollar terms (Flammer, 2021).

Also, this thesis is primarily focusing on the green bond issuance announcements by all the publicly listed non-financial corporates in Europe. According to Tang & Zhang (2020), only the corporates conducting green projects witness the benefits from increased firm valuation due to green bond issuance announcements, whereas for the financial institutions issuing the green bonds, insignificant stock market reactions were identified, as they issue these bonds to provide green loans to their borrowers, or to invest in other firms' green projects and not in their own. Accordingly, this thesis while focusing on the non-financial corporates, generates a value adding contribution to the existing literature given the significance these non-financials hold in terms of the relationship between stock market reactions to green bond issuance announcements.

Moreover, this research also looks at whether the financial leverage of the respective corporates making the green bond issuance announcements holds an impact over the stock market reaction to the green bond issuance announcement.

1.5 Structure of thesis

In the following chapters of the thesis, a detailed explanation on the bonds and green bonds specifically is presented while analysing the bond pricing as well. Followed by this,

a chapter on stock valuation is included providing an in depth discussion on concepts such as stock pricing techniques and other theories and models related to securities. Afterwards, the literature review section is included where value adding literature in terms of green bonds, environmental performance of firms and its impact on firm value, and the stock price and green bond relationship has been pointed out. This is followed by the chapter which focuses on the data collected for the research and the methodology chapter, which describes the event study methodology used together with a discussion on significance tests and regression model adopted. The empirical findings section is included thereafter, in which the results derived from the event study and the regression analysis are discussed while providing an overall summary of results together with incorporating previous literature. Finally, the conclusion chapter is included with concluding remarks on the study and areas for future research.

2 Overview of bonds

A bond is a security issued in terms of a borrowing arrangement, in which the borrower issues the bond to the lender in exchange of a certain amount of cash, and in return the issuer gets obliged to make specified payments to the bondholder on specified dates, in addition to the face value of the bond paid to the lender at bond's maturity (Bodie et al., 2018, p. 426). These bonds are issued by a wide array of groups including the corporates and governments and in this thesis the focus is on corporate bonds and here the green bonds issued by the non-financial publicly listed corporates in Europe, are considered.

In this chapter the bond features, risks of bonds, bond pricing, and credit rating agencies are discussed, as understanding these concepts is important, since this knowledge can be applied to green bonds as well.

2.1 Bond features

A bond can be termed as a debt instrument which requires the issuer of the bond to repay the lender or the bondholder the amount borrowed together with the interest over a specific time period (Fabozzi, 2000, p. 1). When analysing bonds, a proper understanding on bond indentures is of importance. An indenture can be defined as a legal agreement between the bond issuer and the bondholder, specifying all the terms of the bond agreement (Chen, 2025). This constitutes the bond's issuer type, maturity date, par value, coupon rate, and some other restrictions such as provisions relating to collateral, dividend policy, and further borrowing which protect the rights of the bondholders (Bodie et al., 2018, p. 426-453).

One of the prominent features of a bond is the type of the issuer. There are several issuers of bonds including the sovereign governments and their agencies, local government authorities, supranational bodies such as the World Bank, and corporations (Choudhry, 2010, p. 22-24).

Another feature of a bond is the term to maturity. This is the period over which the bond will exist before its expiry. This is the duration over which the issuer has promised to meet the conditions of the bond towards the bondholder and from the maturity date onwards the respective bond will cease to exist with issuer redeeming the bond by paying the principal to the bondholder (Fabozzi, 2000, p. 3). The factors such as the bond yield and the bond price volatility also depend on the maturity of the bond, whereas, longer the maturity greater the bond price volatility would be resulting from changes in market yields (Choudhry, 2010, p. 22-24). The yield to maturity represents the interest rate that would make the present value of all the future cash flows/the payments of the bond equal to its price or this is the average rate of return a bondholder will receive if the bond is purchased now and held until its maturity (Bodie et al., 2018, p. 438).

The principal of the bond is referred to the amount that the bond issuer agrees to pay the bondholder when the bond reached its maturity and this is also termed as redemption value, maturity value, par value, or face value (Fabozzi, 2000, p. 3).

The coupon rate or the nominal rate is the interest rate that the bond issuer agree to pay to the bondholder each year, over the lifetime of the bond, and in terms of the US and Japan, this coupon is paid in semi-annual instalments and in European bond market and the Eurobond market the practice is to make the coupon payments once a year (Fabozzi, 2000, p. 3-4). Also, there are zero coupon bonds and in this type the holder buys the bond at a price substantially below the principal value of the bond and at the maturity the holder realizes the interest with that amount being the difference between the bond's principal value and the price paid for the bond initially (Fabozzi, 2000, p. 3-4).

2.2 Risks of bonds

There are several risks related to the bonds and under this part of the chapter, the interest rate risk, the default risk, and the inflation risk are discussed.

The change in interest rates will result in a significant risk to the bondholders. The interest rate and the price of the bond is inversely related with increasing interest rates leading to decreasing bond prices and vice versa (Fabozzi, 2000, p. 6). Bondholders are likely to witness a capital loss in the event of selling the bonds if the bond prices have gone down due to increasing interest rates and this interest rate risk is identified as the most significant risk faced by an investor in the bond market (Fabozzi, 2000, p. 6).

The default risk or the credit risk is another important risk criteria especially in terms of the corporate bonds. Corporate bonds differ mostly from the treasury bonds in terms of the default risk consideration associated with corporate bonds (Bodie et al., 2018, p. 38). This is the risk that the bond issuer being unable to make the timely interest payments and principal payment of the bond to the bondholder due to getting default (Fabozzi, 2000, p. 7). The default risk of corporates can be determined by the quality ratings assigned by rating companies such as Moody's Investors Service, Standard & Poor's Corporation, Duff & Phelps Credit Rating Company, Fitch IBCA, and credit research staffs of security firms (Fabozzi, 2000, p. 7). A further discussion on these credit rating agencies will be done in a latter section of this chapter.

The inflation risk arises when the purchasing power of the bond's cash flows changes due to changes in the inflation rate, whereas if the inflation rate is higher than the coupon rate of a bond, the bondholder encounters a disadvantageous situation as the overall purchasing power of the bond cash flows has declined (Fabozzi, 2000, p. 7). However, for floating rate bonds this inflation risk will be relatively lower, given the extent to which the interest rates reflect the expected inflation rate (Fabozzi, 2000, p. 7).

2.3 Bond pricing

When pricing a bond the focus should be given to the future cash flows getting generated from that bond and an appropriate required yield in order to discount the future cash flows to the present value (Fabozzi, 2000, p. 19). The future cash flows arising from a

bond are the periodic coupon payments and the bond's principal being paid at the maturity. Therefore, the price of a bond will be the summation of the present value of coupons and the present value of the principal or par value of the bond (Bodie et al., 2018, p. 432).

Accordingly, the formula for valuing a bond is as follows:

$$P = \sum_{t=1}^{n} \frac{C}{(1+r)^t} + \frac{M}{(1+r)^n} \quad (1)$$

Where,

P=Price

n=Number of periods

C=Coupon payment

r=Periodic interest rate

M=Maturity value

t=time period when the payment is to be received (Fabozzi, 2000, p. 20)

In order to calculate the present value of the coupon payments, the annuity factor can be considered, and the summation of the present values of the coupon payments can be derived by multiplying the coupon by the annuity factor, whereas in order to derive the present value of the bond's principal, the principal can be discounted using the periodic interest rate, since it is a single payment (Bodie et al., 2018, p. 432).

The bond price and the required yield are inversely related and whenever the required yield increases the bond price decreases, resulting in a risk for the bondholders (Fabozzi, 2000, p. 23). The main source of risk in terms of fixed income securities can be identified as interest rate fluctuations (Bodie et al., 2018, p. 435). Also, with regard to bond's maturity, if a bond has a relatively longer maturity period, that bond's price is more sensitive to the interest rate fluctuations compared to a bond with a relatively shorter maturity period (Bodie et al., 2018, p. 432).

2.4 Credit rating agencies

The main distinguishing factor of the corporate bonds from treasury bonds is the level of risk associated, with default risk being a major consideration with regard to corporate bonds (Bodie et al., 2018, p. 38). Default risk or credit risk arises from corporates not being able to make the coupon payments and the principal payment to the bondholders on time. There are three leading credit rating agencies namely Moody's, Standard & Poor's (S&P), and Fitch Ratings, which provide credit ratings to the companies while analysing the level of default risk associated. When making a decision to invest in a bond of a particular corporate, the investors are highly likely to refer these credit ratings, in order to determine whether the investment is worthwhile to make or not (Fabozzi, 2000, p. 149).

Table 1 presents the rating scales of the three leading credit rating agencies as below (Moody's, 2025; S&P Global, 2025; Fitch Ratings, 2025):

Table 1. Credit ratings.

Moody's	**Standard & Poor's (S&P)**	**Fitch**	
Aaa Aa A Baa	AAA AA A BBB	AAA AA A BBB	Investment Grade
Ba B Caa Ca C	BB B CCC CC C D	BB B CCC CC C RD/D	Speculative/ Non-Investment Grade

According to Moody's (2025), Aaa rating is an indicator for the highest quality and the lowest credit risk level in terms of the issuers or obligations, whereas Aa and A ratings are also associated with relatively low credit risks. Baa rating is medium grade and is associated with moderate credit risk with the likelihood of possessing some speculative features in it. Ratings from Ba to C represent substantially increasing credit risks with Ca and C ratings depicting a near default or default with least chances of recovering the principal or interest (Moody's, 2025). With regard to S&P ratings also, AAA rating indicates the highest capability to meet the financial commitments, with AA and A rating also showcasing a strong capability (S&P Global, 2025). BBB rating depicts an adequate capability to meet the financial commitments and from BB rating onwards a gradual increase in the vulnerability is shown, with D rating representing a payment default or a situation when a bankruptcy petition has been filed (S&P Global, 2025). According to Fitch Ratings (2025), AAA rating depicts the highest credit quality similar to the other two rating agencies, and AA and A ratings are also showcasing a high level of credit quality, while BBB representing adequate or good credit quality. Starting from BB rating onwards the vulnerability starts to gradually increase with C to D ratings depicting a near default or a default situation (Fitch Ratings, 2025).

With regard to classification as investment grade and speculative grade, the ratings in the investment grade reflect low to moderate credit risk and the rating in the speculative grade depicts high level of credit risk or a situation of default (Fitch Ratings, 2025).

3 Green bonds

At present, a majority of the corporates are engaging in their business practices while incorporating the Environmental, Social, and Governance (ESG) standards into their policies and strategies, as the companies have currently realized that how important it is to operate with favourable impacts on all of the stakeholders around them, in order to ensure long term survival in the market.

The negative reaction of investors to a company's negative news on Corporate Social Responsibilities (CSR) is more significant, if the news released is related to the environment or communities (Kruger, 2015). This means that the investors consider the companies' stance on environment very seriously and therefore the management and the employees at a corporate cannot undertake the business tasks while ignoring the impact of their business activities on the environment. The companies are increasingly adopting measures to operate in an environmental friendly manner, whereas the stock market tends to react positively to announcement of eco-friendly initiatives by the companies and negatively to eco-harmful initiatives, with this negative stock market reaction increasing over time (Flammer, 2013).

Accordingly, in order to go green and preserve the natural environment, one of the major practices being adopted by today's companies is issuing green bonds. These green bonds are similar to the other conventional bonds being issued by a corporate, except for the fact that the proceeds from these green bonds will be used to finance or refinance green projects of the corporate (Agliardi & Agliardi, 2021; ICMA, 2025). These green projects could include projects on renewable energy, sustainable water management, pollution prevention, and climate change adaptation (Tang & Zhang, 2020).

3.1 Green bond principles

Green Bond Principles (GBP) can be termed as a voluntary guideline originated in year 2014, and this was established by investment banks including Bank of America Merrill Lynch, Citi, JPMorgan, BNP Paribus, and HSBC (Tang & Zhang, 2020). Since 2014, the International Capital Market Association (ICMA) serves as the Secretariat undertaking the administrative duties and offering guidance for the green bond principles governance and other issues (ICMA, 2014).

As per ICMA (2025), GBP can be defined as voluntary process guidelines recommending transparency and disclosure for the issuers, while facilitating integrity in the green bond market development through the clarification of the approach for issuing a green bond. These clear processes and disclosure recommendations by GBP help investors, banks, underwriters, arrangers, placement agents, and others to get a good understanding of any green bond (ICMA, 2025).

Below listed are the four core components set by the GBP, in order to emphasise the required transparency, accuracy, and integrity of the information being disclosed and reported by issuers to stakeholders (ICMA, 2025).

1. Use of proceeds
2. Process for project evaluation and selection
3. Management of proceeds
4. Reporting

3.1.1 Use of proceeds

The proceeds from green bonds should be utilised to finance or refinance eligible green projects and this utilisation must be appropriately described in the legal documents of the respective security by the issuer (ICMA, 2025). The environmental benefits being

generated from the eligible green projects should be clearly provided by the issuer, while assessing those benefits and as well as quantifying the benefits if doing so is feasible (ICMA, 2025).

The GBP has identified some eligible green project categories that will ultimately contribute towards the environmental objectives such as climate change mitigation, climate change adaptation, natural resource conservation, biodiversity conservation, and pollution prevention and control (ICMA, 2025). The categories are listed below:

- Renewable energy
- Energy efficiency
- Pollution prevention and control
- Environmentally sustainable management of living natural resources and land use
- Terrestrial and aquatic biodiversity
- Clean transportation
- Sustainable water and wastewater management
- Climate change adaptation
- Circular economy adapted products, production technologies, and processes
- Green buildings

3.1.2 Process for project evaluation and selection

Under this component, the issuer of a green bond is required to clearly communicate to the investors on the below aspects (ICMA, 2025):

- The eligible green projects' environmental sustainability objectives
- Process used by the issuer in understanding how the green projects fit within the eligible green project categories discussed in the previous section

- Information on processes that the issuer will be using to identify and manage the perceived environmental and social risks associated with the projects in consideration

3.1.3 Management of proceeds

As GBP suggests, the green bond's net proceed or an amount equivalent to the net proceeds must be credited/transferred to a sub account, or to a sub portfolio, or must be tracked by the issuer appropriately, and attested to by the issuer through a formal internal process linked to lending and investment operations of the issuer for eligible green projects (ICMA, 2025). During the lifetime of the green bond the issuer has to adjust the balance of the tracked net proceeds in order to tally that with the allocations made to eligible green projects during the period. Also, the GBP recommends using an external auditor or a third part to verify the internal tracking process and the green bond proceeds allocation by the issuer (ICMA, 2025).

3.1.4 Reporting

The green bond issuers are required to maintain annual reports on the use of green bond proceeds and these reports must include the project list to which the green bond proceeds have been allocated, a brief description of those projects, the allocated amounts together with their expected impact (ICMA, 2025). These reports should have timely information with the information being renewed annually until full allocation, and on a timely basis with regard to material developments (ICMA, 2025).

Meantime, the GBP has established some key recommendations in order to ensure high level of transparency and those are (ICMA, 2025):

- Green bond frameworks: The green bond issuers are required to maintain a framework or a legal documentation explaining their green bond or green bond

programme alignment with the four core components of GBP discussed above, and this should be available in a readily accessible format for the investors to refer

- External reviews: In terms of the pre issuance of the green bond, it is recommended by GBP for the issuers to have an external review provider to assess the alignment of the issuer's green bond or the green bond programme with the four core components of GBP. In terms of the post issuance, the recommendation is to have an external auditor or a third party to verify the internal tracking conducted by the issuer and the allocation of green bond proceeds to eligible green projects.

3.2 Development of green bond market

The corporates are increasingly focusing on operating in an environmental friendly manner, as currently all the stakeholder of a company including especially the investors are more concerned about what kind of a stance the corporates hold in terms of the environment. It can be argued that, this is led by the increasing environmental issues such as climate change, environmental pollution, and biodiversity destruction. According to World Health Organization (2024), the percentage of people getting exposed to extreme heat is growing significantly due to climate change, across all regions of the globe. According to Flammer (2013), the stock market tends to react positively to announcement of eco-friendly initiatives by the companies and negatively to eco-harmful initiatives, with this negative stock market reaction increasing over time.

In order to ensure that the corporates operate in an environmental friendly manner, they adopt several practices and one such practice is issuing green bonds, out of which the proceeds will be utilised for environmental friendly projects. The first green bond was issued by the European Investment Bank (EIB) in year 2007 and this bond was called the "climate awareness bond" (Tang & Zhang, 2020). Followed by this, the World Bank issued its first green bond in year 2008 (Climate Aligned, 2025). In year 2011, when the Climate

Bonds Initiative (CBI) launched the first dedicated certification scheme for the climate bonds termed the “Climate Bond Standard”, the green bonds market started to show a significant growth. And this growth was further facilitated by the publication of the Climate Bond Taxonomy in year 2012, and then with the Green Bond Principles (GBP) publication by International Capital Market Association (ICMA) in year 2014 (Climate Aligned, 2025). In year 2013, the first corporate green bond was issued by a French electricity generating firm, with the motive of raising funds for a technologically advanced climate friendly project (Bhutta et al., 2022). Green bonds market started to grow rapidly since year 2015 with the green bond annual issuance volume increasing from approximately USD40 billion in year 2015 to more than USD500 billion in year 2021 and during this period the corporate participation in the green bonds segment also expanded (Climate Aligned, 2025). The green bonds market crossed the USD100 billion threshold by year 2017 and this was driven by the USD1.5 billion worth green bond issuance by the China Development Bank (Climate Aligned, 2025).

According to CBI (2024), aligned annual volume of the green bond market has reached USD671.7 billion by year 2024 and this was a 9.4% year on year increase. In terms of issuer types, the non-financial corporates have top the list in year 2024 with the aligned issuance from non-financial corporates growing by 30% on a year on year basis (CBI, 2024).

3.3 Green bonds in Europe

The Europe holds a significant and a prominent position in the green bonds market with the world’s first green bond being issued by the European Investment Bank (EIB) in year 2007. This bond was worth EUR600 million and was termed as the “climate awareness bond” (Climate Aligned, 2025).

According to CBI (2024), Europe has dominated the aligned green bond market with accounting for 58% of total aligned green bond volume in 2024 and in value terms this was USD388.4 billion indicating a 17% year on year increase (USD322.3 billion in year 2023). In terms of green bond issuance region wise in year 2024, Europe has accounted for the highest share (56.97%), with Asia (17.23%), North America (12.70%), Supranational (9.22%), Oceania (2.81%), and South America (0.95%) being the followers (ICMA, 2025). As per the European Environment Agency (2025), in the European Union (EU) region the green bond issuance has increased from 0.1% of total bond issuance in year 2014 to 6.9% of total bond issuance in year 2024. The European Green Deal and EU's decarbonisation goals have driven this green bond popularity to a greater extent (European Environment Agency, 2025). The European Green Deal is a growth strategy which aims at transforming the EU's economy for a sustainable future with a goal of achieving zero net emissions of greenhouse gases in year 2050 (European Commission, 2019). Also, in the EU the corporate green bond issuance has also increased from 5.6% of the total corporate bonds issued in year 2020 to 12.8% of total corporate bonds issued in year 2024 (European Environment Agency, 2025). In the EU region, Sweden, Denmark, and France hold the highest proportion of green bond issuance in terms of total bonds issued and this was more than 16% in year 2024 (European Environment Agency, 2025).

3.4 Greenwashing and green bonds

Led by the increasing concerns of the society to protect the environment, at present it is mandatory for the corporates to incorporate policies and strategies to their business practices which are environmental friendly, in order to sustain their reputation in the market (Berrone et al., 2017). Going green has been an institutional norm and as a result if a company does not operate in an environmental friendly manner, that company will be punished for not following the norm and therefore a negative stock market reaction has been realised for eco harmful behaviour by corporates and this negative reaction increases over time (Flammer, 2013). The stakeholders have started to realise that in

order to analyse a particular company not only the financial performance of the company but also the social and environmental performance of that company is needed and as a result the number of corporates publishing sustainability reports covering their social and environmental performance has significantly increased over time (Marquis et al., 2016).

Accordingly, led by the market interest for the companies to go green, sometimes when issuing the green bonds companies are likely to engage in greenwashing. Greenwashing is when a corporate provides misleading information on its environmental commitments to its stakeholder and especially to the investors (Flammer, 2021). The differentiating factor between the green bonds and the conventional bonds is, that the proceeds from green bonds are being used for green projects. However, sometimes a corporate would not comply with this and they will fabricate the information to indicate the stakeholders that the proceeds have been used for a green initiative, and thereby will mislead the stakeholders.

The green labels can be cited as an effective solution to the greenwashing concern. Once a green bond is labelled it provides a proof that the green projects and the internal sustainability plans of the corporate have been verified by a second party (Tang & Zhang, 2020). Driven by this verification the investor confidence would increase on the green bond as it provides a guarantee that the corporate would not undertake any action related to greenwashing. However, obtaining a green label or a certification is costly as it requires the corporate to get a third party verification to prove that the proceeds from green bonds are being directed to eco-friendly projects (Flammer, 2021). A corporate's compliance with the GBP by ICMA, the Climate Bonds Standard by CBI, or the EU Green Bond Standard will be evaluated when providing these certifications. According to CBI (2025), their independent verification requires 95% of the proceeds to align with climate goals and up to 5% of the proceeds can fund projects or assets not completely aligning with eligibility criteria, as long as they meet the ICMA principles.

3.5 Greenium and green bonds

The greenium can be defined as the negative premium realized by the investors for the green bonds issued by a particular corporate compared to the conventional bonds issued by that same corporate (Agliardi & Agliardi, 2021). As a result of this negative premium the green bonds would be relatively expensive for the investors compared to buying conventional bonds from that same issuer and on the other hand this would be favourable to the issuer as their funding cost would be relatively lower in terms of green bonds, due to the negative premium (Agliardi & Agliardi, 2021).

This negative premium gets generated when the green bond price is inside its own yield curve (Agliardi & Agliardi, 2021). According to CBI (2021), in H2 2020 out of 33 green bonds in the sample, 19 were priced inside the yield curve, showcasing the concept of greenium. As per Agliardi & Agliardi (2021), if the firm's core business has a direct benefit from the green project the greenium is relatively higher for those companies compared to the companies in which the green policy is adopted as a part of their sustainability practices.

4 Stock valuation

Under this chapter, the stock valuation and return on stocks will be discussed while analysing the Dividend Discount Model (DDM) as one of the widely used valuation techniques. Moreover, this section would contain a discussion on modern portfolio theory, capital assets pricing model, arbitrage pricing theory, and market efficiency and information asymmetry.

4.1 Stock valuation

As this thesis focuses on the stock market reaction to the green bond issuance announcement, having an understanding on stock valuation techniques is of importance. The Dividend Discounted Model (DDM), the Discounted Cash Flow Model (DCF), the Residual Income Model, and the Method of Comparable can be stated as some of the stock valuation techniques. Out of these techniques the DDM can be cited as one of the most commonly used stock valuation techniques. DDM is a commonly used valuation model by security analysts to value a firm (Bodie et al., 2018).

4.1.1 Return of stock

When an investment is made on a company stock, the returns for this investment get generated in two ways for the investors, and that is in terms of dividends and in terms of capital gains. The DDM will capture the returns generated for the investors in the form of dividends. However, a drawback of DDM is that, some companies would not have the consistency in paying the dividends and sometime instead of distributing the returns as dividends the companies would be inclined towards reinvesting the profits and generating capital gains out of that. Therefore, using this DDM for stock valuation would sometimes not be feasible, if the company in consideration does not pay dividends regularly.

4.1.2 Stock pricing

Under this section the stock pricing will be discussed in terms of the DDM. In this method in order to arrive at the stock value, all the future cash flows to the investors in terms of dividends from the stock will be discounted to its present value. This method of valuation is similar to the bond pricing method discussed in chapter 2 and the only difference is that, with regard to stocks there is an uncertainty of dividends, lack of a fixed maturity date, and unknown sales price at the horizon date (Bodie et al., 2018). Accordingly, when pricing a stock using the DDM, the formula for calculating the present value of a perpetuity can be utilized.

The equation for pricing a stock with constant dividend with no growth is as follows:

$$V_0 = \frac{D_1}{k} \qquad (2)$$

Where,

V_0 = Stock value

D_1 = Future dividend

k = Discount rate (Bodie et al., 2018).

On the other hand if there is a corporate paying dividend with a constant growth rate the equation will be as follows and this equation is termed as constant growth DDM or the Gordon model (Bodie et al., 2018).

$$V_0 = \frac{D_1}{k-g} \qquad (3)$$

Where,

V_0 = Stock value

D_1 = Future dividend

k = Discount rate

g = Constant dividend growth rate (Bodie et al., 2018).

However, if a company is not prioritizing dividends and if they have irregular dividend patterns with reinvestment strategies prioritised, for such companies this DDM would not be the ideal stock valuation technique and in such a situation the companies can adopt other stock valuation techniques namely, the DCF method, the Residual Income method, or the Method of Comparable based on the nature of the business.

4.1.3 Modern portfolio theory

The modern portfolio theory was introduced by Harry Markowitz in year 1952 and this theory explains how the investors can engage in diversification in such a way to maximize their expected returns from the portfolio at a given level of risk.

In the modern portfolio theory an investor should focus on the variance and correlation aspects when investing in a portfolio of securities, in order to achieve the highest expected returns while minimizing the risk (CFI, 2025). Two securities are positively correlated if they move in the same direction and if one security shows a poor performance the other would show the same, accordingly. Therefore, if an investor invests in a portfolio of securities whose correlation is positive, the overall risk or the variance or the standard deviation of the portfolio would be high and this would not be a good portfolio for an investor who wants to maximise the expected return while minimising risk and more specifically the idiosyncratic or the asset specific risk (CFI, 2025).

As Markowitz (1952) pointed out, diversification is not just about investing in many securities, instead in order to minimise the variance the investors should focus on investing in securities across different industries because the companies in different industries, and more specifically in different industries with different economic characteristics have relatively lower covariance than the companies within the same industry.

Accordingly, if the investment in a portfolio is done while ensuring low covariance among the securities this would enable the investor to ultimately encounter an overall favourable outcome form the investment, because when one security performs negatively the other would perform positively resulting in an overall positive outcome.

4.1.4 Capital asset pricing model

As discussed in the previous section, the modern portfolio theory focuses on minimizing the idiosyncratic or unsystematic risk (asset or firm specific risk) through diversification and when Capital Asset Pricing Model (CAPM) being discussed in this section is concerned, this model is focusing on managing the systematic risk (market risk) related to a security or an investment.

The CAPM measures the rate of return expected by an investor while compensating for the market risk or systematic risk being borne in making the investment and this can be termed as the market risk premium which is the difference between the market rate of return and the risk free rate of return (CFI, 2025). The beta in the CAPM formula is the indicator for the security's systematic risk. If the security's beta is equal to 1, this means the expected return of the stock is equal to the market rate of return, if the beta is greater than 1, this implies highly volatile stocks with more systematic risk, and the securities with a beta less than 1 shows less volatility with relatively low systematic risk. If the beta is negative, this means the security is negatively correlated with the market (CFI, 2025). According to Sharpe (1964), diversification enables in escaping all the risk except for the risk resulting from fluctuations in economic activity and therefore in assessing the risk only an asset's rate of return responsiveness to the changes in economic activity is relevant. The prices tend to adjust until a linear relationship is achieved between the magnitude of such responsiveness and expected return. Assets unaffected by the economic activity changes are expected to return the pure interest rate, whereas the assets getting affected by the changes in economic activities will guarantee higher expected rates of returns (Sharpe, 1964).

Accordingly, the expected rate of return of a security can be calculated using the CAPM model by multiplying the market risk premium by the security's beta and adding the risk free rate to it.

The CAPM model is being increasingly used at present to calculate the cost of equity and thereby to calculate the Weighted Average Cost of Capital (WACC) for firms, which is an important element in arriving at a stock valuation for an entity.

4.1.5 Arbitrage pricing theory

The Arbitrage Pricing Theory (APT) was introduced by Stephen Ross in 1976 and this can be considered as an alternative to CAPM (Roll & Ross, 1980). In CAPM the systematic risk getting generated from the market is only being taken into consideration, whereas in APT, the systematic risk getting generated from a variety of sources are being considered when determining the risk and return of a security (CFI, 2025). This can be termed as a multi factor model which incorporates a variety of macro-economic factors determining the risk and return of an asset (CFI, 2025). APT's ability to incorporate several sources of systematic risk is considered as an advantage compared to CAPM (Shanken, 1982).

APT model assumes a market that is always less than perfectly efficient with mispriced assets for a shorter time period (CFI, 2025). However, the belief is that the market participants would quickly correct this situation moving the price back to its fair market value. According to Roll & Ross (1980), contrary to CAPM, the APT does not require the market portfolio to be mean variance efficient.

However, with regard to APT, this requires an investment of a significant level of effort and time in identifying all sources of systematic risk that have an impact over the price of the security, making the process relatively complex and complicated (CFI, 2025).

4.1.6 Market efficiency and information asymmetry

The market efficiency concept can be discussed by referring to the Efficient Market Hypothesis introduced by Eugene Fama in year 1970. According to Fama (1970), a market is efficient when the prices in the market always fully reflect the available information. However, as Fama (1970) suggested, this hypothesis stating that the prices in the market always fully reflect the available information was a null hypothesis and, it was not expected to be true, therefore. Rather the most important contribution of this study was understanding the three forms of efficiencies namely, the weak, semi-strong, and strong form (Fama, 1970).

Weak form of efficiency states that the market price reflects only the historical prices or return sequences, semi-strong form of efficiency assumes that all the publicly available information is reflected in the market prices, and the strong form of efficiency is concerned with whether there is any monopolistic access to price information by individual investors or any other groups (Fama, 1970). In this thesis, in order to understand stock market reaction to the green bond issuance announcement, the market is considered to have semi-strong form of efficiency, with the stock market reacting quickly to the green bond issuance announcements made by the publicly listed non-financial corporates.

Information asymmetry occurs when one party in a transaction has relatively more information compared to the other party in the transaction. According to Li (2020), information asymmetry between the management in a company and the shareholders, increases the likelihood of miscalculating equity values by shareholders. In terms of green bonds this situation can be identified in an event of greenwashing where the corporate issuing the green bonds mislead the investors on the utilization of the proceeds from the green bond. However, this situation can be eradicated to a greater extent using the green labels as discussed in the previous chapter. These green labels aim at improving transparency while providing a guarantee to the investors on the compliance of the green bonds with the respective standards and principles such as GBP, Climate Bond Standards, or EU Green Bond Standards. The green labels act as a proof that a second party has

verified the green projects and the sustainable plans of the company (Tang & Zhang, 2020).

5 Literature review

In this chapter of the thesis previous studies conducted on the arena of green bonds and related concepts will be described. Here, the content will mainly be focusing on three areas namely, the research conducted on green bonds, studies on how the environmental performance of a corporate impacts the corporate's stock value, studies analysing the relationship between the green bonds and the stock value of an entity.

5.1 Research on green bonds

In this section the previous literature on green bond markets, and the green bond related concepts such as greenwashing, green labels, and greenium will be discussed. According to Deus et al. (2022), a study has been conducted analysing the growth of green bond market in emerging economies while analysing the certified green bond market evolution in China and Brazil. The results of the study suggested that the certified green bond market in China is superior to Brazil and as the study concluded the main reason for China's effective performance in the green bond market is the leading role the government plays in terms of going green while establishing the national green policies and the government's capability to intervene in the financial systems of the country to ensure implementation of these policies. Contrary to this, when Brazil is concerned, as the study suggests, the role of the government is limited with lack of strong national green policies in place. Also, when the sectors financed using the green bonds are concerned, as per the study, China has indicated a greater diversity compared to Brazil, with China allocating the funds across six eligible categories, whereas in Brazil it has only been solar and wind energy. Therefore, this study concludes that a well-established and a robust green bond market can be witnessed in emerging economies, if there are well-coordinated green national policies in the respective country, if the state has the ability to implement these policies with successful interventions in financial system of the country, and if there is a diversity in the sectors of investing the green bond proceeds (Deus et al., 2022).

According to Bhutta et al. (2022), for the development of the green bond market the regulatory support is of utmost importance. If a country is prioritizing the climate friendly projects, those countries facilitate and motivate the corporates to invest in environmental friendly initiatives while providing them a platform to get the financing required for the initiative. Also, this study has pointed out the importance of disclosures stating that the issuer has to disclose its environmental commitments to the stakeholders and this will in turn result in the green bond market growth (Bhutta et al., 2022). This finding on disclosures can be closely linked with the certifications on the green bonds or the green labels attached to the green bonds which will improve the transparency on the context of the green bonds, while mitigating the risk of greenwashing.

According to Li et al. (2025), the green bond issuance in China is positively correlated with greater corporate greenwashing, stating that the firms issuing green bonds are more likely to provide misleading information on the company's environment performance to the investors. Further, the study has highlighted that higher the risk taking nature of the company, more the company engages in greenwashing. Accordingly, in order to limit greenwashing, the study has proposed that stricter standards should be established by the regulators while requiring the companies to provide consistent reports and disclosures on the company's green commitment. Also, as the study suggests, measures should be taken to improve the transparency and independence of third party certifications (Li et al., 2025).

According to MacAskill et al. (2021), a study conducted on understanding the existence of greenium in the green bond markets, the results have proved that a green premium with relatively low yields to investors exists in the green bond markets compared to conventional bonds. When analysing the characteristics of the green bonds that result in a greenium, the results suggested that the investors value the green bonds with strong bond governance procedures. As per the study, if a green bond is complying with the green bond standards such as GBP and if it has acquired sufficient levels of certifications

and third party assessments, then the investors value these green bonds the most leading to a greater greenium (MacAskill et al., 2021). In a study conducted by Wang et al. (2020), the results have also pointed out the existence of a green premium in the green bonds market and issuer's strong social reputation and the investor's interest on green investments were cited as the driving factors for a greenium. According to Löffler et al. (2021), institutional investors' pro-environmental preference drives their willingness to pay a relatively higher price for green bonds. According to Agliardi & Agliardi (2021), if the adoption of a green project generates direct benefits to a firm's core business (utility and power), then the greenium is relatively larger compared to a firm whose green policy is in place just to showcase their commitment to the environment.

5.2 Environmental performance and stock value

According to Flammer (2013), when understanding the stock market reaction to corporate news related to environment, the results have suggested that the stock market reacts positively for company news on environmental friendly initiatives and negatively to company news on environmental harmful initiatives. Further, the study has pointed out that, since behaving in environmental friendly manner has been a norm in the present business context, over time the negative stock market reaction to eco-harmful behaviour by companies has increased and the positive stock market reaction to eco-friendly behaviour has decreased (Flammer, 2013).

As per Krüger (2015), a study was conducted on analysing how the stock market reacts to positive and negative events with regard to a firm's Corporate Social Responsibility (CSR). The results from the study have shown that the stock market responds strongly negative to negative events and that negative reaction is more for events related to environment and communities (Krüger, 2015). Accordingly, this suggests that a company's environmental performance holds a significant impact over the stock market reactions.

A study conducted by Capelle-Blancard & Petit (2019) on analysing the stock market reaction to corporates' Environmental, Social, and Governance (ESG) news has concluded that the stock market reacts negatively to negative ESG news with barely significant impact on stock prices for positive ESG news. Also, the study has understood that, if a particular firm has previously disclosed more positive ESG information compared to its peers and if the sector in which the firm operates has a good ESG reputation, this negative stock market reaction to negative ESG news will be limited (Capelle-Blancard & Petit, 2019).

5.3 Green bonds and stock value

Tang & Zhang (2020) in the study conducted on analysing how the stock prices would react to a green bond issuance, have found out significant stock price increments around the announcement of green bond issuance by corporates. This study has covered all corporate bonds issued worldwide during a ten year period from 2007-2017. Also, this study has concluded that this positive stock market reaction is much stronger for first time issuers of green bonds compared to repeated issuers and for corporate issuers compared to financial institutions issuing corporate bonds (Tang & Zhang, 2020). As this study suggests, by issuing green bonds the investor base can be expanded in a corporate, because green bond issuance is likely to attract more media attention and also the attention of impact investors who are looking forward to invest in sustainable bonds such as green bonds (Tang & Zhang, 2020).

Flammer (2021), in the research conducted analysing the stock market reaction to green bond issuance announcements has realised that when a corporate makes a green bond issuance announcement that sends a signal to the market on the company's commitment to natural environment, and driven by this signal the stock market responds positively to the announcement leading to an increase in stock price. According to Flammer (2021), this reaction is much stronger for the first time issuers of green bonds and also for those green bonds with certification from an independent third party. Also, this study

has realised that post the green bond issuance, the environmental performance by companies has improved and also the companies have witnessed an increase in ownership by long term and green investors (Flammer, 2021). This study was done at a global level covering the period from 2013 to 2018.

Lebelle et al. (2020) in a study analysing the stock price reaction around a green bond issuance announcement understood that the market reacts negatively to a green bond issuance announcement and this study was covering an international sample. According to this study, the interpretation for this negative reaction is, when a company announces a green bond issuance, the investors would doubt whether the future business model could be as profitable as it is at present and led by this doubt the investors are likely to revise the profitability projections downwards leading to a negative market reaction (Lebelle et al., 2020). Also, this analysis has understood that this negative stock market reaction is higher in developed markets compared to emerging markets and as the study suggests the reason for this is the higher legal constraints being faced by issuers in developed markets on transparency and if an issuer engages in greenwashing investors can easily identify that in developed markets, resulting in a greater reputational loss for such firms, and investors divesting their investments in the firms finally leading to a negative market reaction. Also, the study has concluded that this negative stock market reaction is much stronger for first time green bond issuers and moreover, the study has not realised a significant difference in the stock market reaction across the two types of the issuers namely the corporates which use the green bond proceeds to directly finance green projects and financial institutions which engages in indirect financing through loans to other corporates, while stating that irrespective of the issuer type, the market anticipates the same risk for the same asset types (Lebelle et al., 2020).

6 Data

This chapter focuses on the data aspect of the thesis including the data limitations encountered and the final dataset arrived after refining the data as per the requirement. Together with the final dataset, descriptive statistics for both the dependant and independent variables of the study are also presented, in this chapter. The primary aim of the study has been to collect data on all the green bond issuance announcements from publicly listed non-financial corporates in the Europe region from year 2014 to year 2024. The required data were primarily sourced from the Refinitiv Datastream and, the LSEG Datastream was also used for data which were not available on the Refinitiv.

The study's dataset is covering a period from May 2014 to November 2024, whereas the Refinitiv Datastream has been primarily used to extract data related to both the bond and company characteristics over the period identified. In terms of green bonds, data points including the issuer name, issuer ticker, country of the issuer, issue date, amount of the bond, coupon, and maturity date were extracted from the Refinitiv Datastream. LSEG Datastream was used to extract the announcement dates of the green bond issuances, as this data point was not available on the Refinitiv. In order to extract the data points on company characteristics, solely the Refinitiv Datastream has been used and those data points include the financial indicators of the respective companies including the total assets, total liabilities, total debt, net property, plant, and equipment, return on assets, and market capitalisation. When extracting these financial data, it was made sure that the data was extracted from the fiscal year before the announcement of the green bond in consideration. The daily share prices and the daily prices of market indices for the respective companies were also extracted from the Refinitiv Datastream.

6.1 Data limitations

This study is concentrated to all the green bond issuance announcements by publicly listed non-financial corporates in the Europe region. Here, the green bonds issuance announcements by private corporates have not be considered, because of the difficulties in accessing the data, as those companies are not publicly listed with easily accessible information on the corporates. Also, this study does not focus on the green bond issuance announcements by financial institutions. This is led by the difference in the use of green bond proceeds by corporates and financial institutions. Corporate use the green bond proceeds to finance their own green projects and initiatives, whereas the financial institutions use green bond proceeds to make green loans or to invest in other firms to finance their green projects (Tang & Zhang, 2020).

Moreover, when finalising the dataset for the study, all the green bond issuance announcements with no sufficient data over the estimation window of 250 days have been removed, since this study has taken into consideration the stock prices during the period starting from 300 days before the announcement to 50 days before the announcement, in calculation of abnormal returns.

6.2 Final dataset

Table 2 reflects the green bond issuance announcements in terms of the countries and the table contains both the quantity of green bond issuance announcements and the amount of green bond issuance announcements in million Euros. Altogether 93 announcements have been made during the period and in value terms this is EUR33 million. In terms of the quantity, Norway surpasses the other countries accounting to a green bond issuance volume of 15.05% out of the total green bond issuances. Followed by this, Sweden (13.98%), Germany (12.90%), and France (11.83%) are also among the highest proportions in terms of the quantity. These results are to a greater extent similar to the findings by European Environment Agency (2025) which was presented in chapter 3,

which has highlighted that Sweden and France are also among those countries in the EU region with the highest proportion of green bond issuance in terms of total bonds issued. However, in value terms Germany dominates the list with a proportion of 20.84% from the total green bond issuance value. Followed by Germany, France (16.90%), Italy (10.90%), and United Kingdom (10.65%) are also among the highest proportions.

Table 2. Dataset by country.

Country	*GB issuance (pcs)*	*%*	*Total amount (M€)*	*%*
AUSTRIA	1	1.08%	0.50	1.51%
BELGIUM	2	2.15%	0.75	2.27%
DENMARK	2	2.15%	1.00	3.03%
FINLAND	7	7.53%	2.18	6.59%
FRANCE	11	11.83%	5.58	16.90%
GERMANY	12	12.90%	6.89	20.84%
ITALY	7	7.53%	3.60	10.90%
NETHERLANDS	5	5.38%	3.05	9.22%
NORWAY	14	15.05%	1.40	4.22%
POLAND	3	3.23%	0.49	1.50%
PORTUGAL	1	1.08%	1.00	3.03%
SPAIN	2	2.15%	0.43	1.29%
SWEDEN	13	13.98%	1.73	5.24%
SWITZERLAND	4	4.30%	0.58	1.75%
TURKEY	1	1.08%	0.35	1.06%
UNITED KINGDOM	8	8.60%	3.52	10.65%

Total	93	100%	33.03	100%

In this table, green bonds are illustrated as per the countries in Europe region in which its issuing organisation operates. The volumes of issuances and the sum of their monetary value in millions of euros in the country are reported both in absolute and in relation to all issuances.

Table 3 reflects the green bond issuance announcements in terms of the years and the table contains both the quantity of green bonds issuance announcements and the amount of the green bonds issuance announcements in million Euros. Also, the table contains the mean maturities of the green bonds issued across all years in consideration in the study. As per the table, it can be concluded that, as an overall the green bond issuance amount has increased over time from year 2014 to 2024. Though there has been a drop in year 2022, it has again started rising since year 2023. In terms of the Euro value as well, the values have been increasing till year 2021 and in year 2022 a drop in value can be witnessed, with the values again increasing from year 2023. Further, the mean maturity of the green bonds issued during the period in consideration is approximately 8.29 years as the table suggests. Here, it is worthwhile to note that year 2016 is not available in the table and this is because after refining the data collected as per the required criteria, the final dataset resulted does not include any green bond issuances for the year 2016.

Table 3. Dataset by years.

Year	*GB issuance (pcs)*	*Total amount (M€)*	*Mean Maturity*
2014	2	1.80	11.00
2015	3	0.95	8.00
2017	4	1.24	6.75
2018	4	1.89	4.50
2019	15	6.30	13.93
2020	13	5.25	11.31
2021	19	6.23	9.89
2022	9	1.71	6.56
2023	11	3.74	5.55
2024	13	3.94	5.46
Total	93	33.03	8.29

This table provides the yearly data on green bond issuances, the total amount issued and the mean maturity. The amount issued is in million euros and the mean maturity is reported in years.

6.3 Dependant variables

The primary aim of this study is to understand whether the green bond issuance announcements made by corporates hold any impact over the stock prices of those respective corporates. In order to examine this, Cumulative Abnormal Returns (CAR) across an array of event windows have been tested inspired by previous literature (Tang & Zhang, 2020; Flammer, 2021; Lebelle et al., 2020). Accordingly, cumulative abnormal returns across the event windows of [-10,10], [-5,5], [-1,1], and [0,1] have been considered in the study. According to McWilliams & Siegel (1997), choosing shorter event windows

facilitates the researcher in avoiding any confounding effects that would sometimes get materialised over longer event windows and this will be further discussed in chapter 7. The event window of [-10,10] accounts for 10 days before and after a green bond issuance announcement, while resulting in a testing period of 21 days altogether. Similarly, the event window [-5,5] results in a 11 day testing period, with the event windows [-1,1] and [0,1] resulting in 3 day and 2 day testing periods, respectively.

Table 4 reflects the descriptive statistics of cumulative abnormal returns across the event windows [-10,10], [-5,5], [-1,1], and [0,1]. As per the table, mean values of CAR[-10,10], CAR[-5,5], and CAR[0,1] are negative and this means that stock prices react negatively for green bond issuance announcements by corporates. This reaction is in line with the findings of Lebelle et al. (2020) which concluded that the stock market reacts negatively to green bond issuance announcements, while suggesting that the investors react in the same way for both green bonds and conventional or convertible bonds. However, when CAR[-1,1] is considered, it holds a positive mean value suggesting that the stock prices react positively for green bond issuance announcements. This is in line with the findings of Tang & Zhang (2020), and Flammer (2021), which concluded positive stock market reactions to green bond issuance announcements. If the minimum and maximum values in the table are considered, it can be concluded that the cumulative abnormal returns range in a broad spectrum indicating some outliers. If CAR[-10,10] is considered the values can range between -37% and +41.2% whereas in CAR[0,1] the values are likely to range between -13% to +6.8%. Also, if the skewness, kurtosis, and Jarque-Bera figures are considered, it can be concluded that the cumulative abnormal returns are not normally distributed across the event windows (Kolari & Pynnonen, 2011).

Table 4. Descriptive statistics of CARs.

	CAR[-10,10]	CAR[-5,5]	CAR[-1,1]	CAR[0,1]
Mean	-0.007	-0.004	0.002	-0.000
Median	0.004	-0.004	0.002	0.002
Maximum	0.412	0.181	0.079	0.068
Minimum	-0.370	-0.218	-0.123	-0.130
Std. Dev.	0.091	0.063	0.032	0.027
Skewness	0.044	-0.417	-0.761	-0.911
Kurtosis	9.307	5.755	6.268	7.740
Jarque-Bera	154.190	32.106	50.368	99.953
Probability	0.000000	0.000000	0.000000	0.000000
Sum	-0.620	-0.409	0.167	-0.008
Sum Sq. Dev	0.756	0.369	0.097	0.069
Observations	93	93	93	93

This table reports the summary statistics of average cumulative abnormal returns across the four event windows considered in the thesis around the green bond issuance announcements. The CARs were calculated using the market model approach where the index of each country in which the green bond issuing companies identified operate, has been utilized.

6.4 Independent variables

In order to understand whether the reaction of stock prices to green bond issuance announcements are affected by different bond and company specific factors, an array of independent variables have been identified. These independent variable were chosen while getting inspired by previous literature on green bond issuance announcements and stock market reaction (Tang & Zhang, 2020; Flammer, 2021; Lebelle et al., 2020). Accordingly these independent variables were classified into bond characteristics and company characteristics.

Table 5 depicts the descriptive statistics of bond characteristics and as per the table if coupon and maturity years variables are concerned, these variables are likely to range in wider spectrum with maximum values reaching 13.5% for coupon and 61 years for maturity years. This highlights the existence of outliers and if skewness, kurtosis, and jarque-bera are considered, non-existence of normal distribution can be concluded to a greater extent.

Table 5. Descriptive statistics of green bond characteristics.

	Amount_issued_LOG	*Coupon*	*Maturity_years*
Mean	12.352	3.694	8.882
Median	12.612	3.125	6.000
Maximum	14.078	13.500	61.000
Minimum	9.210	0.000	3.000
Std. Dev.	1.036	2.749	11.217
Skewness	-0.523	0.977	4.172
Kurtosis	2.563	3.858	19.352
Jarque-Bera	4.982	17.654	1305.860
Probability	0.082826	0.000147	0.000000
Sum	1148.719	343.525	826.000
Sum Sq. Dev	98.650	695.132	11575.700
Observations	93	93	93

This table reports the descriptive statistics of green bond characteristics. *Amount_issued_LOG* is natural logarithm of green bonds issued in million euros, *Coupon* is the coupon rate of green bonds in percentage terms, and *Maturity_years* is maturity of green bonds in years.

Table 6 depicts the descriptive statistics of company characteristics and if ROA, Size_Log, and TobinQ are concerned, the values are likely to range in a broader spectrum with

significant gaps between minimum and maximum values. Accordingly, existence of outliers can be concluded and while looking at skewness, kurtosis, and jarque-bera figures, it can be understood that most of the company characteristics are not normally distributed.

Table 6. Descriptive statistics of company characteristics.

	Leverage	*ROA*	*Size_LOG*	*Tangibility*	*TobinQ*
Mean	0.592	6.623	15.307	0.367	1.005
Median	0.606	5.090	15.835	0.322	0.625
Maximum	0.861	131.880	19.508	0.921	9.240
Minimum	0.049	-5.710	-15.566	0.002	0.100
Std. Dev.	0.156	13.911	3.703	0.229	1.433
Skewness	-0.631	7.966	-6.320	0.544	4.098
Kurtosis	3.641	72.286	53.244	2.619	21.048
Jarque-Bera	7.761	19585.760	10401.590	5.148	1522.528
Probability	0.020636	0.000000	0.000000	0.076213	0.000000
Sum	55.039	615.930	1423.560	34.090	93.425
Sum Sq. Dev	2.238	17802.900	1261.690	4.835	188.947
Observations	93	93	93	93	93

This table reports the descriptive statistics of company characteristics of green bond issuing firms. *Leverage* is the ratio between total debt and total assets of the company from fiscal year before the announcement, *ROA* is the ratio between net income and total assets of the corporate from the fiscal year before the announcement, *Size_LOG* is the natural logarithm of total assets of the issuing firm, *Tangibility* is the ratio between property, plant, and equipment net value and the total assets of the corporate from the fiscal year before the announcement, *TobinQ* is the ratio between market capitalisation and total assets of the green bond issuing firm.

7 Methodology

This chapter discusses the methodology used in the thesis to evaluate the stock market reaction to green bond issuance announcements in the Europe region. After analysing the previous studies conducted on similar research areas focusing on the stock market reaction to firms' environmental performance (Tang & Zhang, 2020; Flammer, 2021; Capelle-Blancard & Petit, 2019; Flammer, 2013), it was decided to use the event study methodology for this purpose. This chapter constitutes a discussion on how the event study methodology was conducted, the type of significance test which was utilised in the study, and the regression model used to evaluate whether any of the independent variables discussed above in chapter 6 holds an impact over this relationship between the green bond issuance announcements and the stock market reaction.

7.1 Event study

According to MacKinlay (1997), the event study methodology determines the impact of a specific event on firm's value, while using financial market data. Event studies focus on understanding how the stock prices behave around specific corporate events (Capelle-Blancard & Petit, 2019). According to McWilliams & Siegel (1997), by using the event study methodology an investor can identify whether there is any abnormal stock price effect driven by an unanticipated event. This event study methodology is associated with the Efficient Market Hypothesis explained in chapter 4. Accordingly, this methodology is based on the idea that whenever some financially relevant information is newly released to the investors, investors will quickly incorporate that information into the stock price resulting in a stock market reaction to a company announcement of new information (McWilliams & Siegel, 1997). Therefore, an event is anything which results in such news to investors and the significance of these events can be understood by identifying its impact on stock prices (McWilliams & Siegel, 1997).

As per McWilliams & Siegel (1997), shorter event windows were preferred over longer event windows stating that, an event window should be long enough to capture the significant effects of an event, but should be short enough to avoid the confounding effects. These confounding effects are related to the second assumption of event study methodology, which assumes that a researcher has isolated the effect of an event from the effects of other events, in order to avoid the confounding effects from other events materialising within the same event window (McWilliams & Siegel, 1997). Therefore, if an event window is too long, the researcher would find difficulties in controlling the confounding effects of other events being materialised during that long window (McWilliams & Siegel, 1997).

Another assumption of this methodology is that, the events are unanticipated and the market did not have any clue on these events before the public announcements were made (McWilliams & Siegel, 1997). However, since there is a likelihood in the business world for insider information, where information would sometimes get leaked to some parties before the public announcement, when determining the event windows it must include a time period prior the announcement date as well to make sure that this insider information concern is also captured in the event study methodology (McWilliams & Siegel, 1997).

In this thesis the idea is to analyse the reaction of stock prices around the green bond issuance announcements of a corporate and therefore the event of interest under the event study methodology is the green bond issuance announcements by the publicly listed non-financial corporates in Europe. The event window can be defined as the time period over which the stock prices associated with this event will be analysed (MacKinlay, 1997). Accordingly, a 21-day event window (-10, +10) have been utilised in this study, while getting inspired by previous studies on the same area as well (Tang & Zhang, 2020). Further, [-5,5], [-1,1], and[0,1] event windows have also been used, in order to enhance the reliability of results, while getting inspired by previous literature (Lebelle et al., 2020; Flammer, 2021). In terms of the estimation window, an estimation window of 250 days

have been utilised in the study, starting from 300 days before the announcement to 50 days before the announcement, inspired by previous work on the same area (Tang & Zhang, 2020). Also, when carrying out the analysis it was made sure that none of the event windows falls within the estimation window. Event period should not be included in the estimation period to make sure that the event does not influence the normal performance model parameter estimates (MacKinlay, 1997).

7.1.1 Estimation of expected returns

In the event study methodology, to evaluate whether a green bond issuance by a corporate has an impact on the stock market reaction, the calculations should be done to understand if there is any abnormal return being realised by the corporate around the announcement of the green bond issuance. Abnormal return can be termed as the difference between the observed return and the return expected in the absence of any firm specific event (Capelle-Blancard & Petit, 2019). According to Flammer (2021), the expected return on the stock can be computed using the below formula:

$$\hat{R}_{it} = a_i + \beta_i R_{mt} + \epsilon_i \qquad (4)$$

Where $\hat{R}_{it}$ is the estimated return of the stock of firm i on day t, with a_i and β_i coefficients of the market model being estimated using ordinary least squares (OLS) based on the 250 day estimation window, specified in the previous section. The R_{mt} in the formula accounts for daily market return with ϵ_i accounting for the residual (Flammer, 2021).

After calculating the expected return on the stock, the abnormal return is arrived at by deducting the expected return from the actual return realised around the event date and the formula is as follows (Flammer, 2021):

$$AR_{it} = R_{it} - \hat{R}_{it} \qquad (5)$$

Where the AR_{it} represents the abnormal return on the stock of firm i on day t and R_{it} refers to the actual return on stock of firm i on day t (Flammer, 2021). Post calculating the abnormal returns these returns should be aggregated across time to arrive at the Cumulative Abnormal Returns (CAR) to understand the impact of green bond issuance announcement on stock price reaction. In order to incorporate multiple period event windows, the CAR concept is required (MacKinlay, 1997).

The formula for calculating CAR is as follows (MacKinlay, 1997):

$$CAR_{i(T_1T_2)} = \sum_{T_1}^{T_2} AR_{it} \qquad (6)$$

Where, T_1 and T_2 showcase the event window's start and end date. After calculating CAR, average CAR is calculated to test the hypotheses developed in the study and the formula is as follows:

$$\overline{CAR}_{i(T_1T_2)} = \frac{1}{N}\sum_{T_1}^{T_2} CAR_i \qquad (7)$$

Where N represents the number of events and CAR_i represents the CAR from τ_1 to τ_2 (MacKinlay, 1997).

7.2 Significance test

Inspired by the previous literature on understanding the impact of environmental performance on stock market reaction, the t-statistics were calculated to understand the significance of results arrived from the event study (Krüger, 2015). However, given the fact that stock prices are not normally distributed, the focus was directed to a nonparametric rank test as well (Kolari & Pynnonen, 2011). Accordingly, while getting inspired by Tang & Zhang (2020), the Wilcoxon signed-rank test was conducted to further confirm the significance of results of the study.

7.3 Regression model

In order to evaluate whether the independent variables discussed in chapter 6 hold an impact over the stock price reaction to green bond issuance announcements by corporates, the Ordinary Least Squares (OLS) regression method was adopted while getting inspired by previous literature (Lebelle et al., 2020). When running the regression, most focus was on the leverage factor, as this study aims at understanding whether financial leverage of corporates accounts for any impact over this relationship between the stock price reaction and green bond issuance announcements. According to Lebelle et al. (2020), the below formula was considered in the study to run the regression:

$$Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki} + \epsilon_i \quad (8)$$

Where Y_i represents dependant variable, with α representing the constant, β_k indicating the coefficient of the independent variable X_{ki}, and ϵ_i being the error term (Lebelle et al., 2020).

Accordingly, the formula used on EViews to run the OLS regression in order to understand whether any of the independent company and bond specific variables hold an impact over CARs across the event windows is as follows:

$$\overline{CAR}_{it} = \alpha + \beta_1 Leverage + \beta_2 ROA + \beta_3 Size\_LOG + \beta_4 Tangibility + \beta_5 TobinQ + \beta_6 Amount\_issued\_LOG + \beta_7 Coupon + \beta_8 Maturity\_years + \epsilon_i$$

Where,

$\overline{CAR}_{it}$	The event window.
α	The intercept term.

$Leverage$	The ratio between the total debt and total assets of the corporate from the fiscal year before the announcement.
ROA	The ratio of net income and total assets of the corporate from the fiscal year before the announcement.
$Size\_LOG$	Natural logarithm of total assets of the corporate.
$Tangibility$	The ratio between the property, plant, and equipment net and total assets of the corporate from the fiscal year before the announcement.
$TobinQ$	The ratio between the market capitalization and the total assets of the corporate.
$Amount\_issued\_LOG$	The natural logarithm of green bond amount issued in million euros.
$Coupon$	The coupon of green bond in percentage terms.
$Maturity\_years$	The maturity of green bond in years.

8 Empirical findings

This chapter discusses the results arrived at from the analysis in the study with regard to understanding whether the stock prices react to green bond issuance announcements by publicly listed non-financial corporates in Europe. The results were arrived at by carrying out the analysis on EViews and statistical significances of the results have also been evaluated using both the t-statistic method and the Wilcoxon signed rank test method as well given the non-normal distribution of stock prices. The regression results are also presented in this section for understanding the impact independent variable have on CARs across the identified event windows. All the results arrived have been discussed while comparing with the results of previous literature on similar contexts. This chapter concludes with a summary of all the results arrived at from the analysis.

8.1 Abnormal returns

Under this section the significance of the CARs across the chosen event windows are being presented while suggesting whether the green bond issuance announcements by corporates hold a major impact over the stock price reactions. When looking at the skewness, kurtosis, and jarque-bera figures in Table 4 of chapter 6 it can be concluded that CARs are not normally distributed in terms of all event windows (Kolari & Pynnonen, 2011). Therefore, while getting inspired by previous literature as well, in addition to t-statistic results, the Wilcoxon signed rank test results have also been presented in order to understand how significant the results are (Tang & Zhang, 2020; Lebelle et al., 2020).

If Table 7 is concerned, the mean CAR of [-10,10] event window is -0.70% which indicates that the stock price reacts negatively for green bond issuance announcements by corporates in a 21 day event window. This result is consistent with the findings of Lebelle et al. (2020), which suggests a negative stock market reaction to green bond issuance announcements. However, based on t-statistic and the Wilcoxon signed rank test, the CAR

[-10,10] result is not significant under all the significance levels. Driven by the insignificance of the result, it can be concluded that, over a 21 day event window the stock market does not indicate a considerable reaction to the green bond issuance announcements by publicly listed non-financial corporates in Europe. This result is different from the findings of Tang & Zhang (2020), which has concluded a statistically significant positive stock market reaction to green bond issuance announcements over a 21 day event window.

Table 7. Stock reaction to green bond announcements in [-10,10] event window.

		CAR[-10,10]
Mean		-0.007
Median		0.004
Std. Dev		0.091
Method	Value	Probability
t-statistic	0.7097	0.4797
Method	Value	Probability
Wilcoxon signed rank test	0.1245	0.9009
Median test summary	Count	Mean rank
Category		
Obs. > 0.000000	49	43.9388
Obs. < 0.000000	44	50.4091
Obs. = 0.000000	0	
Observations	93	

This table reports the t-statistic and Wilcoxon signed rank test results, which are used to determine the statistical significance of the reaction of stock prices to green bond issuance announcements. The statistical significance is determined under 1%, 5%, and 10% levels.

If Table 8 is concerned, the mean CAR of [-5,5] event window is -0.40% and based on the t-statistic and the Wilcoxon signed rank test, this result is not significant under all the significance levels, suggesting that the stock market does not necessarily react to green bond issuance announcements by corporates during a 11 day event window. This result is also different from the findings of previous literature which concluded either a positive or a negative stock market reaction to green bond issuance announcements (Tang & Zhang, 2020; Flammer, 2021; Lebelle et al., 2020). However, this finding goes well with the findings of Capelle-Blancard & Petit (2019), which has concluded that even though the shareholders penalize the negative social responsibility behaviour by corporates they do not necessarily reward the positive social responsibility behaviour by corporates.

Table 8. Stock reaction to green bond announcements in [-5,5] event window.

		CAR[-5,5]
Mean		-0.004
Median		-0.004
Std. Dev		0.063
Method	Value	Probability
t-statistic	0.6702	0.5044
Method	Value	Probability
Wilcoxon signed rank test	0.6380	0.5235
Median test summary	Count	Mean rank
Category		
Obs. > 0.000000	44	45.8864
Obs. < 0.000000	49	48.0000
Obs. = 0.000000	0	
Observations	93	

This table reports the t-statistic and Wilcoxon signed rank test results, which are used to determine the statistical significance of the reaction of stock prices to green bond issuance announcements. The statistical significance is determined under 1%, 5%, and 10% levels.

If Table 9 is concerned, the mean CAR of [-1,1] event window is 0.20% and in terms of the t-statistic and the Wilcoxon signed rank test this result is also insignificant under all the significance levels, suggesting no significant reaction by the stock market for green bond issuance announcements over a 3 day event window. This result contradicts with the findings of Lebelle et al. (2020), which has concluded a statistically significant negative stock market reaction during a 3 day event window. However, according to Capelle-Blancard & Petit (2019), and Flammer (2013), with the immense pressure coming from the external environment for corporates to go green, these eco-friendly corporate be-

haviour has been more of a norm in the present context and given this reason, the shareholders are likely to react in a more insignificant way to these eco-friendly measures undertaken by the companies such as issuing green bonds.

Table 9. Stock reaction to green bond announcements in [-1,1] event window.

		CAR[-1,1]
Mean		0.002
Median		0.002
Std. Dev		0.032
Method	Value	Probability
t-statistic	0.5344	0.5944
Method	Value	Probability
Wilcoxon signed rank test	0.9215	0.3568
Median test summary	Count	Mean rank
Category		
Obs. > 0.000000	53	45.7736
Obs. < 0.000000	40	48.6250
Obs. = 0.000000	0	
Observations	93	

This table reports the t-statistic and Wilcoxon signed rank test results, which are used to determine the statistical significance of the reaction of stock prices to green bond issuance announcements. The statistical significance is determined under 1%, 5%, and 10% levels.

If Table 10 is considered, the mean CAR of [0,1] event window is -0.009% and as per the t-statistic and the Wilcoxon signed rank test this result is also insignificant under all the significance levels suggesting no major reaction by the stock markets to green bond issuance announcements by corporates. This result over the shortest event window is also

different from the results of previous literature which has concluded significant stock market reaction to green bond issuance announcements (Tang & Zhang, 2020; Flammer, 2021; Lebelle et al., 2020). However, this again goes well with the explanation provided under CAR[-1,1]. As per the statistics provided in chapter 3, given the significant position Europe holds in terms of green bond issuances compared to other parts of the globe, it can be argued that issuing green bonds and being environmental friendly has been a norm in the Europe market and as a result of this, insignificant stock market reactions get evident for green bond issuance announcements by corporates in Europe.

Table 10. Stock reaction to green bond announcements in [0,1] event window.

		CAR[0,1]
Mean		-0.000
Median		0.002
Std. Dev		0.027
Method	Value	Probability
t-statistic	0.0313	0.9751
Method	Value	Probability
Wilcoxon signed rank test	0.1628	0.8706
Median test summary	Count	Mean rank
Category		
Obs. > 0.000000	50	44.5600
Obs. < 0.000000	43	49.8372
Obs. = 0.000000	0	
Observations	93	

This table reports the t-statistic and Wilcoxon signed rank test results, which are used to determine the statistical significance of the reaction of stock prices to green bond issuance announcements. The statistical significance is determined under 1%, 5%, and 10% levels.

8.2 Regression results

The regression analysis of the study was conducted on EViews and this was carried out with the motive of understanding whether any of the independent variables listed in chapter 6 has a significant impact on the relationship between stock prices and the green bond issuance announcements by corporates. Here, a considerable focus was directed to the leverage factor as well, since the study also aims at understanding if financial leverage of companies holds an impact over this stock market reaction to green bond issuance announcements. Given the statistically insignificant results across all the event windows, the dependant variables to be used in the regression were chosen while analysing the event windows with the least insignificant results, which has probability values closer to significance levels as per the Wilcoxon signed rank test. Accordingly, CAR[-5,5] with a probability value of 0.52, and CAR[-1,1] with a probability value of 0.36, were chosen to be the dependant variables. The results were derived from running the OLS regression using the formula stated in chapter 7. Three regressions were run for each of the event windows, where Regression 1 includes both the company and bond characteristics, Regression 2 includes only the company characteristics, and Regression 3 includes only the green bond characteristics.

Table 11 showcases the regression results for CAR[-5,5]. As per Regression 1, it can be argued that the variables TobinQ, Amount_issued_LOG, and Coupon are statistically significant with negative coefficients. According to Baulkaran (2019), a statistically significant positive coefficient has been realised for TobinQ, while explaining that stock market reacts substantially for green bond issuance announcements by firms with exceptional growth opportunities. However, the negative statistical significance realised in the study for TobinQ can be supported with the findings of Lebelle et al. (2020), which has concluded that when a corporate announces a green bond issuance the investors will get sceptical on whether the company would be profitable as it has been so far in future as well, given the potential business model resulting from the issuance. Accordingly, it can be concluded that when a company has more growth opportunities, the investors are unlikely to respond favourably for green bond issuances, since they get sceptical on

whether these growth opportunities will get disturbed with the potential changes in ways of doing business resulting from the green bond issuance. In terms of the Amount_issued_LOG variable, the results derived are similar to the findings of Wang et al. (2020), which has also concluded statistically significant negative coefficients for the green bond amount issued. With regard to Coupon, the findings are consistent with Baulkaran (2019), which has concluded that if a corporate has higher cost of debt the stock market reacts less favourably to green bond issuance announcements since the mangers are required to maintain stable level of cash flow in the company to meet high cost of debt. If Regression 2 is concerned, only TobinQ is statistically significant with a negative coefficient, whereas, with regard to Regression 3, the only statistically significant variable is Amount_issued_LOG with a negative coefficient. However, if the F-statistics of Regression1, Regression2, and Regression 3 of CAR[-5,5] dependant variable are concerned, the values are not statistically significant in all three regressions suggesting that it is not possible to arrive at a conclusion on the impact of independent variables on the reaction of stock price to green bond issuance announcements by publicly listed non-financial corporates in Europe. Accordingly, these findings also apply to the financial leverage aspect of corporates, suggesting no significant impact over the stock price reaction to green bond issuance announcements.

Table 11. Results from regression of CAR[-5,5].

	Regression 1	**Regression 2**	**Regression 3**
Leverage	-0.0478	-0.0279	
	(0.9893)	(0.5861)	
ROA	-0.0002	-0.0000	
	(0.3597)	(0.0282)	
Size_LOG	0.0011	0.0008	
	(0.6005)	(0.4223)	
Tangibility	-0.0090	-0.0034	
	(0.3018)	(0.1161)	
TobinQ	**-0.0117****	**-0.0121****	
	(2.4351)	(2.5293)	
Amount_issued_LOG	**-0.0152***		**-0.0160****
	(1.8849)		(2.0218)
Coupon	**-0.0053***		-0.0047
	(1.7627)		(1.5902)
Maturity_years	-0.0001		0.0001
	(0.1359)		(0.1029)
Constant	0.2313	0.0141	0.2098
	(1.9663)	(0.3390)	(2.0271)
Observations	93	93	93
R-squared	0.117115	0.070999	0.047474
Adjusted R-squared	0.033030	0.017608	0.015367
F-statistic	1.392825	1.329797	1.478603
Probability (F-statistic)	0.211562	0.259176	0.225791

This table reports the results from the three regressions conducted. Regression (1) includes all the independent variables, Regression (2) includes only the company characteristics of green bond issuing firms, and Regression (3) includes only the green bond characteristics. *Leverage* is the ratio between total debt and total assets of the company, *ROA* is the ratio between the net income and total assets of the company, *Size_LOG* is the natural logarithm of total assets of the firm, *Tangibility* is the ratio between property, plant, and equipment net value and total assets of the company, and *TobinQ* is the ratio between the market capitalisation and total assets of

the corporate. *Amount_issued_LOG* is the natural logarithm of green bond amount issued, *Coupon* is the rate of coupon in percentage terms, and *Maturity_years* is presented in years. ***, **, and * indicate the statistical significance of result at 1%, 5%, and 10% levels.

Table 12 showcases the regression results for CAR[-1,1]. As per the table, none of the company and bond characteristics are statistically significant under all three regressions carried out. Therefore, this again suggests the impossibility in arriving at a conclusion on the impact of independent variables, which also includes the financial leverage variable, on the stock price reaction to green bond issuance announcements by publicly listed non-financial corporates in Europe.

Table 12. Results from regression of CAR[-1,1].

	Regression 1	**Regression 2**	**Regression 3**
Leverage	-0.0183	-0.0186	
	(0.7060)	(0.7479)	
ROA	-0.0004	-0.0004	
	(1.4328)	(1.4910)	
Size_LOG	-0.0002	-0.0002	
	(0.2403)	(0.1799)	
Tangibility	-0.0010	-0.0021	
	(0.0641)	(0.1327)	
TobinQ	-0.0012	-0.0013	
	(0.4523)	(0.5215)	
Amount_issued_LOG	0.0001		0.0008
	(0.0327)		(0.2019)
Coupon	0.0004		0.0006
	(0.2521)		(0.4106)
Maturity_years	0.0002		0.0002
	(0.5796)		(0.5790)
Constant	0.0155	0.0202	-0.0125
	(0.2463)	(0.9331)	(0.2307)
Observations	93	93	93
R-squared	0.035175	0.030819	0.005407
Adjusted R-squared	-0.056713	-0.024881	-0.028119
F-statistic	0.382803	0.553304	0.161283
Probability (F-statistic)	0.927001	0.735398	0.922123

This table reports the results from the three regressions conducted. Regression (1) includes all the independent variables, Regression (2) includes only the company characteristics of green bond issuing firms, and Regression (3) includes only the green bond characteristics. *Leverage* is the ratio between total debt and total assets of the company, *ROA* is the ratio between the net income and total assets of the company, *Size_LOG* is the natural logarithm of total assets of the firm, *Tangibility* is the ratio between property, plant, and equipment net value and total assets of the company, and *TobinQ* is the ratio between the market capitalisation and total assets of

the corporate. *Amount_issued_LOG* is the natural logarithm of green bond amount issued, *Coupon* is the rate of coupon in percentage terms, and *Maturity_years* is presented in years. ***, **, and * indicate the statistical significance of result at 1%, 5%, and 10% levels.

These statistically insignificant regressions derived for CAR[-5,5] and CAR[-1,1] dependant variables can be supported by the findings of Capelle-Blancard & Petit (2019) and Flammer (2013). Given the prominent position the Europe region holds in terms of green bonds as per the statistics provided in chapter 3, it can be argued that these green bond issuances by corporates has been more of a norm in the Europe region. With the influence coming from the external environment for companies to go green, engaging in environmental friendly initiatives has been a norm for the companies in the present context, with investor's negative reaction for eco-harmful corporate behaviour getting substantial over time and investor's positive reaction to eco-friendly corporate behaviour getting less substantial over time (Capelle-Blancard & Petit, 2019; Flammer, 2013). Accordingly, as per the discussions made in the initial section of this chapter while incorporating the Wilcoxon signed rank test results, it can be argued that whenever a publicly listed non-financial corporate in Europe announces a green bond issuance, the impact of company or bond characteristics on the decisions made by the stock market is insignificant, as the market does not show a significant reaction to the green bond issuance announcements.

8.3 Summary of results

This section summarises the findings generated from the event study and the regression analysis conducted in the study, while incorporating these findings with the hypotheses established in chapter 1. Moreover, the findings resulted from previous literature on similar contexts are also being discussed while critically evaluating those findings with the results of this study.

Led by the Wilcoxon signed rank test conducted, which concluded insignificance in results across all the event windows considered, the study suggested that it is not possible

to arrive at a conclusion that the stock market does react to green bond issuance announcements by publicly listed non-financial corporates in Europe. Accordingly, the null hypothesis (H_0) is accepted which suggested that share value does not react to green bond issuance announcements in Europe. As a result of this, the main research hypothesis (H_1) is rejected which suggested a share price reaction to green bond issuance announcements in Europe. Driven by this rejection the H_2a and H_2b hypotheses are also rejected, which suggested either positive or negative share price reactions.

The OLS regression was conducted on EViews to understand whether the independent variables which included company and bond characteristics hold an impact over stock price reaction to green bond issuance announcements. The dependant variables CAR[-5,5] and CAR[-1,1] were selected to conducted the regression analysis and three regressions were tested for both the dependant variables. Based on the regression results for CAR[-5,5], statistically significant negative coefficients were identified for the independent variables TobinQ, Amount_issued_LOG, and Coupon, whereas for the CAR[-1,1] variable the results were not statistically significant under all three regressions conducted. Though statistically significant independent variables have been identified under CAR[-5,5], due to the insignificant F-statistic values realised under all three regressions for the same dependant variable, the study was unable to conclude a significant impact by independent variables under CAR[-5,5]. Accordingly, the overall findings from the regression analysis conducted for both CAR[-5,5] and CAR[-1,1] suggest the impossibility in arriving at a conclusion on the impact of company and bond characteristics on stock price reaction to green bond issuance announcements by publicly listed non-financial corporates in Europe. Accordingly, since this is applied to the financial leverage variable as well, the H_2c hypothesis in the study is also rejected which suggested that the financial leverage of corporates holds an impact on the stock price reaction to green bond issuance announcements in Europe.

These results generated are different from the findings of several previous literature which concluded significant stock market reactions either positive or negative for green

bond issuance announcements (Tang & Zhang, 2020; Flammer, 2021; Lebelle et al., 2020). In terms of the impact of financial leverage on the stock market reaction to green bond issuance announcements, Lebelle et al. (2020), has realised a statistically significant positive impact while suggesting that higher leverage depicts less financial constraints and better debt market access for a corporate and as a result the stock market reacts more favourably for a green bond issuance announcement by a corporate with a relatively higher leverage.

However, the results derived from this study can be explained further while focusing on the position Europe holds in terms of green bonds. As per the green bond statistics provided in chapter 3 of the study it can be concluded that the Europe region holds a considerably prominent position in terms of green bond issuances compared to other parts of the globe. Accordingly, it can be stated that this green bond concept is not a brand new concept in Europe and adopting green measures by European corporates has been more of a norm at the present context. According to Flammer (2013), when going green has been a norm in the business context, the investors' unfavourable reaction to eco-harmful behaviour increases over time and their favourable reaction to eco-friendly behaviour diminishes over time. A similar situation is evident in Europe among the publicly listed non-financial corporates as well, where the stock prices react insignificantly to a green bond issuance announcement. Therefore, the impact generating from company and bond characteristics on the stock market reaction to green bond issuance announcements in Europe is also insignificant, since the investors do not necessarily react to a green bond issuance announcement while also looking at the company and bond characteristics. The stock market engages in punishing the corporates for its unfavourable actions in terms of environment, society, and governance, while not really rewarding the favourable corporate actions (Capelle-Blancard & Petit, 2019).

9 Conclusion

This study aims at understanding the reaction of stock prices to green bond issuance announcements by publicly listed non-financial corporates in Europe. The thesis also focuses on evaluating whether the financial leverage of the corporates has any impact over this stock price reaction. The data collected for the study is covering the period from year 2014 to year 2024. The event study methodology was adopted to understand the reaction of stock prices to green bond issuance announcements. Four event windows, [-10,10], [-5,5], [-1,1], and [0,1], have been used to evaluate this reaction together with a 250 day estimation window. Since the CARs were not normally distributed, Wilcoxon signed rank test was mainly used in determining the significance of results, in order to evaluate whether the stock market exhibits any significant reaction to green bond issuance announcements across the event windows identified. The OLS regression was conducted to understand whether the independent variables namely company and bond characteristics hold any impact over this relationship between stock prices and green bond issuance announcements in Europe. The analysis was conducted with the help of EViews and data was primarily collected from Refinitiv database, whereas LSEG database has also been used for the data not available on Refinitiv.

The results from the event study suggested that the stock prices do not necessarily show any significant reaction to green bond issuance announcements by publicly listed non-financial corporates in Europe, across all four event windows. Under the regression analysis conducted, though statistical significance with negative coefficients have been realised for some of the independent variables namely TobinQ, Amount_issued_LOG, and Coupon, given the insignificant F-statistic values identified as an overall, the study stated that it is impossible to arrive at a conclusion on the impact of company or bond characteristics on stock price reaction to green bond issuance announcements. Driven by this finding, the study concludes that the leverage factor of corporates also does not necessarily hold any impact over the stock price reaction to green bond issuance announcements.

These results are different to the findings of previous literature on the similar areas, in which the studies have confirmed either a positive or a negative stock market reaction to green bond issuance announcements together with significant impacts coming from independent variables over this reaction (Tang & Zhang, 2020; Flammer, 2021; Lebelle et al., 2020).

However, this insignificant stock price reaction to green bond issuance announcements can be explained while referring to the prominent position Europe holds in terms of green bonds. As per the statistics presented in this study, Europe holds a leading position in terms of green bond issuances compared to other parts of the globe. Accordingly, it is understood that issuing green bonds and being environmental friendly has been a norm in the Europe market, resulting in an insignificant stock price reaction to green bond issuance announcements. As per Flammer (2013), when going green becomes a norm in business context overtime, the favourable stock market reaction to eco-friendly behaviour by corporates becomes less significant. The impact of company and bond characteristics also get insignificant in this situation, since the investors are not necessarily reacting to green bond issuance announcements while focusing on the company and bond characteristics related to that issuance, as well.

The findings of this thesis contributes to the existing literature while facilitating the understanding on how the stock markets would react to environmental friendly measures adopted by the companies in regions in which going green has been a part of their daily business routine. Also, the findings from this study can be used by the corporate managers when developing strategies on being environmental friendly and driven by these findings the managers can also explore new ways and means through which they can further expand the corporate's positive impact on the environment.

Since this thesis focuses on Europe, future research can be done focusing on a different markets to see if the results differ across the regions. Also, inspired by Capelle-Blancard & Petit (2019), further research can be conducted in order to understand whether the

existing reputation and the stance the corporates hold in terms of greenwashing account for any impact on the stock price reaction to green bond issuance announcements.

References

Agliardi, E., & Agliardi, R. (2021). Corporate Green Bonds: Understanding the Greenium in a Two-Factor Structural Model. *Environmental & resource economics, 80*(2), 257-278. https://doi.org/10.1007/s10640-021-00585-7

Baulkaran, V. (2019). Stock market reaction to green bond issuance. *Journal of asset management, 20*(5), 331-340. https://doi.org/10.1057/s41260-018-00105-1

Berrone, P., Fosfuri, A., & Gelabert, L. (2017). Does Greenwashing Pay Off? Understanding the Relationship between Environmental Actions and Environmental Legitimacy. *Journal of business ethics, 144*(2), 363-379. https://doi.org/10.1007/s10551-015-2816-9

Bhutta, U. S., Tariq, A., Farrukh, M., Raza, A., & Iqbal, M. K. (2022). Green bonds for sustainable development: Review of literature on development and impact of green bonds. *Technological forecasting & social change, 175,* 121378. https://doi.org/10.1016/j.techfore.2021.121378

Bodie, Z., Kane, A., & Marcus, A. J. (2018). Investments, Eleventh Edition. McGraw Hill Education.

Capelle-Blancard, G., & Petit, A. (2019). Every Little Helps? ESG News and Stock Market Reaction. *Journal of business ethics, 157*(2), 543-565. https://doi.org/10.1007/s10551-017-3667-3

CBI. (2021, March 10). Climate Bonds Releases Green Bond Pricing Report for H2 2020: Greenium increasingly visible including German Sovereign Green Bund. https://www.climatebonds.net/news-events/press-room/press-releases/climate-bonds-releases-green-bond-pricing-report-h2-2020-greenium-increasingly-visible-including-german-sovereign-green-bund

CBI. (2024). *Sustainable Debt Global State of the Market 2024.* https://www.climatebonds.net/files/documents/publications/Climate-Bonds_Sustainable_Debt_2024_Global-State-of-the-Market_24-Sep-2025.pdf

CBI. (2025). *Clear and Credible Standards for Sustainable Finance.* https://www.climatebonds.net/our-expertise/standard-sector-criteria-certification/the-standard

CFI. (2025). *Arbitrage Pricing Theory.* https://corporatefinanceinstitute.com/resources/wealth-management/arbitrage-pricing-theory-apt/

CFI. (2025). *Capital Asset Pricing Model (CAPM).* https://corporatefinanceinstitute.com/resources/valuation/what-is-capm-formula/

CFI. (2025). *Modern Portfolio Theory (MPT).* https://corporatefinanceinstitute.com/resources/career-map/sell-side/capital-markets/modern-portfolio-theory-mpt/

Chen, J. (2025, October 2). *Understanding Indentures: Key Clauses in Bonds, Real Estate & Bankruptcy.* Investopedia. https://www.investopedia.com/terms/i/indenture.asp

Choudhry, M. (2010). *An Introduction to Bond Markets, Fourth Edition*. John Wiley & Sons, Incorporated.

Climate Aligned. (2025, March 11). *The Evolution of Green Bonds: From Niche to Mainstream.* https://www.climatealigned.co/blog/green-bonds-evolution

de Deus, J. L., Crocco, M., & Silva, F. F. (2022). The green transition in emerging economies: Green bond issuance in Brazil and China. *Climate policy, 22*(9-10), 1252-1265. https://doi.org/10.1080/14693062.2022.2116381

European Commission. (2019, December 11). *The European Green Deal.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN

European Environment Agency. (2025, July 1). *Green bonds in Europe.* Green bonds in Europe | Indicators | European Environment Agency (EEA)

Eurostat. (2025, August 14). *EU economy greenhouse gas emissions: +3.4% in Q1 2025.* https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20250814-1#:~:text=The%20EU%20economy%20greenhouse%20gas,on%20quarterly%20greenhouse%20gas%20emissions.&text=The%202%20economic%20sectors%20responsible,and%20fishing%20(%2D1.4%25).

Fabozzi, F. J. (2000). *Bond Markets, Analysis and Strategies, Fourth Edition*. Prentice Hall.

Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. The *Journal of Finance, 25*(2), 383–417. https://doi.org/10.2307/2325486

Fitch Ratings. (2025, September 19). *Rating Definitions.* https://www.fitchratings.com/research/banks/rating-definitions-19-09-2025

Flammer, C. (2013). CORPORATE SOCIAL RESPONSIBILITY AND SHAREHOLDER REACTION: THE ENVIRONMENTAL AWARENESS OF INVESTORS. *Academy of Management journal, 56*(3), 758-781. https://doi.org/10.5465/amj.2011.0744

Flammer, C. (2021). Corporate green bonds. *Journal of financial economics, 142*(2), 499-516. https://doi.org/10.1016/j.jfineco.2021.01.010

Ge, M., Friedrich, J., & Vigna, L. (2024, December 5). *Where Do Emissions Come From? 4 Charts Explain Greenhouse Gas Emissions by Sector.* World Resources Institute. https://www.wri.org/insights/4-charts-explain-greenhouse-gas-emissions-countries-and-sectors#:~:text=According%20to%20WRI's%20Climate%20Watch%20platform%2C%20greenhouse,Agricultural%20soils%2C%20such%20as%20methane%20from%20manure

ICMA. (2014, April 14). *Green Bond Principles Governance Established ICMA Appointed Secretariat.* https://www.icmagroup.org/assets/documents/Regulatory/Green-Bonds/Green-Bonds-Principles-Governance-Press-Release_14Apr-final.pdf

ICMA. (2025). *Sustainable Bond Market Data.* https://www.icmagroup.org/sustainable-finance/sustainable-bonds-database/

ICMA. (2025, June). *Green Bond Principles: Voluntary Process Guidelines for Issuing Green Bonds.* Green-Bond-Principles-GBP-June-2025.pdf

Kolari, J. W., & Pynnonen, S. (2011). Nonparametric rank tests for event studies. *Journal of empirical finance, 18*(5), 953-971. https://doi.org/10.1016/j.jempfin.2011.08.003

Krüger, P. (2015). Corporate goodness and shareholder wealth. *Journal of financial economics, 115*(2), 304-329. https://doi.org/10.1016/j.jfineco.2014.09.008

Lebelle, M., Lajili Jarjir, S., & Sassi, S. (2020). Corporate green bond issuances: An international evidence. *Journal of risk and financial management, 13*(2), 1-21. https://doi.org/10.3390/jrfm13020025

Li, K. (2020). Does Information Asymmetry Impede Market Efficiency? Evidence from Analyst Coverage. *Journal of banking & finance, 118,* 105856. https://doi.org/10.1016/j.jbankfin.2020.105856

Li, Y., Yang, Z., & Dong, X. (2025). Green bond and greenwashing: New insights from Chinese firms. *Finance research letters, 85,* 107847. https://doi.org/10.1016/j.frl.2025.107847

Löffler, K. U., Petreski, A., & Stephan, A. (2021). Drivers of green bond issuance and new evidence on the "greenium". *Eurasian Economic Review, 11*(1), 1-24. https://doi.org/10.1007/s40822-020-00165-y

MacAskill, S., Roca, E., Liu, B., Stewart, R., & Sahin, O. (2021). Is there a green premium in the green bond market? Systematic literature review revealing premium determinants. *Journal of cleaner production, 280,* 124491. https://doi.org/10.1016/j.jclepro.2020.124491

MacKinlay, A. C. (1997). Event studies in economics and finance. *Journal of Economic Literature, 35*(1), 13-39. Retrieved from https://www.proquest.com/scholarly-journals/event-studies-economics-finance/docview/213164851/se-2

Markowitz, H. (1952). Portfolio Selection. *The Journal of Finance, 7*(1), 77–91. https://doi.org/10.2307/2975974

Marquis, C., Toffel, M. W., & Zhou, Y. (2016). Scrutiny, Norms, and Selective Disclosure: A Global Study of Greenwashing. *Organization science (Providence, R.I.), 27*(2), 483-504. https://doi.org/10.1287/orsc.2015.1039

McWilliams, A., & Siegel, D. (1997). Event studies in management research: Theoretical and empirical issues. *Academy of Management Journal, 40*(3), 626-657. Retrieved from https://www.proquest.com/scholarly-journals/event-studies-management-research-theoretical/docview/199769437/se-2

Moody's. (2025). *Understanding credit ratings.* https://www.moodys.com/web/en/us/solutions/ratings/understanding-ratings.html

Mordor Intelligence. (2026). *Green bonds market size & share analysis – Growth trends and forecast (2026-2031).* https://www.mordorintelligence.com/industry-reports/green-bonds-market

Roll, R., & Ross, S. A. (1980). An Empirical Investigation of the Arbitrage Pricing Theory. *The Journal of Finance, 35*(5), 1073–1103. https://doi.org/10.2307/2327087

S&P Global. (2025). *Understanding Credit Ratings.* https://www.spglobal.com/ratings/en/credit-ratings/about/understanding-credit-ratings

Shanken, J. (1982). The Arbitrage Pricing Theory: Is it Testable? *The Journal of Finance, 37*(5), 1129–1140. https://doi.org/10.2307/2327839

Sharpe, W. F. (1964). Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. *The Journal of Finance, 19*(3), 425–442. https://doi.org/10.2307/2977928

Tang, D. Y., & Zhang, Y. (2020). Do shareholders benefit from green bonds? *Journal of corporate finance (Amsterdam, Netherlands), 61,* 101427. https://doi.org/10.1016/j.jcorpfin.2018.12.001

Wang, J., Chen, X., Li, X., Yu, J., & Zhong, R. (2020). The market reaction to green bond issuance: Evidence from China. *Pacific-Basin finance journal, 60,* 101294. https://doi.org/10.1016/j.pacfin.2020.101294

World Health Organization (2024, May 28). *Heat and health.* https://www.who.int/news-room/fact-sheets/detail/climate-change-heat-and-health

World Health Organization. (2024, October 24). *Ambient (outdoor) air pollution. https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health*

Appendices

Appendix 1. List of stock indices

Country	Index
AUSTRIA	AUSTRIAN TRADED INDEX
BELGIUM	BEL 20
DENMARK	OMX COPENHAGEN
FINLAND	OMX HELSINKI
FRANCE	FRANCE CAC 40
GERMANY	DAX PERFORMANCE
ITALY	FTSE MIB
NETHERLANDS	AEX ALL SHARE
NORWAY	OSLO OBX
POLAND	WARSAW GENERAL INDEX
PORTUGAL	PORTUGAL PSI ALL SHARE
SPAIN	IBEX 35
SWEDEN	OMX STOCKHOLM
SWITZERLAND	SWISS MARKET
TURKEY	BIST ISTANBUL
UNITED KINGDOM	FTSE ALL SHARE

Appendix 2. List of green bond issuing companies in the dataset

Issuing company	Ticker
A2A SpA	A2
ABO Energy GmbH and Company KGaA	AB9
Agilyx ASA	AGLX
Aker ASA	AKER
Alerion Clean Power SpA	ARN
Allreal Holding AG	ALLN
AP Moeller - Maersk A/S	MAERSKa
Arcelik AS	ARCLK
Arise AB	ARISE
Arkema SA	AKE
ASML Holding NV	ASML
Audax Renovables SA	ADXR
BASF SE	BASFn
Baywa AG	BYWG
Benchmark Holdings PLC	BMK
Berkeley Group PLC	BKGH
Besqab Bostadsutveckling AB	BESQAB
Boliden AB	BOL
Bonava AB	BONAVa
Bonheur ASA	BONHR
Borregaard ASA	BRGB
Cinis Fertilizer AB	CINIS
Clariant AG	CLN
Colruyt Group NV	COLR
Compagnie de Saint Gobain SA	SGOB
Covestro AG	1COVG
Cyfrowy Polsat SA	CPS
Derichebourg SA	DBG
E On Se	E.ON SE
EDP SA	EDP
Electrolux AB	ELUXa
Elia Transmission Belgium SA	ELI
Elisa OYJ	ELISA
Elkem ASA	ELK
Elopak ASA	ELO
Enbw Energie Baden Wuerttemberg AG	EBKG
Engie Energia Chile SA	ENGIE
Epiroc AB	EPIRa
ERG SpA	ERG
Evonik Industries AG	EVKn

Issuing company	Ticker
Forvia SE	FRVIA
Getlink SE	GETP
Grenevia SA	GEA1
Grieg Seafood ASA	GSFG
Heidelberg Materials AG	HEIG
Hera SpA	HRA
Husqvarna AB	HUSQa
Iren SpA	IREE
Kesko OYJ	KESKOA
Knorr Bremse AG	KBX
Koninklijke Ahold Delhaize NV	AD
Koninklijke Philips NV	PHG
Mercedes-Benz Group AG	MBGn
Mowi ASA	MOWI
National Grid PLC	NG
Neinor Homes SA	HOME
Neste OYJ	NESTE
Nexity SA	NEXI
Nobina AB	NOBINA
Nordex SE	NDXG
NRC Group ASA	NRC
Orkla ASA	ORK
Photon Energy NV	PENP
Polenergia SA	PEPP
Reka Industrial OYJ	REKA
Renewi Limited	RWI
Romande Energie Holding SA	REHN
RWE AG	RWEG
Salmar ASA	SALM
Scatec ASA	SCATC
Schneider Electric SE	SCHN
SKF AB	SKFa
Snam SpA	SRG
SSE PLC	SSE
Stellantis NV	STLAM
Stora Enso OYJ	STEAV
Svenska Cellulosa Aktiebolaget SCA	SCAa
Swisscom AG	SCMN
Telia Company AB	TELIA
Terna Rete Elettrica Nazionale SpA	TRN
Tomra Systems ASA	TOM
Tritax Big Box REIT PLC	BBOXT
UPM-Kymmene OYJ	UPM
Valeo SE	VLOF

Issuing company	Ticker
Valmet OYJ	VALMT
Vestas Wind Systems A/S	VWS
Vinci SA	SGEF
Vodafone Group Public Limited Company	VOD
Voestalpine AG	VOES
Voltalia SA	VLTSA
Volvo Car AB	VOLCARb
Whitbread Group PLC	WTB
Yara International ASA	YAR