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The Influence of Green Bond Issuances on Stock Market Performance

Transatlantic Perspective

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Tämän pro gradu -tutkielman tavoitteena on selvittää, miten vihreiden joukkovelkakirjalainojen liikkeellelaskun julkistaminen vaikuttaa niitä laskevan yhtiön osakekurssiin lyhyellä aikavälillä. Tutkielma keskittyy Atlantin molemmin puolin toimiviin yrityksiin, jotka edustavat keskeisiä markkinoita vihreän rahoituksen alalla. Teoreettinen viitekehys rakentuu signaaliteoriasta, sidosryhmäteoriasta, agenttiteoriasta sekä tehokkaiden markkinoiden hypoteesista. Tämä antaa perustan hypoteeseille, joiden mukaan vihreän joukkovelkakirjalainan julkistaminen nostaa yhtiön osakekurssia, erityisesti silloin kun kyseessä on yrityksen ensimmäinen vihreä liikkeeseenlasku.

Empiirinen aineisto on koottu Refinitivin Datastream- ja Yahoo Finance -tietokannoista, ja tutkimusmenetelmänä käytetään tapahtumatutkimusta. Lyhyet tarkasteluikkunat osoittivat keskimäärin lievästi positiivisia ja tilastollisesti merkitseviä ylituottoja yhtiöiden osakekursseissa. Pidemmissä ikkunoissa vaikutukset kuitenkin heikkenivät. Robustisuusanalyyseissa havaittiin, että erityisesti äärimmäisten havaintojen poistaminen vaikutti tulosten merkitsevyyteen.

Tutkielma tarjoaa sekä tutkijoille, että yritysten johdolle uutta tietoa vihreiden joukkovelkakirjalainojen lyhyen aikavälin osakemarkkinavaikutuksista. Tulevissa tutkimuksissa kannattaa tarkastella laajempia alueita ja pidempiä tarkastelujaksoja, jotta saataisiin syvällisempi kuva vihreän rahoituksen pitkäaikaisesta vaikutuksesta yritysten arvoon.

AVAINSANAT: vihreä joukkovelkakirjalaina, vihreä rahoitus, tapahtumatutkimus, kestävä kehitys.

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Abbreviations

AR	Abnormal Return
CAPM	Capital Asset Pricing Model
CAR	Cumulative Abnormal Return
CBI	Climate Bonds Initiative
CSR	Corporate Social Responsibility
DAX	Deutscher Aktienindex (German stock market index)
EMH	Efficient Market Hypothesis
ESG	Environmental, Social, and Governance
ESMA	European Securities and Markets Authority
EU	European Union
FTSE	Financial Times Stock Exchange (UK Stock market index)
GBP	Green Bond Principles
IBEX	IBEX 35 (Spanish stock market index)
ICMA	International Capital Market Association

OECD	Organization for Economic Co-operation and Development
SDG	Sustainable Development Goals
SMA	Simple Moving Average
UN	United Nations

1 Introduction

Magill et al. (2015) address that traditional way of seeing that corporations should act in the interest of shareholders by maximizing shareholder value is too restricted. It focuses solely on profit, which leaves out the other externalities affecting stakeholders such as employees, consumers and therefore also the environment. As a result, companies can no longer be valued purely based on their profitability, as corporate social responsibility plays a major role in determining how much funding they can obtain for their projects and consequently their overall financial performance.

The UN Environment Programme Emissions Gap Report (2022) highlights that current climate strategies are insufficient to keep global temperature rise within 1.5°C of pre-industrial levels, with a more realistic estimate being 2.5°C. The report underlines the importance of changing the financing system to support the sectoral transitions needed to address the climate crisis. Green finance is increasingly recognized as a key tool in the response to climate change. Green bonds, as part of this broader green finance approach, are critical in providing the capital necessary for funding environmentally sustainable projects and advancing global climate goals (United Nations Environment Programme, 2022).

A green bond is a type of financial instrument designed to raise capital for initiatives that would benefit the environment. Only approved "green projects," such as clean transportation, energy efficiency, renewable energy, or any other project aiming at lowering greenhouse gas emissions and promoting sustainability, may be financed or refinanced with the proceeds from green bonds (Bhutta et al., 2022).

1.1 Purpose of the study

The purpose of the study is to analyze how green bond issuance announcements affect the stock performance of issuing companies in the short-term. The study is based on the

assumption that green finance can change the allocation of capital to favor sustainable initiatives (Flammer, 2021). The assumption of the positive impact of green bond issuance reflects a broader market trend in which companies signaling stronger CSR performance tend to face fewer capital constraints as highlighted by Cheng, Ioannou, and Serafeim (2014). Based on the initial research review, this study tests the following two hypotheses:

H1: Green bond issuance announcements have a positive short-term impact on the stock prices of issuing firms.

H2: The short-term stock price reaction to green bond issuance is stronger for firms issuing their first green bond than for those that have previously issued green bonds.

1.2 Structure of the study

This thesis is organized into six chapters. The first chapter introduces the research topic, defines its objectives and formulates the main hypotheses regarding the short-term stock price impact of green bond announcements. Chapter 2 provides an extensive literature review on green bonds and sustainable finance, highlighting existing empirical work and the relevant regulatory environment. Chapter 3 outlines the theoretical framework by discussing the core finance and organizational theories such as signaling theory, stakeholder theory, agency theory and the efficient market hypothesis. These serve as the conceptual foundation for this research, informing the research questions.

Chapter 4 describes the data sources and methodological choices, including the selection of event windows, the definition of abnormal returns and the key independent and dependent variables. Chapter 5 then presents the empirical findings, integrating descriptive statistics, event study results and robustness checks. Finally, Chapter 6 concludes by summarizing the main contributions of the study, acknowledging its limitations and offering suggestions for future research paths in green finance.

2 Literature review

This chapter reviews previous research on the topic. First, the importance of green bonds for sustainable finance is linked to previous research. This is followed by a discussion of how the bond issuance has affected the share price. Then, previous research on the impact of green bonds on company performance and share price is presented. Finally, the research methods and approaches used in previous studies are reviewed.

2.1 An Overview of Green Bonds

Flammel (2021) states that green bonds are bonds whose earnings are allocated to funding climate-friendly and environmental initiatives, such resource conservation, green construction, or renewable energy. According to Maltais and Nykvist (2019) green bonds are a type of debt security specifically designed to finance and re-finance projects with positive environment impacts. They argue that the investors are protected from the financial risks of individual projects because the investment is backed by the overall financial strength of the issuer's balance sheet. Tang and Yang (2020) define green bonds as new financial instruments with the specific aim of enhancing environmental impacts and social welfare. They emphasize the importance of green bonds through third-party accreditation. Deschryver & De Mariz (2020) summarize that green bonds are characterized by a commitment to allocate the proceeds to projects with specific environmental objectives. They support initiatives focused on climate change mitigation and adaptation and responding to the increasing awareness of climate-related risks among investors, insurers, banks, and governments (Deschryver & De Mariz, 2020).

Ehlers and Packer (2017) claim that the starting point of green bond market was the European Investment Bank's "climate awareness bond" that was issued in 2007. Another significant development has been the introduction of Green Bond Principles by the International Capital Market Association (ICMA) in 2014. The green bond market has grown exponentially since then. As the market has grown, there has also been a change in the issuers of green bonds. As Figure 1 shows, supranational bonds issued by

international organizations played a significant role until 2013, after which green bonds issued by individual countries and companies started to become more common. The figure shows that as of 2016, emerging markets led by China are responsible for a substantial proportion of the global green bond market.

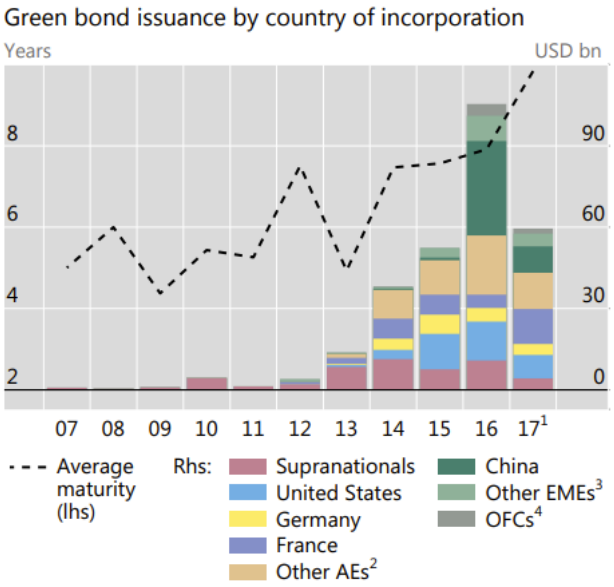

Figure 1 Green bond issuance by country of incorporation (Ehlers & Packer, 2017)

Although green bond issuances are projected to increase in the coming years (CBI, 2024), Tang and Zhang (2020) suggest that there may still be obstacles hindering this growth. They argue that lack of global standards and labeling creates uncertainty for investors which may prevent potential growth in the market. As the green bond market continues to grow, it is important to note that it remains relatively small in comparison to the overall global bond market, as in 2016 the green bond market accounted for 1% of the total bond market (Rebredo, 2018).

2.1.1 Green Bond types

ICMA (2022) divides green bonds into four distinct categories. These categories are Standard Green Use of Proceeds Bond, Green Revenue Bond, Green Project Bond and Secured Green Bond. The standard Green Use of Proceeds is a conventional bond that is

fully backed by the issuer's credit and allocates proceeds to environmentally friendly initiatives. The Green Revenue Bond is backed by revenue streams from certain green projects without relying on the issuer. This means that investors bear exposure to the project's revenue potential. The Green Project Bond is specifically designed to give investors direct exposure to a single or multiple green projects with little recourse to the issuer. Secured Green Bond increases investor protection by using assets or revenue as collateral that can be directly connected to green projects or broader green initiatives (ICMA, 2022).

2.2 Challenges in the green bond market

Deschryver and De Mariz (2020) identify five primary challenges for the development of the green bond market: (1) Lack of standardization, (2) Risks of Greenwashing, (3) Higher costs for issuer, (4) Lack of supply and (5) the underdevelopment of the market in general. These risks along with the relevant research are discussed below (Deschryver & de Mariz, 2020).

2.2.1 Lack of standardization

Deschryver and de Mariz (2020), Ehlers and Packer (2017) and Maltais and Nykvist (2019) underline the lack of standardization as a fundamental challenge for the green bond market. In the conventional bond market, the credit rating system functions as a standardized benchmark, providing investors with a consistent framework for comparing bonds. However, the green bond market lacks a globally accepted standardized framework. Instead, various entities and countries have developed their own voluntary certification schemes, leading to a fragmented and complex certification environment (Deschryver & de Mariz, 2020). According to a survey (Figure 2) conducted by Deschryver and de Mariz (2020), 56% of the experts surveyed claim that an external certification or their own due diligence gives the best comfort that green bonds follow best practices. Only 44% of respondents gave a global framework as an answer, the most preferred the Green Bond Principles (GBP) with 22%. The survey results show the fragmented nature

of the green bond market certifications. While the Green Bond Principles (GBP) hold some level of recognition as the most preferred global framework, external certifications and internal due diligence still outweighs the use of these global frameworks. These results underline the ongoing need for globally recognized standards.

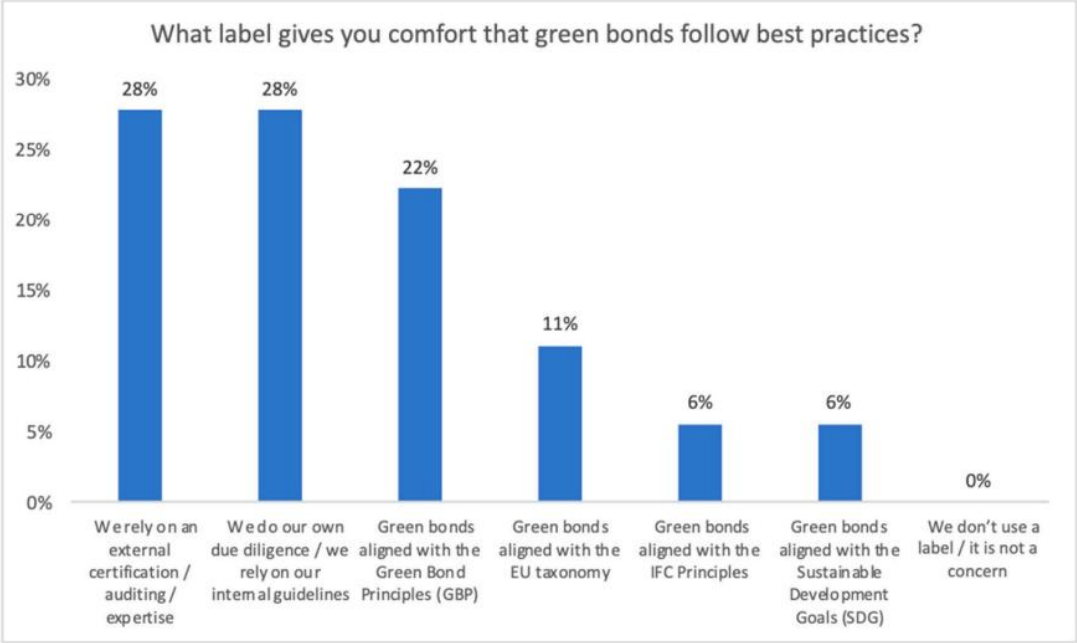

Figure 2 Green Bond Label survey (Deschryver & de Mariz, 2019)

Chapter 2.4 reviews the regulatory framework and most common green bonds standards more thoroughly.

2.2.2 Greenwashing

Delmas and Burbano (2011) define greenwashing as the action where companies communicate positively about their environmental impact although they are actually performing poorly in terms of environmental performance. This creates a misleading image about a company's environmental responsibility (Delmas & Burbano, 2011).

According to Shi et al. (2023) companies may use green bonds to communicate environmental performance to investors by labelling them "green", even if they do not fully meet green bond standards. During the bond's issuance process, some companies may

present misleading information regarding the project's environmental friendliness. Shi et al. (2023) research finds that companies may be engaging in greenwashing activities. They find that companies doing business in highly polluting industries are more likely to be prone to greenwashing activities. Their research shows that while the number of green patent applications rises in response to the issue of green bonds, an increasing percentage of these patents are non-invention patents. In addition, they found that the proportion of green patents granted, and the citation rate do not improve after the issuance of green bonds. This suggests that companies may be in the green bond market for strategic-economic reasons, suggesting possible greenwashing. Wang and Shen (2024) obtained the contrary results regarding greenwashing in the green bond market. In their study, they analyzed data from Chinese listed companies for the period 2011-2020. Their results showed that bond issuance significantly reduces greenwashing by improving the quality of data disclosure. Conversely, they found that access to financing is more accessible for green bonds which may slightly contribute to greenwashing. However, they argue that the positive effects of improved transparency outweigh the risks of improved access to financing.

2.2.3 High costs and lack of supply for green bonds

The lack of standardization is closely associated with the higher costs of issuing green bonds compared to conventional bonds. The process of verifying a bond's "green" status and monitoring that the proceeds are used for environmentally sustainable purposes is typically carried out by third-party assurance organizations. According to a report by OECD (2016), third party assurance fees can vary from $10,000 to $100,000 posing financial challenges for smaller issuers.

A key problem for lack of supply is that many issuers do not have enough green projects to meet the requirements for issuing green bonds. GBP and CBI (see chapter 2.4) standards require that at least 90% of the bond's proceeds need to be allocated to specific green projects (ICMA, 2021) and (CBI, 2023). However, many issuers lack sufficient eligible capital expenditures to justify the issuance of green bonds, particularly given that

bonds smaller than USD 300–500 million often fail to achieve the necessary liquidity or index inclusion (Deschryver & de Mariz, 2020).

2.3 Green bonds as part of the sustainable finance

Sustainable finance is an umbrella term, which means that there is no exact definition for it. European Commission (2024) defines sustainable finance as "Process of taking environmental, social and governance (ESG) considerations into account when making investment decisions in the financial sector, leading to more long-term investments in sustainable economic activities and projects." (European Commission, 2024) In similarly, (Edmans & Kacperczyk, 2022) define sustainable finance as the integration of environmental, social and governance (ESG) issues into financial decisions. (Edmans & Kacperczyk, 2022) In summary, sustainable finance is a broad concept that aims to integrate environmental, social and governance (ESG) criteria into financial decision-making. Green bonds have emerged as a key instrument to direct capital to projects that address urgent environmental challenges. The following section reviews the research literature on the relationship between green bonds and sustainable finance.

Flammer (2021) found that companies improved their environmental performance such as lower CO2 emissions after the issuance of green bonds. The study also rebutted the claim that green bonds are used solely for greenwashing, as real environmental improvements were seen after their issuance. Flammer (2021) also found no significant difference in the cost of capital between green and non-green bonds, indicating that green bonds do not necessarily offer cheaper financing. One conclusion was that investors' positive response to issuance announcements was stronger for first-time issuers as well as for bonds certified by third parties, which highlights even more investors' genuine interest in the environment (Flammer, 2021).

The study from Shah et. al. (2024) concludes that green bond issuance significantly increases clean energy investment (CEI) in selected countries. It confirms that green bonds

help channel funds to renewable energy projects such as wind, solar and hydro, thereby reducing dependence on fossil fuels. The research data shows a direct correlation between the issuance of green bonds and the decrease in CO2 emissions. CO2 emissions are predicted to drop by 0.0643% for every 1% increase in the issuance of green bonds. The results of Shah et al. (2024) suggest that economic growth not only mitigates CO2 emissions but also promotes investments in renewable energy. Conversely, technical developments drive up both CEI and CO2 emissions, most likely due to industrial activity associated with innovation. The green bonds will play an important role in this by encouraging investment in renewable energy sources and reducing carbon emissions, thus contributing to sustainable economic growth.

According to the Climate bonds initiative (2023), Europe as a region accounted for 53% of the 2023 aligned green bond volume, which amounted to 309,6 (USD) billion and represented a rise of 23% compared to 2022. (Climate Bonds Initiative, 2023) Therefore, Europe plays an essential role in directing capital towards renewable energy and thereby establishing a standard for other geographical areas. Hence, research data with a European emphasis is equally relevant. Gharleghi et al. (2024) focuses their study on the purpose of green finance within the European context. The results show that German green finance initiatives are more effective in reducing greenhouse gas emissions than EU-27 initiatives, due to Germany's ambitious goal of becoming greenhouse gas neutral by 2045. Gharleghi et al. (2024) study underscores the crucial role of green bonds in channeling investments towards initiatives that promote environmental sustainability. Furthermore, it emphasizes the requirement for enhanced policy frameworks to optimize the influence of green bonds on the reduction of carbon emissions.

Saha and Maji's (2023) study incorporate the perspective of developing countries, looking at the correlation between green bonds and CO2 emissions for 44 countries for the period of 2016-2020. The study finds that while developed nations are in the forefront of green bond issuances, it is developing countries that produce greater greenhouse gas emissions. The study shows that green bonds have a significant global impact on

reducing carbon emissions. However, the extent of the influence differs significantly among countries, and is more pronounced in emerging nations. Although developing nations issue a smaller number of green bonds, they receive more significant environmental advantages due to their elevated emission levels (Saha & Maji, 2023).

In contrast to previous studies, Jia (2022) shows that the effect of green bonds on reducing carbon emissions is ambiguous. Although companies are increasingly interested in green finance instruments, the development of green finance markets varies across countries. Jia's (2022) study focused on three economies - Russia, China and the United States. At the firm level, the study finds no clear evidence that green bond issuance has significantly reduced carbon intensity or accelerated the transition to a low-carbon economy. However, a study by Jia (2022) acknowledges that this ambiguity is largely due to a lack of sufficient empirical data and relevant studies.

2.4 Regulatory framework of Green Bonds

Green bonds face a complex environment with voluntary standards and new legislation. The following subsections discuss the most well-known green bond frameworks.

2.4.1 Green Bond Principles

Non-profit organization International Capital Market Association (ICMA) has published the Green Bond Principles (GBP), a set of voluntary guidelines designed to promote the integrity and transparency of the green bond market (ICMA, 2021). The GBP consists of four core components which are 1.) Use of Proceeds, 2.) Process for Project Evaluation and Selection, 3.) Management of Proceeds and 4.) Reporting.

According to the first component, the main feature of a green bond is that the funds raised are allocated to projects that benefit the environment. The issuer must describe the use of the funds in the legal documentation and assess the environmental benefits of all green projects. If the funds are used for refinancing, it is advisable to provide an

estimate of the contributions. Green projects should support key environmental objectives such as tackling climate change and protecting natural resources. The second component states that the issuer must clearly communicate to investors the environmental benefit objectives by which projects are selected. Approval criteria and any exclusion criteria must also be disclosed. Transparency and external evaluation are recommended processes to support investor confidence. The third component specifies that the funds collected must be kept separate from other funds and must be deposited in a separate account or transferred to a sub-portfolio. The issuer must continuously monitor the use of the funds and inform investors where the funds are invested. The issuer must also ensure that the funds are correctly allocated to green projects. The reporting component stipulates that issuers must keep up-to-date records on the use of funds and update them annually. The report should include a list of projects on which funds have been invested and an assessment of their expected impact. Transparency is important and it's recommended that both qualitative and quantitative indicators are used (ICMA, 2021).

GBP -principles are entirely voluntary to adopt and they do not create any rights or obligations for any party. However, they have a vital role in promoting green finance and fostering market transparency. The ICMA published the GBP's in 2014 and since then they have been updated several times. Ehlers and Packer (2017) argue that GBP's have a crucial role for the development of the green bond market. The green bond market has grown exponentially since the introduction of the GBP -principles in 2014. In addition, the GBP -principles are the foundation of many of today's green labels.

2.4.2 Climate Bonds Initiative

The Climate Bonds Initiative (CBI) is a global organization dedicated to channeling capital toward climate action. Its primary strategies include the creation of the Climate Bonds Standard and Certification Scheme, Policy Engagement and Market Intelligence work (CBI, 2024).

CBI (2023) has established guidelines for the certification of sustainable debt instruments with the aim of enhancing their credibility in achieving SDG's (Sustainable Development Goal's). The certification scheme is divided into two levels. Level 1 (Figure 1, Company Y) will focus on issuers that are already close to zero emissions, while Level 2 (Figure 1, Company Z) will apply to issuers with higher emissions but who have ambitious plans in place for a 1.5-degree emission reduction transition.

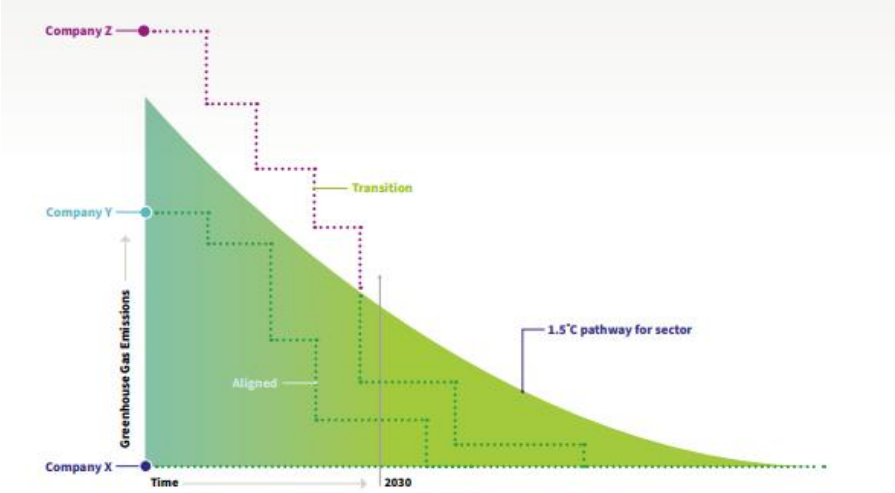

Figure 3 CBI levels (CBI, 2023)

These guidelines state that to qualify for certification, legal entities must issue sustainability-linked debt instruments that are aligned with certain Key Performance Indicators (KPI's). The certification process includes strict verification by Climate Bonds' accredited certifiers, which reinforces the credibility of the initiative. The Certification process is overseen by an independent Climate Bonds Standard Board, which ensures a robust governance structure (CBI, 2023). The entity benefits from certification by giving investors greater confidence in the company's environmental objectives. It can also improve the company's reputation and therefore increase its visibility in the market. This can subsequently enhance investor confidence in the entity, thereby increasing its visibility as an attractive investment opportunity.

2.4.3 EU Green bond standard

The European Commission's proposal for a European Green bond Standard (2021) aims to create a voluntary framework to increase transparency and credibility of the green bond market in the European Union area. The proposal is part of the broader European Commission strategy on sustainable finance.

Under the EU GBS, issuers are required to allocate bond proceeds exclusively to projects that align with the EU taxonomy's strict standards for environmental sustainability. This ensures funded projects make a significant contribution to one of the six designated environmental goals while avoiding substantial harm to others. A critical part of the EU GBS framework is the mandate for third-party verification. Compliance must be verified by independent assessors, under the oversight of the European Securities and Markets Authority (ESMA), both prior to and throughout the lifecycle of the bond. This external verification increases investor's confidence by confirming the authenticity of green bonds and helping to reduce the risks of greenwashing. Although the GBS remains voluntary at present, it serves as an essential component of the European Union's overcharging objective to achieve carbon neutrality by 2050 (European Commission, 2021).

However, according to a 2019 study by Pyka (2019), the EU GBS does not solve the problems of the green bond market because the assumptions underlying it are flawed. The main problem is not the EU's proposed market fragmentation, but rather the lack of effective private enforcement mechanisms that could protect investors from 'green defaults'. In its current form, the EU standard disrupts competition between private and public standards, which can undermine the functioning of markets.

Pyka (2019) proposes the following changes. The EU GBS should be the only standard for all green bonds in the EU market, and private standards should be aligned with EU standards. In addition, aligned private green bond standards should include robust enforcement mechanisms to ensure compliance by issuers and holders, including coverage against "green defaults". Finally, social and sustainable bonds should be included in the

EU Green Bond Standard's scope of applicability. These changes could more effectively address the EU's structural deficiencies in the green bond market, thereby advancing both environmental and financial market objectives while preserving competition between public and private sectors (Pyka, 2023).

2.5 Impact of green bond issuance on share prices

Based on data from 28 countries over a decade (2007-2017), the study by Tang and Zhang (2020) finds a notable increase of about 1,4% in stock prices around the green bond announcement period of 21-day event window. A particularly robust positive correlation was observed among firms that were issuing green bonds for the first time. It was also noteworthy whether the issuer was a corporate entity or a financial institution, as the market response was stronger for corporate issuers. The study Tang and Zhang (2020) reveals that, there is lack of evidence indicating that green bonds are issued at lower yields compared to conventional corporate bonds from the same issuers. This implies that the primary benefit of green bonds is not in the cost of debt financing. The issue of green bonds can expand the investor base by increasing media exposure, therefore enabling impact investors to effectively meet their investment objectives. In summary, the results indicate that current owners have the potential to obtain a financial profit from the issue of green bonds (Tang & Zhang, 2020).

Fan et al. (2023) study contains dataset of 2160 green bonds issued by Chinese agencies between January 5, 2016, and February 28, 2022. The study analyses CAR over the following time windows: (-10, -6), (-5, -1), (1, 5), (0, 5), (6, 10), (11, 20) and (21, 40). For announcement dates the total sample size is 132 and for issuance dates it’s 146. The key finding from the study indicates a positive short-term stock market reaction to the announcement of issuing green bonds. Chinese green bonds must fulfill the strict requirements of allocating over 50% of the funds collected towards environmentally friendly initiatives. In addition, issuers are still required to provide relevant information under supervision. In this scenario, some companies may exhibit a lack of effort to acquire the green label, even if they issue factual green bonds. The study found that this positive

reaction does not apply to green bonds, which do not have this official "green" label. This outcome underlines the importance of certification for investors.

A study by Flammer (2021) examines the impact of green bond issuance on stock market performance. The dataset includes a global sample of 1,189 green bonds issued by 400 different companies between 2013 and 2018. Flammer uses an event-based approach to analyze cumulative abnormal returns (CAR), with a base event window of (-5, +10) days. The key finding is that green bond issuances generate a positive market reaction, with CARs averaging around 0.49%. The positive reaction is particularly significant for first-time green bond issuers and third-party certified bonds. Flammer's findings highlight the importance of green bond certification in boosting investor confidence, as the positive reaction of certified green bonds was stronger than that of uncertified bonds. Research suggests that the issuance of green bonds can be seen as a credible signal of a company's commitment to environmental sustainability, which attracts socially responsible investors and increases the market value of the company (Flammer, 2021).

The study by Wang et al (2020) examines the economic impact of green bond issuance in China, where the green bond market is a fast-growing segment of the sustainable finance industry. Through an event study analysis of 159 green bonds issued by 56 firms from 2016 to 2019, the authors reveal that green bonds have a significant pricing premium over conventional bonds. This premium is particularly evident for issuers and underwriters with a stronger reputation for CSR. Furthermore, their findings show that for green bond issuance announcements, stock abnormal returns are positive, with a CAR of 1.2% in the [-10, +10] and CAR of 0.5% in the [-3, +3] day transaction windows. These results suggest that both debt and equity markets respond favorably to firms participating in sustainable finance, supporting the notion that environmentally responsible investment practices can increase firm value in emerging markets (Wang et al., 2020).

The findings from Lebelle et al. (2020) challenge the general assumption that green bonds consistently provide positive value for the company who issues them. The study

analyses how the market reacts to the announcement of a green bond issuance. A dataset consists of 475 green bonds issued by 145 companies throughout the period from 2009 to 2018. The study by Lebelle et al. (2020) emphasizes that market responses are often negative, since stock prices generate cumulative abnormal returns ranging from -0.5% to -0.2% around the periods when green bonds are announced. The negative response is particularly evident in developed markets and among firms that are issuing green bonds for the first time. Labelle et al. (2020) suggest a possible reason for this is that negative market reactions to green bond issuance may be driven by investor uncertainty. Announcement of green bonds by companies indicates a transition towards more environmentally friendly business models and capital spending, perhaps causing investors to doubt if future profitability would be equivalent to past levels. According to Labelle et al. (2020) the other reason for this is that investors may be fearing greenwashing, which could result in reputational damage. This is more pronounced in developed markets than in developing markets, possibly due to stricter transparency and legal obligations in developed countries.

The impact of green bond issuance on a company's share price has been studied in different ways, as shown in the table below (Table 1).

Table 1 Impact of Green Bond Announcements on Stock Market

Author(s) and Year	Time period	Region	Data sample size and issuers	Methodology	Result
Fan et al. (2023)	2016–2022	China	2160 bonds	Event study with different event windows (CAR)	Positive short-term stock market reaction especially for labeled green bonds.
Flammer (2021)	2013-2018	Global	1189 bonds and 400 issuers	Event study with baseline event window (-5,+10) CAR	Positive stock market reaction (CAR of 0.49%). Stronger for certified green bonds and first-time issuers
Lebelle et al. (2020)	2009–2018	Global	475 bonds and 145 issuers	Event study with CAPM, Fama-French 3-factor model and Carhart 4-factor model	Negative market reaction with CAR between −0.5% and −0.2%.
Tang & Zhang (2020)	2007-2017	Global	1510 bonds and 132 issuers	Event study and CAR (-10,+10) window	Positive stock market reaction (CAR of 1.4%)
Wang et al. (2020)	2016–2019	China	159 bonds and 56 issuers	Event study comparing yield spreads of green bonds and matched conventional bonds, assessing stock price reactions over [−1,1] , [-10,10] and [−3,3] event windows.	Positive abnormal stock returns for green bond issuance announcements

2.5.1 Event study

All the studies in section 2.4 used event study as the research methodology to determine the impact of green bond announcements on stock prices by calculating abnormal returns in specific event windows and comparing these returns to a baseline of expected returns. According to MacKinlay (1997), an event study is a method that measures the economic impact of a specific event on value of the company or its stock price. The Efficient Market Hypothesis discussed in chapter 3.4 is heavily linked to the event study methodology, because if the market is efficient, any new information such as a green

bond issue will be quickly incorporated into the stock price, which will then be reflected in the event study. This methodology originates from Ball and Brown (1968), who were the first to show that accounting earnings reports have a significant impact on stock prices. The methodology was further developed by Fama et al. (1969), who introduced the event study method in their study of how stock prices adjust to new information.

This study uses the event study method to examine the impact of green bond issuance announcements on the stock prices of issuing firms. This approach allows us to measure abnormal returns in specific event windows, providing information on how markets react to new information related to green financing. The event study methodology is presented in more detail in chapter 4.3 and the results are presented in chapter 5.

3 Theoretical Framework

In this chapter the theoretical framework is presented to be able to understand the connection between stock market reactions and green bond issuance. The chapter presents fundamental financial theories that explain the market's reaction to corporate bond issuances and puts green bonds within these theoretical frameworks. This theoretical foundation will be essential for the subsequent empirical analysis of the impact of green bonds on corporate stock valuations.

3.1 Signaling theory

In situations where information is incomplete, signaling theory by Spence (1973) describes how individuals inform employers about their productivity. Observable characteristics, such as education, are utilized by applicants as indicators of their productivity, as employers are unable to assess the actual capabilities of a job applicant prior to employment. In order for a signal to be considered credible, it must be costly. More productive individuals are able to invest in higher education, whereas less productive individuals are unable to do so. This signaling establishes an equilibrium in the labor market, in which wages are determined by these observable signals rather than directly by observed productivity. This theory was first introduced by Michael Spence in 1973, and it only covered the asymmetric information problem in the labor market. Subsequently, signaling theory has been applied in many different instances, such as insurance market (Rothschild & Stiglitz, 1973), initial public offerings (IPO's) (Carter & Manaster, 1990), marketing (Kirmani & Rao, 2000), corporate governance (Zhang & Wiersema, 2009) and strategic management (Connelly et. al, 2011).

Signaling theory is vital for understanding how the issuance of green bonds may serve as a signal to the broader market and investors. A company's commitment to sustainable, environmentally friendly projects can be shown to the market through the issuance of green bonds. This signal has the potential to mitigate the information asymmetry

between the company and investors in relation to the firm's ESG practices. This relationship between signaling theory and the issuance of green bonds is described in studies by Flammer (2021), García et al (2023), Fatica et al (2021) and Yeow & Ng (2021).

According to Myers and Majluf (1984), the signaling theory emphasizes that firms should prefer to issue debt rather than equity when seeking external finance. They argue that managers have more information about the value of the firm than outside investors and they can minimize negative market perceptions by favoring debt issuance over equity. Debt issuance signals to investors that the firm is confident in its future cash flows, while equity issuance can raise concerns that managers believe the firm's stock is overvalued, which can lead to a decline in the stock price. Companies that issue green bonds not only express their commitment to sustainability but may also strategically strengthen their financial strength. By choosing debt instruments such as green bonds over equity, companies are following a key principle of signaling theory: they are signaling their strength with safer financing options.

3.2 Stakeholder theory

Stakeholder theory by Freeman (1984) underscores that firms have obligations not only to their shareholders, but also to a larger range of stakeholders such as employees, customers, suppliers, communities, and the environment. The concept issues the traditional emphasis on shareholder wealth maximization, suggesting that enterprises should consider the interests and well-being of all groups affected by their business activities (Phillips, 2003). This viewpoint contends that firms rely on these stakeholders for success, and hence there are moral and strategic motivations to interact with and fulfill duties to them.

Green bonds connect with stakeholder theory since they demonstrate an organization's dedication to addressing environmental concerns that are increasingly important to many stakeholders. Stakeholders are insisting on increased accountability from

corporations concerning climate change especially. Green bonds offer a way for firms to address these expectations. Stakeholder theory suggests that companies should consider all entities affected by companies' actions (Phillips, 2003). Through the issuance of green bonds, corporations may address the concerns of both their financial and non-financial stakeholders. Shareholders get potential financial benefits, whereas other stakeholders, such as governments and the general public, see the favorable externalities of a company's efforts in sustainability. Green bonds also reflect long-term value creation, which is fundamental according to the Stakeholder Theory (Phillips, 2003).

3.3 Agency theory

In the situation of an agency theory, the principal and the agent get into a contractual relationship whereby the principal delegates a certain job to the agent. The parties agree on the goals of the contract but omit decisions required for actual implementation by the agent (Braun & Guston, 2003). According to agent theory, when both are trying to maximize their own benefit, there is reason to believe that the agent will not always act in the best interests of the principal (Jensen & Meckling, 1976). The information asymmetry caused by this omission between these two parties may result in the dispersing of interests.

Agent theory focuses on finding a solution to two problems in the relationship between agent and principal. The first agency problem occurs when the interest and objectives of the principal and agent are not aligned or when it's challenging or expensive for the principal to verify that agent has behaved appropriately. From the principal's perspective, this would imply a moral hazard of either an agent who acts in his/her own interests and of an agent making an adverse selection for the principal on account of an information mismatch. The second agency problem occurs when parties have distinct views on risk. They may choose different solutions in the same circumstances, which creates an issue with risk sharing (Eisenhardt, 1989).

García et al. (2023) combine in their study green bond issuances and corporate governance characteristics. According to them, green bonds have an impact for mitigating the principal's and agent's divergence of objectives since green bonds are often used to finance projects that create value in the long-term rather than focusing on short-term profitability. It highlights particularly the importance of the board of directors in avoiding conflicts of interest with the management and shareholders of the company.

3.4 Efficient Market Hypothesis (EMH)

Market efficiency is a foundational concept in financial theory. It describes a condition in which no investor can consistently achieve higher risk-adjusted returns than the market average. In an efficient market, all relevant information is accessible to every investor, ensuring that asset prices accurately reflect this information. Eugene Fama first introduced the Efficient Market Hypothesis (EMH) in 1965, and it was continuously evaluated and extended from the 1960s through the 1990s (Malkiel, 2021). The core principle of EMH is that in an efficient market, no investor can consistently "beat the market" or earn returns exceeding the market's risk-adjusted average (Fama, 1970). Despite its influence, the EMH has faced substantial criticism, as various anomalies observed in financial markets challenge its assumptions. Behavioral finance theories have since emerged to address these anomalies and expand on the EMH and other traditional finance theories (Ramiah, Xu & Moosa, 2015).

3.4.1 Forms of Efficient Market Hypothesis

According to Fama, market efficiency can be classified into three forms: weak efficiency, semi-strong efficiency, and strong efficiency (Figure 2) (Fama, 1970). In the weak form, stock prices reflect all past information, such as historical price trends, trading volumes, and other market data. The semi-strong form asserts that stock prices incorporate all publicly available information, meaning investors cannot achieve excess returns using public data alone, though insiders may still profit from private information. The strong form of efficiency includes both public and private information, implying that no investor

can consistently earn excess returns, as all information is fully integrated into stock prices (Tung & Marsden, 1998).

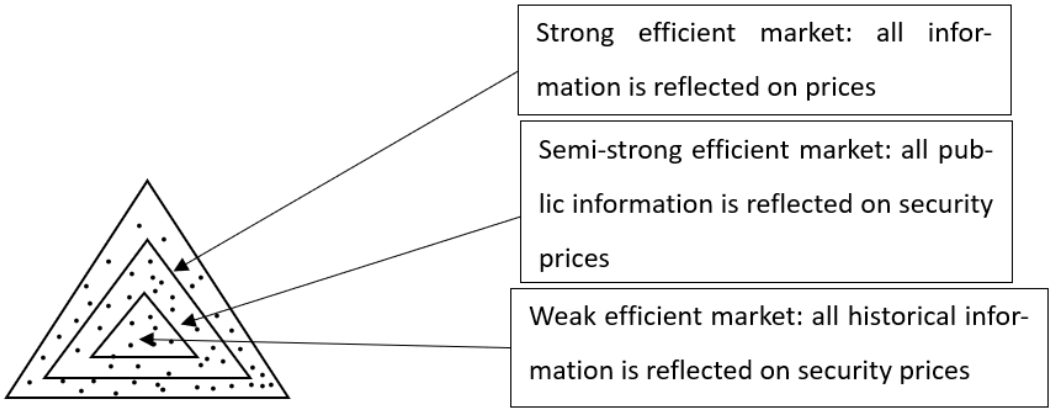

Figure 4 Three forms of market efficiency (Fama, 1970)

Empirical event studies (e.g., Flammer, 2021, Tang & Zhang, 2020, Fan et al., 2023) show short-term abnormal returns following green bond announcements, suggesting that the issuance provides meaningful information about the issuer's environmental initiatives. Under EMH such abnormal returns tend to disappear fairly quickly once markets fully adopt the new information. If a positive price effect is observed, it usually occurs within a short event period before returning to baseline levels. Studies examining the impact of green bond issuance on stock prices (e.g. Wang et al., 2020) often use an event study approach based on a strong form of market efficiency. To detect potential information leakages, these studies usually define event windows that start before the announcement date. This will allow a more accurate assessment of the market's immediate reaction to the new information available.

3.5 Corporate Social Responsibility (CSR)

Academic literature presents a variety of different definitions for corporate social responsibility (CSR). Carroll (1999) sees Bowen's (1953) definition of corporate responsibility as the obligation to comply with the values of society as the beginning of an era of social responsibility. The main point of Keith Davis' article "Social responsibility is

inevitable " (1970) is that corporate social responsibility is an inevitable part of modern business. Davis (1970) argues that socially responsible actions can ultimately benefit businesses in the long run by preventing social counter-reactions. He underlines that CSR should not be seen as a burden, but as an integral part of companies' long-term success. Freeman (1984) emphasizes that businesses must respond to the larger group of stakeholders impacted by their activities in addition to shareholders. The main idea underlying all these definitions is that companies have obligations beyond the mere pursuit of profit. According to Carroll, CSR consists of four components; economic, legal, ethical and philanthropic (Figure 3). Economic responsibility is linked to the profitability of the company, which enables the other parts of the model to be made responsible. Legislation refers to the respect for laws in the company's activities. Ethical responsibility involves behaving in a way that is generally considered to respect social values. Examples of voluntary activities include charity for example. Each of these definitions underlines that companies have a responsibility to consider the wider impact of their activities on society.

Figure 5 Pyramid of Corporate Social Responsibility (Carrroll, 1991)

4 Data and methodology

This chapter describes the data sources, the sample selection process and the methodological framework used to investigate the impact of green bond issuance on stock prices.

4.1 Sample selection

Given the high concentration of global green bond issuance in certain European markets, this analysis focuses on countries that cumulatively issued more than $50 billion in green bonds between 2014 and 2023 (Climate Bonds Initiative, 2022). According to the same report, the United States, Canada, Japan, and China also surpass this threshold. However, China is excluded due to its distinct green bond guidelines and political environment, which complicate consistent cross-country comparisons (International Finance Corporation, 2020). Although Japan is an advanced economy, it lies outside the transatlantic region emphasized in this research. Consequently, the final sample comprises major transatlantic economies—the United States, Germany, France, the Netherlands, the United Kingdom, Italy, Spain, Sweden, Canada, and Norway, ranked by the aggregate dollar value of green bonds issued.

The raw data was obtained from Refinitiv's Datastream -platform. The raw data included a total of 2659 green bonds from 2014-2023. In line with prior research focusing on corporate issuers (Flammer, 2021) bonds issued by agencies, financial institutions, sovereign entities, sub-sovereign entities, and supranational organizations were excluded based on issuer type. The dataset was further refined to exclude bonds issued by unlisted companies and delisted companies. If the bond-issuing entity was owned by a publicly listed parent company, it would be generally included in the dataset. However, in cases where a significant degree of separation existed between the issuing entity and its parent, the issuance was excluded to maintain consistency with corporate-level event study frameworks (Flammer, 2021). The rationale is that a relatively small or functionally independent subsidiary may not significantly reflect the overall market perception of the parent company, thus diluting the observable stock price reaction to the bond issuance. If

the dataset included more than five bonds issued by the same company, only the five oldest bonds from that company were retained in the dataset, while the remaining bonds were excluded. A proportionally large number of bonds from a single issuer could influence the overall results unduly and thus distort the statistical analysis. By limiting the number of bonds per company, the dataset maintains a more balanced representation across issuers, which improves the reliability of the results. The final dataset includes a total of 108 bonds. All the green bond issuances used in this study are listed in Appendix 1. Table 2 below shows the geographic distribution between the bonds in the final dataset.

Table 2 Sample selection by country

Sociodemographic Characteristics of Participants at Baseline

Country	Amount	
	n	%
United States	30	27,78%
Norway	29	26,85%
Canada	14	12,96%
France	14	12,96%
Sweden	13	12,04%
Spain	4	3,70%
Germany	3	2,78%
Italy	1	0,93%
UK	0	0,00%
Netherlands	0	0,00%

4.2 Market and financial data

Market data have been collected from the following different sources. The intraday data for the companies is obtained from the Refinitiv data service, from which the intraday return is then calculated. The benchmark indices utilized are outlined in the following table below (Table 3). Benchmark indices were selected based on their capacity to most accurately reflect the performance of their respective markets.

Table 3 Benchmark indices

Country	Benchmark index
United States	S&P 500
France	CAC 40
Norway	OSEBX
Sweden	OMX Stockholm 30
Canada	S&P/TSX Composite Index
Spain	IBEX 35
Germany	DAX
Italy	FTSE MIB
UK	FTSE 100
Netherlands	AEX

Bond-specific data, including the issue date, issuance amount, coupon rate, and identification of a company's first green bond, is gathered from Refinitiv's Datastream. Data on the bond-issuing companies was sourced from Yahoo Finance, including company-specific parameters such as market capitalization, beta coefficient, ROA and Total debt-to-equity.

4.3 Event study

Fan et al. (2023), Flammer (2021), Lebelle et al. (2020), Tang & Zhang (2020) and Wang et al. (2020) used the event study approach in their studies to capture stock market reactions to green bond issuance announcements. The studies employed varying event windows to identify possible overperformance after stock announcements. Event windows are chosen to capture immediate or more extended market responses, accounting for potential information leakage or delayed investor reactions.

The aim of the study is to identify immediate or slightly delayed market reactions. Therefore, four distinct even windows are employed to capture short-term event intervals. The event window intervals chosen are [-1, 1], [-3, 3], [-5, 5] and [-10, 10]. The first window [-1, 1] captures the immediate market reaction around the announcement day by considering the possible information leakage on the day before. The second window [-3, 3]

captures the slightly delayed immediate market response by extending the observation period to three days before and after the announcement. The third [-5, 5] and fourth [-10, 10] windows provide slightly longer event intervals which seek to capture extended price adjustments or corrections that may arise as investors respond to the implications of green bond issuance.

4.3.1 Cumulative abnormal return (CAR)

Cumulative abnormal return is a measure used in event studies that sums abnormal returns of a company's stock over a given time window surrounding a particular event. CAR is defined as the sum of all abnormal returns (AR) during the event window (MacKinlay, 1997). In this study, Cumulative Abnormal Returns (CAR) are calculated using the formula:

$$CAR_i(t_1, t_2) = \sum_{t=T_1}^{T_2} AR_{i,t} \tag{1}$$

where CAR represents the cumulative abnormal returns over the specified event window T_1 and T_2. AR represents the abnormal return for a specific stock i at time t. Following MacKinlay (1997), the abnormal return AR is defined as:

$$AR_{i,t} = R_{i,t} - E(R_{i,t} \mid X_t) \tag{2}$$

where R is the *actual* return of stock i at time t, and E(R) is the expected return for firm i given information X. E(R) is estimated by using Market model as described by MacKinlay (1997), is a simple linear framework that links an individual asset's returns to the broader market's returns:

$$R_{i,t} = \alpha_1 + \beta_i R_{m,t} + \varepsilon_{i,t} \quad (3)$$

where a is the intercept estimated in the estimation window described in Chapter 4.3.2, B is the market beta coefficient, and R is the market return. The market return is calculated from the index of the market in which the company is listed.

CAR captures the total effect of the event on the stock's return compared to what would have been expected if the event had not occurred. A positive CAR suggests the firm's stock outperformed its normal expectation during the event window while a negative CAR implies an underperformance

4.3.2 Estimation window

To obtain a control baseline for the returns within the event window, an estimation window must be defined to evaluate the historical expected returns of a stock. This approach ensures that any anomalies in stock movements related to the event do not influence the estimation of expected baseline returns (Lebelle et al., 2020). The estimation window is defined as the period extending from 250 days prior to the announcement date to 50 days prior to the announcement date [-250, -50]. Thereby, baseline returns are calculated over a 200-day period. This timeframe aligns with the widely used 200-day simple moving average (SMA), frequently utilized by market analysts to identify long-term trends in stock prices (Zakamulin, 2013).

4.4 Variables

Dependent and independent variables included in the empirical analysis are listed in this chapter. The dependent variables are the cumulative abnormal returns (CARs) around the event, whereas the independent variables consist of bond-specific and firm-specific variables.

4.4.1 Dependent variables

The dependent variables are the cumulative abnormal returns (CAR's). CARs, consistent with previous literature (e.g., Fan et al., 2023; Flammer, 2021; Lebelle et al., 2020; Tang & Zhang, 2020; Wang et al., 2020) are calculated for the event windows, compared against the baseline established in the estimation window, as described in Section 4.3. Therefore, the dependent variables in this study are the cumulative abnormal returns (CARs) calculated for the event windows CAR[-1, 1], CAR[-3, 3], CAR[-5, 5], and CAR[-10, 10].

4.4.2 Independent variables

This study incorporates both bond-specific and firm-specific variables to capture the drivers behind abnormal returns around green bond issuance announcements. Bond-specific variables include the coupon rate, maturity, the total amount of issued and the first green bond dummy variable. The coupon rate refers to the nominal annual yield promised to investors, while maturity (in years) indicates how long it will take the issuer to repay the bond's principal. The total amount issued is expressed in logarithmic form to handle the wide variation in bond sizes more effectively. In addition, a dummy variable identifies whether the bond represents a firm's first green bond issuance, capturing the possibility that entering the green bond market may signal a heightened commitment to sustainability.

To account for firm-level influences, the analysis includes market capitalization (log) as a measure of company size. Beta reflects the volatility of the firm's stock relative to the overall market, whereas return on assets (ROA) estimates operational efficiency by comparing net income to total assets. Finally, the total debt-to-equity ratio indicates the degree to which the company relies on borrowed funds. By combining these bond- and

firm-specific factors, the study offers a comprehensive view of the key drivers behind abnormal returns associated with green bond announcements.

4.5 Statistical Tests for Abnormal Returns

After calculating abnormal returns (ARs) across the defined event windows, the next step is to determine whether these returns differ significantly from zero. This study primarily relies on parametric t-tests, following MacKinlay's (1997) event study methodology. The t-test assumes that returns are sufficiently close to a normal distribution or that the sample size is large enough for the Central Limit Theorem to apply. Although the t-test is often effective in empirical research, data on green bond issuers may contain smaller sample sizes or skewed distributions, which can reduce the reliability of parametric assumptions.

To evaluate the robustness of the findings, an alternative estimation window is employed in addition to the baseline period. Instead of using only the baseline window (−250, −50), a longer window (−300, −50) is also considered to assess whether the choice of estimation period impacts the estimated abnormal returns. In addition, the analysis is repeated after excluding observations identified as outliers based on an interquartile range method, allowing for an assessment of how extreme outliers may affect the results.

5 Empirical results

This chapter presents the results of an event study to examine whether green bond issuance announcements lead to statistically significant short-term movements in stock prices.

5.1 Overview of Hypotheses

The first hypothesis (H1) examines whether green bond issuance announcements have a positive impact on stock prices. This is based on the signaling theory that green bond issuance can signal a company's commitment to environmental responsibility and sustainability, which attracts environmentally conscious investors and increases the value of the company. Previous studies (Flammer, 2021; Tang & Zhang, 2020) have found evidence of positive market reactions following green bond announcements.

The second hypothesis (H2) focuses on the possible difference in investor reactions between firms issuing the first green bond and firms that have previously issued green bonds. It is expected that a first-time bond issuer may have a stronger signaling effect because it provides the market with new information about the firm's environmental commitment. Repeated issues, on the other hand, may provide less new information and thus lead to a weaker market reaction (Flammer, 2021).

5.2 Descriptive statistics

This chapter presents descriptive statistics for the key variables included in the regression analysis. The descriptive statistics provide basic statistical information of both bond and firm-specific variables, as well as cumulative abnormal returns (CARs) across different event windows.

Table 4 shows the descriptive statistics for the bond-specific variables: maturity years, amount issued (log) and coupon rates. The maturity of the bonds in the sample ranges considerably, with a mean of 9,54 years and a median of 6 years. The distribution is skewed to the right (skewness = 3,07) and has a significant kurtosis (kurtosis = 10,73), indicating the presence of extreme values in the dataset. More specifically, the shortest maturity of bonds in the dataset is two years, while the longest is 60 years.

The mean of the logarithm of the amount issued is 5,52 and the median is 5,70, indicating that the distribution is slightly skewed to the left (skewness = -2,74). The negative skewness shows that there are many smaller bond issues and fewer large bond issues in the data. The kurtosis value of 8,42 suggests a heavy tail of the distribution, confirming that some issues have some outlier values.

The distribution of coupon rates is relatively symmetric, with a mean of 4,71% and a median of 4.65%. The standard deviation is 2,66, indicating modest variation in coupon rates. The skewness of the distribution is minimal (skewness = 0,56) and the kurtosis is small (kurtosis = 0.36), indicating that extreme values of coupon rates are relatively rare with minimum coupon rate of 0% (zero-coupon bond) and maximum coupon rate of 13%.

Table 4 Bond-specific variables

	Maturity years	*Amount issued (log)*	*Coupon*
Mean	9,54	5,52	4,71
Standard Error	0,98	0,07	0,26
Median	6	5,70	4,65
Mode	5	5,70	1,38
Standard Deviation	10,15	0,76	2,66
Sample Variance	103,05	0,58	7,06
Kurtosis	10,73	8,42	0,36
Skewness	3,07	-2,74	0,56
Range	58	4,20	13
Minimum	2	2,35	0
Maximum	60	6,54	13
Sum	1030	596,07	509,21
Count	108	108	108

Table 5 presents descriptive statistics for the firm-specific variables, including market value (log), beta, ROA and total debt-to-equity ratio. The logarithm converted market value has a mean of 0,78 and a median of 0,80, indicating a relatively balanced distribution. The distribution is close to normal, as shown by low skewness of 0,39 and kurtosis of 0,75. The observed range of -1,16-3,12 reflects significant differences in size between firms, which is consistent with the fact that the sample includes both large and small firms.

The mean of the beta values is 0,98, indicating that the volatility of the average firm's stock is very similar to that of the broader market. The median beta value of 1,00 confirms this finding. A slight negative skewness (-0,45) suggests that firms with lower-than-average market risk are more common. The standard deviation of 0,32 indicates that the variation in beta values is small.

ROA has a mean of 0,02 and a median of 0,03, indicating that the average firm is only marginally profitable. However, the distribution of ROA is highly skewed to the left (skewness = -2,45) and its kurtosis is significant (kurtosis = 7,76), suggesting that firms are making substantial losses. A minimum ROA value of -0,31 indicates poor financial performance of some of the firms in the sample. Many smaller green bond issuers are companies positioning themselves for substantial future profits driven by the green transition. However, their current operations may be unprofitable due to significant investments.

The mean value of the total debt to equity ratio is 1,18, indicating that the sampled firms are on average slightly more dependent on debt financing than on equity. The median value of 1,03 is close to the mean, suggesting that most firms have a balanced leverage ratio. However, the maximum value of 3,46 indicates that some firms have a high leverage ratio, which may affect their risk taking. The positive skewness (0,89) and moderate

kurtosis (0,34) also suggest that the distribution is asymmetric and that firms with relatively low leverage are concentrated in it.

Table 5 Company-specific variables

	Market cap (log)	*Beta*	*ROA*	*Total debt/Equity*
Mean	0,78	0,98	0,02	1,18
Standard Error	0,09	0,03	0,01	0,08
Median	0,80	0,98	0,03	1,03
Mode	0,91	1,20	0,03	0,25
Standard Deviation	0,90	0,32	0,07	0,80
Sample Variance	0,81	0,10	0,00	0,64
Kurtosis	0,75	0,01	7,76	0,34
Skewness	0,39	-0,45	-2,45	0,89
Range	4,28	1,45	0,44	3,46
Minimum	-1,16	0,05	-0,31	0,01
Maximum	3,12	1,50	0,13	3,46
Sum	84,33	105,45	2,03	127,48
Count	108	108	108	108

Table 6 presents a summary of the descriptive statistics for the dependent variable, cumulative abnormal returns (CAR), for four event windows: CAR[-1, +1], CAR[-3, +3], CAR[-5, +5] and CAR[-10, +10].

The average abnormal return for the shortest event window CAR[-1, +1] is 0,01, suggesting a mild positive reaction after the event. The median value of 0,02 corresponds exactly to the mean. However, the distribution is strongly skewed to the left (skewness = -1,47) and has significant kurtosis (kurtosis = 9,02), indicating that the data contain extreme negative outliers. This pattern is consistent in the CAR[-3, +3] and CAR[-5, +5] windows, both with mean values of 0,01 and 0,00, and equal kurtosis and negative skewness.

The CAR[-10, +10] window shows a clear pattern with a mean of -0,03, suggesting that firms on average had negative abnormal returns over the longer observation period. This window is characterized by a positive skewness (2,81) and extreme kurtosis (22,24),

indicating that some firms had significant positive returns while others suffered significant losses.

Table 6 Cumulative Abnormal Returns

	CAR -1,+1	*CAR -3,+3*	*CAR -5,+5*	*CAR -10,+10*
Mean	0,01	0,01	0,00	-0,03
Standard Error	0,05	0,05	0,05	0,01
Median	0,02	0,01	0,03	-0,04
Mode	0,00	0,01	0,02	0,03
Standard Deviation	0,52	0,52	0,51	0,14
Sample Variance	0,27	0,27	0,26	0,02
Kurtosis	9,02	8,80	8,23	22,24
Skewness	-1,47	-1,38	-1,35	2,81
Range	4,23	4,30	4,17	1,41
Minimum	-2,71	-2,72	-2,72	-0,47
Maximum	1,52	1,57	1,45	0,94
Sum	1,43	0,73	-0,50	-3,29
Count	108	108	108	108

5.3 Regression analysis

To test the hypotheses presented in Section 5.1, the following multiple regression model is applied:

$$CAR_{i,t} = \alpha + \beta_1(Maturity)_i + \beta_2(Amount\ issued)_i + \beta_3(Coupon\ rate)_i + \beta_4(First\ Green\ Bond)_i + \beta_5(Market\ cap)_i + \beta_6(Beta)_i + \beta_7(ROA)_i + \beta_8(Total\ debt - to - equity)_i + \epsilon_i \quad (4)$$

Where:

- CAR_i^t = Cumulative abnormal return for the company $_i$ in the specified event windows CAR[-1, +1], CAR[-3, +3], CAR[-5, +5] and CAR[-10, +10].
- α = Intercept
- β_1-β_8 = Regression coefficients
- ϵ_i= Error term

The independent variables used in regression are selected based on the prior literature:

- β_1 = Maturity: Bond's maturity in years. Longer maturities may increase investor uncertainty, potentially reducing CAR.
- β_2 = Amount issued: Total issue size in dollar value (logarithm). Higher issue volumes can be a sign of a company's strength, which has a positive impact on CAR.
- β_3 = Coupon rate: A higher coupon rate can be a sign of risk or a weaker performance of the company, which may lower the CAR.
- β_4 = First Green Bond: A dummy variable that is 1 if the bond is the first green bond of the company and 0 if it's not. First-time issues may have a stronger signaling effect on investors, which can have a positive impact on CAR.
- β_5 = Market cap: Company's market value (logarithm). Larger companies may have weaker investor reactions due to their established stability
- β_6 = Beta: A measure of stock volatility that reflects a company's sensitivity to market movements. Companies with higher beta values are typically more volatile, which can increase both positive and negative CAR reactions. As a result, beta is expected to have a negative impact on CAR, as higher volatility can increase investor uncertainty
- β_7 = ROA: Return on assets measures the profitability of a company. Higher profitability can reduce the market's reaction to green bond issuance because positive expectations are already reflected in the share price.
- β_8 = Total Debt-to-Equity: This represents the financial leverage of the company. Higher leverage can increase financial risk, which negatively affects the CAR value.

Table 7 Regression results

	CAR [-1,+1]	*CAR [-3,+3]*	*CAR [-5,+5]*	*CAR [-10,+10]*
Intercept	-0,97 (-1,80)*	-0,94 (-1,74)*	-0,91 (-1,70)*	0,21 (1,36)
Maturity years	0,0004 (0,09)	0,0003 (0,06)	0,0003 (0,06)	-1,03 (-2,99)
Amount issued (Logarithm)	**0,154** (2,17)**	**0,146** (2,06)**	**0,142** (2,01)**	-0,037 (-1,87)*
Coupon	**0,048** (2,54)**	**0,047** (2,52)**	**0,048** (2,53)**	-0,004 (-0,75)
First GB (Dummy)	-0,025 (-0,26)	-0,021 (-0,21)	-0,019 (-0,20)	0,011 (0,69)
Market cap (logarithm)	0,066 (1,05)	0,063 (1,10)	0,064 (1,03)	-0,025 (-1,42)
Beta	0,168 (1,02)	0,154 (0,93)	0,153 (0,93)	-0,015 (-0,15)
ROA	**-1,76** (-2,47)**	**-1,66** (-2,34)**	**-1,66** (-2,33)**	**0,45** (2,19)**
Total debt/Equity	**-0,21** (-3,62)**	**-0,21** (-3,61)***	**-0,21** (-3,61)***	**0,04** (2,35)**
Observations	108	108	108	108
Adjusted R Square	0,1760	0,1650	0,1590	0,0650
F-Statistic (p-value)	3,84 **(0,0006)**	3,65 **(0,0009)**	3,52 **(0,0013)**	1,93 (0,064)

*T-statistics are shown in parentheses beneath each coefficient. Superscripts marked with *** indicate significance at the 1% level, ** at the 5% level, and * at the 10% level.*

The regression analysis presented in Table 7 examines the relationship between different independent variables and the cumulative abnormal return (CAR) in four different event windows: [-1, +1], [-3, +3], [-5, +5] and [-10, +10]. The regression results show that the statistically significant results are mainly focused in the event windows [-1,+1], [-3,+3]

and [-5,+5], suggesting that investor reactions are strongest in the short term. This is in line with previous studies and the hypothesis. In contrast, there is little significance in the [-10,+10] window, indicating that abnormal returns tend to stabilize in the longer term. Variables such as Amount issued, Coupon, ROA and Total debt-to-equity ratio show consistent and significant effects across a multiple of windows, confirming their importance in influencing short-term market reactions.

Bond maturity exhibits no significant influence on stock price reactions in any of the four event windows. However, in the [−10,+10] window, the Maturity coefficient is negative, although statistically insignificant. This suggests that while there may be a weak negative relationship between longer maturities and cumulative abnormal returns over a more extended horizon, the effect is not strong enough to draw firm conclusions. This pattern may reflect investor concerns about a company's ability to manage long-term debt effectively, but the absence of statistical significance limits the strength of this interpretation.

The coefficient for the Amount Issued (Logarithm) variable is positive and statistically significant at the 5% level in the [-1,+1], [-3,+3], and [-5,+5] event windows. This finding indicates that firms issuing larger green bonds tend to experience higher cumulative abnormal returns shortly after the announcement, which aligns with signaling theory (Myers & Majluf, 1984). Larger issuances may convey stronger financial resilience or reflect greater investor confidence in the firm's sustainability initiatives (Flammer, 2021). However, the effect becomes insignificant and even slightly negative in the [-10,+10] window, suggesting that the initial positive market reaction may fade over a longer horizon.

The Coupon rate has a consistently positive and significant impact across the three shorter event windows, with coefficients 0,048 for [-1,+1], 0,047 [-3,+3], and 0,048 [-5,+5]. This result implies that green bonds offering higher coupon rates elicit a more favorable short-term market response (Baker & Wurgler, 2004). Investors may perceive higher coupons as compensation for potential risks or an indicator of more attractive

returns, thereby boosting stock prices in the immediate period following issuance. Nevertheless, the effect loses significance in the [−10,+10] window, suggesting that the sentiment associated with coupon rates could be transitory (Malcolm Baker & Wurgler, 2005).

ROA consistently shows a negative and significant relationship with abnormal returns in shorter windows. This is somewhat counter-intuitive, as higher profitability tends to attract positive investor sentiment. One possible explanation is that investors prefer companies that have strong growth potential in the future even if they are not yet profitable. This is in line with the growth vs. value investing approach, where growth investors focus their investments on companies with strong potential for future returns rather than on companies that are currently generating substantial profits (Fama & French, 1995). In the [-10,+10] window, the effect becomes positive and significant, suggesting that over time the market will reassess the company's profitability in conjunction with its green bond issuance strategy and ultimately reward the successful combination of sustainability and financial performance.

The Total Debt-to-Equity ratio is negative and significant across the three shorter event windows, implying that firms with higher leverage experience lower cumulative abnormal returns soon after issuing green bonds. In the short term, investors may be wary of a company’s ability to balance debt obligations with the costs of sustainable projects. However, this effect reverses and becomes positive over the [−10,+10] window.

Neither Market Cap (Logarithm) nor Beta shows a statistically significant relationship with cumulative abnormal returns across all event windows. This outcome runs counter to some previous studies claiming that larger firms often attract stronger reactions from investors (Fama & French, 1992). Nonetheless, in the context of green bond issuance, it appears that firm size and stock volatility do not play a substantial role in driving abnormal returns during the examined windows. (Fama & French, 1992) Additionally, the First Green Bond dummy variable is statistically insignificant and negative across all event

windows. These results do not support the hypothesis H2 which predicted that first-time green bond issuers would experience a stronger market reaction than recurring issuers. The expectation was that a firm's first green bond issuance would act as a stronger signal of its environmental commitment (signaling theory), providing new information to the market. This result may suggest that investors may be more focused on the tangible characteristics of bonds, such as coupon rates rather than if it's the company's first green bond issuance.

5.4 Robustness Check

To ensure the reliability of the main regression results, robustness checks are performed. These checks ensure that the observed results remain consistent across different methodological assumptions, thus confirming the validity of the conclusions drawn from the event study analysis. The robustness check results are summarized in Table 8.

Firstly, an alternative estimation window from [-300, -50] is tested alongside the baseline window [-250, -50]. Utilizing alternative windows helps confirm that results are not significantly driven by the specific choice of estimation period (Brown & Warner, 1985). The analysis indicates that the CAR's remain largely consistent across these two windows, within the shorter intervals surrounding the event date. This consistency suggests that the immediate investor reaction to green bond issuances is stable and not overly dependent on the selected historical data range for estimation. Notably, only the two shortest event windows [-1, +1] and [-3, +3] show statistically significant results, while longer windows lose significance. This pattern underscores that investor reactions are strongest in the immediate aftermath of the event.

Additionally, a robustness test involving the exclusion of outliers is conducted. Outliers can bias empirical results, if the data is influenced by extreme values. As highlighted in Chapter 5, the distribution of CARs shows signs of skewness and high kurtosis. After excluding observations identified as outliers based on the interquartile range method, the cumulative abnormal returns continue to demonstrate similar patterns to the baseline

results. This suggests that the initial findings are not substantially influenced by extreme values, the CAR's no longer show statistical significance and turn negative across all examined windows. This outcome diverges from the baseline results, indicating that extreme observations may have played a notable role in driving the initial positive findings. Overall, although excluding outliers reduces the statistical significance of the results, the results are still in line with the wider literature, where immediate market reactions tend to be stronger, while longer-term reactions tend to stabilize (Flammer, 2021).

Table 8 Robustness Test

	CAR [-1,+1]	*CAR [-3,+3]*	*CAR [-5,+5]*	*CAR [-10,+10]*
Baseline Results	0,0132***	0,0067***	-0,0046**	0,0305*
Alternative Window [-300, -50]	0,0109*	0,0044***	-0,00690	-0,0304*
Excluding Outliers	-0,0111	-0,0273	-0,0143	-0,0302

*T-statistics are shown in parentheses beneath each coefficient. Superscripts marked with *** indicate significance at the 1% level, ** at the 5% level, and * at the 10% level.*

5.5 Interpretation of Results

The analysis in Chapter 5 reveals that companies issuing green bonds often experience a short-term upswing in share prices, a pattern reflected in the event windows [−1,+1], [−3,+3] and [−5,+5]. This immediate positive reaction is consistent with the signaling argument that sustainability-focused financing can attract favorable investor attention. Nevertheless, as indicated in Chapter 5, the effect weakens or becomes statistically insignificant in the longer [−10,+10] window, suggesting that the initial upswing is not sustained when more time elapses after the announcement.

The descriptive statistics were presented in Tables 4, 5, and 6. The bond-specific variables show variation, particularly in maturity, which ranges from 2 to 60 years with a mean of 9,54 years. This wide range combined with a high kurtosis value of 10,73, suggests the

presence of outliers with significantly longer maturities. The logarithm of the amount issued reveals a left-skewed distribution, indicating that smaller bond issuances are more common. Coupon rates display a more symmetric distribution, with a mean of 4,71% and relatively modest variation.

Firm-specific variables show similar results. The mean market capitalization (log) is 0,78, but the range extends from -1,16 to 3,12, highlighting differences in firm sizes within the sample. Beta values average 0,98, indicating that most firms have volatility like the broader market. ROA values are low on average (mean = 0,02), with high negative skewness and kurtosis reflecting that several firms in the sample are unprofitable. The total debt-to-equity ratio shows a mean of 1,18, with some firms displaying notably higher leverage levels.

The CAR results in Table 6 indicate a mild positive market reaction in the shorter event windows. CAR values average 0,01 in both the [-1, +1] and [-3, +3] windows, while the [-5, +5] window shows a near-zero mean. The [-10, +10] window turns slightly negative (-0.03), suggesting that initial upswing may fade over time. Negative skewness and high kurtosis across all windows indicate that the data contain extreme downward movements, which may weaken the average CAR results.

The regression results reveal some clear patterns in how investors respond to green bond announcements. The positive market reaction appears to be strongest in the short term, as shown by the statistically significant results in the CAR [−1,+1], CAR[−3,+3], and CAR[−5,+5] windows. In contrast, the longer CAR [−10,+10] window shows weaker significance, suggesting that any positive sentiment tends to fade over time.

Among the key variables, the amount issued has a notable positive impact on the shorter windows. This suggests that larger green bond issuances may signal financial strength or greater commitment to sustainability, boosting investor confidence. However, this effect

turns negative in the longer window, indicating that the initial optimism may wear off as investors reassess the firm's overall financial position.

The coupon rate demonstrates a significant influence in the short-term event windows, with coefficients of 0,048 (CAR [−1,+1]), 0,047 (CAR[−3,+3]) and 0,048 (CAR[−5,+5]), all significant at the 5% level. Higher coupon rates are likely to attract investors seeking better returns, adding to the positive response. However, this effect diminishes over time, as seen in the CAR [−10,+10] window, where the coefficient becomes negative (-0,004) and statistically insignificant, suggesting that investors may eventually focus on broader financial fundamentals rather than coupon levels alone. The results for ROA show a surprising pattern. Firms with lower profitability tend to experience stronger positive reactions in the short term, perhaps because investors see these firms as having unexploited growth potential tied to their green financing. The total debt-to-equity ratio is another key factor. Companies with more debt face greater caution from investors in the short term, probably due to concerns about their ability to meet new financial obligations. In the shorter windows, the coefficient is negative (-0,21) and highly significant at the 1% level, indicating that firms with higher leverage face greater investor caution in the immediate aftermath of a green bond announcement. In the longer CAR [−10,+10] window, the relationship reverses with the coefficient turning positive (0,04) and remaining significant at the 5% level. The First Green Bond dummy variable shows no significant effect, indicating that first-time issuers don't experience stronger positive reactions than repeated issuers. This contradicts my hypothesis and previous literature.

Robustness checks show that the regression results are sensitive to extreme observations. While the alternative estimation window [-300,-50] confirmed the initial positive short-term effects, but the exclusion of outliers significantly weakened the results. After the removal of outliers, previously positive CAR values became negative and did not show statistical significance in all event windows. This suggests that the initial positive findings were largely due to a few extreme events. Given these inconsistencies, further

research is needed to better understand the circumstances under which green bond announcements can create positive market signals.

6 Conclusions

The aim of this thesis was to examine whether the announcement of a green bond issue is reflected in the company's share price in the short term. The focus was on a transatlantic sample of green bond issuers by including firms from the United States, Germany, France, the Netherlands, the United Kingdom, Spain, Italy, Sweden, Canada, and Norway. The thesis drew on previous research literature highlighting the growing importance of green bonds as financial instruments for environmentally sustainable projects. The literature review also discussed key challenges such as the lack of standards and the phenomenon of greenwashing.

The results showed that a green bond announcement can be associated with a small but statistically significant positive price change over short periods of time. This supports the signaling theory that a green bond can signal a company's environmental responsibility. However, the effect faded over longer periods. In contrast, there was no consistent evidence that the first green bond would generate a stronger market reaction than repeated issues. This finding differs somewhat from previous studies. In addition, the results of the robustness tests were not fully consistent. When the outliers were excluded from the data, the relationship between green bond issuance and stock price excess returns disappeared. This suggests that individual extreme observations can have a significant impact on short-term market reactions.

While the thesis covers several companies in transatlantic markets, it may overlook certain regional companies. In addition, the event study model focuses on short-term price reactions, which means that long-term benefits of green projects are excluded from this analysis.

With new research areas, the data can be extended to emerging markets where demand and issuance of green bonds is growing. Longer-term monitoring to assess the emission reductions metrics of financed projects could also provide insight into the real impact of

green bonds. In addition, an examination of corporate governance could help to understand how strong corporate governance influences market responses.

The thesis concludes that there may be positive stock market reactions to the green bond issuance, but their persistence is limited. This reflects the growing interest of financial markets in sustainability issues, while stressing the importance of consistent standards for sustainable finance.

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Appendices

Appendix 1. Green bond Issuances

Name	Symbol
AES CORP. 2020 1 3/8% 15/01/26 144A	625A5V
AES CORP. 2020 2.45% 15/01/31 144A	625DFT
AKER ASA 2022 6 1/2% 17/11/29 AKER18	959F7G
AKER ASA 2022 6.275% 27/09/27 AKER17	954Z2D
AKER ASA 2022 6.3% 22/11/32 AKER19	959QXP
AKER ASA 2022 F/R 09/27 AKER16	954Z2F
AKER HRZS.ASA. 2021 F/R 08/25 Q	632Y0G
ALGONQUIN POWER CO. 2019 4.6% 29/01/29 S	220VTM
ALGONQUIN POWER CO. 2021 2.85% 15/07/31 S	639YY8
ARENDALS 2021 2.615% 24/03/28	636C17
ARISE AB 2022 F/R 05/26 Q	9165G9
ARISE AB 2018 F/R 03/21 EARLY	202N8J
ARKEMA SA 2020 1/8% 14/10/26	6203GY
ARRIVAL SA CV 3 1/2% 01/12/26 DEFAULT	6612ZE
AUDAX RENOVABLES SA 2020 4.2% 18/12/27 2	627UNZ
AUDAX RENOVABLES SA 2020 G/R 18/04/22 1 EARLY	617W41
BENCHMARK HOLDINGS 2022 F/R 09/25 Q	954LVV
BOLIDEN AB 2022 5.136% 01/03/27 5	959WDV
BOLIDEN AB 2022 5.53% 22/09/27 4	954D7Y
BOLIDEN AB 2022 F/R 03/27 6	959WDN
BOLIDEN AB 2022 F/R 03/28 7	959WDR
BOLIDEN AB 2022 F/R 09/25 3	954D7X
BONAVA AB PUBL 2020 F/R 03/27 Q	6170G5
BONHEUR 2020 F/R 09/25 Q	618KCD
BONHEUR 2021 F/R 07/26 BONHR01	648C37
BONHEUR 2023 F/R 09/28 Q	994CHH
BORREGAARD ASA 2023 F/R 06/28 Q	983H94
BRKF.RENEW.PTNS.ULC 2018 4 1/4% 15/01/29 11	213JE0
BRKF.RENEW.PTNS.ULC 2019 3.38% 15/01/30 S	240C0W
BRKF.RENEW.PTNS.ULC 2019 4.29% 05/11/49 13	240C1P
BRKF.RENEW.PTNS.ULC 2020 3.33% 13/08/50 14	615QXR
BRKF.RENEW.PTNS.ULC 2022 5.88% 09/11/32 15	958TVQ
CAPITAL POWER CORP. 2022 7.95% 09/09/82 1 EARLY	9496UL
DTE ELECTRIC CO. 2018 4.05% 15/05/48 A	205N3Y
DTE ELECTRIC CO. 2019 3.95% 01/03/49 2019 SE	221MZU
DTE ELECTRIC CO. 2021 1.9% 01/04/28 A	638DP2
DTE ELECTRIC CO. 2021 3 1/4% 01/04/51 B	638DP9
DTE ELECTRIC CO. 2022 3.65% 01/03/52 B	9032FQ
ELKEM ASA 2023 5 3/4% 31/08/28 ELK07 E	989N4A

ELKEM ASA 2023 F/R 08/28 ELK06 E	989N39
ENGIE SA 2014 2 3/8% 19/05/26	793TZV
ENGIE SA 2017 1 3/8% 28/02/29 78	855U5K
ENGIE SA 2014 1 3/8% 19/05/20	793TL3
ENGIE SA 2017 7/8% 27/03/24	845T9J
ENGIE SA 2018 1.375%(F/R)PERP. EARLY	861P9E
ENPHASE ENERGY CV ZERO 01/03/26 144A	63438Z
ENPHASE ENERGY CV ZERO 01/03/28 144A	63439A
EQUINIX INCO. 2020 1% 15/09/25 S	619YGF
EQUINIX INCO. 2020 1.55% 15/03/28 S	619YG5
EQUINIX INCO. 2020 2.95% 15/09/51 S	619YNM
EQUINIX INCO. 2021 2 1/2% 15/05/31 S	642J0E
EQUINIX INCO. 2022 3.9% 15/04/32 S	910XXK
EVERGY KANSAS CTL. 2016 2.55% 01/07/26 S	831J3G
FORTISBC EN.INCO. 2020 2.54% 13/07/50 33	612VHG
FORTISBC EN.INCO. 2022 4.67% 28/11/52 35	964PTD
GRENERGY RENOVABLES 2019 4 3/4% 08/11/24	244TLE
GRENERGY RENOVABLES 2022 4% 05/04/27	913PAV
GRIEG SEAFOOD ASA 2020 F/R 06/25 GSF01 E	611A0U
HYDRO ONE INCO 2023 4.85% 30/11/54 58	164VQR
HYDRO ONE INCO 2023 5.54% 20/10/25 57	160W7W
HYDRO ONE INCO 2023 F/R 09/26 56	995DQ5
INNOVATEC SPA CV G/R 21/07/21 EARLY	800DR7
LEROY SEAFOOD GP. 2021 3.35% 17/09/31 LSG03 E	6546TG
LEROY SEAFOOD GP. 2021 F/R 09/26 LSG01 E	6546TY
LEROY SEAFOOD GP. 2021 F/R 09/27 LSG02 E	6546UY
LEROY SEAFOOD GP. 2023 5.1% 26/04/30 LSG05 E	977R00
LEROY SEAFOOD GP. 2023 F/R 04/28 LSG04 E	977P9D
LUCID GROUP INC. CV 1 1/4% 15/12/26 144A	6635QY
MIDSUMMER AB 2019 F/R(13%) 04/26 Q	225RG1
MILLICOM INTL.CELU. 2019 F/R 05/24 EARLY	227GZE
MOWI ASA 2020 F/R 01/25 Q	250D7W
NEOEN SA CV 2 7/8% 14/09/27 REG.S	950VPH
NEOEN SA CV 2% 02/06/25 REG.S	608KT7
NEXITY SA 2019 2.257% 20/12/26	247FPT
NEXITY SA 2019 2.464% 20/12/27	248HHL
NIKOLA CORPORATION CV 8 1/4% 15/12/26 S	165T18
NORDEX SE CV 4 1/4% 14/04/30 REG.S	976TU1
NORTHLAND POWER INC 2023 9.25%(F/R) 06/83 2023-A	984DQH
NRC GROUP ASA 2023 F/R 10/27 Q	160NFT
ORKLA ASA 2021 2.4425% 04/06/31 ORK86 E	644XDM
ORKLA ASA 2021 F/R 06/28 ORK85 E	644XDW
ORMAT TECHS.INCO CV 2 1/2% 15/07/27 144A	930KX6
ORMAT TECHS.INCO CV 2 1/2% 15/07/27 S	9845V7
PHOTON ENERGY NV 2021 6 1/2% 23/11/27 Q	658ANR

PHOTON ENERGY NV 2017 7 3/4% 27/10/22 Q	206HCY
RIVIAN AUTV. CV 3 5/8% 15/10/30 144A	996MJX
RIVIAN AUTV. CV 4 5/8% 15/03/29 144A	971W27
SALMAR.ASA 2021 F/R 01/27 SALM01	640ED3
SCATEC ASA 2021 F/R 08/25 Q	633NCV
SCATEC ASA 2023 F/R 02/27 Q	9693Y3
SCATEC ASA 2017 F/R 11/21 S EARLY	858UV9
SCHNEIDER ELECTRIC 2015 1.841% 13/10/25 21	819DFH
SUNNOVA EN.CORP. 2021 5 7/8% 01/09/26 144A	652A54
SUNNOVA EN.CORP. 2023 11 3/4% 01/10/28 144A	995LDQ
SVENSKA CELL.AB.SCA 2021 1 3/8% 21/06/28 108	646VZ9
SVENSKA CELL.AB.SCA 2021 F/R 06/28 107	646VZH
TESLA ENERGY OPS. 2015 5.45% 26/03/30 2015/C1	823TL2
TESLA ENERGY OPS. 2015 3.6% 26/03/20 2015/C8	823TD1
TESLA ENERGY OPS. 2015 4.7% 19/03/25 2015/C4	819KVW
TESLA ENERGY OPS. 2015 5.45% 19/03/30 2015/C5	819KVY
TESLA ENERGY OPS. 2015 3.6% 19/03/20 C24-10	817PXR
TOMRA SYSTEMS ASA 2022 F/R 11/25 TOM03 E	957VZZ
TOMRA SYSTEMS ASA 2022 F/R 11/27 TOM04 E	957V3N
TRANSALTA CORP. 2022 7 3/4% 15/11/29 S	9586YW
VALEO SE 2023 5 7/8% 12/04/29	996MKJ
VINCI SA 2020 0% 27/11/28	624ZWF
VOLTALIA SA CV 1% 13/01/25 REG.S	629APR
WASTBYGG GRUP.AB 2021 F/R 11/24 Q	661YHD