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Do green bonds impact on stock values?

Evidence from emerging markets

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ABSTRACT:
Green bonds are a relatively new financial instrument in the financial markets, as the first green bond was only issued in 2007. Green bonds are structurally similar to conventional bonds, but their proceeds are used for environmentally friendly projects such as renewable energy projects. The purpose of this work is to examine the impact of the announcement of the green bond on the share price of publicly listed non-financial issuers, by using 155 bond issuance announcements from 66 different companies. This study focuses on companies who operate in emerging countries and have issued green bonds between 2015 and 2021. Issuances used in the work are from organisations operating in Brazil, Chile, China, India, Lithuania, Mexico, South Korea, Taiwan, Thailand or Turkey.

This study uses the event study methodology to determine the cumulative abnormal returns, which have also been identified in previous academic studies investigating the impact of green bond issuance on the stock price. The previous research show that the stock markets have both positive and negative reactions when a company announces the issuance. As there has been no previous research specifically focused on emerging countries, this study focuses on them. By focusing solely on emerging green bond markets that has been largely unexplored, this thesis aims to fill the research gap in the literature that has primarily focused on global markets.

The research hypotheses of this thesis focus on determining and evaluating the impacts of the announcement on the stock price. The results of the event studies show that the green bonds have a significant negative effect on the company's stock price during the event windows of [-10,10] and [-1,1]. The negative result is partly explained by the fact that the market reactions to conventional bonds have also been shown to be negative in previous academic studies. The greenwashing, novelty value and cost of the green bonds are also possible reasons for the negative reaction.

The statistical significance of the results is evaluated using the non-parametric Wilcoxon signed-rank test. The other event windows of [-5,5] and [0,1] are not statistically significant according to the test performed. An OLS regression analysis is also performed for statistically significant event windows, which indicates that there are statistically significant variables for the parameters related to the green bonds and the parameters related to the characteristics of the issuers.

KEYWORDS: green bonds, emerging markets, market reaction, event study, sustainable finance

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TIIVISTELMÄ:
Vihreät joukkovelkakirjalainat ovat verrattain uusi rahoitusväline rahoitusmarkkinoilla, sillä ensimmäinen vihreä joukkovelkakirja laskettiin liikkeelle vasta vuonna 2007. Vihreät joukkovelkakirjalainat ovat rakenteellisesti samanlaisia kuin perinteiset joukkovelkakirjalainat, mutta niiden tuotto käytetään ympäristön kestävyyttä edistäviin hankkeisiin, kuten uusiutuvaan energiaan. Tämän työn tarkoituksena on tutkia, miten vihreiden joukkolainojen ilmoitukset vaikuttavat julkisesti listattujen, ei rahoitusalalla toimivien yhtiöiden osakekurssiin käyttäen 155 joukkovelkakirjan liikkeellelaskuilmoitusta 66 eri yritykseltä. Tämä tutkimus keskittyy yrityksiin, jotka toimivat kehittyvissä valtioissa ja ovat laskeneet liikkeelle vihreitä joukkovelkakirjalainoja vuosina 2015–2021. Työssä käytetyt liikkeellelaskut ovat yrityksiltä, jotka operoivat Brasiliassa, Chilessä, Kiinassa, Intiassa, Liettuassa, Meksikossa, Etelä-Koreassa, Taiwanissa, Thaimaassa ja Turkissa.

Työssä käytetään tapahtumatutkimusmenetelmää määrittämään kumulatiiviset epänormaalit tuotot, joita myös aiemmat akateemiset tutkimukset ovat määrittäneet tutkiessaan vihreiden joukkovelkakirjalainojen vaikutusta liikkeellelaskijan osakkeen arvoon. Aiemmat tutkimukset osoittavat, että osakemarkkinoilla on sekä positiivisia että negatiivisia reaktioita, kun yritys julkistaa liikkeellelaskevansa vihreän joukkovelkakirjalainan. Koska aiempaa tutkimusta ei ole tehty vain kehittyvien maiden osalta, tämä tutkimus keskittyy erityisesti vain niihin. Tämän työn tavoitteena on siis täyttää aiemman kirjallisuuden aukko, joka on keskittynyt ensisijaisesti globaaleihin vihreiden joukkolainojen markkinoihin.

Tutkimuksen pääolettamana on, että vihreät joukkovelkakirjalainat aiheuttavat muutoksen osakkeen arvossa. Tapahtumatutkimuksen tulokset osoittavat, että vihreällä joukkovelkakirjalainalla on merkittävä negatiivinen vaikutus yhtiön osakkeen hintaan [-10,10] ja [-1,1] tapahtumaikkunoiden aikana. Negatiivinen tulos selittyy osittain sillä, että myös perinteisten joukkolainojen markkinareaktio on aiemmissa tutkimuksissa osoitettu negatiiviseksi. Viherpesu, uutuusarvo ja vihreiden obligaatioiden kustannukset ovat myös mahdollisia syitä negatiiviseen reaktioon.

Tulosten merkittävyys arvioidaan ei-parametrisen Wilcoxonin signed-rank-testin avulla. Muut työssä käytetyt aikaikkunat [-5,5] ja [0,1] eivät ole Wilcoxonin signed-rank-testin mukaan tilastollisesti merkittäviä. Tilastollisesti merkittäville tapahtumaikkunoille suoritetaan myös OLS-regressioanalyysi, jonka mukaan tilastollisesti merkittäviä muuttujia löytyy sekä erityisesti vihreään velkakirjaan liittyvistä muuttujista sekä liikkeellelaskijan ominaisuuksiin liittyvistä muuttujista.

KEYWORDS: vihreät joukkovelkakirjalainat, kehittyvät markkinat, tapahtumatutkimus, vastuullinen rahoitus

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1 Introduction

Financial decisions are essentials when it comes to corporate life. In order to be able to invest in the future, companies need to obtain external financing, since profits alone are rarely enough to cover all costs. Depending on the size of the company and the size of the investment, the sources of the capital will vary. Small enterprises often rely on bank loans while large companies can raise capital by issuing bonds. (Barua & Chiesa, 2019.)

Bonds have been developing through time. As the economic environment is in a continuous state of change, the interest in creating new variations of the bonds is increasing. The important position of green finance and green investments are more and more featured in academic literature since through activities and operations, organisations can have an impact on both the economy and the environment either positively or negatively. One of the factors that has an influence on climate change is finance. Finance is in a significant influential role in the sustainable development because by creating and providing environmentally friendly financial instruments, it impacts on environmental benefits and support low-carbon economy. (Caldecott, 2021; Russo et al., 2021.) There are several labelled thematic bonds available in the bond market such as green bonds, sustainability bonds and climate transition bonds, which are designed to enable sustainable debt funding (World Bank, 2022a).

This thesis focuses on green bonds in emerging markets. Green bonds are new fixed-income sustainable-oriented instruments that are specialized in financing green projects (Reboredo, 2018). These projects commonly include environmental, social and sustainability considerations. The original intention for these bonds is to attract green investors who are specified on funding green projects (Dou & Qi, 2019). Despite the potential benefits of issuing the green bonds, especially for the first-time issuers, the process can be arduous and costly (Tang & Zhang, 2020). Therefore, it is important that the shareholders of the issuing firm and the firm itself can benefit from the issuance (Baulkaran, 2019).

1.1 Background and motivation

In emerging economies, the relationship between financial development and economic growth is particularly significant due to its potential to promote sustainable economic growth and development (Oroud et al., 2023). As capital markets play a crucial role in financing green development, it is imperative to study the responsiveness and reactions of such markets to green initiatives. (Ji & Zhang, 2019; Liu et al., 2021). The background for studying the impact is motivated by the growing green bond markets and the trend of financing environmentally friendly projects, such as renewable energy, with green bonds. Green bonds are specifically earmarked to finance projects that generate environmental benefits (Gao et al., 2023.) In recent years, the market for green bonds has expanded rapidly, with increasing numbers of issuers operating in emerging markets have issued this financing tool for funding their sustainability developments (Lebelle et al. 2020).

Emerging markets have been found to have notable potential to respond to significant environmental and social challenges. According to the International Finance Corporation (IFC) it is projected that the green bond market will surpass the annual issuance threshold of $100 billion by the year 2023 (IFC, 2021). Thus, emerging economies are considered having their own role in promoting sustainable development through the adoption of green financial instruments such as green bonds (ICMA, 2021).

Examining the green bonds issued in emerging markets can help identify the opportunities and threats of the development of green finance in these market areas, as well as the potential benefits and risks of investing in green bonds (World Bank, 2022a). Ultimately, research on green bonds in emerging markets can contribute to building a more sustainable and inclusive global financial system (World Bank, 2022a). The motivation of this thesis is to investigate the influence of green bonds on the stock price of the issuer in emerging markets and to determine the degree of impact of green bond disclosure.

1.2 Purpose of thesis

This thesis examines the possible financial benefits for companies and their shareholders in connection with the announcement of the issuance of green bonds, focusing on the change in the value of the shares after the announcement. Although the green bonds are a relatively new financial instrument in the market, many researchers have already addressed this topic from different perspectives and have shown that the disclosure of sustainable investments affects the value and performance of the company. However, the results of the announcements have been mixed, with certain studies reporting a statistically significant positive reaction and others indicating a significant negative reaction (see Baulkaran, 2019; Tang & Zhang, 2020; Lebelle et al., 2020; Wang et al., 2020; Flammer, 2021).

The impact of the green bond announcement will be analysed with the event study methodology and the regression analysis. To ensure the scope of the thesis, this study is limited to cover only the green bonds issued in emerging economies. The dataset utilized covers the green bonds that have been issued by publicly listed non-financial companies in emerging markets between 2015-2021. This thesis focuses on emerging markets to complement the existing green bond literature, which is mainly focused on global markets, and specifically seeks to assess the extent to which green bond issuance generates positive or negative reactions in the emerging markets.

1.3 Research hypotheses

The purpose of the thesis is to examine how the announcement of the green bond affects the stock value of the publicly traded firm in emerging markets. In previous academic studies, the impact of green bonds on the share value have mostly focused on global markets or a wide range of countries, except for the research by Wang et al. (2020) and Xi and Jing (2022), which both focuses specifically on China.

The results of the previous literature have been contradictory since some studies find a significant positive market reaction to the green bonds and others find a significant negative reaction. The purpose of this thesis is to contribute to the existing green bond literature by filling the gap by examining how emerging markets react to the announcement of the green bond. To achieve this, the thesis aims to test the following research hypotheses:

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

If the null hypothesis is correct, the announcement of the green bond will not affect the value of its issuer's share. However, based on the previous literature and their results, it is assumed that the announcements have an effect on the stock value. Therefore, main research hypothesis is as follows:

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

To support H_1, the possible market reactions are divided into the following hypotheses:

H_2a: The value of the share reacts positively to the announcement of the green bond issuance in emerging countries.
H_2b: The value of the share reacts negatively to the announcement of the green bond issuance in emerging countries.

H_2a focuses on whether the announcement creates value to shareholders by assessing the cumulative abnormal returns (CARs). This hypothesis aims to confirm the positive results of the previous study. In contrast, *H_2b* indicates the negative abnormal returns suggesting that green bonds do not increase the share prices and reinforce the negative results of the academic literature.

Similarly to the research by Lebelle et al. (2020) and Flammer (2021), the purpose of this thesis is also to study whether the impact of green bond announcements differs for first-time issuers compared with subsequent issuances. The hypothesis is formed as follows:

H_3: The reaction differs between the first-time green bond announcement and the subsequent announcements.

Based on the studies by Lebelle et al. (2020) and Flammer (2021), the effect on the first-time issuers is more significant than on subsequent announcements. Therefore, the assumption of this thesis is that the results for the first announcements are more positively or negatively significant than for the subsequent announcements.

1.4 Contribution of thesis

This thesis contributes of the previous academic literature by studying the impact of green bonds in emerging markets by providing information into whether the announcement of the green bond has a positive or a negative impact on the stock price in emerging economies. While previous research studies such as Tang and Zhang (2020), Flammer (2021) and Lebelle et al. (2020) study the effects of green bonds issuances in various countries, this thesis limits the market to emerging economies and aim to provide research that fills the gap in the literature. Overall, the green bond market in emerging countries is relatively nascent and therefore its development and impact are a fruitful and important topic to explore.

The scope is limited to the green bonds issued by non-financial publicly listed issuers in emerging markets. Thus far, there is no previous studies in the academic literature that focuses solely on investigating how announcing the issuance of the green bond affects the value of the company in emerging markets since the previous papers by researchers have either focused on examining one emerging country or on a comparison between

emerging countries and developed economies (Wang et al., 2020; Lebelle et al., 2020). Therefore, this thesis enables a relevant topic to support previous literature.

1.5 Structure of thesis

The structure of the thesis consists of nine chapters. After introduction, the second chapter goes through the theoretical framework of conventional bonds presenting an overview of bond features, followed by the third chapter that focuses solely on the green bonds and the green bond market. The fourth chapter focuses on stock valuation theory and chapter five presents the literature review of the previous studies. Chapter six presents the data of this thesis and the methodology is presented in chapter seven. The most interesting part of the work is found in chapter eight where the results of the work are presented and discussed. Finally, chapter nine concludes the thesis.

2 Overview of bonds

When a company wants to borrow money from the public on a long-term basis, it usually issues debt instruments commonly known as bonds (Banga, 2019). Generally, the purpose of issuing bonds is to use them for a supplement of working capital, a construction of projects, a replacement of debt or a repayment of bank loans. Historically, the bonds are one of the first forms of securitization and hence, they are among the eldest financial instruments. (Mazzi, 2013, p. 127; Dou & Qi, 2019.) The purpose of this chapter is to present the theoretical framework of the green bonds. This is done by introducing the properties of conventional bonds, as these bond types theoretically do not significantly differ. Despite being restricted to financing environmental projects, the use of proceeds from green bonds does not significantly alter their risk and return characteristics compared with conventional bonds. As such, the theory of conventional bonds can also be applied to green bonds. By presenting the theory of conventional bonds, it therefore also covers the theory of green bonds. (Eurosif, 2018; Banga, 2019.)

2.1 Bond features

In a nutshell, a bond is a marketable fixed interest debt instrument which the issuer of the bond pays to the bondholder on a maturity date (Nikkinen et al., 2002, p. 93). The bond issued is separated into several divisions as the amounts needed by large companies, municipalities and states, are commonly too large to borrow from a single lender. Bonds are defined as a way for companies to obtain capital while retaining control. In addition to the issuance, bonds are tradable securities and therefore can be sold and bought in the secondary market. (Mazzi, 2013, p. 127-128.)

An indenture of a bond is a legal and binding contract between the issuer and the holder that includes the important features of the bond such as its par value, maturity date and coupon. The par value represents the amount that the issuer will repay the bondholder at maturity. (Bodie et al., 2014, p. 446.) Maturity refers to the date when the issuer is

obligated to repay the principal amount of the bond. Typically, bonds provide a fixed income, called a coupon, to the bondholder throughout the bond period. The coupon rate is the fixed interest rate established at the time of the issuance, and it determines the interest payment that the issuer agrees to pay during the term of the bond. These characteristics enable investors to calculate the yield of the bond. (Mazzi, 2013, p. 128-131.)

Bonds are issued with the par value, for which a fixed annual coupon rate is often paid throughout the duration of the loan (Mazzi, 2013, p. 128-131). In general, bonds are paid at either periodic coupon payments, regular, semi-annual or annual fixed interest, to the exclusion of zero-coupon bonds where the investor receives a par value at maturity but no interest (Fabozzi, 2013, p. 13-14). The potential profitability of zero-coupon bonds depends on the difference between their initial purchase price and the subsequent secondary market price (Bodie et al., 2014, p. 446-447).

It is important to understand the fundamentals of bond characteristics and pricing in general before moving on to analyse and discuss the effect of their issuance on the share price. As stated at the beginning of the chapter, by examining the properties of conventional bonds, we also examine green bonds in those respects. As a note, this chapter does not present all the relevant terminology related to bonds, but the presented terms have been selected and limited to support the following sections of the thesis as they play a critical part in the empirical part.

2.2 Risks of bonds

Risk and return are both important and significant characteristics in making financial decisions. Since the financial crisis in 2008, the importance of risk in particular has been emphasized (Indrani & Clayman, 2015). Although bonds are generally considered risk-free investment options, they involve a variety of investor risks. The most important

characteristics of exposing investors and impacting on the risks of the bonds are the issuer and the maturity of the bond (Nikkinen et al., 2002, p. 94).

Corporate bonds are typically seen riskier than government bonds, despite the fact that corporate bonds generally provide the bondholders flows of income. This is because various risks, primarily default risk and market risk, are tied to the financial condition of the issuer and can impact both the coupon payments and principal repayment of the bond. As a result, investors require higher yields to compensate the possible increased risk. (Bodie et al., 2014, p. 447-449.)

Default risk refers to the risk where the issuer will not be able to repay the loan to the holder of the bond (Fabozzi, 2013, p. 18). For this reason, the role of the issuer is emphasized in terms of minimizing the risks. The default risk is evaluated by quality ratings assigned by three nationally recognized rating companies, which are presented later in the subchapter of 2.4. Market risk, in turn, consists of various individual risks such as interest rate risk, volatility risk and currency risk. According to Fabozzi (2013, p. 18-20), one of the most significant market risks that the investor faces in the bond market is related to the relationship between the price and the interest rates of the bonds. If the investor must sell the bond below the purchase price before maturity, an increase in the interest rate realizes the capital loss due to the interest rate risk (Fabozzi, 2013, p. 18.)

2.3 Bond pricing

In summary, the value of a bond is calculated by discounting the expected cash flows at an appropriate discount rate (Fabozzi, 2013, p. 27-28). The present value of future cash flows, which is affected by maturity, creditworthiness and interest, determines the price that the investor will pay for the bond (Bodie et al., 2014, p. 446). This calculation formula is demonstrated in Formula 1 below.

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

where,

P_0= Present value

T=Time to maturity (in years)

t= Number of periods

r= Required rate of return

C_t= Annual coupon rates

PV = Par value (Vanhanen, 1988, p. 20-21).

Formula 1 shows the inverse relationship between the discount rate and the price of the bond. A higher discount rate results in a lower present value and a lower market price of the bond (Nikkinen et al., 2002, p. 100). The required rate of return of the investor, r, is the yield of the bond. On the secondary market, corporate bondholders bear the previously presented risks, the most significant of which the issuer will not be able to meet its repayment obligation, and thus bondholders request a higher return to compensate the default risk. The present value therefore depends heavily on the return requirement of the investor (Berk & DeMarzo, 2014, p. 223-224).

2.4 Credit rating agencies

Whether it is a government bond or a green bond, there is always a risk associated that the issuer of the bond will not be able to pay the principal and the interest in the future. Therefore, a credit risk assessment is recommended when considering investing in bonds. This risk is measured by quality ratings issued primarily by three nationally recognized rating agencies; Standard & Poor's (S&P), Moody's, and Fitch. These rating agencies estimate the issuer's capacity to fulfil its upcoming payment obligations. When predicting credit ratings, the future default risk of an organisation is seen low if it is given a high credit rating. For this reason, the organisation is able to borrow money from the market at a relatively low cost due to its assurance in the repaying the future payment

obligations. (White, 2010.) Table 1 provides information of how the three major credit agencies report their credit ratings creditworthiness symbols.

Table 1. Rating grades (Moody's, 2023; S&P Global, 2023, Fitch, 2023a).

Moody's	S&P	Fitch
Aaa	AAA	AAA
Aa	AA	AA
A	A	A
Baa	BBB	BBB
Ba	BB	BB
B	B	B
Caa	CCC	CCC
Ca	CC	CC
C	C	C
		RD
D	D	D

Investment Grade Bonds

Non-Investment Grade Bonds (High-Yield Bonds)

At Moody's, the highest creditworthiness is marked as Aaa, while S&P and Fitch use AAA to indicate their highest ratings (Moody's, 2023; S&P Global, 2023; Fitch, 2023a). Ratings are assigned on a scale that ranges from the highest rating down to D (Moody's, 2023; S&P Global, 2023; Fitch, 2023a). As Table 1 shows, to be considered as investment grade and observed as having an adequate capacity to pay the par value and interest, the company must be rated at least Baa or BBB depending on credit agencies' symbols (Moody's, 2023; S&P Global, 2023; Fitch, 2023a). If the rating is lower than BBB or Baa, this indicates that the organisation has defaulted on its debt obligations. RD rating by Fitch (2023a) informs the issuer that, in the agency's opinion, the bond has defaulted, but has not yet entered formal liquidation proceedings or bankruptcy nor has the issuer ceased operations ceased operations. Since the risk for investor is higher when investing in high-yield bonds, the investors expect higher rate of return for these investments. In contrast, the highest rated bonds do not pay as high rated return because they are classified more likely to repay the bondholders (Hull et al., 2004).

While credit ratings can be regarded as a significant assessment for investors, according to Stephanou (2010) credit rating agencies, on the other hand, have played a contentious

role in the financial markets. Although they are seen vital for the markets, following the financial crisis in 2008, there has been concerns about their ability to predict future crises since the agencies failed to properly value the risks of sub-prime mortgages (Stephanou, 2010). However, after this awareness, the regulatory framework of credit rating agencies has since been updated and strengthened. Cheng and Neamtiu (2009) research how rating agencies react to increased regulatory pressure that has threated their market position and find that rating agencies have reacted by improving quality of the ratings.

3 Green bonds

The increasing demand for environmental sustainability has driven the emergence of green bonds in the recent past. Green bonds are specifically earmarked for green projects to incorporate environmental, social and sustainability considerations (Tang & Zhang, 2020). The initial intention for green bonds is to attract green investors by raising funds for green projects (Dou & Qi, 2019).

Green bonds are a subcategory for thematic bonds, that are issued to finance projects with a positive environmental impact, such as renewable energy projects and projects reducing carbon emissions (World Bank, 2022a). Thematic bonds have emerged as a financial instrument that offers investors the opportunity to invest in projects related to specific themes, such as renewable energy, healthcare or education. Governments, corporations or other organisations can issue thematic bonds and the proceeds are usually used for projects related to the theme or purpose of the bond. It should be noted that although green bonds fall under the category of thematic bonds, not all thematic bonds are green bonds. Thematic bonds are issued more broadly to finance projects related to different causes, not necessarily only environmental projects. Nevertheless, with the growing demand for sustainable finance and increased awareness of environmental issues, green bonds have gained considerable popularity and become one of the most common thematic bonds. (World Bank, 2022a.)

3.1 Green bond principles

In the green bond markets, the need for standardization and verification is real. The greenness separates green bonds from conventional bonds and without clear standardization and principles, a bond is categorized as green if it is labelled green by its issuer. (Christophers, 2018.) The Green Bond Principles (GBP) published by International Capital Markets Association (ICMA) are considered one of the standard definitions of the

green bonds (ICMA, 2021). ICMA has regularly updated its principles and according to ICMA (2021) the definition of "green bond" from June 2021 is as follows:

> *Green Bonds are any type of bond instrument where the proceeds or an equivalent amount will be exclusively applied to finance or re-finance, in part or in full, new and/or existing eligible Green Projects and which are aligned with the four core components of the GBP (ICMA, 2021).*

In the early years of the green bonds, securities regulations guided the issuing process but there were no clear policies or standards on which bonds could be classified as green or which are environmentally friendly projects (World Bank, 2015). ICMA's (2021) Green Bond Principles and Social Bond Principles as well as the Sustainability Bond Guidelines have established a leading framework for the worldwide issuance of green, social, and sustainable development bonds. These international principles provide a framework for green bonds and are the most widely adopted green bond standards in the markets (ICMA, 2021). A number of financial institutions developed the GBP in 2014, and later they have been endorsed and monitored by ICMA. These principles aim to harmonize the practices of the green bond market and to increase the credibility of the green bond label among stakeholders. These standards are essential for the green bond market to ensure that investors have access to all relevant information to make investment decisions. However, according to ICMA (2021) the GBP are voluntary guidelines. In other words, the issuer itself decides whether to comply with the principles (ICMA, 2021).

The Green Bond Principles by ICMA (2021) improve the awareness of the relevance of environmental and social impact with the goal of attracting more investors to support sustainable development. The GBP have been developed to support and recommend transparency and disclosure and intended for the broad range of markets to use.

The four core principles are (ICMA 2021):

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

4. Reporting (ICMA, 2021).

The key feature of a green bond or any other green instrument is, naturally, that it is directed towards environmentally friendly operations. According to ICMA (2021) the guidelines of GBP aim to improve the ability of the green bond market to finance environmentally sustainable projects by emphasizing transparency, disclosure and reporting. The overall goal of the GBP is to highlight the central role of information dissemination in directing capital flows towards sustainable initiatives (ICMA, 2021).

The first principle, use of proceeds, determines which types of projects can be funded through the green bond label. This guideline recommends the issuer to properly report and describe the use of the green bond proceeds. By following this principle, it is easier to monitor the allocation of the funds to environmental projects and to report the expected impacts of those projects (ICMA, 2021). According to ICMA (2021), this first principle is the most important component. According to the second principle by ICMA (2021), process for project evaluation and selection, the issuer is required to openly disclose to all parties, particularly investors, the sustainability objectives, the project process, and other environmental implications of the supported projects. In order to ensure that the funds are exclusively used for green initiatives, in accord with the third principle, the proceeds should be stored in a separate account, according to the component of profits management. The fourth principle, reporting, recommends that the issuer retain a record of how the proceeds from the green bonds are used annually. The Green Bond Principles focus on the transparency and accuracy of the information reported to shareholders. The principles aim to improve the ability of the green bond markets by promoting disclosure, transparency, and reporting. (ICMA, 2021.)

According to the World Bank (2022a), by providing a clear and robust regulatory framework in emerging markets, governments can increase investors' confidence in green bonds, reduce the risk of greenwashing, and ensure that proceeds are used for sustainable projects. In addition, regulation can help address financial factors such as credit

profile and political risk that are important to investors when evaluating thematic bonds (World Bank, 2022a). For this reason, from the perspective of emerging markets, the importance of standardized reporting is emphasized (Li et al., 2022). The standards support the facilitation of transparency, the development of market growth and the improvement of market liquidity. As the GBP underline, it is important to consider investors and issuers, as clear standards and guidelines to facilitate the development of green bond investments will attract more issuers in the future (ICMA, 2021).

3.2 Development of green bond market

At the beginning, the green bond market began only as a small retail target. The European Investment Bank issued the first green bond in 2007, and since then, green bonds have increasingly gained significance as a market-based mechanism for raising funding to address environmental challenges (Tang & Zhang, 2020). In recent years, both institutional and private investors have been interested in the threat of environmental degradation and the need to shift financial investments to environmentally friendly and environmentally sustainable companies. Therefore, the green bond market has been experiencing the impressive rates of growth (Reboredo, 2018.) Since the issuance of the first corporate green bond by the Élecricité de France in 2013, the growth and the development of the green bond market has been exponential, and the market has witnessed an important trend with the growing amounts and the investments in renewable energy represent the biggest share of use of proceeds (CBI, 2013; World Bank, 2022a). In their study, Tang and Zhang (2020) state that the growth of green bond issuances has not only been quantitative but also the green bond market's geographic base has expanded.

Figure 1 provides the number of green bonds issued in US dollars between 2007 and 2021. The graph in Figure 1 shows an increase in the number of green bonds since the first corporate green bond in 2013 (CBI, 2013). The GBP by ICMA (2021) are published in 2014 can also contribute to volume growth, as the principles provide investors with more information on green bonds. The data in Figure 1 is from Climate Bonds Initiative (CBI)

which is an international non-profit organisation with the aim of creating a large and liquid market for the green bonds (CBI, 2021.)

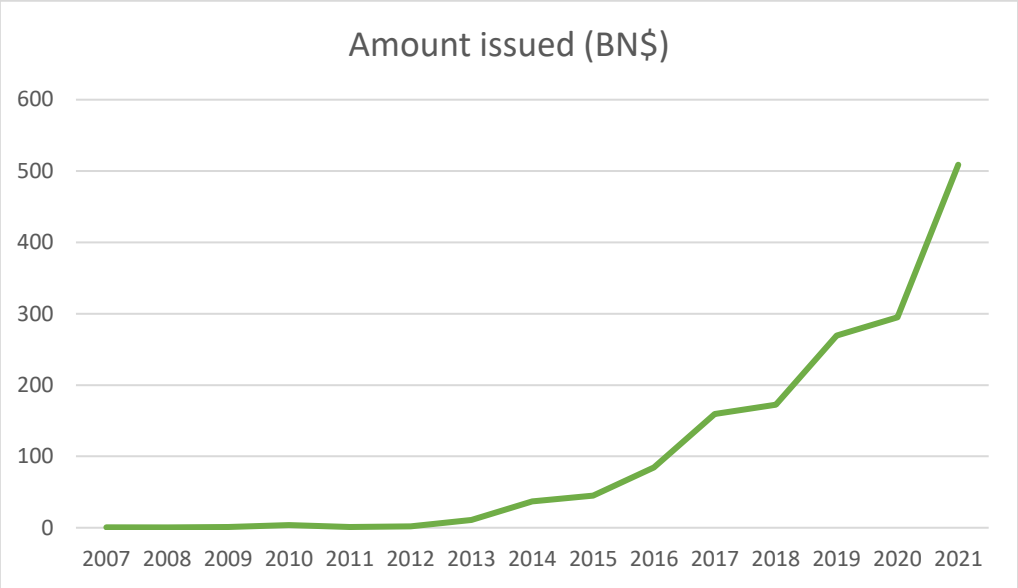

Figure 1. Total amount of green bonds globally. (CBI 2021.)

Figure 1 includes all labelled green bonds by CBI (2021). The green bond market has started to grow in 2013 and the market has continued to grow at an exponential interest rate until the end of 2021. The green bond market, while experiencing rapid growth, currently represents a relatively small fraction of the total bond market, accounting for less than one percent. (Reboredo, 2018).

3.3 Green bonds in emerging markets

Hoskisson, Eden, Lau and Wright (2000) define an emerging market as a country that must meet two criteria; rapid economic progress and legal regulations that favour economic liberalization and the approval of a free-market arrangement. According to Bekaert and Harvey (2002) and Zhao et al., (2014), emerging markets rise gradually from a less developed position to a group of developed countries. It is important to note that the delineation of an emerging economy is subject to varying definitions, contingent

upon the specific criteria employed to gauge economic development (World Bank, 2022b). Common metric for measuring economic development include indicators such as gross domestic product that the World Bank (2022b) uses for categorizing economies.

Figure 2 shows the volume of the green bonds issued in US dollars in both developed and emerging markets. Figure 2 shows that developed markets have issued significantly more green bonds than emerging markets between 2014 and 2021. In the CBI (2021) data, 25 countries are classified as developed and 54 as emerging countries.

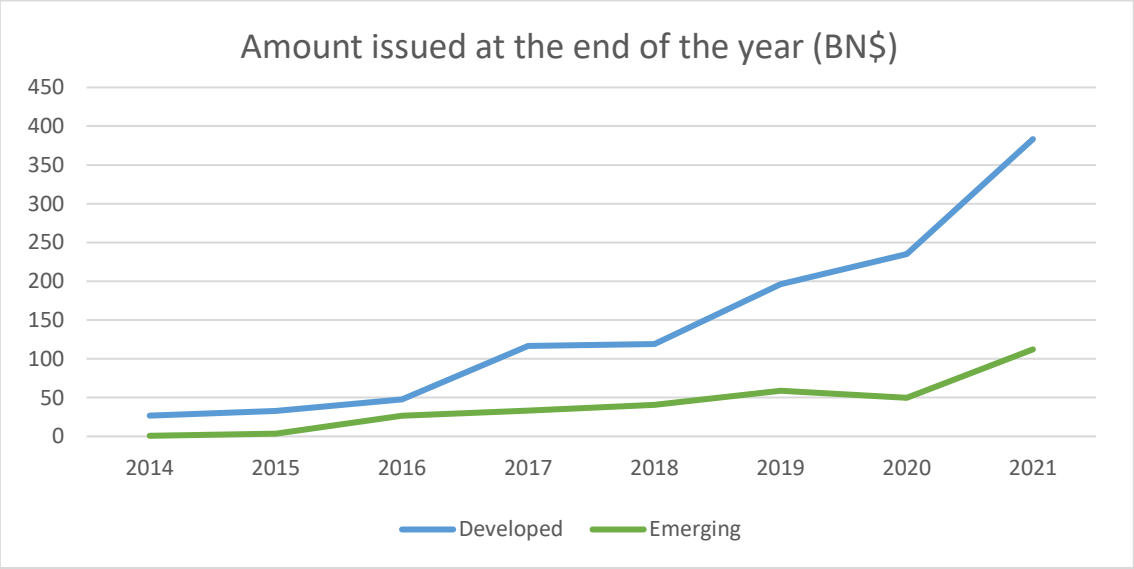

Figure 2. Green bonds issued in developed and emerging markets. (CBI 2021.)

In Figure 2, the number of green bonds in emerging markets has been increasing until the end of 2019. The amount of green bond issuances at the end of 2020 has been decreasing compared with the previous year, and one explanatory reason might be coronavirus disease which spread around the world by impacting on the economic and financial markets in 2020. The markets experienced high volatility and uncertainty, which may have affected the willingness and ability of the organisations to make new investments and issue new bonds. However, the growth at the end of 2021 of green bond issuances has been markedly upward. Overall, in the emerging markets, the growth of issued green

bonds has been steady but not nearly as great as in developed countries where the amount of green bond issuances has grown significantly and steadily. (CBI, 2021.)

While the trend of green bond issuance in emerging markets is increasing, it is worth noting that the market is still relatively small and more volatile in comparison with developed markets (Long et al., 2014). However, there is growing recognition of the potential of green bonds to finance sustainable development in emerging economies and efforts are being made to increase the availability of green financing in these markets. (CBI, 2021.) The World Bank (2022a) report identifies similar results for thematic bonds. According to the World Bank (2022a), despite emerging market prospects, only 15 percent of the total thematic bonds have been issued in emerging economies.

In terms of the geographical distribution of the green bonds in emerging countries, Figure 3 shows how the issuances have centred. In the figure, the darker the blue colour is, the more green bonds that emerging country has issued between 2014 and 2021. This figure is a demonstration of the prevalence of green bonds and the figure shows how widely green bond issuances have spread in emerging markets.

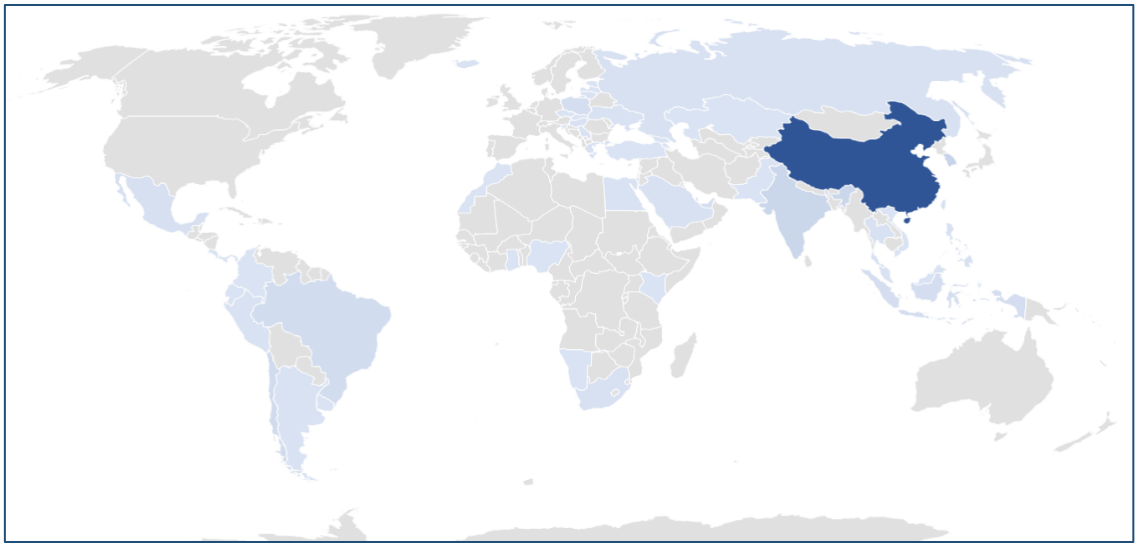

Figure 3. Prevalence of green bonds. (CBI, 2021.)

Figure 3 shows that a significant quantity of the green bond issuances is concentrated in China. With a cumulative value of nearly $200 billion, China is a leading economy in terms of issuing green bonds in emerging markets (CBI, 2021). The second largest issuer is South Korea, which has issued a total of about $22 billion in green bonds. In addition to China and South Korea, India is also a significant green bond issuer in emerging markets. However, according to CBI (2021), the majority of the green bonds in Figure 1, Figure 2 and Figure 3 have been issued by national governments, but there has also been an increasing trend of corporate issuers in emerging markets that have entered the green bond market.

3.4 Greenwashing and green bonds

Although the amount of green bonds has grown in popularity in recent years, they face certain challenges, such as greenwashing, where issuers make exaggerated or unsubstantiated claims about the environmental benefits of their projects being financed (Guo et al., 2018). The benefits of sustainable business and the growing importance of environmental issues for investors are widely recognized. However, the financial incentives associated with environmentally friendly activities create opportunities for dishonesty. Because of this, there is a risk that some issuers may use green bonds to improve their reputation and not to finance genuinely sustainable projects. This risk highlights the importance of strict standards and certification processes for green bonds to ensure that issuers meet clear environmental and social performance criteria and that investors can trust the sustainability requirements of the projects being financed. (Guo et al., 2018.)

According to Dahl (2010), the concept of greenwashing is not a new phenomenon. The term gained recognition and has been used since the mid-1980s. When a company issues a green bond, investors may be sceptical about the reliability of the environmental claims of the company due to the prevalence of greenwashing. Authors such as Flammer (2021) and Christophers (2018) have raised concerns about the effect of greenwashing on the effectiveness of green bonds. As a relatively new type of financial instrument,

green bonds may confront more scrutiny and uncertainty from investors concerned about the risk of greenwashing (Delmas & Burbas, 2011).

To reduce the risk of greenwashing, it is essential that robust regulatory measures are taking into a consideration. According to Paranque and Revelli (2019), the primary advantage to investors is the legitimacy and communication process of green bonds, which encourages companies to meet investors' expectations of effectiveness. The process creates a direct link between words and actions, allowing investors to assess the sustainability of the issuer's operations (Paranque & Revelli, 2019). Therefore, third-party audits and verification processes play a critical part in ensuring that companies follow environmental policies and practices that are relevant to the stakeholders of the issuers. The use of various guidelines such as the Green Bond Principles presented in this chapter earlier and other third-party audits and guidelines can help reduce the risk of greenwashing in the green bond market. These measures are necessary to ensure that the proceeds of green bonds are used to finance accurately sustainable projects and that investors can trust the issuers' environmental claims. (Guo et al., 2018; Ramus & Montiel, 2005.)

To conclude, this chapter highlights the importance of the Green Bond Principles by ICMA in establishing principles for the issuance of the green bonds. The GBP provide guidance on transparency, disclosure, and accountability to ensure that investors have access to reliable information about the environmental impact of the projects being funded. Although looking at the overall picture, the green bond market has been growing in both developed and emerging markets, this chapter also takes into account the challenges of the green bonds in emerging markets, such as the regulatory framework and greenwashing. Overall, taking into consideration the information presented in this chapter, it can be concluded that green bonds have emerged as an effective tool for financing environmentally sustainable projects globally, however, it is crucial to ensure that they are issued and managed transparently to ensure that investors can trust the environmental benefits of the projects. ICMA's GBP and third-party audits therefore play

a key role in achieving this and contributing to the growth of the green bond market as a whole.

4 Stock valuation

This chapter consists of a brief presentation of most important theoretical framework of the stock valuation. First, the return and pricing of stocks are presented following by a brief summary of Modern portfolio theory, Capital asset pricing model, Arbitrage pricing theory and Market efficiency and information asymmetry.

4.1 Stock valuation

In this part, the most important features of stock pricing are examined. Since this thesis studies the changing prices of stocks in a short-term period, it is relevant to present the formulas related to the valuation. Commonly used valuation method is to use dividend-based models (Nikkinen et al., 2002, p. 149–150). However, according to Knüpfer and Puttonen (2018, p. 93) the valuation of stock is not straightforward due to the future cash income prediction, as there are no defined limits for distributing dividends.

4.1.1 Return of stock

The profit of an investment represents how well the investment has increased in respect of other investments. By calculating profits simplify the comparison between investments, in this case, stocks. However, the value of stock is not simply to determine because dividends depend on the company's future success. Also, companies are not obliged to pay dividends to its investors. (Knüpfer & Puttonen, 2014, p. 93; Nikkinen et al., 2002, p. 149–150.)

4.1.2 Stock pricing

Despite the difficulty of valuing shares, before examining the relationship between green bonds and the stock prices after a green bond announcement, it is reasonable to present

how stocks are commonly priced in the stock markets. Similarly to the bond pricing presented in chapter 2.3, pricing shares are based on the discounted expected dividends (Nikkinen et al., 2002, p. 148). Price of a stock is calculated by means of dividend discount model. According to the model, the price of the share is sum of the company's future dividends' current value discounted by investor's rate of return. This is illustrated in the following formula (Nikkinen et al., 2002, p.150):

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t} \quad (2)$$

where,

P_0= Current stock price

r= Rate of return

D_t= Future dividends

t= Time in years (Nikkinen et al., 2002, p. 150).

If the dividends do not grow in the future, the former formula can be presented (Knüpfer & Puttonen, 2018, p. 96-97):

$$P_0 = \frac{D_1}{\mathrm{r}} \quad (3)$$

If dividends are predicted to increase in the future, the price of the stock can be formulated to the equation:

$$P_0 = \frac{D_1}{\mathrm{r-g}} \quad (4)$$

where,

g= Constant growth rate expected for dividends. (Knüpfer & Puttonen, 2018, p. 96-97).

Formula 4 is called the Gordon growth model. Based on this model, the value of a stock, which assumes a constant rate of dividend growth in the future, can be determined (Knüpfer & Puttonen, 2018, p. 96-97).

4.1.3 Modern portfolio theory

Modern portfolio theory (MPT) is a framework based on the idea of diversification (Markowitz, 1952). Markowitz (1952) states that instead of investors focusing on the risk-return ratio of individual assets, investors should create a portfolio consisting of these individual investments. According to Markowitz (1952), diversification allows for a better return on a portfolio with less risk and the core idea is to choose a portfolio of investments whose returns correlate as minimally as possible (Markowitz, 1952).

In the MPT, the investor achieves the highest return by setting the constructed portfolio to the efficient frontier. As determined by MPT, a portfolio on the efficient frontier offers the best possible return for each level of risk. Since investing below the limit means exposing yourself to a higher risk with a lower return, the only reasonable option for the investor is to take advantage of the market effectively by investing with a limit. (Markowitz, 1952.)

When analysing the impact of green bonds on the share value of the organisations, it is important to consider how the issuance of green bonds might affect the overall risk and return of the company. If green bonds help to reduce the overall risk of the company, this could potentially lead to an increase in its share value as investors are more willing to invest in the company. On the other hand, if the issuance increases the risk of the company, this could potentially lead to a decrease in its share price.

4.1.4 Capital asset pricing model

Capital asset pricing model (CAPM) has been one of the most important theoretical models in finance literature for calculating the future expected returns of securities and it is based on the modern portfolio theory presented above. In accordance with the assumptions of the portfolio theory, CAPM predicts coherence in investor behaviour (Sharpe 1964). In general, asset pricing models explain how asset prices are formed and attempt

to calculate the risk measure for a single asset as well as the market price for risk (Copeland et al., 2014, p. 145).

According to CAPM, the return on the capital requirement is obtained by adding the average market risk premium to the risk-free interest multiplied by the company-specific beta (Bodie et al., 2014, p. 281–282). CAPM connects the returns directly with its risk. As the specific risk can be diversified, the risk premium of a stock depends only on the market risk of the stock. In this model, the expected rate of return of a stock is divided into the risk-free rate of return and the rate of market return and therefore, the sensitivity of the stock, beta, is known, the total risk of the stock is also known. (Bodie et al., 2014, p. 281–282.) However, CAPM relies on the assumptions that all investors have similar expectations about the future returns, risks and correlations, and also have a goal of maximizing fund diversification (Bodie et al., 2014, p. 281–282). Moreover, CAPM assumes that borrowing and lending happen at risk-free rates, relevant information about securities is publicly available and that there are no transaction costs or taxes.

CAPM has received criticism that its restrictive assumptions do not actualize, and investors do not behave in this manner in the markets. However, in CAPM, the profit of the stock depends on the market risk and therefore, the model is the valuable description of the markets and can help investors to understand its operation. (Bodie et al., 2014, p. 305; Knüpfer & Puttonen, 2018, p. 153)

4.1.5 Arbitrage pricing theory

Where the CAPM analyses how investors construct efficient portfolios, another important asset pricing model, arbitrage pricing theory (APT), explains the profits from the stocks by using macroeconomic factors. However, APT makes no attempt to find efficient portfolios, but the initial assumption is that every investor is willing to increase their portfolio's return if it is performed without increasing risk. (Nikkinen et al., 2002, p. 76).

According to APT, there are two risks towards every stock. The first risk bases on the macroeconomic factor and the second one is the company-specific risk. As in the CAPM, the first mentioned macroeconomic factor cannot be excluded by diversification but however, the company-specific risk can be excluded. Therefore, according to the APT, the risk premium of a share is influenced by the risk premium associated with each factor and the sensitivity of the share. Because arbitrage profits are risk-free, every investor is eager to capitalize on them as soon as they come across one. However, arbitrage should not be possible if the market is functioning efficiently. (Nikkinen et al., 2002, p. 76-77.)

4.1.6 Market efficiency and information asymmetry

According to a generally accepted theory, capital markets are efficient when investors have equal access to information affecting the changes of prices and the prices adjust and reflect the available information (Fama, 1970). As one of the founders of the efficient market, Fama (1970), states that the efficient market becomes accustomed only when all investors have access to both public and private information. In accordance, prices react rapidly and accurately to new information, thereby eliminating the opportunities of the investors to achieve risk-adjusted excess returns based on publicly available information (Fama, 1970). If this assertion is valid, there is no possibility to outperform the market because there are no undervalued or overvalued stocks available. The market will correct itself if the pricing is incorrect (Fama, 1970).

Fama (1970) presents three perceptions of the market efficiency. The author states that the market can be efficient in a weak, semi-strong or strong form (Fama, 1970). The weak form refers to degree where complete historical data is included in current market prices. The semi-strong form of the market efficiency indicates that all publicly available information is included in prices. Lastly, a strong form is maintained when all existing information, including private or insider information, is considered at market prices. However, Fama (1970) states that there are several indications in the market that the efficiency of the market is semi-strong.

Information asymmetry arises when one party has more or better information than the other parties (Cuypers et al., 2017). This can lead to the party without comprehensive information making decisions that lead to suboptimal outcomes. In the efficient capital markets, all participants have equal access to information at the same time. However, realistically, one party often has an information advantage over another when engaging in business activities. Under these conditions, information is unequal and causes information asymmetry. (Dierkens, 1991; Glücskman, 2020.)

As a summary, understanding the presented theories related to stock valuation is necessary for analysing the relationship between green bond announcements and stock prices as the presented concepts provide a theoretical framework for the behaviour of financial markets. Particularly, market efficiency and information asymmetry are important factors to consider when analysing the impact of the announcement on stock values as it may affect the interpretation of the results. However, the overall theory of stock valuation provides a broad view of the markets as it is necessary to present before examining the impacts of green bonds on the stock price.

5 Literature review

The main purpose of the literature review is to present academic studies that have examined the relationship between green bonds and share value. However, in order to provide a broader view on the topic, academic research exploring green bonds and empirical insight about the value effect of ecology have been incorporated. This chapter can be divided into three areas. First, recent research on green bonds is presented. This is followed by an introduction to the literature that has examined the relationship between ecology and the economy followed by the studies that focus in particular on researching and analysing the relationship between green bonds and stock prices.

5.1 Research on green bonds

The green bonds have been studied from several perspectives, including the evolution of the green bond market, the green bond premium, the role of green bonds in sustainable development, and greenwashing (Bhutta et al., 2022). Li et al. (2022) study the development of the green bond market in the United States and China and compare the market development and analyse the advantages and disadvantages of different market structures, focusing, however, mainly on the market development of China. In the US, the market developed primarily through the spontaneous demand from market participants, and only after the US presidential election is 2020, climate issues received renewed attention, and the government began to develop a more standardized framework for the green bond market. According to Li et al. (2022), in China, the green bond market activated nearly 10 years later than the global green bond market. At the exploratory stage in 2016-2018 People's Bank of China and the National Development and Reform Commission issued guidelines and provisions for the issuance of green financial and green corporate bonds. With the implementation of the policies, China's green bond market has developed steadily and the number of issuances has increased annually (Li et al., 2022). Based on the market comparison, the study by Li et al. (2022) provides a

qualitative research perspective that has particular relevance to the development of green bond markets, especially in other emerging countries.

The research by MacAskill et al. (2021) presents a review of green bond premium in the green bond market. According to MacAskill et al. (2021) the investors value green bond measures, such as third-party evaluation and compliance to green bond standards. The authors identify the characteristics commonly associated with the green premium is strong governance procedures and highlight the harmony on the existence of the green premium in the primary and secondary markets of green bonds (MacAskill et al., 2021).

When it comes to the sustainable development, Bhutta et al. (2022) discuss the importance of green bonds in achieving the targets of sustainable development goals by United Nations and limiting the increase in global temperature as agreed upon in the Paris agreement. The study present critical macroeconomic indicators for the development of the green bond market highlighting the need for regulatory support for the growth of the market. The authors suggest that more research is needed to fully understand the evolution of modern financial instruments such as green bonds and their potential to finance environmentally friendly projects. (Bhutta et al., 2022.)

The term of greenwashing is introduced in subchapter 3.4 earlier. Xu et al. (2022) study the impact of greenwashing on the pricing of green bonds in China. The authors demonstrate that greenwashing affects the green bond market of China, which is reflected in higher credit spreads compared with conventional bond spreads. Xu et al. (2022) suggest that third-party green bond certification can lead to lower credit spreads by reducing the possibility of greenwashing. These results of the study provide information on green bond pricing and similar to the previously presented articles, highlight the importance of regulation in the development of the green bond market. (Xu et al., 2022.)

Zerbib (2019) conducts a global study and investigates the effect of pro-environmental preferences on bond market prices by using green bonds as the instruments. The

findings of the author show a statistically significant yield premium of -2 basis points that investors are willing to pay for green bonds compared with conventional bonds at the same level of risk. This indicates that investors prefer green investments, but the impact of pro-environmental motives on bond prices is low (Zerbib, 2019).

The paper by Russo et al. (2021) explores the factors determining the performance of green bonds. The authors present a theoretical framework by triangulating different perspectives, including the project-specific characteristics of green bonds, the corporate sustainability-oriented strategy of the issuer, and general country-level determinants of the performance. Russo et al. (2021) find that project characteristics such as eco-efficient products, pollution control and water management have a positive impact on bond performance. In contrast, the authors find a negative effect of the credit risk rating of the country on green bonds.

5.2 Ecology and stock value

Examining the relationship between ecology and stock value modifications is not a fresh topic in academic literature. Shane and Spicier (1983) analyse eight studies about companies' pollution control conducted by the Council on Economic Priorities. The studies used in the paper has been carried out with a database since the 1970s. According to Shane and Spicier (1983), the purpose of this paper is to examine how the stock market reacts to firms' amounts of contamination. This study shows the results of a negative association between stock prices and pollution. The authors find that this association is mitigated for companies with more developed pollution control performance. According to the results, companies with a low pollution-control performance ranking have significantly more negative returns comparing companies with high pollution-control rankings. (Shane & Spicier, 1983.)

Based on Klassen and McLaughlin's (1996) study, the impact of ecological rewards on stock prices are notable. Database that the authors use in the study, are announcements

from 1987 to 1991. The authors claim that firm's eco-friendly activity has an impact on firm's stock price. The authors find a positive market reaction to firm's announcement of eco-friendly activity. According to the study, the share prices of winning company rise after earning an environmental reward (Klassen & McLaughlin, 1996.)

Hamilton (1995) studies both media and stock market reactions to the toxic related releases of the companies. The study shows that there is an impact of pollution on company's financial performance. Hamilton's (1995) research indicates that print journalists writing about pollution correlation to certain firms concern investors and therefore negatively affect the stock value of stated companies. (Hamilton, 1995.)

Weidenbaum et al. (1997) the relationship between ecology and the economy using a perspective on the economic conditions of the United States. The authors first present investors who are concerned about environmental health and then investors who are concerned about the state of the economy. They find that economic and environmental objectives are often fully compatible, and at the same time the United States would be able to achieve a healthier environment and a stronger economy. (Weidenbaum et al., 1997.)

Such as the study by Klassen and McLaughlin (1996), the purpose of the paper by Flammer (2013) is to examine how stock prices react to the ecological initiatives. The parity between these studies is notable. The findings of the paper by Flammer (2013) indicates that there is a relationship between stock prices and environmental earmarked projects. Flammer (2013) examines in more detail about how the shareholders react to either eco-friendly or eco-harmful corporate events in the short-term and long-term. According to the study, the stock market prices react negatively to corporate events causing environmental damage. The study provides evidence that shareholders are positive towards environmentally friendly behaviour and negative towards environmentally harmful initiatives and that environmentally friendly investments improve the long-term performance and value of companies. (Flammer, 2013.)

Krüger (2015) examines the different stock market reactions of environmentally rated firms in the short-term. The study provides evidence that stock prices react strongly to major negative events and less strongly to weak negative events. The study also shows that investors react slightly negatively when positive news emerges from the corporate social responsibility policies of the companies. According to the results of the paper, the costs of corporate social irresponsibility reduce the wealth of the shareholders and thus lead to lower share prices. (Krüger, 2015.)

The articles presented provide an overview of the fact that taking environmental factors into account in business activities is not a completely new subject in academic literature. To conclude these studies between the market reactions and announcements of environmental factors, environmentally friendly solutions seem to have a positive effect on the operations of the companies, while negative measures seem to have a negative effect. The following articles focus specifically on green bonds, but due to the novelty of green bonds, there are currently only few studies focusing specifically on the impact of green bonds on stock prices.

5.3 Green bonds and stock value

Flammer (2021) studies whether a corporate green bond issuance affects the value of the issuer's stock price. The paper discusses how the company changes after the green bond has been issued, including improvements in environmental performance, changes in equity ownership, and the cost of capital. Flammer (2021) finds the results of a positive reaction to the announcement of a green bond on the stock value. The dataset of the study consists of nearly 1200 issuances from 400 different issuers from both private s and public enterprises. By using the event study methodology and the event window of [-5,10] Flammer (2021) finds a significant cumulative abnormal returns of 0,49 percent. Research results show that green bonds improve both the company's environmental and financial performance. Flammer (2021) also discusses potential rationales for the

green bond issuances, including signalling, greenwashing and cost of capital, and suggest that green bonds serve as a credible signal of a firm's commitment to the environment, leading to positive stock market reactions and improved environmental performance.

Roslen et al. (2017) examine the share price response to green bond issuance by using data from multicounty samples. The authors conclude positive evidence of green bonds impacting on the wealth of the stakeholders. They also find that the stock value increases, especially on the day following the announcement of the issue. However, these results are not statistically significant at the 5 percent level of significance. (Roslen et al., 2017.)

Tang and Zhang (2020) study the benefits of the green bond issuances by using the data of publicly issued green bonds. The dataset consists of 1510 green bond issuances by 132 individual issuers. By using CAPM to appraise the abnormal returns of stock reaction of the green bonds, the event window of [-10, 10] and the estimation window of 300 days before up until 50 days prior to the date of the green bond announcement, the results show a cumulative abnormal return of 1,4 percent for the event window of [-10, 10]. The authors find that stock prices react positively to the announcement of the green bond issuance and the authors suggest that green bond issuances are beneficial to its existing shareholders. (Tang and Zhang, 2020.)

Wang et al. (2020) examine the impact of the green bond issuances on share prices using 159 green bonds issued by issuers with a public listing in China. The authors use three event windows, [-1,1], [-3,3], and [-10,10], to determine the CARs. The results show positive significant impact on event windows of [-3,3], and [-10,10]. However, the primary focus of the research is on the yield spread between conventional and green bonds as well as whether green bonds have a price premium (Wang et al., 2020).

Baulkaran (2019) indicates that results of green bond issuance increase shareholder's value by using event study methodology and regression analysis. The author examines stock market reaction before and after the issuance by publicly traded organisations.

Baulkaran (2019) studies how shareholders react to the green bond announcements with a sample from 72 publicly traded companies that are mostly located in Europe. By using event windows of [-10, 10] and [-10, 20] in the event study analysis, the paper shows a positive and significant impact of green bond issuance to changes in stock values. With the event window of [-10, 10] and significance level of 5 percent, the CAR is 1,48 percent. The conclusion states that green bonds add value to the shareholders by mitigating the risks of the company. Hence, the results show that shareholders reaction is positive to issuing green bonds.

Lebelle et al. (2020) use data of corporate green bonds to study if the green bond issuances have a positive effect to the share price. The dataset consists of 475 corporate green bonds issued by international individual publicly listed companies. The authors examine international green bonds by using different event windows and different asset pricing models. The length of the estimation window extends from 250 days before to 50 days prior to the event, with five event windows tested that are [0,1], [-1,1], [-3,3], [-5,5], and [-20,20] (Lebelle et al., 2020). The CARs of the event windows [0, 1], [-1,1], and [-20,20] are negative and statistically significant on a 5 percent level. According to Lebelle et al. (2020) the green bond issuances do not create value for their issuer around the announcement date, and the results show a negative market reaction to the announcement of a new corporate green bond issuance (Lebelle et al., 2020). Lebelle et al. (2020) also further distinguish between green bonds issued in developed economies and those issued in emerging markets with a surprising finding that developed markets respond less favourably to green bond issuance than emerging economies do. The authors conclude that investors react similarly to the announcements of green bonds and conventional bonds.

Xi and Jing (2022) study the green bond issuances of listed companies in Shanghai and Shenzhen stock markets from 2016 to 2018. The empirical part of the paper consists of two parts. First, the authors use the event study method to prove that there is a stock price influence in green bond issuance by comparing Fama-French five-factor model and

CAPM. Secondly, the authors then use a comprehensive regression model to investigate the origins of the stock price effect of green bond issuance in depth via three channels: finance cost, investor attention, and fundamental. The event windows of [1,1], [1,5] and [1,7] are used to examine the impact of green bond issuances on the stock prices of publicly traded companies. According to the results, the stock price effect of the initial issue of green bonds is not significant in three window periods but it is significant in subsequent issuances.

6 Data

This chapter presents the dataset used in this thesis. Firstly, the chapter presents where the data originates from, following by the data limitations. Thereafter, the final dataset along with its descriptive statistics is presented. Lastly, this chapter presents the descriptive statistics of the dependent and the independent variables.

Data for this study has been obtained from three sources. The source of the green bond issuances is the University of Vaasa's Bloomberg Lab that includes rights to the Bloomberg databases. The initial dataset includes all green bonds listed in emerging countries between January 2013 to September 2021. Including issuer name, issuer ticker, announcement date, issue date, issuer's country, amount of the bond, maturity, and coupon rate, the data from Bloomberg consists of basic characteristics of green bond issuances. Descriptive information about the bond issuers and the index data of country-specific indices are collected from Refinitiv Datastream. The indices used are listed in Appendix 1. Acquired company characteristics from Datastream include total assets, total debt, earnings before interest and tax (EBIT), return on assets (ROA), market capitalization and tangible assets from the fiscal year before the announcement date of the bond. The stock data of companies, including stock values before and after a green bond announcement, is loaded from Yahoo Finance. If the organisation has the multiple series of stock listed on the exchange, the most traded stock was selected for the dataset.

6.1 Data limitations

The purpose of the thesis is to examine the green bond issuances of publicly listed companies in emerging economies. However, there are differences in the classification of which countries fit in and fulfil the characteristics of an emerging market. According to Morgan Stanley Capital International (2022) Brazil, Chile, China, Colombia, Czech Republic, Egypt, Greece, Hungary, India, Indonesia, Korea, Kuwait, Malaysia, Mexico, Peru, Philippines, Poland, Qatar, Saudi Arabia, South Africa, Taiwan, Thailand, Turkey, and United

Arab Emirates meet the criteria of an emerging country (MSCI, 2022). Conversely, many parties today classify South Korea as a developed economy. The Financial Times Stock Exchange (FTSE) has been classifying South-Korea as a developed economy since 2013 and United Nations Conference on Trade and Development (UCTAD) since 2021. (FTSE, 2013; UNCTAD, 2021) However, since a part of the issuances are announced when South Korea has not yet been classified as an emerging market according to UCTAD, and according to MCSI (2022) it still meets the criteria of emerging economy, green bonds that have been issued by companies that operate in South Korean have been included as part of the dataset.

Because of the data limitations, the data does not include green bonds issued by private companies. Although the work addresses listed companies, however, publicly listed banks and financial institutions are excluded from the final dataset because financial companies may use the funds to finance green projects instead of using them for their own operations. Thus, the elimination of the risk that the issuer's proceeds are not invested directly in eligible green projects ensures that deviating results are averted. (Fatica et al., 2021; Gilchrist et al., 2021).

The total dataset consists of 155 issuances from 66 companies operating in the following countries; Brazil, Chile, China, India, Lithuania, Mexico, South Korea, Taiwan, Thailand and Turkey. Data availability and data coverage at Bloomberg database has significantly guided the data scope.

6.2 Final dataset

Table 2 displays an overview of the final dataset of the announcements. Overall, the dataset consists of 155 announcements from 66 companies operating in 7 different industries with the total amount of over 17 billion United States dollars. The country with the greatest amount of green bond issuances (34,8 percent of all issuances) and the largest issuances in monetary terms (55,6 percent) is South Korea. China has issued a greater

number of green bonds compared with the amounts that Brazil, Chile, India and Mexico have issued but nevertheless, the size of the aggregate monetary value in all countries is relatively equal. The results of the countries with the largest number and amount of green bond issuances correspond to the information from CBI presented previously in chapter 3. In both datasets, the biggest issuers of emerging countries are China, South Korea and India.

Table 2. Dataset by country.

Country	*GB issuances (pcs)*	*%*	*Total amount (M$)*	*%*
BRAZIL	6	3,87	1201,84	6,92
CHILE	2	1,29	1400,00	8,06
CHINA	43	27,74	1179,12	6,79
INDIA	3	1,94	1950,00	11,22
LITHUANIA	1	0,65	22,30	0,13
MEXICO	3	1,94	1150,00	6,62
SOUTH KOREA	54	34,84	9654,49	55,57
TAIWAN	11	7,10	331,95	1,91
THAILAND	30	19,35	58,14	0,33
TURKEY	2	1,29	426,97	2,46
Total	155	100,0	17374,80	100,0

In this table, green bonds are divided according to the emerging country in which its issuing organisation operates. The volumes of issuances and the sum of their monetary value in millions of US dollars in the country are reported both in absolute terms and in relation to all issuances.

In Table 3 below, the data is presented by the year of announcements. Table 3 illustrates how the issuance volumes have increased in emerging countries over time. Considering the data limitations, the number of green bond issuances has grown exponentially and increased almost 45-fold since 2015, however, noting that 2021 is only covered until September and therefore does not cover the whole year of 2021. The CBI data results presented earlier in chapter 3 show a corresponding accelerated growth trend in the number of green bond announcements and issuances. Although according to the subchapter of 6.2, the data has originally been retrieved from 2013 to 2021, but after the data

limitations, the first announcement of the green bond that fits the data description is from 2015.

Table 3. Dataset by years.

Year	*GB issuances*	*Total amount (M$)*	*Mean maturity*
2015	2	1125,49	7
2016	3	117,97	6,3
2017	8	743,32	6,4
2018	8	518,51	5,6
2019	28	3638,19	6,4
2020	20	1176,21	7,3
2021	86	10055,12	5,2
Total	155	17374,91	5,85

This table provides the yearly statistics for the green bond issuances, the total amount issued and the mean maturity. The amount issued is in millions of US dollars and the mean maturity is reported in years.

6.3 Dependent variables

As the purpose of this thesis is to determine if the announcements of the green bonds have an impact on the stock price of the issuer, the CARs for different event windows are determined and tested with different regression models. The chosen dependent variables for the regression models are CAR[-10,10], CAR[-5,5], CAR[-1,1] and CAR[0,1]. The event window of CAR[-10,10] extend from ten days before the event and ten days after the event covering 21 days of the testing period. For CAR[-5,5] the period is 11 days, for CAR[-1,1] it is 3 days and for CAR[0,1] it is 2 days of the testing period.

Different time windows are tested, since when a company announces the issuance of a green bond, it requires time for the announcement to be reflected in the value of the stock. In the previous academic literature examining the relationship between the green bond announcement and the stock price changes, Tang and Zhang (2020) use only the

event windows of [-10,10] and [-5,10], while Wang et al. (2020) have several windows of [-1,1], [-3,3] and [-10,10] studied in the paper.

Table 4 provides descriptive statistics for the chosen event windows of [-10,10], [-5,5], [-1,1] and [0,1]. The means of CAR[-10,10], CAR[-1,1] and CAR[0,1] are negative indicating that emerging markets have reacted negatively to the green bond announcements with the largest change of -1,0 percent. The maximum and the minimum values of the CARs differ partially from the values of the means indication that there might be a few outliers in the average returns. In the event window of [-10,10], the changes in the stock prices vary between -25,9 to +32 percent while in the smallest event window of [0,1], the value of the stock prices ranges from -7,1 to +11 percent. Similarly to these results, Lebelle et al. (2020) also find a negative reaction from market to the announcement. Kurtosis, skewness and Jarque-Bera values presented in Table 4 suggest that the data is not distributed normally (Brooks, 2014, p. 217-224). This factor is considered later in chapters 7 and 8 when significance tests are presented and performed.

Table 4. Descriptive statistics of CARs.

	CAR[-10,10]	CAR[-5,5]	CAR[-1,1]	CAR[0,1]
Mean	-0.010	0.002	-0.003	-0.002
Median	-0.002	0.003	-0.005	-0.002
Maximum	0.320	0.160	0.148	0.110
Minimum	-0.259	-0.169	-0.119	-0.071
Std. Dev.	0.099	0.058	0.036	0.025
Skewness	0.488	-0.050	0.550	0.730
Kurtosis	4.641	2.889	7.507	7.511
Jarque-Bera	23.536	0.144	138.994	145.145
Probability	0.000008	0.930733	0.000000	0.000000
Sum	-1.478	0.265	-0.516	-0.313
Sum Sq. Dev.	1.524	0.524	0.196	0.097
Observations	155	155	155	155

This table reports summary statistics of average cumulative abnormal return over four different event study windows studied in the thesis. The analysis of the CARs is conducted with a market model approach where the index of each country in which the issuing company operates, has been used.

6.4 Independent variables

The selected independent variables used to describe the characteristics of the issued green bonds in this thesis are consistent with the prior research conducted by Wang et al. (2020), Tang and Zhang (2020), Lebelle et al. (2020) and Flammer (2021) presented earlier in chapter 5. The independent variables are divided into two groups for presenting the summary statistics.

Table 5 provides descriptive statistics of the green bond characterises for the independent variables in the model. The variables of green bond characterises with the greatest deviations are Coupon and Maturity_years. The mean coupon percent is around 2,86 percent although the range of percent differs between 0,4 to almost 20 percent and the mean maturity ranges from approximately 4 months to 30 years.

Table 5. Descriptive statistics of green bond characteristics.

	Amount_ issued_LOG	*Coupon*	*D_FirstGB*	*Maturity_years*
Mean	6.726	2.875	0.426	5.857
Median	6.726	2.750	0.000	5.000
Maximum	9.000	19.997	1.000	30.00
Minimum	4.264	0.400	0.000	0.330
Std. Dev.	1.369	1.844	0.496	4.021
Skewness	-0.089	5.228	0.300	3.017
Kurtosis	2.000	49.218	1.090	17.801
Jarque-Bera	6.661	14501.75	25.886	1650.093
Probability	0.035780	0.000000	0.000002	0.000000
Sum	1042.525	445.680	66.000	907.830
Sum Sq. Dev.	288.675	523.450	37.898	2490.228
Observations	155	155	155	155

This table reports the descriptive statistics of the green bond characteristics. $Amount\_Issued$ is the logarithm of the amount issued by the company, $Coupon$ is the coupon rate presented in percent, $D\_FirstGB$ is a dummy variable which equals to one if the bond is the first green bond that the organisation issue, otherwise equal zero and $Maturity\_years$ is recited in years.

Table 6 contains a compilation of independent variables of company specified factors. Leverage, Size_LOG and TobinQ present and are selected as variable to describe the financial performance of the issuer. The deviations with the most significant broad range are Tangibility and TobinQ both of which have large differences in minimum and maximum values and in relation to median values. The correlation matrix of all the characteristics is in Appendix 2. However, the results of the correlations confirm that the green bond and company variables do not suffer from multicollinearity (Brooks, 2014, p. 217-224).

Table 6. Descriptive statistics of the company characteristics.

	Leverage	*ROA*	*Size_LOG*	*Tangibility*	*TobinQ*
Mean	0.399	0.048	16.354	0.020	0.810
Median	0.402	0.044	16.542	0.004	0.507
Maximum	0.822	0.161	19.063	1.553	6.171
Minimum	0.052	-0.024	12.180	0.000	0.010
Std. Dev.	0.168	0.035	1.378	0.126	0.870
Skewness	0.112	0.927	-0.250	11.786	2.710
Kurtosis	2.584	3.985	2.620	143.822	13.360
Jarque-Bera	1.445	28.460	2.548	131663.5	882.794
Probability	0.485543	0.000001	0.279654	0.000000	0.000000
Sum	61.863	7.491	2534.957	3.064	125.615
Sum Sq. Dev.	4.331	0.184	292.626	2.439	116.587
Observations	155	155	155	155	155

This table reports the issuer's descriptive statistics. $Leverage$ for each company is calculated by scaling total liability by company's s total assets. ROA is a ratio measuring company's profitability from fiscal years prior to the event date. $Size\_LOG$ is a natural logarithm of the total assets of the company and $Tangibility$ is the ratio of the company's net property to the total asset from the fiscal year prior the announcement of the green bond and $TobinQ$ is the ratio of market divided by company's total assets. The characteristics of the issuers are gathered from the fiscal year before the green bond announcement.

7 Methodology

In order to fit the data and hypotheses, this empirical section of this thesis is divided into two sections. Following previous research by Tang and Zhang (2020) and Flammer (2021), the present thesis employs the event study methodology to investigate whether there exists a relationship between issuing green bonds and changes in stock value. To complete the research, OLS regression is run to see whether company features can influence on the possible abnormal return.

7.1 Event study

The aim of the event study research in this thesis is to quantify the possible effects of the announcement on the share price of the company. This particular methodological analysis is a forward-looking approach based on the efficient market hypothesis. Within this methodology, it is possible to test the research hypotheses of this thesis by identifying the possible price increases and decreases of the stocks.

In this thesis, similarly to the paper by Flammer (2021), the cumulative abnormal return is measured while examining the impact of the green bond's announcement date on the stock price. The method assumes that the markets are efficient and that it therefore immediately or with a slight delay reflect new information in prices (MacKinlay, 1997). Instead of an issuance date, the announcement date is used to determine the CARs, since in almost every issuance, the announcement of the green bond has occurred before the issuance date, i.e., in those cases the issuance date should no longer cause abnormal returns. (Ball & Brown, 1968; Malkiel, 2003). The estimation window is defined prior to the announcement in order to evaluate the normal returns of the issuers, which are equated with the announcement period's return. According to Strong (1992) and McWilliams and Siegel (1997), the length of the estimation window should be selected in such way that it reduces the variance of the daily returns while capturing the fluctuations of the share prices. The event window that comes after the estimation period is

used to determine if the event period returns vary from the estimated normal returns (McWilliams & Siegel, 1997). Correspondingly, the length of the event window should be appropriately selected to capture the effects of the announcement on the stock price while preventing any possible exclusion of impacts (McWilliams & Siegel 1997). Based on previous research by Tang and Zhang (2020), Wang et al. (2020), Lebelle et al. (2020) and Flammer (2021), the event window is set to last 21 days, but shorter event windows are also being tested in this thesis. The estimation window is set to [-250, -30], with a normal return estimation window of 220 trading days before the event.

7.1.1 Estimation of expected returns

To approximate the influence of green bonds on the share price of the issuing company, the calculation and determination of the CAR is assessed. CAR is an amount consisting of the combined daily abnormal returns of the stock over the entire event period, but before CARs can be calculated, daily abnormal returns are determined by computing the difference between actual and normal returns, particularly, expected returns. This approach is used in previous research by Tang and Zhang (2020) and Flammer (2021). The model used is as follows (Flammer, 2021):

$$\hat{R}_{it} = a_i + \beta_i R_{mt} + \epsilon_i \quad (5)$$

where $\hat{R}_{it}$ is the expected return of the stock i on day t. R_{mt} figures the return of the domestic market index on day t, which represents the main stock market index for the respective country (MacKinlay, 1997). Both a_i and β_i are determined by the model and are estimated for every green bond announcement in their event window (Sharpe, 1964).

The expected return is specified as a stock's return if the event being studied does not occur. The abnormal returns are calculated for each issuance of each company in the event study with the following formula (MacKinlay, 1997):

$$AR_{it} = R_{it} - \hat{R}_{it} \quad (6)$$

where AR_{it} presents the abnormal returns, R_{it} presents the actual return and $\hat{R}_{it}$ is the expected return of the stock i at time τ (MacKinlay, 1997). With Formula 6, it is possible to determine the abnormal returns for each day τ in the event window (MacKinlay, 1997).

The market model by MacKinlay (1997) is be used to determine the abnormal return with the following formula:

$$\begin{gathered} AR_{it} = R_{it} - (a_i + \beta_1 R_{m_t}) + \epsilon_{it} \\ E(\epsilon_{it}) = 0 \\ Var(\epsilon_{it}) = \sigma_{\epsilon i}^2 \end{gathered} \quad (7)$$

where ϵ_{it} is an error term that measures the model's unexplainable estimation errors. The error term is assumed to be independent, with the expected value of zero, and identically distributed assuming that the error terms are uncorrelated with stock or market returns (MacKinlay, 1997).

The cumulative abnormal return (CAR) is calculated to investigate the overall impact of the announcement by totalling all the abnormal returns on each event study window. The model is following:

$$CAR_{i(T_1 T_2)} = \sum_{T_1}^{T_2} AR_{it} \quad (8)$$

where $T1$ and $T2$ represent the start and end date of the event window.

To test the hypotheses of this thesis, the average cumulative abnormal return is measured by the following formula to approximate the impact of the green bond announcement. The CARs are defined as follows:

$$\overline{CAR}_{i(T_1T_2)} = \frac{1}{N}\sum_{T_1}^{T_2} CAR_i \quad (9)$$

where CAR_i represents the average abnormal return at the time τ and N refers to the number of observations. The estimated $\overline{CAR}$s must be statistically significant before formulating conclusions.

7.1.2 Significance test

Based on the results from descriptive statistics in previous subchapter of 6.3 the dependent variables are not normally distributed. In order to test the significance of the $\overline{CAR}$s and enhance the validity of the analysis, a non-parametric test is performed (Pratt, 1959). Most authors in the previous literature test the significance by running a parametric t-test, however, one of the assumptions of t-test that is representative for only normally distributed populations (Tang & Zhang, 2020). Since the data of this thesis is not distributed normally, a non-parametric test, Wilcoxon signed-rank test is conducted (Tang & Zhang, 2020).

7.1.3 Regression model

In order to examine the results of the event study method in even more detail, regression models are conducted to determine possible factors affecting cumulative abnormal returns. In order to identify which characteristics have a significant impact on the announcement of green bonds, the explanatory variables are categorized into two groups; company-specific and green bond specific. The regression analysis utilised in this thesis is the ordinary least squares (OLS) method to determine the results and significances. The basic model in the OLS method include the dependent variable which is explained by one or more variables. This work tests several different regression models based on the following formula (Lebelle et al., 2020):

$$Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki} + \epsilon_i \quad (10)$$

where Y_i is the dependent variable, α is constant, β_k is the coefficient of the independent variable X_{ki} indicating the increased or decreased effect on the Y_i and ϵ_i is the error term (Lebelle et al., 2020).

The OLS regressions are tested using test measures described above to explain CARs by using all nine independent variables in one model as well as conducting only company-specific and green bond specific variables to test the dependent variable. Exemplified, the OLS regression of all independent variables to test CARs is tested as following:

$$\begin{aligned}\overline{CAR_{\mathrm{it}}} = \alpha &+ \mathrm{Amount\_Issued\_LOG} + \beta_2 Coupon + \beta_3 \mathrm{D\_FirstGB} + \beta_4 Leverage \\ &+ \beta_5 \mathrm{Maturity\_years} + \beta_6 ROA + \beta_7 \mathrm{Size\_LOG} + \beta_8 Tangibility \\ &+ \beta_9 \mathrm{TobinQ} + \epsilon_i\end{aligned}$$

where,

$\overline{CAR_{\mathrm{it}}}$	The event window.
α	The intercept term.
$\mathrm{Amount\_Issued\_LOG}$	The logarithm of the green bond amount issued, given in million dollars (USD).
$Coupon$	The coupon of the green bond expressed in percentage form.
$\mathrm{D\_FirstGB}$	Dummy variable giving value 1 if the green bond is the first of the company and 0 if the green bond is not the first green bond of the company.

$Leverage$	Ratio between the debt and assets of the organisation from the fiscal year prior to the announcement.
Maturity_years	The maturity of the green bond expressed in years.
ROA	Ratio of the profitability of organisation from fiscal years prior to the announcement.
Size_LOG	Natural logarithm of the total assets.
$Tangibility$	Ratio between the net property and total asset of the company from the fiscal year prior to the announcement.
TobinQ	Ratio of market value divided by total assets of the company.

8 Empirical findings

This chapter presents the empirical results from the tests performed. First, the statistical significance of the cumulative abnormal results is assessed, followed by regression model analyses based on these results. The empirical findings further include an analysis of the cumulative abnormal returns of both the first and subsequent announcements. Additionally, the presentation of the results incorporates a comparison and discussion of the obtained findings with previous theoretical studies. The chapter concludes with a summary of the main findings.

8.1 Abnormal returns

In order to determine the statistical significance of the event windows, a non-parametric test is conducted to ensure the robustness of the findings (Lu & White, 2014). Based on Table 4 in chapter 6, the skewness and the kurtosis indicate about the possible outliers in the distribution and therefore a significance test for the non-normally distributed dataset is run instead of a parametric test.

The key findings of the event studies are presented in Table 7, Table 8, Table 9 and Table 10. The tables are combined with the statistical values of the Wilcoxon signed-rank test, and in addition the results of Median test summaries are insert. The results of the Wilcoxon signed-rank test procedure for event window of [-10,10] are presented in the Table 7. According to the results, the complete dataset of 155 green bond announcements, 21-day mean of the CAR is -0,95 percent. According to this result, the announcement of the green bond causes a negative impact on the value of the issuer’s stock. By using the Wilcoxon signed-rank test, the finding is statistically significant at the 10 percent level of significance.

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

	CAR [-10,10]	
Mean	-0.0095	
Median	-0.0021	
Std. Dev.	0.0994	
Method	Value	Probability
Wilcoxon signed rank	1.6802	0.0929*
Median Test Summary		
Category	Count	Mean Rank
Obs > 0.000000	74	68.9730
Obs < 0.000000	81	86.2469
Obs = 0.000000	0	
Observations	155	

This table presents the results of Wilcoxon signed ranked test. This significance test measures how the median of the event window of [-10,10] differ from zero. ***, ** and * indicate statistical significance on a 1%, 5% and 10% level.

The mean of the CAR[-5,5] is determined by the event study method for the 11-day period and its statistical significance is presented in Table 8. The mean of CAR[-5,5] is 0,17 percent and this positive reaction result is in line with the previous academic studies by Tang and Zhang (2020), Wang et al. (2020) and Flammer (2021). However, the positive impact of the announcements in Table 8 is not statistically significant based on the Wilcoxon signed ranked test results and for this reason, it cannot be concluded that the announcements have a positive impact on the share value during the tested time period and no conclusions based on the impact of CAR[-5,5] on the value of the share can be formulated.

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

	CAR[-5,5]	
Mean	0.0017	
Median	0.0025	
Std. Dev.	0.0583	
Method	Value	Probability
Wilcoxon signed rank	0.4815	0.6302

Median Test Summary

Category	Count	Mean Rank
Obs > 0.000000	86	73.4302
Obs < 0.000000	69	83.6957
Obs = 0.000000	0	
Observations	155	

This table presents the results of Wilcoxon signed ranked test. This significance test measures how the median of the event window of [-5,5] differ from zero. ***, ** and * indicate statistical significance on a 1%, 5% and 10% level.

Table 9 presents the results for the event window of [-1,1]. Based on the event study method, the mean of the CAR is -0,33 percent. The finding indicates that the markets have reacted negatively to the issuance during the 3-day period. Based on the significance test, the negative reaction is statistically significant on a 5 percent level of significance. The result is consistent with the finding from the event window of [-10,10] in Table 7, where the reaction to the announcement is similarly statistically negative and with the findings by Lebelle et al. (2020). Based on the findings in Table 9, It can be concluded that the announcement of the green bond issuance causes a negative reaction in the share value of the issuer.

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

	CAR [-1,1]	
Mean	-0.0033	
Median	-0.0050	
Std. Dev.	0.0356	
Method	Value	Probability
Wilcoxon signed rank	1.9642	0.0495**

Median Test Summary		
Category	Count	Mean Rank
Obs > 0.000000	67	73.80597
Obs < 0.000000	88	81.19318
Obs = 0.000000	0	
Observations	155	

This table presents the results of Wilcoxon signed ranked test. This significance test measures how the median of the event window of [-1,1] differ from zero. ***, ** and * indicate statistical significance on a 1%, 5% and 10% level.

Finally, Table 10 presents the mean and the median of the CARs for the shortest event window of [0,1]. The result of the mean demonstrates a negative market reaction with the value of -0,2 percent which is in accordance with the findings of Table 7 and Table 9 and Lebelle et al. (2020). However, the Wilcoxon signed rank test does not establish the statistical significance of result of the event window of 2-day period at any level.

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

	CAR [0,1]	
Mean	-0.0020	
Median	-0.0020	
Std. Dev.	0.0252	
Method	Value	Probability
Wilcoxon signed rank	1.60519	0.1085

Median Test Summary		
Category	Count	Mean Rank
Obs > 0.000000	60	85.76667
Obs < 0.000000	95	73.09474
Obs = 0.000000	0	
Observations	155	

This table presents the results of Wilcoxon signed ranked test. This significance test measures how the median of the event window of [0,1] differ from zero. ***, ** and * indicate statistical significance on a 1%, 5% and 10% level.

The calculation of the cumulative abnormal return is applied to determine how the emerging markets react to the announcements of the issuances. Fama (1970) assert that the stock markets that react and respond more quickly to the events are more effective. Based on the theory by Fama (1970), the reactions from the event studies imply that the

efficiency of the emerging markets is semi-strong. According to modern portfolio theory by Markowitz (1952), the reason for the stock price decline is the result of investor behaviour which can be explained by the fact that the issuance of green bonds did not meet the objectives of the investors.

As a summary, the event windows of [-10,10] and [-1,1] are statistically significant and based on the obtained results, the null hypothesis presented in the subchapter 1.3 can be rejected. The H_2b is accepted since according to the results, the emerging markets react negatively to the green bond announcement. In the academic literature, the similar negative results are presented in the study by Lebelle et al. (2020) where the authors find statistically significant negative results on the 5 percent level for the event windows of [-20,20], [-1,1] and [0,1]. The authors present findings that differ from the previous positive reactions of studies by Baulkaran (2019), Tang and Zhang (2020), Wang et al. (2020) and Flammer (2021). Zerbib (2019) explain that the discrepancy is because the issue of the green bond does not add value to companies at the time the bond is published and thus are similar to the existing literature of conventional bonds.

To complement the previous negative findings, Table 11 presents the means of the CARs of the first-time green bond announcements and the subsequent announcements. The CARs of the first-time announcements shown on the left are all negative in every event window, but the Wilcoxon signed rank test determines the values as statistically insignificant. As none of the CARs for the first-time announcement are significant, this implies that the first announcement does not have a statistically significant impact on the stock prices of the issuer and therefore no conclusions can be drawn.

Table 11. CARs for first-time and subsequent announcements.

	First Announcement				Subsequent Announcement			
Event Window	[-10,10]	[-5.5]	[-1.1]	[0.1]	[-10,10]	[-5.5]	[-1.1]	[0.1]
CAR	-0.008	-0.004	-0.003	-0.003	**-0.010***	0.006	**-0.003***	-0.001
Wilcoxon (prob.)	0.702	0.698	0.392	0.454	0.081	0.320	0.075	0.133
Skewness.	-0.26	-0.13	-0.27	-0.08	0.718	-0.021	1.018	1.400
Kurtosis	3.99	3.58	4.37	4.31	4.46	2.44	9.09	10.01
N	66	66	66	66	89	89	89	89

This table displays the CARs for initial and subsequent green bond announcements, with the first announcement on the left and the subsequent announcement on the right. Wilcoxon (prob.) presents the Wilcoxon signed rank statistical significance test presented in its probability value. ***, ** and * indicate statistical significance on a 1%, 5% and 10% level.

On the right, the CARs for the subsequent green bond announcement are observed to be negative in each event window excluding the event window of [-5.5]. However, the statistical significance of the findings is only demonstrated for the longest event window of [-10,10] and the event window of [-1,1]. This implies that the subsequent announcements have a significant negative impact on the stock values. Nonetheless, it is worth noting that the sample size used to test the first and subsequent market reactions is relatively small. Based on the obtained results, it can be inferred that the initial green bond announcement of the issuer does not prompt a market reaction. However, the subsequent issuances are likely to impact the market negatively.

The results presented in Table 11 differ mostly from the previous literature where, firstly, Lebelle et al. (2020) find a negative and significant reaction to the green bond announcements by the first-time issuers and a negative but not statistically significant result for the subsequent issuers. Secondly, Flammer (2021) finds a significant and positive reaction to the first-time announcement following the subsequent announcements that the author finds positive but not statistically significant. However, the study by Xi and Jing (2022) do not find a statistically significant reaction to the first-time issuances, but the authors find a statistically significant positive result for the subsequent issuances.

Several factors may explain the negative reactions observed within the event windows of both first-time and subsequent announcements, including the following explanations. Russo et al. (2021) state that the credit rating of a country has a negative impact on the performance of the green bond. According to Fitch (2022, 2023b), the dataset contains of countries with the grade of high-yield bonds including Brazil and Turkey. Therefore, the negative reaction of the issuer might could be explained by the ratings of the countries. Due the potential greenwashing, investors may be sceptical regarding the true environmental friendliness of the green bonds analysed in this thesis (Xu et al., 2022). Therefore, investors can take the risk associated with green bonds into account when determining the share price of the company. Overall, the studies that examine the green bonds emphasize the importance of regulation in the market. The focus is on emerging markets and their regulatory framework, and one possible explanation for the negative market reaction could be the lack of clear guidelines for green bonds. (MacAskill et al., 2021; Li et al., 2022.)

8.2 Regression results

The purpose of the regression analysis is to determine which independent variables possible explain the dependent variables. The statistically significant dependent variables of this thesis are CAR[-10,10] and CAR[-1,1]. The regression analyses are performed as OLS regression models in EViews. All the independent variables are previously discussed in chapter 7.

Three regression analyses are tested to determine whether explanatory variables are significant for the sample. Regression 1 consists of all the independent variables, regression 2 only contains the company-specific independent variables and regression 3 includes only specific explanatory variables in the green bond. The regression results for CAR[-10,10] are presented in Table 12 and regression findings of for CAR[-1,1], in Table 13.

Based on the regression 1 in Table 12, the statistically positive significant independent variable on a 10 percent level of significance is Leverage variable which measures the debt-to-capital. This finding implies that companies with less financial constraints respond to the announcement more favourably than companies with more severe financial limitations. Additionally, ROA is positively significant at 5 percent level. Regarding the nine independent variables included in the regression model, it is noteworthy that six of them have a positive effect on the dependent variable. In regression 2 where the green bond specific variables are excluded, the only significant variable is the ROA of the organisation with a positive impact on the CAR[-10,10] at 5 percent level of significance. Based on the F-test, the first regression is significant only on a 10 percent level, but the second regression is significant at the 5 percent level. The last regression of the green bond specific variables does not have statistically significant independent variables and therefore the available evidence does not permit drawing any conclusions regarding the impact of the variables on the dependent variable.

Similarly to findings presented in Table 12, Lebelle et al. (2020) indicate that the leverage ratio of a company has a statistically significant positive impact on its stock price. The authors provide an explanation for this result, arguing that a higher leverage ratio indicates greater access of debt financing and less financial constraints for the company.
Additionally, the variable of ROA is statistically significant in regression 1 and 2. While previous studies by such as Baulkaran (2019) and Flammer (2021) have also utilized return on assets as an explanatory variable, they have not observed statistically significant positive effects. The positive result in Table 12 is expected finding as a higher ROA indicates more profits per unit of assets, which can be perceived as a positive indicator by investors and lead to higher stock prices and cumulative abnormal return (Baulkaran, 2019).

Table 12. Results from regression of CAR [-10,10].

	Regression 1	Regression 2	Regression 3
AMOUNT_ISSUED_LOG	-0.0047		0.003024
	(0.4819)		(0.6160)
COUPON	-0.0039		-0.003834
	(0.4011)		(0.3885)
D_FIRSTGB	0.019057		0.015382
	(0.2496)		(0.3515)
LEVERAGE	**0.0934***	0.071690	
	(0.0808)	(0.1649)	
MATURITY_YEARS	0.002353		0.002947
	(0.2527)		(0.1522)
ROA	**0.7460****	**0.7117****	
	(0.0214)	(0.0246)	
SIZE_LOG	0.008132	0.008429	
	(0.2331)	(0.1941)	
TANGIBILITY	0.012078	0.020016	
	(0.8542)	(0.7568)	
TOBIN_Q	0.007897	0.007915	
	(0.5484)	(0.5311)	
CONSTANT	-0.201953	**-0.2172****	0.042659
	(0.1409)	(0.0717)	(0.3057)
Observations	155	155	155
R-squared	0.095785	0.075627	0.023612
Adjusted R-squared	0.039661	0.044608	-0.002425
F-Statistic	1.706673	2.438066	0.906854
Prob (F-statistic)	**0.092402***	**0.037134****	0.461645

This table displays the finding from three regressions. Regression (1) includes all independent variables, Regression (2) includes all company-specific independent variables and Regression (3) consist of all green bond specific variables. *Amount_Issued_LOG* variable is presented as a natural logarithm, *Coupon* variable is in percentage, *D_FIRSTGB* is a dummy variable receiving value of 1 if it is the issuer's first announcement, 0 otherwise. *Leverage* variable is the ration between the debt and assets of the organisation, *Maturity_years* is presented in years, *ROA* variable indicates the profitability of the organisation in relation to its total assets. *Size_LOG* presents the total assets of the organisation as a natural logarithm, *Tangibility* variable is the ratio of tangible assets to the total assets of the organisation and *TobinQ* is the market value divided by the total assets of the company. ***, ** and * indicate statistical significance on a 1%, 5% and 10% level.

Table 13 present the regression analyses for the event window of CAR[-1,1]. Based on the regression 1, a statistically positive significant independent variable on a 1 percent level of significance is Amount_Issued_LOG which demonstrates the monetary value of

the green bond that has been converted into a natural logarithm. Furthermore, Leverage variable is statistically significant with a negative impact on the dependent variable. In regression 2, the statistically significant explanatory variable is Size_LOG which reflect the company's overall financial strength. However, the regression is not statistically significant according to the F-statistic, and therefore no conclusion can be drawn on the effects on the dependent variable. Again, the variable of Amount_Issued_LOG is statistically significant on a 1 percent level of significance in regression 3.

The amount issued is used in prior literature as an independent variable. Wang et al. (2020) find a negative association indicating that there exists a negative market reaction to the announcement of larger green bonds compared with smaller ones. In contrast, the findings of Table 13 demonstrate a positive impact of the amount variable signalling that a larger issuance informs the market that the company is more committed to sustainable activities and is willing to invest a significant amount of capital towards environmentally friendly activities. This outcome can create positive perceptions among investors, which in turn may lead to a rise in stock prices.

While regression 1 in Table 12 reacts positively to the effect of Leverage, Table 13 shows that Leverage has a negative effect on the event window. A higher leverage may be associated with higher risk because companies that borrow more money to finance their investments may be more exposed to changes in economic conditions. Thus, higher leverage may be associated with higher return volatility and perceived risk, which may lead to lower stock prices and negative cumulative abnormal returns. Wang et al. (2020) and Flammer (2021) includes the size of the issuer to their independent variables. Both studies find a positive and statistically significant relationships between firm size and the stock price reaction. However, the finding from Table 13 show a negative impact on CAR[-1,1].

Table 13. Results from regression of CAR [-1,1].

	Regression 1	Regression 2	Regression 3
AMOUNT_ISSUED_LOG	**0.006****		**0.005*****
	(0.010)		(0.010)
COUPON	0.002		0.002
	(0.202)		(0.129)
D_FIRSTGB	0.003		0.004
	(0.667)		(0.4382)
LEVERAGE	**-0.034***	-0.023	
	(0.078)	(0.231)	
MATURITY_YEARS	-0.001		-0.001
	(0.166)		(0.191)
ROA	0.077	0.134	
	(0.501)	(0.243)	
SIZE_LOG	-0.003	**-0.005***	
	(0.208)	(0.053)	
TANGIBILITY	-0.0167	0.019	
	(0.475)	(0.412)	
TOBIN_Q	-0.007	-0.006	
	(0.130)	(0.163)	
CONSTANT	0.0203	**0.080***	**-0.043*****
	(0.675)	(0.069)	(0.003)
No. observations	155	155	155
R-squared	0.109	0.042	0.077
Adjusted R-squared	0.053	0.010	0.052
F-Statistic	1.961	1.302	3.116
Prob (F-statistic)	**0.048****	0.266	**0.017****

This table displays the finding from three regressions. Regression (1) includes all independent variables, Regression (2) includes all company-specific independent variables and Regression (3) consist of all green bond specific variables. *Amount_Issued_LOG* variable is presented as a natural logarithm, *Coupon* variable is in percentage, *D_FIRSTGB* is a dummy variable receiving value of 1 if it is the issuer's first announcement, 0 otherwise. *Leverage* variable is the ration between the debt and assets of the organisation, *Maturity_years* is presented in years, *ROA* variable indicates the profitability of the organisation in relation to its total assets. *Size_LOG* presents the total assets of the organisation as a natural logarithm, *Tangibility* variable is the ratio of tangible assets to the total assets of the organisation and *TobinQ* is the market value divided by the total assets of the company. ***, ** and * indicate statistical significance on a 1%, 5% and 10% level.

To test the multicollinearity, in addition to the correlation matrix in Appendix 2, the variance inflation factors (VIFs) are tested to detect multicollinearity. According to O'Brien

(2007) the model does not contain multicollinearity. Table 14 presents the VIFs for every explanatory variable. As the values of centered VIFs are less than 10, there is no multi-collinearity between the explanatory variables.

Table 14. Results from multicollinearity test.

Variable	Centered VIF
AMOUNT_ISSUED_LOG	1.312
COUPON	1.196
D_FIRSTGB	1.084
LEVERAGE	1.287
MATURITY_YEARS	1.100
ROA	1.995
SIZE_LOG	1.420
TANGIBILITY	1.104
TOBIN_Q	2.114
CONSTANT	N/A

8.3 Summary of results

This subchapter summarizes and discusses the main results of the event study and the regression analyses. The discussion about the results centres on addressing the research

hypotheses, which examines the influence of the green bond announcement on the stock price of the listed emerging companies. Additionally, the findings from the regression analyses are assessed with the theory presented in chapter 4. Furthermore, the results are compared with the previous studies discussed in chapter 5.

Based on the tests performed, the findings indicate that the null hypothesis (H_0) can be rejected, and the alternative hypothesis (H_1) is be accepted. This implies that the announcement of green bond issuance in emerging countries affects the value of a stock, indicating that there is a reaction in the market to the announcement. Furthermore, the results also support H_2b, which suggests that the market react negatively to the announcement. However, the assumption for H_3 that the first green bond announcement of the issuer has a more significant impact on the markets compared with the subsequent announcement cannot be interpret since the findings of this thesis are not statistically significant for the first-time issuances.

To investigate the results in more detail, the findings show that there are both negative and positive cumulative abnormal returns around the green bond announcement date depending on the chosen event window. Nevertheless, given that three out of four event windows result in a significant negative impact on the stock price, while only one shows an insignificant positive impact, it can be concluded that green bond announcements negatively affect the stock price of non-financial firms in emerging markets.

The negative impact on the stock price is reflected in cumulative abnormal returns ranging from -1,0 to -0,33 percent for the negative event windows and are consistent with the study by Lebelle et al. (2020). The study by Lebelle et al. (2020) also finds a statistically significant negative impact and the authors argue that the stock market's response to green bonds mirrors that of conventional bonds, as evinced by a negative reaction. As such, it is argued that the issuance of green bonds does not confer any additional value to the issuing firm (Lebelle et al., 2020).

The reasons for negative reaction can be attributed to several factors. First, the negative reaction may be due to the increased costs of issuing green bonds. Overall, emerging economies react more sensitively to changes in the markets (Long, 2014). The investors know that the issuance of the green bond is costly and how the issuance have a negative impact on the short-term profitability of the company (Tang & Zhang, 2020). However, Contractor et al. (2023) find that green bonds might be more resilient than conventional bonds leading to benefits in the long-term basis. It is important to note that the event study only looks at the short-term reaction of the emerging market, which in this work extends at most 21-day period. Therefore, the long-term results of the green bond issuances cannot be analysed in this thesis.

Moreover, investors may still be sceptical about green bonds and the sustainability efforts of the organisations. This is due to the fact that greenwashing, where companies include sustainability matters in their strategy only to improve their reputation, is possible. Additionally, green bonds are still a relatively new type of financial instrument, and investors may not fully understand the risk associated with them. Therefore, investors may factor in the risk associated with green bonds when determining a company's share price. (Lebelle et al. 2020; Xu et al. 2022.)

By conducting the regression analyses, three regression models are tested for the event windows of [-10,10] and [-1,1]. The regression 1 includes all nine explanatory variables, while the other two models consist only a part of the variables. The study analyses two event windows, [-10,10] and [-1,1], and identifies significant variables in each window. Specifically, the event window of [-10,10] shows significant results for Leverage and ROA, while Amount_Issued_LOG and Leverage are significant for the event window of [-1,1]. Interestingly, while Leverage is statistically significant in both event windows, its impact on CAR differs. The analysis find a positive impact for CAR[-10,10], but a negative reaction for CAR[-1,1].

9 Conclusions

This thesis examines the financial benefits of green bonds by analysing their impact on emerging stock markets. The thesis focuses on publicly traded non-financial companies that have announced the green bond issuance between 2015 and 2021. In conclusion, this thesis has examined the reaction of the stock market by analysing a broad theoretical framework, which includes the theory of conventional and green bonds, stock valuation and previous academic studies. The primary research methodologies of this thesis are the event study method to determine cumulative abnormal returns for event windows, the Wilcoxon signed rank test to analyse the significance of CARs and regression analyses to test how the green bond and company-specific independent variables affect the CARs.

The findings show a statistically significant negative relationship between the green bond announcements and the issuers' stock value for event windows of [-10,10] and [-1,1]. The negative impact of the cumulative abnormal returns ranges from -1,0 percent to -0,33 percent for the statistically significant event windows. Based on the findings, it can be concluded that the announcement of the issuance has a negative impact on the share value of the issuer in the short term. Identifying a singular reason for the negative reaction to the announcement of the issuance is challenging. It can be observed that emerging economies are generally more volatile to changes in the markets compared to developed economies, which may provide an explanation for the markets to even react to the announcements. The negative reaction may be due to a number of explanatory factors, including increased cost of the company caused by the issuance, the novelty value of green bonds or concerns related to greenwashing. The factors can influence the valuation and response of the investor causing a negative impact on the value of the share.

An integral component of this study, potential effects for the first and the subsequent green bonds on the stock value are also tested, but however, the first green bond announcement do not show any statistical significance. The regression analysis shows

several statistically significant independent variables for the significant event windows, which is partially in line with previous academic literature, leaving however opportunity for further research.

Further research could also explore this topic in other emerging countries and with a larger sample of green bonds to analyse. Over time, when the cumulative amount of issued green bonds is increased, it would be interesting and fruitful to examine the comparisons between different emerging countries, given that the market is constantly changing and evolving and that not all countries currently classified as emerging will be able to match this classification in the future. In a wider context of green bonds, it would be interesting to examine further the causes of different market reactions of the green bonds and to analyse the impact of green bonds on sustainability.

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Appendices

Appendix 1. List of stock indices

Country	Index
BRAZIL	IBOVESPA
CHILE	IPSA
CHINA	CSI 300 Index
INDIA	BSE SENSEX
LITHUANIA	OMX Vilnius
MEXICO	IPC
SOUTH KOREA	KOSPI
TAIWAN	TAIEX
THAILAND	SET100 Index
TURKEY	BIST 100

Appendix 2. Correlation matrix of independent variables

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	Amount_issued_LOG	*Coupon*	*D_FirstGB*	*Leverage*	*Maturity_years*	*ROA*	*Size_LOG*	*Tangibility*	*TobinQ*
Amount_issued_LOG	1.000000								
Coupon	0.142155	1.000000							
D_FirstGB	0.024043	0.123829	1.000000						
Leverage	0.069135	0.253823	-0.051573	1.000000					
Maturity_years	0.179101	0.040014	-0.126074	-0.09266	1.000000				
ROA	0.393760	0.043880	0.029312	-0.17523	0.205706	1.000000			
Size_LOG	-0.274231	-0.262470	-0.163977	-0.22401	-0.076726	-0.289304	1.000000		
Tangibility	0.021415	-0.103027	0.101891	-0.10110	-0.038343	0.063158	-0.20380	1.000000	
TobinQ	0.390804	-0.070533	-0.016995	-0.23893	0.226474	0.679638	-0.26093	0.039344	1.000000

Appendix 3. List of issuers in the dataset

Issuer Name	Ticker
Adani Green Energy Ltd	ADANIG
Aluminum Corp of China Ltd	ALUMCH
Arcelik AS	ACKAF
ASE Technology Holding Co Ltd	ASETEH
AUGA Group AB	AGROWI
B Grimm Power PCL	BGRIMT
BAIC Motor Corp Ltd	BAICM
BCPG PCL	BCPGTB
BRF SA	BRFSBZ
BTS Group Holdings PCL	BTSTB
CECEP Solar Energy Co Ltd	CECEPS
CECEP Wind-Power Corp	CECEPW
China Datang Corp Renewable Power Co Ltd	CHDATA
China Longyuan Power Group Corp Ltd	LONGYU
Coca-Cola Femsa SAB de CV	KOF
Datang Environment Industry Group Co Ltd	DTENIN
Datang International Power Generation Co Ltd	BEIDAT
ECOVE Environment Corp	KDHOLD
Energy Absolute PCL	EATB
Engie Brasil Energia SA	TREB
Evergreen Marine Corp Taiwan Ltd	EVRGTT
FIBRA Prologis	FIBRAP
Fujian Haixia Environmental Protection Group Co Ltd	FJHXEP
GD Power Development Co Ltd	GUOPOW
Global Power Synergy PCL	GPSCTB
Hanwha Corp	HANWHA
Hanwha Solutions Corp	HANYAN
Huaneng Lancang River Hydropower Inc	HUANEN
Huaneng Power International Inc	HNINTL
Hyosung Heavy Industries Corp	HYOSHI
Hyundai Mobis Co Ltd	HYNPRE
Hyundai Motor Co	HYNMOT
Hyundai Steel Co	INCIRO
Jiangxi Copper Corp Ltd	JIACOP
Kia Corp	KIAMTR
Korean Air Lines Co Ltd	KOREAN
LG Chem Ltd	LGCHM

Issuer Name	Ticker
LG Display Co Ltd	LGPHIL
LG Electronics Inc	LGELEC
Lotte Corp	LOTCON
Mando Corp	MANDNW
NAVER Corp	NHNCOR
Posco International Corp	DAEINT
PTT PCL	PTTTB
Ratch Group PCL	RATCH
REC Ltd	REC Ltd
Rongsheng Petrochemical Co Ltd	ZJRSHO
SeAH Steel Corp	SEAHST
SGC Energy Co Ltd	SAMKWA
Shaanxi Coal and Chemical Industry Group Co Ltd	SXCOAL
Shandong Chiway Industry Development Co Ltd	SHALIP
Shanghai Environment Group Co Ltd	SHGCHT
Shenergy Co Ltd	SHECOL
Shenzhen Energy Group Co Ltd	SZENGY
SK Hynix Inc	HYUELE
SK Inc	SKCCCO
SK Rent A Car Co Ltd	AJUAUT
Sociedad Quimica y Minera de Chile SA	SQM
SSANGYONG C&E Co Ltd	SSACEM
Taiwan Semiconductor Manufacturing Co Ltd	TAISEM
United Microelectronics Corp	UNIMIC
Vestel Elektronik Sanayi ve Ticaret AS	VESTL
Yageo Corp	YAGEO
Yunnan Energy Investment Group Co Ltd	YNPOWE
Zhongshan Public Utilities Group Co Ltd	ZSUTIL
Zijin Mining Group Co Ltd	ZJMGCL