UNDERSTANDING GREEN BONDS

AN EMPIRICAL STUDY ON SHAREHOLDER VALUE OF GREEN BONDS AND ITS APPLICATION IN CORPORATIONS

ALMA FRIBERG

ALICE ÅLUND

Master Thesis

Stockholm School of Economics

2023

Understanding Green Bonds: An empirical study on shareholder value of green bonds and its application in corporations

Abstract

In this paper, we conduct an event study to understand how equity investors react to the issuance of a corporate green bond. Furthermore, we interview five Swedish public companies that have issued green bonds. Our results from our event study indicate that there is no significant share price reaction concerning the issuance. Potential reasons for the lack of significant results could be attributed to a saturated green bond market, a lack of market differentiation between issuers, sample characteristics, and investor skepticism. Furthermore, as research has shown that energy companies are overrepresented in green bond issuances, we investigate if there is a more substantial share price reaction when the issuer belongs to the energy sector but cannot find evidence for this. We conclude that the reason for their overrepresentation is that the nature of their operations easily allows them to find environmentally positive, distinguishable, capex-intensive projects to which the use of proceeds can go. Our interviews indicate a bias towards some sectors, leading to different adoption rates of green bonds among industries. We also propose a critique of green bonds that their criteria limit companies whose operations are not considered to have a direct positive environmental effect but whose role is needed in driving climate mitigation forward.

Keywords

Green bonds, Sustainable Finance, Signaling, Corporate Sustainability

Authors

Alma Friberg (24385)

Alice Ålund (42181)

Tutor

Ramin Baghai, Associate Professor of Finance at the Stockholm School of Economics

Acknowledgments

We want to direct our gratitude towards Ramin Baghai for his guidance, invaluable feedback, and insightful suggestions. The responsibility for all errors is with the authors.

Master Program in Finance

Stockholm School of Economics

© Alma Friberg and Alice Ålund, 2023

1. Introduction

In 2007, the European Investment Bank raised EUR 600 million for the world's first green bond. However, it was not until six years later that the first corporate green bond was issued when Vasakronan, a Swedish real estate company, issued a SEK 1.3 billion green bond to finance the upgrades of existing buildings with the goal of making them more carbon efficient. Since then, green bonds have steadily grown in popularity among corporate issuers as a financing tool for sustainable projects (Flammer, 2021). This debt instrument differs from conventional fixed-income security instruments as the issuer pledges that the bond proceeds will only finance projects with a positive environmental or climate impact (Fatica & Panzica, 2021). This means that the company issuing the green bond needs to be able to identify a distinguishable, sustainable project with capital expenditure needs for which the proceeds from the bond will go towards. These projects can vary from renewable energy to waste management and sustainable agriculture to clean transportation projects. Despite its versatile use, certain industries have been more prominent adopters of green bonds, with companies in the energy sector taking up a disproportionately large percentage of issued green bonds (Flammer, 2021).

Our thesis aims to deepen the knowledge around the effects of issuing green bonds and compare it across sectors, with a focus on the energy sector, to understand why this industry is overrepresented in issuing green bonds. Firstly, our thesis builds on the research on stock market reactions following the issuance of green bonds (Tang & Zhang, 2020; Flammer, 2021). Our research extends these findings by using a mixed method to understand how the implications of how green bonds are structured impact their usage across sectors, including analyzing the share price reaction and conducting interviews with Swedish green bond issuers belonging to different sectors. This paper aims to study how equity investors react to public companies issuing green bonds in the short term. Additionally, the paper investigates how green bonds' practical application differs depending on the issuer's industry. This results in the paper aiming to answer the following research questions:

i. Does issuing a green bond have an immediate impact on the company's share price?

ii. How does the process of issuing green bonds and the immediate share price effect differ depending on the industry in which the company operates?

To answer our research questions, we employ an event study methodology. Specifically, we construct the cumulative abnormal return for the companies that have issued bonds, including green bonds, and analyze it over a seven-day event window [-3,3]. The data is then used to perform a multivariable regression. Our results show no significant result on the cumulative abnormal return between issuing a green bond and a conventional bond. These findings are tested using a three-day event window [-1,1], confirming the lack of significant results.

Our results are in contrast with previous studies by Flammer (2021) and Tang & Zhang (2020), who find evidence for a share price reaction when companies issue green bonds. The conflicting results may be attributable to the emergence of potential market saturation, lack of market differentiation between issuers, sample characteristics, and investor skepticism. Through our qualitative research, we investigate if green bonds are useful for demonstrating firms' sustainability efforts over time and find support for this. We also explore if energy companies disproportionately issue green bonds because of energy shareholder preference. However, our event study does not have significant evidence of this. Instead, we explore if this popularity of green bonds among energy companies is due to the use-of-proceeds nature of green bonds and find support for this in our qualitative research. Based on our findings in our qualitative research, we propose a new critique for green bonds. Green bond criteria limit companies whose operations are not considered green due to the lack of direct positive green effect but whose role is needed in driving climate mitigation forward.

2. Literature Review and Theoretical Framework

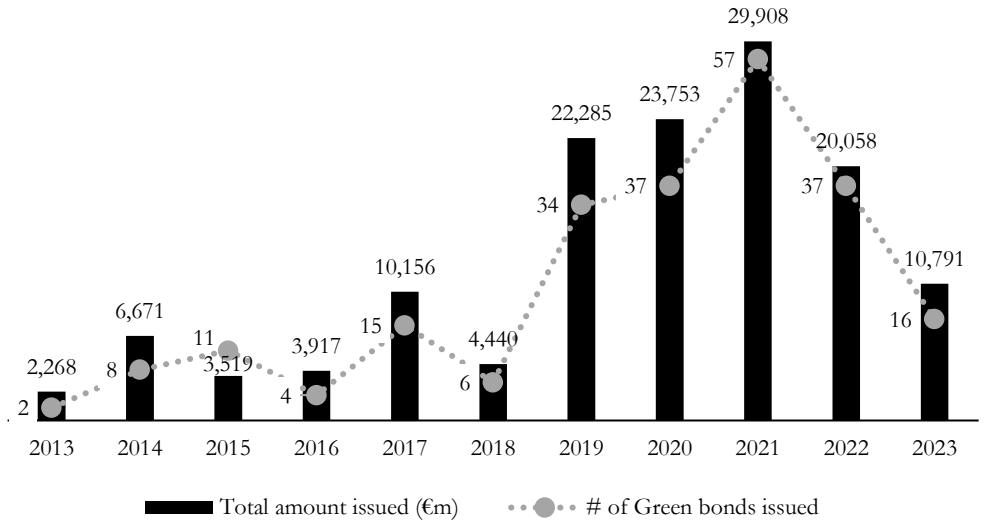
2.1 The Green Bond Market

Green bonds debuted in 2007 and have since been increasing in popularity. The objective of green bonds is to improve the environmental impact and social welfare, which includes goals such as reducing CO_2 emissions and preventing pollution (Tang & Zhang, 2020). Uttamchandani and Carosi (2019) outline the key differences between a green bond and its conventional counterpart. The proceeds from green bonds are earmarked for environmentally sustainable projects, with requirements on the issuer to provide regular reporting on how the funds are being used to ensure that the proceeds are going towards its intended green projects. In turn, this means that green bonds are restrictive in their nature since their proceeds are only to be used to finance a predetermined set of green projects (Flammer, 2021).

Chart 1

Corporate Green Bonds Issued in Euro Over Time

The graph below shows the development of the EUR green bond market among public corporates, excluding issuances from financial firms. The chart includes all green bond issuances, prior the sample construction used in the paper. In 2013, there were only two green bond issuances by public companies where the bond was denominated in Euros, which can be compared to the 57 issuances in 2021. The data for 2023 only includes data for green bonds issued up until the 14th of February and does therefore not include all issuances for 2023.



Green bonds are often certified by a third-party agent to ensure their validity. For instance, the Climate Bonds Initiative ("CBI") is a not-for-profit international organization that aims to promote capital solutions via green bonds for environmental-related projects. A CBI-certified bond has historically had an added benefit of a positive pricing effect, as shown by Baker et al., 2022. They find an incremental green bond premium ("greenium") for CBI-certified green bonds in the first two years of their sample, between the years 2016 to 2018. This incremental "greenium", compared to self-labeled green bonds, does not persist after 2018, indicating that over time, investor concerns about greenwashing may have diminished as the added price benefit of a certification has diminished.

Green bond issuances are most common in the energy, transportation, real estate, and water and waste management industries. The energy sector alone accounts for 60% of green bond issuances (Van den Berghe & Marneffe, 2018). Flammer (2021) compares the characteristics of green bond issuers to public firms that are non-green bond issuers. In this paper, she finds that companies operating in sectors "(…) where the environment is financially material to the company's operations" are overrepresented in the proportion of green bond issuances and highlights the energy sector as an overrepresented industry. In other sectors, such as the real estate sector, green bonds are increasingly popular for sustainable building projects, such as those incorporating energy-efficient design features or utilizing renewable energy sources (Böhm et al., 2020). There are, however, some difficulties in measuring and reporting the environmental impact of these projects, leading to investors requiring greater transparency and verification of the project impact.

2.2 Stock Market Reactions to Green Bond Issuances

Because of the novelty of the green bond market, the academic literature on stock markets' reactions to green bond issuances is limited. Tang & Zhang (2020) are among the first to do a comprehensive empirical study on the shareholder impact of green bond issuances, including an event study on the share price reactions at the time of these issuances. They study CBI-certified green bonds between the years 2007 to 2017 and find a significant positive abnormal return for green bond issuances when the company is an inaugural issuer, but no significant result for subsequent issuances. As the abnormal return is greater when the issuance comes from an inaugural issuer of a green bond, this indicates results in line with the signaling theory. Their study explores the benefits to shareholders after green bond

issuances to explain the positive stock market reaction. They do not find enough evidence that green bonds could provide cheaper debt financing. Hence, the share price reaction they see is not attributed to the lower cost of capital. Instead, they attribute the positive reaction to increased institutional ownership and increased stock liquidity. Flammer (2021) finds in her study on green corporate bonds issued between 2013 and 2018 that stock price reactions are significant and larger for certified green bonds but small and insignificant when the green bond lacks a certification. In this study, Flammer studies the rationales behind issuing a green bond. While there was no evidence to suggest that the rationale for issuing green bonds was greenwashing or lower cost of capital, she finds that issuing a green bond is a credible signal of a firm's dedication to sustainability. Flammer also concludes that a certification can act as a more credible signal that the firm is financing environmentally positive projects. Therefore, this difference in stock price reaction is consistent with the signaling effect (Flammer, 2021).

2.3 Signaling

Being able to signal their sustainability dedication is important for green bond issuers for multiple reasons. Lyon and Montgomery (2015) study the information asymmetry between companies and investors related to the company's dedication to sustainability. Companies have more information about their sustainability objectives than their investors. Thus, a transaction cost arises because of the difficulties for investors to determine which companies are dedicated to their sustainability efforts (Akerlof, 1970; Lyon & Montgomery, 2015). Previous research has found that, when issuing green bonds, the issuer signals a strong dedication to sustainability as a result of the specific criteria that one needs to fulfill when issuing a green bond (Tang & Zhang, 2020). Recent academic literature has shown that investors positively reward companies who act in ESG-friendly manners (e.g., Flammer, 2013; Flammer, 2021; Albuquerque et al., 2020; Klassen & McLaughlin, 1996; Krueger, 2015). Hence, by reducing the information asymmetry, the companies would give the investors credible signals of their dedication to sustainability (Akerlof, 1970; Williamson, 1985). Such a signal can be the issuance of a green bond (Flammer, 2021). Issuing a green bond sends a credible signal to the investors since there is a rigorous process to get approval, especially in instances of third-party verification. In addition to being a time-consuming process, it can be costly. Flammer (2021) argues that because of the strict criteria for a green bond project, there is low uncertainty about how the proceeds will be used.

2.4 Critique of Green Bonds

Green bonds have been critiqued primarily on their exclusivity and greenwashing risk. The issue of exclusivity refers to how some issuers are excluded from participating if they are not able to identify sufficient capital expenditure in projects that have a positive environmental impact (Coldeweijer & Hsu, 2021). Furthermore, there is a risk of greenwashing (Fatica & Panzica, 2021). This is when firms engage in seemingly green investments to attract investors when in fact, their investments have a minimal positive environmental impact (Greene, 2015). The concern for greenwashing comes largely from the lack of legal enforcement mechanisms to ensure that the proceeds from the green bond issuance go towards what was stated in the prospectus (Fatica & Panzica, 2021). For example, the issuer could worsen its environmental performance through other projects not included in the specific bond's prospectus after issuing a green bond (Caldecott, 2020).

2.5 Sustainably Linked Bonds

An adjacent debt instrument to green bonds is sustainably linked bonds ("SLB"). SLBs differ from green bonds in the aspect that their proceeds are not exclusively for financing or refinancing projects with positive ESG impact, but rather have the proceeds go to general purposes. Instead, companies are incentivized by achieving pre-defined sustainability targets in exchange for a lower cost of capital (Vulturius et al., 2022). The purpose of SLBs is to fund companies contributing to ESG measures (International Capital Market Association). Their similarity to green bonds is the commitment to environmentally friendly behavior by the issuing firm.

2.6 Contribution

Due to the recent surge of green bond issuances and the relative novelty of green bonds, there is limited academic literature yet on the topic. This literature has primarily centered on the pricing of green bonds and is focused mainly on municipal and sovereign bonds (Baker et al., 2022; Zerbib, 2019). Bond issuances' effect on public equity markets has been studied, but the datasets in these studies include green bond issuances only up until 2018 (Flammer, 2021; Tang & Zhang, 2020). The sample in our data consists of bond issuances up until February of 2023, allowing us to contribute to this literature with an updated and nuanced perspective, as investors' perceptions of green bonds may have changed over time.

The available literature performing event studies on green bond issuances rely on the pecking order theory. Stocks tend to react negatively when firms issue equity but show no significant reaction when firms issue bonds (Eckbo et al., 2007). With this assumption, they only collect data on green bond issuances and assume that the abnormal returns of regular bond issuance are zero to test their hypothesis. Instead, we also collect conventional bond issuances in our sample to compare the abnormal returns from green bond issuances with those from conventional bond issuances. This allows us to more accurately compare the abnormal returns from green bond issuances to conventional bond issuances during our sample period.

Furthermore, there has not been research on whether equity investors favor green bond issuances from energy companies, and if this could be a reason for the overrepresentation of the energy sector in green bond issuances. Hence, our study adds to this field of research by studying share price reactions following green bond issuances from energy companies.

To our knowledge, we are the first to combine a study on share price reactions around green bond issuances with qualitative data collection from green bond issuers. This gives us a broader understanding of how the instrument's usability takes form in practice across different industries.

3. Hypotheses

i. We expect there to be a positive stock return reaction to a green bond issuance

Aligned with previous findings in academic literature, which concludes that investors value commitments to environmentally friendly behavior (Flammer, 2013; Flammer, 2021; Albuquerque et al., 2020; Klassen & McLaughlin, 1996; Krueger, 2015), our first hypothesis is that investors will react positively to a company announcing the issuance of a green bond, indicating that we will see positive stock return reactions around the time of announcement.

This hypothesis is also in line with previous studies done on the market reactions to green bond issuances that find evidence for significant positive reactions (Tang & Zhang, 2020; Flammer, 2021).

ii. We expect there to be a larger positive stock return reaction to a green bond issuance when the issuing company is operating in the energy sector compared to if the issuing company is not operating in the energy sector

Flammer (2021) finds that energy companies are overrepresented in green bond issuances. This hypothesis is based on the idea that such an overrepresentation is because equity investors value green bond issuances from the energy sector higher than other sectors. Such preference may arise from stronger credibility that the use of proceeds from energy issuers will go towards its intended use. The effect of such increased credibility would be shown by a stronger positive share price reaction, which could explain why energy companies often use this debt instrument. The greenwashing concern among shareholders may be less prevalent when an energy company issues a bond because investors are familiar with the notion that projects such as renewable energy are easily distinguishable eligible green bond projects (Fatica & Panzica, 2021).

4. Data

4.1 Data Sources and Sample Construction

We obtain most of the bond data using the SDC Platinum ("SDC") database, where we compile a unique dataset containing both green and conventional bonds between January 1st, 2013, to February 14th, 2023. The sample is limited to public companies and bond issuances in Euros. Following Tang & Zhang (2020), if the issuer is a subsidiary, but the parent company is public, we use the parent company's information in the dataset, i.e., its financial information. When compiling our dataset in SDC, we exclude issuances by companies in the financial industry, as the designs for green bonds are different for financial institutions. Financial institutions issue green bonds to finance other firms' projects, in contrast to corporates who issue green bonds to finance their own green projects (Tang & Zhang, 2020).

For each bond, SDC Platinum provides information on the issuer name, issuer industry, issuer domicile nation, marketplace on which the issuer is listed, issuer ticker, issuer credit rating, as well as the maturity, principal amount, announcement date and use of proceeds for the bond. The use of proceeds is used to determine whether the bond is classified as green and if it is certified by CBI. We complement the data from SDC Platinum with firm-specific data from S&P Capital IQ. This includes the firm ISIN number, the firm revenue, the debt-to-total-assets ratio, and the operating income over total assets for the year before the bond issuance. We also cross-check a handful of dates from SDC Platinum with the announcement dates reported in Bloomberg to ensure that the dates reported are the actual announcement dates. The announcement date is relevant since it is when the equity investors factor in the information in the share price. We use Moody's rating to divide the companies into investment grade and high-yield companies. If a company is unrated, we place it among the high-yield companies, indicating our assumption that if it were to be rated, it would be classified as a high-yield.

Companies that were listed during their issuance but at the time of data collection have been delisted are excluded from the data. We exclude all bond issuances where the maturity is at perpetuity or not provided by SDC Platinum since, in these instances, we cannot control for maturity length. To avoid double-counting events, we omit instances when a firm issues multiple bonds on the same day. Additionally, data that is missing information for a variable

in S&P Capital IQ is also excluded from the sample. Lastly, we use the parameter that controls illiquid securities in the event study tool by Wharton Research Data Services ("WRDS"). Events with a missing return rate of over 20%, or where no abnormal return for the event window could be determined, are excluded from our sample. In instances where WRDS failed to generate abnormal returns for any day in our event window [-3,3], the event is excluded from the sample for our main regression. In total, 1936 events are excluded from the sample. The original sample contained 3127 events, and the final sample contains 1191 events.

4.2 Variables

4.2.1 Dependent Variable

4.2.1.1 Cumulative Abnormal Return

Following the articles by Flammer (2021) and Tang Zhang (2020), we have chosen to analyze the cumulative abnormal return as the dependent variable for this paper. The normal return or the expected return is a well-used method confirmed and used by MacKinlay (1997) and Qiu et al. (2021), among others. The market model explains the expected return by assuming a linear relationship between the stock return and the market return (MacKinlay, 1997).

The expression for cumulative abnormal return, for the company *i*, at day *t* is:

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

Where:

$CAR = \ Cumulative\ abnormal\ return$

$t_1 = \ First\ day\ of\ the\ event\ window$

$t_2 = \ Last\ day\ of\ the\ event\ window$

$AR \ = \ Abnormal\ return$

4.2.2 Independent Variables

The independent variables used in the regression include variables that control for debt characteristics, firm characteristics, and time period with the aspiration of providing a high degree of explanation.

4.2.2.1 Controls for Bond Characteristics

$Green\ bond\ =\ Dummy\ variable\ for\ if\ the\ bond\ issued\ is\ a\ Green\ Bond$
$Maturity\ =\ The\ number\ of\ full\ years\ of\ the\ maturity\ of\ the\ issued\ bond$
$Principal\ amount = Natural\ logarithm\ of\ the\ amount\ raised\ for\ the\ bond$

4.2.2.2 Controls for Firm Characteristics

$\frac{Liabilities}{Assets} = The\ firm's\ total\ liabilities\ over\ its\ total\ assets\ the\ year\ prior\ to\ issuance$
$Revenue = Natural\ logarithm\ of\ the\ firm's\ revenue\ the\ year\ prior\ to\ issuance$
$\frac{Income}{Assets} = The\ firm's\ operating\ income\ divided\ by\ assets\ for\ the\ year\ prior\ to\ issuance$
$Energy\ company = Dummy\ variable\ for\ if\ the\ company\ belongs\ to\ the\ energy\ sector$

4.2.2.3 Controls for Time Period

We control for the period with a fixed-year effect.

4.2.3 Variable Motivation

The dependent variables account for the potential influence of other factors that could affect the outcome being studied. Controlling these variables allows us to isolate the effect of the independent variable on the relevant dependent variable and thereby increase the accuracy and reliability of the results. Maturity is included as a control variable as longer maturity bonds are generally perceived as riskier and may affect share prices differently than shorter maturity bonds. The principal amount can impact the perceived riskiness of the bond, and hence we control for this by including logarithmized principal amount as a control variable. The principal amount, as opposed to the proceeds amount, is relevant since it is independent of fees. The company's leverage is accounted for with the variable liabilities over assets, as shareholders may view a company with high leverage as riskier. Furthermore, revenue is included as a control variable and is also logarithmized. This is a way to control for size, as larger companies tend to receive greater attention from investors. Profitability is controlled through the variable operating income over total assets, as a company with high profitability

is likely to be perceived as less risky. The Moody rating controls for the effect of the bond's credit rating on share prices; a company with a high credit rating might is likely to be considered less risky by investors. We include fixed-year effects to control for factors that change from year to year. Controlling for these variables increases the study's internal validity by ensuring that any observed effects can be attributed to the independent variable being tested and not to other confounding factors.

4.2.4 Descriptive Statistics on Corporate Green Bonds

To better understand green bonds, we are providing statistics based on our sample that shows the breakdown between regions, industries, the issuance of green bonds over the years as well as green bond characteristics for the issuances used in our sample.

Table 1

Regional Differences in Green Bond Issuances

This table presents regions, the amount issued, and the number of green bonds issued. In the sample, 97% of the green bonds issued by companies in Europe, followed by Asia (2%) and South America (1%). The sample has no green bond issuances in North America or Oceania. In total, the sample contains 100 green bond issuances.

Region	**# of Green Bonds (% of the sample)**	**Principal Amount from Green Bonds (€ million)**	**Principal Amount from Non-Green Bonds (€ million)**
Asia	2 (2%)	1,000	2,279
Europe	97 (97%)	44,189	413,088
North America	n/a	n/a	70,714
Oceania	n/a	n/a	7,000
South America	1 (1%)	500	4,700
Total	100	45,689	497,781

Table 2

Green Bond Distribution Across Sectors

Table presenting corporate green bonds (EUR denominated) issued in different sectors, amounts, and number of green bonds. There is a clear majority of green bond issuances in the Energy and Power sector in the sample, followed by the Real Estate Sector. The sectors with the least issuances are the Consumer Products and Services and the Healthcare sectors, with only one issuance each. The Energy and Power sector has issued 44 bonds over the period and is the sector with the most issuances. The data reports the accumulated green bond issuances over the period of 2013-2023.

Sector	Principal amount (€ million)	# Green bond
Consumer Products and Services	300	1
Consumer Staples	700	2
Energy and Power	21,799	44
Healthcare	750	1
Industrials	5,475	11
Materials	3,550	7
Real Estate	12,015	31
Telecommunications	1,100	3
Total	45,689	100

Chart 2

Green Bond Issuance Evolution

The evolution of green bond issuances for January 2013 and February 2023 for our data set used in the regressions.

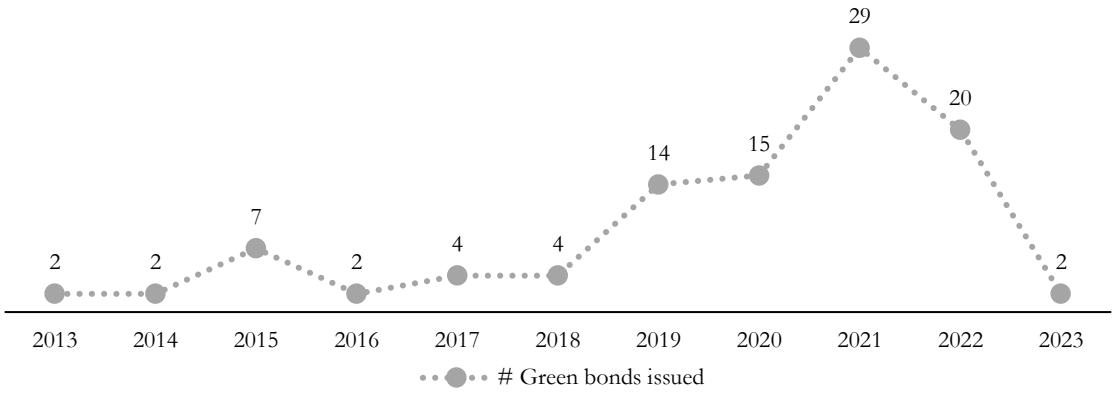


Table 3

Green Bond Characteristics

The table below presents the characteristics of the green bonds in the sample used in the regression. It shows the minimum, median, and maximum values for each variable. As well as showing the number of green bonds that are classified as investment grade or high yield by Moody's. Maturity is calculated as the number of years between when the bond was issued up until maturity, hence if a company issued a green bond at any time in 2013 and it matures in 2015 the maturity is calculated as 2 years.

	Maturity	Principal Amount	Offer yield to maturity	Liabilities/ Assets	Revenue (in €m)	Operating Income/Assets	Moody's rating (in #)
Min.	0	22	0.05%	31%	19	-0.1%	
Median	8	500	2%	60%	2 719	4%	
Max.	61	1400	7%	98%	172 745	22%	
Investment grade							56
High yield							44

Table 4

Correlation Matrix for the Dependent Variables

The table below presents the correlation matrix for the dependent variables used in the regression. The two variables with the highest correlation are the Revenue and Principal amount variables.

	1	2	3	4	5	6	7	8
Greenbond	1.000							
Energy	0.239	1.000						
Maturity	0.108	0.142	1.000					
Principal amt.	0.028	0.092	0.117	1.000				
Revenue	-0.113	0.076	0.108	0.379	1.000			
Income/Assets	-0.094	-0.069	-0.006	0.100	0.205	1.000		
Liabilities/Assets	0.026	-0.017	-0.020	-0.030	-0.046	-0.024	1.000	
Rating	0.069	0.161	0.081	0.303	0.376	0.218	-0.042	1.000

4.3 Data Tests

4.3.1 Multicollinearity - Variance Inflation Factors

The multicollinearity tests show if two or more of the explanatory variables are strongly correlated to each other. If there is multicollinearity in a model, the independent variables cannot be separated, creating a difficult result to analyze. We test the degree of multicollinearity through a Variance Inflation Factors ("VIF") test.

Table 5

Results from the VIF Test

Presents the results from a VIF test of our dependent variables.

Variable	VIF
Greenbond	1.07
Maturity	1.05
Principal amt.	1.33
Revenue	1.42
Income/Assets	1.10
Liabilities/Assets	1.01
Rating	1.28

Our regression model and the independent variables are tested for multicollinearity by calculating the Variance Inflation Factors ("VIF"). Since the variables all have a VIF value lower than ten, we do not consider multicollinearity a problem for our regression (Hair et al., 1995).

4.3.2 Heteroskedasticity - White test

A common problem for regression analysis is the occurrence of heteroscedasticity. Heteroscedasticity occurs when the variance of the error term is not constant, which means that if the value of an independent variable increases, it will increase or decrease the unexplained variance in the dependent factor. This can result in inefficient model parameters and covariance matrix estimates, leading to the possibility of making misleading inferences (White, 1980). To test our data for homoscedasticity, which is when the variance of the error term is assumed to be constant, we perform a White test where the null hypothesis is that the variance of the error term is homoscedastic.

Table 6

Result from the White Test for Hypothesis I

Presents the result of the White Test on our first regression. We reject the null hypothesis of homoscedasticity in our sample at the 1% level.

Source	chi2	df	p
Heteroskedasticity	246.4	113	0.0000
Skewness	30.5	17	0.0229
Kurtosis	5.0	1	0.0250
Total	281.9	131	0.0000

Table 7

Result from the White Test for Hypothesis II

Presents the result of the White Test on our second regression. We reject the null hypothesis of homoscedasticity in our sample at the 1% level.

Source	chi2	df	p
Heteroskedasticity	282.2	144	0.0000
Skewness	31.3	19	0.0374
Kurtosis	5.0	1	0.0248
Total	318.5	164	0.0000

4.3.3 Controls for Standard Errors

In a regression analysis that uses OLS, the variance of the error terms is assumed to be constant, meaning homoscedasticity is assumed. The results from the White test indicate heteroscedasticity in our sample. This can result in the standard error from an OLS regression that might be too conservative, and our results could be skewed to significance. To correct this, we perform a robustness test where we cluster standard errors by issue year.

5. Interview Data

5.1 Interview Collection

To obtain a comprehensive understanding of our research, we use semi-structured interviews as a method for data collection for the interviews (Silverman & Marvasti, 2008). Using a semi-structured interview process has several advantages. Firstly, it allows for consistency between the interviews in the information that is collected. Furthermore, the semi-structured approach opens up the opportunity to ask follow-up questions to the respondents based on the answers they provide during the interview.

5.2 Research Quality

Qualitative research has been suggested not to have the same conventional validity and reliability assessment criteria widely used in quantitative research to determine data quality (Lincoln & Guba, 1985). Instead, four criteria for trustworthiness were introduced; credibility, transferability, dependability, and confirmability.

The credibility aspect is fulfilled by sending the collected data for review to the interviewees for confirmation and asking potential follow-up questions to ensure that our understanding aligns with the participants. The purposive sampling ensured the transferability aspect, which provided a detailed description of our study context and participants that employed a saturation point approach to the data collection. Dependability is ensured by having a reflexive approach throughout the research process, constantly reflecting on our potential biases and assumptions. Finally, to address confirmability concerns, we use a transparent and systematic approach to data analysis, ensuring that our findings are grounded in the data gathered rather than influenced by our biases and preconceptions.

5.3 Interviewees

Table 8
Interview Participants

Table presenting the interviewee's company, title, and the sector that their company belongs to.

Interviewee	Company	Title	Sector	Interview Date
Joel Skagerberg / Sarah Fleischer	SEB	Head of Project & Infrastructure Finance / Sustainable DCM Analyst	Financial Institution	2023-03-22
Markus Larsson	Arise	CFO	Energy	2023-04-04
Håkan Gabrielsson	Boliden	CFO	Materials	2023-04-06
Mats Nelson	Telia	Sustainable Finance Manager	Telecommunications	2023-04-12
Åsa Roslund	Hufvudstaden	CFO	Real Estate	2023-04-13

6. Methodology

6.1 Mixed Methods

A mixed methodology approach is used to investigate companies' incentives to issue green bonds. This approach is chosen as it allows for a comprehensive understanding that cannot be fully captured by quantitative or qualitative methods alone. As argued by Johnson and Onwuegbuzie (2004), mixed methods research is an important research paradigm that offers a unique way of addressing research questions that cannot be fully answered by a single approach. In this study, an event study was used to collect quantitative data on the share price reaction from issuing green bonds. Interviews were conducted to gather qualitative data on the decision and implementation feasibility of issuing a green bond across sectors. Additionally, the qualitative data allows an understanding of how green bond issuance is received by equity investors as part of a long-term sustainability strategy. In summary, the use of a mixed methodology in this study allows for the triangulation of data, enabling a more thorough understanding of the impact of the issuance.

6.2 Event Study Analysis

We test our hypotheses using the event study method. This empirical tool is useful when analyzing a share price reaction to a singular event. Our analysis follows the methodology laid out by Ball and Brown (1968) and Fama et al. (1969).

First, we specify t_0 as the event day when a company announces a green bond issuance. Second, we specify which model we will use to define normal returns that predict what the returns for the company would have been in the absence of the event. For this, we opt for the WRDS Event Study application. This tool uses the normal market model for the firm, *i,* for the day, *t* :

$$R_{it} = a_i + \beta_{it} \cdot R_{Mt} + \varepsilon_{it}$$

Where:

$R_{it} = Return\ of\ the\ company\ i\ on\ day\ t$

$a_i = Intercept$

$\beta_{it} = Regression\ coeff.\ that\ is\ a\ measure\ of\ the\ sensitivity\ of\ R_{it}\ on\ the\ reference\ market$

$R_{Mt} = Return\ on\ the\ reference\ market\ on\ day\ t$
$\varepsilon_{it} = Error\ term$

Thirdly, we calculate the cumulative abnormal returns for our chosen event window. We use a seven-day event window consisting of three days before and three days following the event [-3,3]. This is to be able to account for possible information leakage occurring before the announcement, as well as to capture a staggered effect of the announcement returns. We use the WRDS event study tool to calculate the abnormal return, AR_{it} for the company *i* for day *t*:

$$AR_{it} = R_{it} - E(R_{it})$$

Where:
$R_{it} = excess\ daily\ return$
$E(R_{it}) = normal\ daily\ return$

We calculate the Cumulative Abnormal Return, CAR_i, for each specific event by compounding the Abnormal Return, AR_{it}, for the company *i* during the event window (t_1, t_2).

$$\widehat{CAR_i}(t_1, t_2) = \sum_{t_1}^{t_2} \widehat{AR_{lt}}$$

6.3 Regression Models

An unbalanced panel regression is used to determine the relationship between the cumulative abnormal returns, CAR, and green bond issuance. The regression tests the relationship between the cumulative abnormal return and the explanatory variables. The regression equation for Hypothesis I is as follows:

$$CAR = \beta_0 + \beta_1 Greenbond + \beta_2 Principal\ Amount + \beta_3 Maturity + \beta_4 \frac{Liabilities}{Assets} + \beta_5 lnRevenue + \beta_6 \frac{Income}{Total\ Assets} + \beta_7 Rating$$

To test Hypothesis I, we are interested in the coefficient of the Greenbond dummy variable. The variables with names lnPrincipalAmount, Maturity, Liabilities/Assets, lnRevenue, Income/Total Assets, and Rating variables are controlling variables. Our

hypothesis is that the share price reaction for a green bond issuance is larger than that of a conventional bond. Hence, the expected sign of the Greenbond coefficient is positive.

The regression equation for Hypothesis II is stated as follows:

$$CAR = \beta_0 + \beta_1 Energycompany + \beta_2 Energy\#Greenbond + \beta_3 Greenbond + \beta_4 Principal\ Amount + \beta_5 Maturity + \beta_6 \frac{Liabilities}{Assets} + \beta_7 lnRevenue + \beta_8 \frac{Income}{Total\ Assets} + \beta_9 Rating$$

To test Hypothesis II, we are interested in the coefficient of the Energy#Greenbond variable, which is an interacted dummy between the Energycompany and Greenbond variables. The variables with names lnPrincipalAmount, Maturity, Liabilities/Assets, lnRevenue, Income/Total Assets, and Rating variables are controlling variables. Our hypothesis is that the share price reaction for a green bond issuance from an energy company is larger than that from firms in other industries. Hence, the expected sign of the Energy#Greenbond coefficient is positive.

6.4 Interview Methodology

The interviews are based on a semi-structured approach with a broad set of interviewees representing different industries. The semi-structured approach allowed us to adapt the questions based on the interviewees' responses during the interview (Bryman & Bell, 2015). Our interviewees can be divided into two groups; representatives from companies that have issued green bonds and representatives from a bank that facilitates green bond issuances. The interviewees at companies issuing green bonds have similar roles where they were actively involved in the issuance of a green bond at their company.

In this study, a total of five interviews with six unique interviewees took place over two weeks, with each interview being circa thirty minutes, and were all held online through Microsoft Teams. The interviews were all held in Swedish due to it being the preferred language of the respondents, and hence the quotes from the interviewees are translated for this study. The respondents are given the opportunity to be anonymized for this study. However, all respondents are comfortable disclosing their names and role at their companies. Both authors participated in each interview, with one author taking an active role to ensure efficiency during the interviews.

To minimize misinterpretations, the interviews are recorded, with consent from the interviewee, to ensure that the respondent is quoted correctly. Both authors also took notes during the interviews. The selected quotes were sent for approval to the respondents after the interview to allow them to address any confusion or clarification.

7. Results of Regression Analysis

7.1 Hypothesis I

To test Hypothesis I, we conduct three regression analyses to examine the relationship between green bond issuances and the dependent variable, as seen in Table 9 below. In the first regression, we test the variable of interest (Greenbond) without any control variables. In the second regression, we added the control variables for the bond characteristics, including maturity, principal amount, and Moody's rating. Lastly, in the third regression, we added the control variables for firm characteristics, including operating income over assets and liabilities over assets.

However, none of the variables in the three regression models were statistically significant at the 95% confidence level, as shown below in Table 9. The coefficient values and the p-values for each variable suggested no significant relationship between green bonds and the dependent variable, even after adding controls for bond and firm characteristics.

Table 9

Regression Result for Hypothesis I

The result of our regression for Hypothesis I, in steps of adding control variables. In the final column, we have added fixed-year effects. Standard errors are in parentheses.

		Controls for bond characteristics	Controls for firm characteristics
	Coefficient	**Coefficient**	**Coefficient**
Greenbond	0.0012	0.0010	0.0003
	(0.0041)	(0.0041)	(0.0044)
Maturity		0.0001	0.0001
		(0.0015)	(0.0001)
Principal amt.		-0.0010	-0.0003
		(0.0013)	(0.0015)
Revenue			-0.0009
			(0.0007)
Income/Assets			-0.0538
			(0.0254)
Liabilities/Assets			0.0000
			(0.0007)
Rating			0.0038
			(0.0026)
Constant	-0.0002	0.0054	0.0066
	(0.0012)	(0.0074)	(0.0152)

We observed a notable change in the value of the constant across the three regression models, going from -0.0002 to 0.0054 and lastly to 0.1156. However, none of the regression models' variables were statistically significant at the 95% confidence level.

Table 10

Summary of CAR from Regression

Summarizes the relevant output from the regression at the 0.1, 0.05, and 0.01 significant levels, shown by *, **,***.

	CAR (%)	**CAR (%)**	**CAR (%)**
Greenbond	0.12	0.10	0.03

7.2 Hypothesis II

Table 11

Regression Result for Hypothesis II

Shows the result of our regression for Hypothesis II in steps of adding control variables. In the final column, we have added fixed-year effects. Standard errors are in parentheses.

		Controls for bond characteristics	Controls for firm characteristics
	Coefficient	**Coefficient**	**Coefficient**
Energy#Greenbond	0.0073	0.0070	0.0086
	(0.0086)	(0.0086)	(0.0087)
Greenbond	-0.0011	-0.0012	-0.0025
	(0.0053)	(0.0053)	(0.0056)
Energycompany	-0.0029	-0.0027	-0.0037
	(0.0086)	(0.0036)	(0.0036)
Maturity		0.0001	0.0001
		(0.0001)	(0.0001)
Principal amt.		-0.0001	-0.0002
		(0.0013)	(0.0015)
Revenue			-0.001
			(0.0007)
Income/Assets			-0.0559
			(0.0255)
Liabilities/Assets			-0.0000
			(0.0007)
Rating			0.0041
			(0.0026)
Constant	0.0002	0.0052	0.0046
	(0.0013)	(0.0074)	(0.0165)

Table 12

Summary of CAR from Regression

Summarizes the relevant output from the regression at the 0.1, 0.05, and 0.01 significant levels, shown by *, **,***.

	CAR (%)	CAR (%)	CAR (%)
Energy#Greenbond	0.07	0.07	0.09

The regression testing Hypothesis II does not indicate a significantly higher cumulated abnormal return for energy companies issuing green bonds than companies in other industries.

7.3 Robustness Tests

Certain macroeconomic factors may influence market dynamics. Therefore, we perform a robustness test by clustering the standard errors by the year of the bond announcement. This way, the regression can account for correlation within each year and estimate more accurate standard errors.

Table 13

Regression Result for Hypothesis I with Clustered Standard Errors

Presents the regression result for Hypothesis I, where standard errors are clustered by the year the bond was issued. Standard errors are in parentheses.

	Coefficient
Greenbond	0.0003
	(0.0036)
Maturity	0.0000
	(0.0002)
Principal amt.	-0.0003
	(0.0017)
Revenue	-0.0010
	(0.0006)
Income/Assets	-0.0538
	(0.0354)
Liabilities/Assets	-0.0000
	(0.0001)
Rating	0.0038
	(0.0024)
Constant	0.0116
	(0.0111)

Table 14

Regression Result for Hypothesis II with Clustered Standard Errors

Presents the regression result for Hypothesis II, where standard errors are clustered by the year the bond was issued. Standard errors are in parentheses.

	Coefficient
Energy#Greenbond	0.0086
	(0.0063)
Greenbond	-0.0025
	(0.0047)
Energycompany	-0.0037
	(0.0022)
Maturity	0.0001
	(0.0001)
Principal amt.	-0.0002
	(0.0017)
Revenue	-0.001
	(0.0005)
Income/Assets	-0.0559
	(0.0341)
Liabilities/Assets	-0.0000
	(0.0001)
Rating	0.0041
	(0.0024)
Constant	0.0046
	(0.0121)

The result of no significance remains when clustering standard errors by issue year.

In our final robustness test, we run an event study on the same events using a shorter event window. Following Zhou & Cui (2019), we accumulate abnormal returns from one day before to one day after the green bond announcement [-1,1].

Table 15

Regression Result with Shorter Event Horizon for Hypothesis I

Presents the regression results for the event window [-1,1]. The regression has fixed-year effects. Standard errors are in parentheses.

	Coefficient
Greenbond	-0.0016
	(0.0027)
Maturity	0.0000
	(0.0001)
Principal amt.	-0.0004
	(0.0009)
Revenue	-0.0002
	(0.0004)
Income/Assets	-0.0273
	(0.0156)
Liabilities/Assets	0.0002
	(0.0005)
Rating	0.0033
	(0.0016)
Constant	0.0067
	(0.0104)

Table 16

Regression Result with Shorter Event Horizon for Hypothesis II

Presents the regression results for the event window [-1,1] with the interacted dummy. The regression has fixed-year effects. Standard errors are in parentheses.

	Coefficient
Energy#Greenbond	0.0093*
	(0.0054)
Greenbond	-0.0051
	(0.0035)
Energycompany	-0.0032
	(0.0023)
Maturity	0.0000
	(0.0001)
Principal amt.	-0.0003
	(0.0009)
Revenue	-0.0003
	(0.0156)
Income/Assets	-0.0290
	(0.0156)
Liabilities/Assets	0.0002
	(0.0005)
Rating	0.0035
	(0.0016)
Constant	0.0053
	(0.1041)

The interacted variable is also not significant at the 5% level. It is, however, significant at the 10% level. However, due to the consensus in research that a 10% significance level is only considered marginally significant, it will not be considered significant enough to be interpreted as such.

8. Results of Interview Analysis

The purpose of the interviews was to gain a nuanced understanding of the reasoning behind issuing green bonds and the issuer's perspective on potential share price reaction but also their understanding of differences in issuances between sectors. By conducting the interviews, aspects that cannot be captured solely by our quantitative tests become clearer. It allows us to understand how firms use the issuance of a green bond as part of their sustainability strategy and the resulting consequences.

8.1 Companies Changed Approach to Green Financing

Skandinaviska Enskilda Banken ("SEB") has participated as a book runner for several green bond issuances over the years and has worked with companies from various industries. SEB is also a pioneer in the green bond market, collaborating with the World Bank on its issuance of a Green Bond in 2008, which has given them great insight and knowledge within the field.

For larger companies, a sustainability agenda and green financing have gone from being considered nice to have to need to have. Nevertheless, issuing green bonds can be difficult for companies depending on their size due to a lack of resources since it is more time- and resource-consuming than regular bonds.

- *Joel Skagerberg*

8.2 Investor Sustainability Interest

There is overall pressure on companies to become more sustainable in their operations but also their financing, including pressure from stakeholders, customers, and employees.

Green financing (including green bonds) has become an important way for companies to communicate their sustainability strategy and improve their branding. It has also become a way to retain and attract talent and customers

- *Joel Skagerberg*

Sustainability-linked bonds have, however, been under scrutiny for the materiality and ambition of the KPIs and targets set by companies. Setting unmaterial and unambitious goals that have already been achieved or partly achieved, or goals that do not address the most material issues of companies, increases the risk of greenwashing allegations of these companies

- *Sarah Fleischer*

The pressure from the stakeholders is increasing as the demand from the EU Taxonomy and other regulatory changes are changing. Therefore, the frameworks that the companies create in conjunction with green bond issuances become a megaphone for the company's sustainability agenda and business structure

- *Sarah Fleischer*

Table 17

Overview of the Rationale of Connecting Sustainability and Financing

Presenting seven reasons for the rationale of connecting sustainability and financing.

Source: SEB Presentation

The Rationale of Connecting Sustainability and Financing
Maximize investor base
Minimizing execution risk
Potential price advantage
Forestall investors' questions
Increase cross-organizational cooperation
Communicate sustainability efforts
Invite stakeholders to the ESG journey

Additionally, for the company interviewed operating in the energy sector, the issuance was not an attempt at reaching new equity investors. They did not expect an increase in the shareholder base, as their current shareholders already comprise investors who value their investments' sustainability agenda. The Boliden representative highlighted a similar perspective that their company has a sustainable profile. Therefore, they did not consider a potential expansion of the shareholder universe.

The companies expressed an increasing interest in their sustainability strategy from their shareholder base. The companies were able to use the decision to issue a green bond as an effective tool to signal their commitment to an increased sustainability focus. Before issuing its green bond, Telia developed its green bond framework, which it presented to its debt investors on a non-deal roadshow, emphasizing its commitment to green financing even prior to announcing its first green bond issuance. For the company belonging to the real estate sector, Hufvudstaden, the issuance of a green bond was an attempt to clarify its stance

and efforts toward sustainability. Through an extensive sustainability focus, Boliden had positioned itself as a sustainable mining company to investors even before issuing its green bond. Thus, the signaling effect was not the main focus of the issuance but rather a long-term sustainability commitment.

8.3 Shareholder Reaction to Green Financing

The interviewees were all in consensus regarding the potential share price reaction was not a part used as support for the decision to issue a green bond. Mats Nelson from Telia discussed how the issuance of a green bond could result in indirect effects, such as increased credibility of their sustainability work. Still, a potential share price reaction was not a factor in decision-making. When Telia introduced its Green Bond Framework, it went on a non-deal roadshow to its debt investors. They met with debt investors throughout Europe and discussed Telia's overall sustainability strategy and presented their newly developed Green Bond Framework. The framework is evidence of Telia's commitment to a sustainable strategy. Mats Nelson explains that instead of focusing on the potential of a share price reaction, the financial benefits could be seen in a "greenium" effect on their first issued green bond.

8.4 Green Bonds in the Energy Sector

A question raised for several respondents but specifically discussed with SEB was their view on why the energy sector is the sector in our quantitative data that has issued the most green bonds.

The energy sector is capex intensive and often makes investments in green generation capacity (e.g., wind/solar). The project that will be financed also needs to be easily differentiated from other projects to show that the proceeds will be used for green investments, and that is usually easy in the energy sector. If the project is less tangible and focuses on emissions reductions, then it could be easier to use sustainability-linked financing

- *Joel Skagerberg*

Arise operates within the energy sector, engaged in renewable energy. They build, sell and manage wind farms. Even during the past year, they have been able to see increased interest from investors in ESG-related issues. Despite the nature of their operations being part of creating renewable energy, the issuance of a green bond was a tool to signal this commitment

to environmentally positive projects. Given the company's profile, a green bond would be the natural choice of a debt instrument, considering that all areas of their operations would likely be qualified for green bond funding.

8.5 Green Bonds in the Mining Sector

Boliden, a Swedish metal, mining, and smelting company, issued its first green bonds in September of 2022 to a value of SEK 2 billion, with proceeds going to expanding zinc smelters in Norway, intending to lower the carbon emissions on their already low zinc production. In an industry associated with high carbon emissions, Boliden is known for being an industry leader in producing metals with a lower carbon footprint. Their strong sustainability efforts, low governance risk, and high technological advances are among the reasons shareholders hold this stock. Issuing a green bond aligned well with their goal of being a frontrunner in sustainability.

Outside of China, their green bond is the first to have proceeds for base metal production. However, it has not been easy to find an appropriate project for a green bond, primarily because of the large amount of emissions from mining and smelting metals. Boliden's green bond is therefore financing parts of their largest investment in the expansion of the smelting plant Odda.

Håkan Gabrielsson, CFO at Boliden, brings up the challenges with the current taxonomy. The criteria for green bond financing are difficult to fulfill to finance a new mine and are, therefore, by many used to finance smaller investments, such as the water treatment plant of a mine. Without mines, it will be challenging to solve the current climate crisis since the electrification of society is highly dependent on the outputs of mines.

9. Discussion

9.1 Hypothesis I

There was no significant indication that there is a significant positive stock market reaction when a corporate issues a green bond.

The regression results show that the coefficient for green bond issuance has a slight positive effect on the cumulative abnormal return when controlling for bond, firm, and time factors. However, the coefficient is not statistically significant, and therefore the effect cannot be considered meaningful or reliable. This finding contrasts with previous research by Flammer (2021) and Tang and Zhang (2020), who concluded a positive relationship between green bond issuances and share price. However, Tang and Zhang (2020) only see a statistically significant result for first-time issuers, while Flammer (2021) reports a significant result for all green bond issuances.

As can be seen in Chart 2, the green bond market has grown rapidly over the past few years. Based on our small sample, there were only two issuances in 2013, and in 2021 green bonds reached a new high with 29 issuances. This implies that the past few years have a substantial weight in our regression analysis. Moreover, the increase in green bond issuances is demonstrated by the fact that as of February 2023, the number of issuances in the dataset has reached the same level as that of the entire year of 2013. The studies by Flammer (2021) and Tang & Zhang (2020) contained data from 2013-2018 and 2007-2017, respectively. The increase in green bond issuances after these periods could have resulted in the market becoming saturated. In turn, this could reduce the novelty effect that green bonds once had on investors. A consequence of a potentially saturated market could be that the signaling effect of issuing a green bond has subsequently decreased in value. As mentioned by Joel Skagerberg, having a sustainability agenda and green financing has gone from something that is considered "nice to have to need to have", as indicated by the increase of green bond issuances in our sample and other green bond research (Flammer, 2021; Tang & Zhang, 2020).

Another potential consequence of the increase in green bond issuances is the lack of market differentiation. With the increase in green bond issuances, it could become difficult for equity

investors to differentiate between the environmental performance of different issuers. This could reduce the perceived value of green bonds, which can lead to a less pronounced share price reaction. Williamson (1985) claims that a lack of market differentiation among products can lead to adverse selection where buyers/investors cannot distinguish between high-and low-quality products. They may therefore be hesitant to pay a premium price for a particular product, in this situation being a premium for the share. If the investors are unable to differentiate between the environmental performance of different issuers, this could lead to uncertainty and potentially negative or no effects on the share price.

When a company creates a green bond framework prior to issuing its first green bond, it suggests to the equity investors that the firm will issue a green bond in the near term. Hence, there is a chance that investors have already priced in the commitment to sustainable financing, diminishing the share price effect on the actual announcement day of the green bond. Telia's Mats Nelson discussed how before the issuance of their green bond, they had a non-deal roadshow for their debt investors where they presented their new green bond framework as well as other adjustments in their sustainability strategy.

Sample differences can also be an explanatory factor for the contradicting results. Our sample consists of bonds issued in Euros; hence, the sample is tilted towards European companies, with 97% of the issuers in our sample being European countries. If equity investors in European companies are more skeptical of the credibility of green bonds, i.e.., concerned about greenwashing, this may impact our sample. Furthermore, a possible explanation for obtaining non-significant results in the regression analysis is the issue of statistical power that can arise when the sample size is inadequate to detect meaningful relationships between the variables. In such a scenario, the small sample size may result in low variability within the data to accurately estimate the relationship between the variables, thereby leading to non-significant findings. Consequently, it can be challenging to discern whether the non-significant results are a product of a lack of statistical power or if there is no relationship between the variables. Our sample consists of 100 green bonds, compared to 241 and 384 in Tang & Zhang's (2020) and Flammer's (2021) samples, respectively.

An additional plausible explanation for the small reaction and insignificant regression result is a concern of greenwashing. Investors may have gathered further knowledge about green

bonds and their risk, including the lack of legal enforcement to ensure that proceeds go toward their intended projects (Fatica & Panzica, 2021). Lyon and Montgomery (2015) conclude that a lack of transparency in the green bond market can limit the impact of green bond issuance on share price if there is a risk of greenwashing or misrepresenting the environmental benefits of a bond. However, investor skepticism as an explanation for the lack of market reaction can be discredited by findings by Baker et al. (2022), which indicate that the concerns about greenwashing concerning green bonds have faded over time.

9.2 Hypothesis II

There was no significant indication that there is a stronger positive reaction when the issuer of a green bond is a company in the energy sector.

The lack of statistical significance in our regression means we cannot determine if equity investors view the financed projects in the energy sector more credible than projects in other sectors. The adverse selection problem that would lead investors to value the issuer of green bonds higher might not be prevalent in our sample. The fact that the green bonds in our sample are certified green bonds could be a strong enough signal that the companies will be monitoring and ensuring that the proceeds go toward the intended green project. In this case, the fact that it would be easier for energy companies to have distinguishable projects does not lead to investors valuing them higher. Furthermore, investors might already expect that energy companies should invest in green projects. The signal from issuing a green bond is rooted in the fact that the company signals to investors that it will invest in projects that will go towards environmentally sustainable projects. However, due to external pressures and regulations, investors may already expect energy companies to be engaged in these projects and that it is, therefore, already priced in the share. The signaling effect from an energy company issuing a green bond might be treated differently by shareholders depending on the level of green the company is already perceived as. This means that an energy company such as Arise, which is involved in producing renewable energy, may not gain the same amount of attention when they announce a green bond issuance. Equity investors already expect the company's operations to be green, and hence none or a small positive shock in relation to the issuance occurs. The results may therefore differ if it focused on energy companies that are not perceived as green. Altogether, we do not see evidence suggesting that because equity

investors favor their issuances, energy companies are incentivized to use the green bond more than other industries.

Instead, the easily distinguishable, green projects prevalent in the energy companies' operations are likely why this industry favors this debt instrument. Our interviews gave us insights into how the nature of green bonds impacts their use in practice. By default, it is easier for some companies to issue green bonds than others (Coldeweijer & Hsu, 2021). As mentioned throughout this paper, this is true for the energy sector and is likely why energy companies disproportionately issue a large number of green bonds compared to conventional bonds. Due to the nature of their operations, companies such as Boliden and Telia have more difficulties presenting green projects that are distinguishable from non-green operations. This analysis prompts the question about the "fairness" of green bonds. Because of its structure, it favors companies whose green projects are easily distinguishable from other operations and whose operations have a direct positive environmental effect. These companies, in turn, then benefit from using the instrument as a signaling tool to investors. Even though it may not cause an immediate share price reaction, it can have alternative benefits or spinoff positive effects, such as lower financing costs, as indicated by our interviews. In turn, companies whose environmentally positive efforts are more intertwined with other, less evidently green operations, or companies whose projects do not have a direct, positive effect on the environment, are disadvantaged in this regard. This can be exemplified in the case of Boliden, whose mining operations are crucial for society's electrical transformation. Nevertheless, the green bond taxonomy has yet to move past the arguably, outdated idea of mines being a source of carbon emission rather than a potential piece in the puzzle of solving the climate crisis. This limitation of green bonds might be a reason for the prominent rise of a new green debt financing tool, the sustainably linked bonds. Since sustainably linked bonds are not proceeds-specific but rather company-specific, it might make them a more usable debt instrument in companies outside of the "classic" green bond industries.

9.3 Limitations

A few limitations of our study are worth highlighting. The timing of the bond issuance and market conditions at the time can play a role in determining the share price reaction. By having a fixed-year effect on our regression, we have attempted to minimize this effect.

However, it is important to acknowledge that many factors beyond the green bond announcement itself may influence share prices.

Secondly, we are limited by a small sample size. Firstly, we only include bonds denominated in Euros and exclude industries in the financial sector, which reduces our sample size. Furthermore, we exclude companies that issue multiple bonds on the same day, following Flammer (2021). This is due to our regression model requiring us to include unique input for each issued bond, and including multiple bonds from the same company would result in double-counting of the effect. However, this limitation also reduces the sample size of our study. Excluding companies that issued multiple bonds on the same day may limit the generalizability of our findings to companies that typically issue multiple bonds at once.

10. Concluding Remarks

10.1 Conclusion

For Hypothesis I, the results of the regression analysis do not support a meaningful or reliable positive effect on cumulative abnormal return by issuing green bonds. This means that we cannot determine if shareholders see the issuance of a green bond as a strong enough signal of credible environmental behavior to be able to significantly affect the share price. The increase in green bond issuances from 2013 to 2023 may have resulted in a saturated market, reducing the novelty effect and signaling value of green bonds. A lack of market differentiation and a potential lack of transparency could also contribute to the decreased share price reaction. Shareholders may also be skeptical of the environmental claims of the green bond issuers as well as the validity of their reporting. Furthermore, our sample size could limit our ability to detect the true effect of the regressions. Nonetheless, the issuance of green bonds can still serve as a credible signal of a company's commitment to sustainability over the long term.

Additionally, we cannot determine if there is a stronger share price reaction when energy companies issue green bonds compared to companies in other sectors from our regression analysis. Hence, we cannot determine that energy companies are incentivized to issue green bonds because of favorable treatment from shareholders. Instead, we conclude that the energy industry is compatible with the use of proceeds nature of green bonds, which is why they are overrepresented in this debt tool. However, our data gathered from interviews supports the idea that green bonds are limiting to companies not operating in industries where it is easy to identify specific projects with positive environmental effects. We propose that there is a potential bias towards companies whose operations do not have a direct positive environmental effect. For companies engaged in, for example, mining, we see difficulties for companies to find adequate capital-intensive projects that fulfill green bond criteria, even though their operations are essential for a greener society. Overall, we conclude that the green bond instrument is not created equally for all industries. The new sustainably linked bonds may be the debt tool needed to incentivize all companies, regardless of their operations, to work towards running a more sustainable business.

To conclude, this study finds that there is not sufficient evidence to determine that there is a positive market reaction to announcements of green bonds issued in the Euro between 2013-2023. Additionally, it does not find support for energy companies experiencing a larger share price reaction in connection to green bond issuances. Instead, we find support for potential bias towards industries whose operations allow for clearly defined and distinguishable sustainable projects. We also propose a new idea that the current process and structure of issuing a green bond discriminates against industries whose operations do not directly have a positive environmental impact.

10.2 Future Research

The green bond market is still considered relatively new. However, other forms of sustainable financing tools have emerged during its existence, including sustainability-linked bonds. SLBs differ from green bonds in that they are linked to the issuer's broader sustainability objectives instead of to specific projects or assets. They were first introduced to the market in 2019 and are, compared to green bonds, a new type of sustainable finance instrument. Therefore, future research can explore the reaction to an issuer's share price in connection to SLB issuances to further study sustainable finance. This research can focus on KPIs commonly included in SLB prospectuses and whether shareholders or bond investors prefer specific KPI segments. Furthermore, a similar analysis to Flammer (2021) can be applied to the SLB market to understand what industries, if any, overrepresent the SLB market compared to the conventional bond market. This would be interesting to explore to understand if SLBs are more industry agnostic than green bonds. As these bonds are not limited by their use of proceeds, a bias towards industries where finding a specific project to be funded by a green bond may not persist.

Future research on energy companies with low ESG scores could bring interesting perspectives on if there is a potential difference in the share price reaction depending on the companies' scores. This can be particularly relevant to understand if energy companies with low ESG scores will see a strong reaction, as it would signal that they are able to find green projects within their operations and are investing in green energy.

Bibliography

Akerlof, George A. "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism." *Quarterly Journal of Economics*, vol. 84, 1970, pp. 488–500.

Albuquerque, Rui, et al. "Resiliency of Environmental and Social Stocks: An Analysis of the Exogenous COVID-19 Market Crash." *The Review of Corporate Finance Studies*, vol. 9, no. 3, 2020, pp. 593–621, https://doi.org/10.1093/rcfs/cfaa011.

Baker, M., Bergstresser, D., Serafeim, G., Wurgler, J. "The Pricing and Ownership of US Green Bonds." *Annual Review of Financial Economics*, vol.14, pp. 415-437, https://doi.org/10.1146/annurev-financial-111620-014802

Ball, Ray, and Philip Brown. "An Empirical Evaluation of Accounting Income Numbers." *Journal of Accounting Research*, vol. 6, 1968, pp. 169–178.

Bryce, Helen J., and Raul Reuveny. "Supply Chains and the Diffusion of Cleaner Technologies: Evidence from the Introduction of Natural Gas Vehicles in the United States." *Environmental Science & Policy,* vol. 101, 2019, pp. 1–10.

Bryman, Alan, and Emma Bell. Business Research Methods. 4th ed.*, Oxford University Press*, 2015.

Böhm, Steffen, Samantha Gardiner, and Alex Shortland. "Green Bonds: The State of the Market and the Challenges of Disclosure." *Journal of Business Research*, vol. 108, 2020, pp. 186-195.

Caldecott, Ben. "Achieving Alignment in Finance." EIT Climate-KIC, *Aligning Finance for the Net Zero Economy*, 2020, pp. 1–39, https://www.climate-kic.org/wp-content/uploads/2020/09/200902_J932-CKIC-UNEP-ThoughtLeadershipSeries-DrBenCaldecott-1.pdf.

Coldeweijer, Antoinette, and Jimmy Hsu. "Sustainability-Linked Bonds: A Viable Alternative for Green Bonds?" *NN Investment Partners,* 6 May 2021, https://www.nnip.com/en-INT/professional/insights/articles/sustainability-linked-bonds-a-viable-alternative-for-green-bonds.

Eckbo, B. Espen, Robert W. Masulis, and Øyvind Norli. "Security Offerings." *Handbook of Empirical Corporate Finance*, edited by B. Espen Eckbo, Elsevier/North-Holland, 2007, pp. 233-373.

Fama, Eugene F., Lawrence Fisher, Michael Jensen, and Richard Roll. "The Adjustments of Stock Prices to New Information." *International Economic Review*, vol. 10, no. 1, 1969, pp. 1–21.

Fatica, Serena, and Roberto Panzica. "Green Bonds as a Tool Against Climate Change?" *Business Strategy and the Environment, vol.* 30, no. 5, 2021, pp. 2688-2701, https://doi.org/10.1002/bse.2771.

Flammer, Caroline. "Corporate Social Responsibility and Shareholder Reaction: The Environmental Awareness of Investors." *Academy of Management Perspectives*, vol. 27, 2013, pp. 758–781.

Flammer, Caroline. "Corporate Green Bonds." *Journal of Financial Economics*, vol. 142, 2021, pp. 499–516.

Greene, Jennifer C. "The Emergence of Mixing Methods in the Field of Evaluation." *Qualitative Health Research*, vol. 25, no. 6, 2015, pp. 746–750.

Hair, J. F. Jr., Anderson, R. E., Tatham, R. L. & Black, W. C. 1995, "Multivariate Data Analysis", 3rd ed, Macmillan, New York.

Ilhan, Emre, et al. "Climate Risk Disclosure and Institutional Investors." Swiss Finance Institute Research Paper No. 19-66, *European Corporate Governance Institute – Finance Working Paper* No. 661/2020, 2021.

Johnson, R. Burke, and Anthony J. Onwuegbuzie. "Mixed Methods Research: A Research Paradigm Whose Time Has Come." *Educational Researcher*, vol. 33, no. 7, 2004, pp. 14-26.

Klassen, Robert D., and Curtis P. McLaughlin. "The Impact of Environmental Management on Firm Performance." *Management Science*, vol. 42, no. 8, 1996, pp. 1199–1214.

Kruger, Philipp. "Corporate Goodness and Shareholder Wealth." *Journal of Financial Economics*, vol. 115, no. 2, 2015, pp. 304–329.

Lincoln, Yvonna S., et al. "Naturalistic Inquiry." *International Journal of Intercultural Relations*, vol. 9, no. 4, 1985, pp. 438–439.

Lyon, Thomas P., and Andrew W. Montgomery. "The Means and End of Greenwash." *Organization & Environment*, vol. 28, no. 2, 2015, pp. 223–249.

MacKinlay, Andrew Craig. "Event Studies in Economics and Finance." *Journal of Economic Literature*, vol. 35, no. 1, 1997, pp. 13–39.

Qui, T. Q., Vuong, Q. H., Tran, T. D., Nguyen, T. H., & Vuong, T. T. (2021). Can corporate social responsibility protect firm value during the COVID-19 pandemic? Evidence from Vietnam. *Journal of Cleaner Production*, 318, 128854. https://doi.org/10.1016/j.jclepro.2021.128854

Silverman, David, and Amir Marvasti. Doing Qualitative Research: A Comprehensive Guide. *Sage*, 2008.

Tang, Dragon Yongjun, and Yue Zhang. "Do Shareholders Benefit from Green Bonds?" *Journal of Corporate Finance*, vol. 61, 2020, art. no. 101427.

Uttamchandani, Mahesh, and Alessandro Carosi. "Green Bonds and the Green Bond Market: The State of the Art." *Journal of Business Ethics*, vol. 159, no. 3, 2019, pp. 871–889.

Van den Berghe, Lutgart, and Wouter Marneffe. "Green Bonds: The Ultimate Handbook." *Journal of Sustainable Finance and Investment*, vol. 8, no. 3, 2018, pp. 177-201.

Vulturius, Gregor, et al. "Sustainability-linked Bonds – Their Potential to Promote Issuers' Transition to Net-zero Emissions and Future Research Directions." Journal of Sustainable Finance & Investment, vol. 12, no. 4, 2022, pp. 310–332.

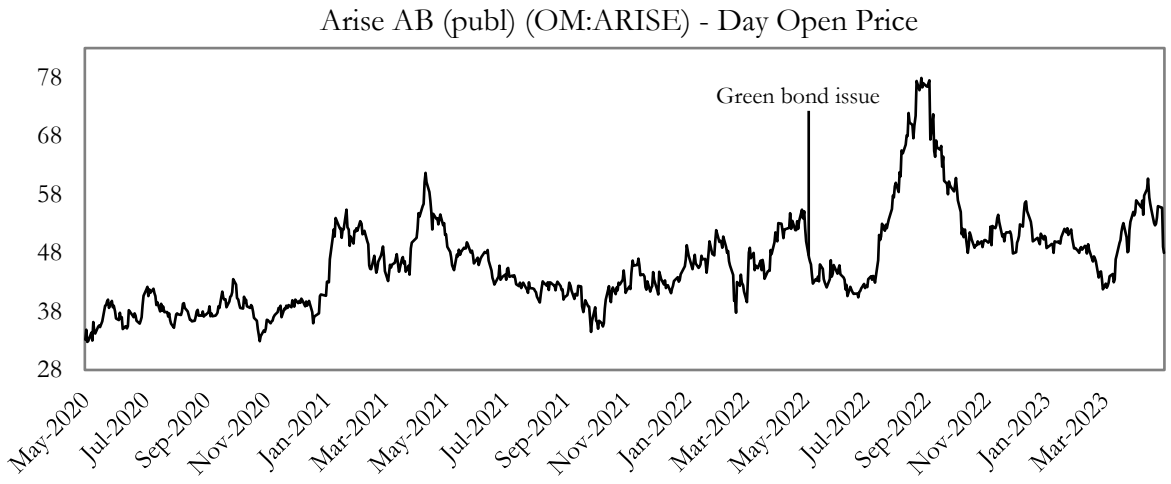
Williamson, Oliver E. The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting. The Free Press, 1985.

Zerbib, M. (2019). The effect of pro-environmental preferences on bond prices: Evidence from green bonds. Journal of Business Finance & Accounting, 46(7-8), 864-893.

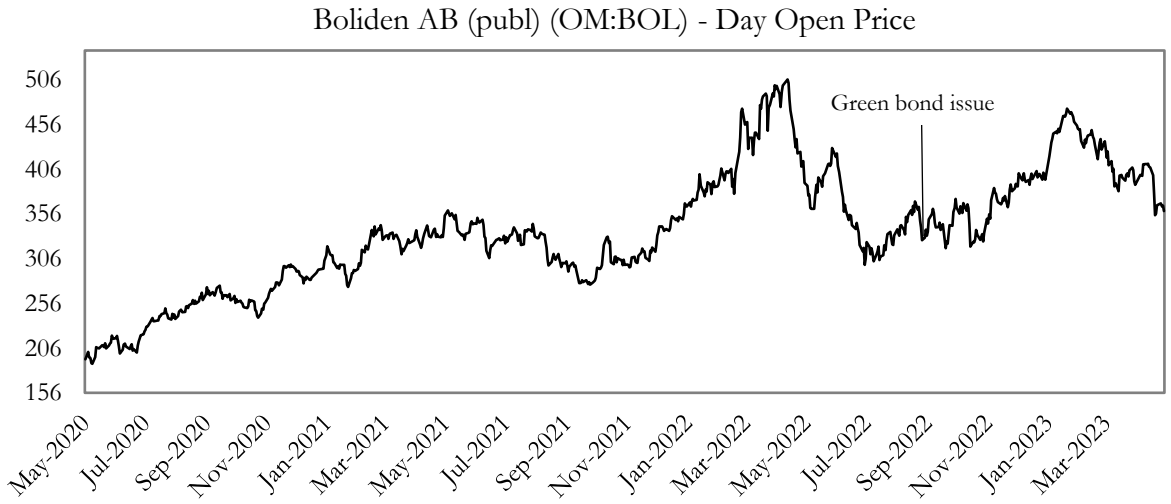
Zhou, X., & Cui, Y. (2019). Green bonds, corporate performance, and corporate social responsibility. Sustainability, 11(23), 6881.

Appendices

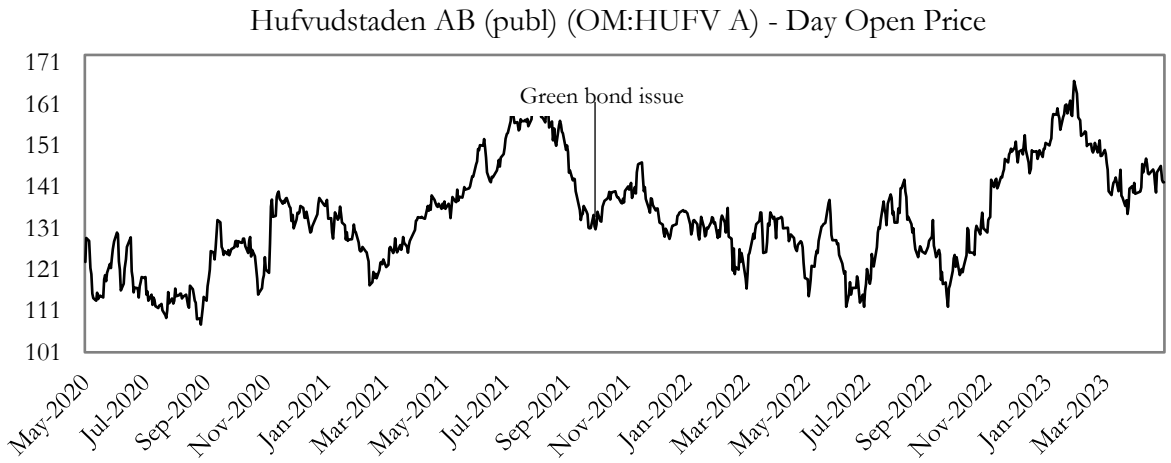
Appendix 1: Share price development of Arise AB ("Arise")



Appendix 2: Share price development of Boliden AB ("Boliden")

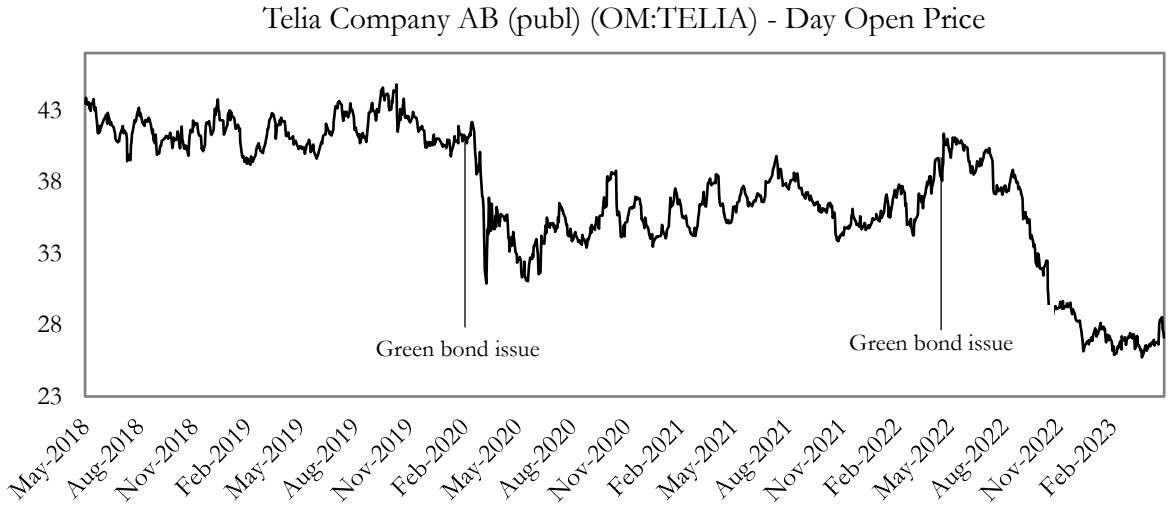


Appendix 3: Share price development of Hufvudstaden AB ("Hufvudstaden")



Appendix 4: Share price development of Telia Company AB ("Telia")

Note: Telias's share price development chart spans five years while Arise's, Boliden's, and Hufvudstaden's spans three years



Appendix 5: Recurring questions from interviews with respective answers
Note: These are not the only questions asked during the interviews.

When deciding on issuing a green bond, did you consider possible share price reactions or investor interest?

Markus Larsson Arise	Håkan Gabrielsson Boliden	Mats Nelson Telia	Åsa Roslund Hufvudstaden
The focus was more on the long-term sustainability strategy than the share prices. In the discussion, possible share price effects were not discussed	No, the green bond itself was not. However, our sustainability strategy is of high importance for our share price development	It was not directly a part of the decision, but potential indirect effects were discussed but not used for the decision	No, it was not part of the decision

Was the issuance of a green bond an attempt at reaching a larger shareholder universe?

Markus Larsson, Arise	Håkan Gabrielsson Boliden	Mats Nelson Telia	Åsa Roslund Hufvudstaden
Given the profile of the company, I believe that our investors are already interested in sustainability	No, since we are already profiled ourselves as a sustainable company, this was nothing that we considered	The issuance of a green bond was not an attempt to reach new equity investors	There are more investors on the "green side"; however, we do not have a hard time finding investors, and we do not have much outstanding debt

Was the issuance of a green bond part of a signaling process to the shareholders?			
Markus Larsson Arise	Håkan Gabrielsson Boliden	Mats Nelson Telia	Åsa Roslund Hufvudstaden
Saw an increased sustainability interest from the shareholder universe during the year and found that this could be a good way to clearly show their dedication since the demand from stakeholders is increasing all the time	Since we are already profiled ourselves as sustainable, this was not the primary concern	No, the focus was on our debt investors. When issuing the green bond, we also created a green bond framework that was presented to institutional investors in a roadshow. It is also a way to ensure that our investors fully understand the effort we put into our sustainability work. However, there are some positive signaling effects for our equity investors, but that was not our primary focus	It was one of the reasons for the decision; we want them to clearly know what our strategy is

What was difficult about issuing a green bond?			
Markus Larsson Arise	Håkan Gabrielsson Boliden	Mats Nelson Telia	Åsa Roslund Hufvudstaden
The third-party verification was challenging since we had yet to work with sustainability in such a structured approach prior to the issuance. We had all the information needed for the admin for the issuance but needed to locate it	Some admin work, writing some reports, external verification, and validation for our treasury functions. This leads to increased costs, but in relation to our company the costs are not high It is difficult in our industry to issue green bonds since mining itself usually does not fulfill the criteria. Cannot issue a green bond to finance an entire mining project but can get it for smaller investment (i.e., water treatment plant for the water in the mine). Also has the benefit that we have access to hydropower that many competitors do not (instead, they use coal), which makes it easier to issue a green bond	We do not mark our capex projects as green or non-green when creating them, which led to us needing to do quite a lot of manual work to find the suitable projects In addition, the bond demanded quite a lot of admin work, creating reports, etc., that we did not have developed routines for It is also difficult for us to find projects to use green bonds for since many of our projects create positive environmental effects in a "second effect" aspect that is difficult to track and quantify	The difficult part was creating the framework and getting a second opinion approval, the annual reports, etc., creating quite some "double working"

What other green measures has the company taken? I.e., implementing other green strategies in the company			
Markus Larsson Arise	Håkan Gabrielsson Boliden	Mats Nelson Telia	Åsa Roslund Hufvudstaden
The issuance of the green bond was due to the increased demand for sustainability focus from the investors. When issuing the green bond, we realized that we had other things that we needed to improve and have therefore done so	Has always worked closely with sustainability but four years ago, we did a lot of work implementing sustainability more into our overall strategy	We have done quite a lot of work with our overall strategy and put a lot of effort into our sustainability strategy. For instance, developed a green bond framework	Have implemented sustainability targets and created an overall strategy for the company; the sustainability work is going to be part of every part of the company

Why did you choose to issue a green bond?			
Markus Larsson Arise	Håkan Gabrielsson Boliden	Mats Nelson Telia	Åsa Roslund Hufvudstaden
It was never a discussion whether we would issue a green or "normal" bond. We always knew that the bond was going to be green; it was more of a discussion if issuing a bond was the right way to go	The green bond is part of a larger sustainability strategy. Also looked at sustainability-linked bonds, but it is difficult with the KPIs since our sustainability targets often have a longer horizon than the maturity of the loans. And it, therefore, demands some work to find the right KPIs and decide on the best shorter-term goals	Needed to issue a hybrid bond and had the possibility to make it a green hybrid bond. Have also done a lot of sustainability work, and issuing a green hybrid bond aligns with that strategy	