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Does the Market Emphasize Violation of Green Commitment?

A comparison of stock price response to negative ESG incidents between companies that have issued a green vs. conventional bond

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NORWEGIAN SCHOOL OF ECONOMICS

Preface

This thesis symbolizes the completion of the programme Master of Science (MSc) in Economics and Business Administration, with a major in Financial Economics, at the Norwegian School of Economics (NHH).

We chose the topic of green bonds due to the high relevance of corporate social responsibility (CSR). Green bonds have appeared to work as a tool in achieving a more sustainable business. We wanted to contribute to the research on green bonds by studying whether the market emphasizes violation of green commitment by examining the difference the stock price response to ESG incidents between green and conventional bond issuers.

It has been interesting and rewarding working on this thesis. We have gained a deep knowledge of our methodology and increased insight on the corporate green bond market.

We would like to use this opportunity to thank our supervisor, Roberto Ricco', for constructive feedback and helpful thoughts throughout the thesis. We would also like to extend our appreciations to our families and friends for showing interest in our thesis and showing support during this spring.

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Abstract

This thesis examines the difference in stock price response to ESG incidents between green and conventional bond issuers. By using exact and nearest-neighbor matching on a sample of 86 green bond issuers and 177 conventional bond issuers with issuance between 2013 and 2019, we obtain 24, 20 and 35 matches for the environmental, social, and governance dimension, respectively. Aligned with previous research, we conduct event studies for the three dimensions to examine the stock price response to ESG incidents. As a new contribution, we examine whether the stock price response differs between the bond issuers by conducting a difference-in-differences estimation.

The event study results indicate that the market responds differently for the three dimensions in the main event window [-4, 4]. We find a significantly positive stock price response when environmental incidents occur, while the opposite is the case for governance incidents. For social incidents, we find no indication of an abnormal stock price response.

In the DD estimation, we find no indication of a difference in stock price response to ESG incidents between green and conventional bond issuers. By examining the pre-trends, we observe that the parallel trend assumption does not hold to the extent needed to ensure validity. Hence, we cannot provide insight on whether the market emphasizes violation of green commitment.

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1. Introduction

People tend to forget that the Earth is a system where everything is connected. Due to this, the planet has suffered through many years already. We experience an increasing number of disasters, such as intense droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms, and declining biodiversity (United Nations, 2022). If this pattern continues, there will not be a planet to live on for future generations. However, an increasingly number of people have begun to realise this. Due to the many challenges of climate change, solutions protecting the environment have been developed. Among these are global frameworks and agreements like the Sustainable Development Goals, the UN Framework Convention on Climate Change, and the Paris Agreement.

The threat of climate change has led to the development of sustainable finance. One of the key instruments is the green bond, created for financing environmental-friendly projects. Green bonds are a recent development and have increased in popularity in recent years. Previous research has shown that green bonds play a role in companies' path to becoming more sustainable (Flammer, 2021; Glavas, 2018) and profitable (Flammer, 2021). The ability to attract investors is crucial for survival, and an increasing number of investors emphasize ESG and specifically how companies deal with ESG issues.

Environmental, social, and governance (ESG) issues can be translated into reputational and financial risk for companies. How companies respond to these issues is becoming as important as traditional financial targets when evaluating company performance and plays an important role in decision-making to identify long-term opportunities and risks for companies (Refinitiv Eikon, n.d.). Thus, managing ESG issues is directly linked to a company's operational performance and social reputation. This has led stakeholders to focus on the companies' environmental impact and has become an important reason why managers in companies have turned their attention toward their environmental impact. Jørgensen & Pedersen (2018) have stated that companies not considering the environmental impact of their business will not be able to remain profitable in the future. This has led to the need for integration of managing ESG issues into all aspects of companies. As a consequence of this, databases like RepRisk have emerged, aiming to shed light on material ESG risks and violations, providing an overview of ESG incidents in companies worldwide (Wrds, 2021). ESG incidents are referred to as incidents related to the environmental, social, or governance dimension that have led to media exposure.

Several studies are conducted regarding stock price response to ESG incidents (Krüger, 2015; Teng & Yang, 2021; Kim, 2020; Capelle-Blancard & Petit, 2017). To our knowledge, studies that compare stock price response between green and conventional bond issuers are not conducted. Thus, we aim at contributing to the research on green bonds by examining whether there is a difference in stock price response to ESG incidents between green and conventional bond issuers. The research question derives from the findings of Flammer (2021), who found that green bond issuance credibly signalizes commitment toward the environment. If this is the case, we expect a more pronounced negative response in the stock price when environmental incidents occur for green bond issuers compared to conventional bond issuers. For social and governance incidents, we do not expect a significant difference in the stock price due to green bond proceeds being aimed at combating environmental issues.

To examine the research question, we match green bond issuers with its nearest neighbor among the pool of conventional bonds based on country, sector, and year of first ESG incident reported, in addition to several company-specific characteristics. Further, we conduct an event study for each of the dimensions, examining how the market responds to ESG incidents. We use the average cumulative abnormal return (CAR) obtained in the event studies to answer whether there is a difference between green bond issuers and conventional bond issuers for the three dimensions.

The research question is interesting because it can reveal information on whether the market emphasizes violation of green commitment. Aligned with previous research, we expect a negative response in the stock price for both bond issuers when ESG incidents occur (Krüger, 2015; Teng & Yang, 2021; Kim, 2020; Capelle-Blancard & Petit, 2017), but as an additional contribution, we wish to examine if the response is more pronounced negative for environmental incidents for green bond issuers compared to conventional bond issuers.

In the continuing, we present relevant theory regarding corporate green bonds in section 2 and previous research in section 3 to build a foundation for our thesis. Our research question is further elaborated by developing hypotheses in section 4. Section 5 includes a data presentation, where we describe from where our data is retrieved and what data we have retrieved for the analyses. This section also includes summary statistics. The chosen methodology is presented in section 6, which includes a presentation of the matching methodology, the event study methodology including the parametric test and robustness

tests, the difference-in-differences methodology, and finally, the importance of the parallel trend assumption. In section 7, we present our results based on the chosen methodologies and discuss the results obtained. Section 8 presents limitations in our thesis that creates a foundation for further research. At the end, section 9 concludes our thesis and sums up the findings.

2. Corporate green bonds

Green bonds are financial instruments that is aimed at financing green projects and provide investors with regular or fixed income payments (The World Bank, 2022). For a project to be considered as green, it must provide environmental or climate-related benefits. The financing of these projects is the characteristic that differs green bonds from conventional bonds and other fixed income securities. In present time, green bonds are divided into four types: standard green use of proceeds bond, green revenue bond, green project bond, and green securities bond (GBP, 2021, p. 8).

The asset class operates with a green label, having an approach that includes more than only financial aspects. Unlike conventional bonds, profit maximization is not the purpose behind the issuance. The purpose of the issuance is to support projects that focus on minimizing the environmental footprint. The motive behind the issuance is thereby on the impact in lieu of on the financial gains related to the issuance.

The bond market plays along with other financial markets, which is important when it comes to combating climate change. Where people choose to invest their money is of great importance. If non-sustainable projects hold a lot of capital, the climate change situation will continue in the same negative direction. Making it beneficial to place capital in projects with a sustainable approach is thereby crucial.

In the following, the development of green bonds over time, across countries, and across sectors will be presented.

2.1 Corporate green bonds over time

Green bonds are a recent and fast-growing phenomenon within sustainable finance. The first green bond issuance was done by the European Investment Bank in 2007 (Schoenmaker & Schramade, 2019). The market started out with a moderate development due to the financial crisis in 2008 and the growth first started to escalate in 2014 (Climate Bonds Initiative, 2022).

Figure 1 illustrates the existing and expected green bond issuance amounts. The measurements are given in USD trillions and follow a positive trend.

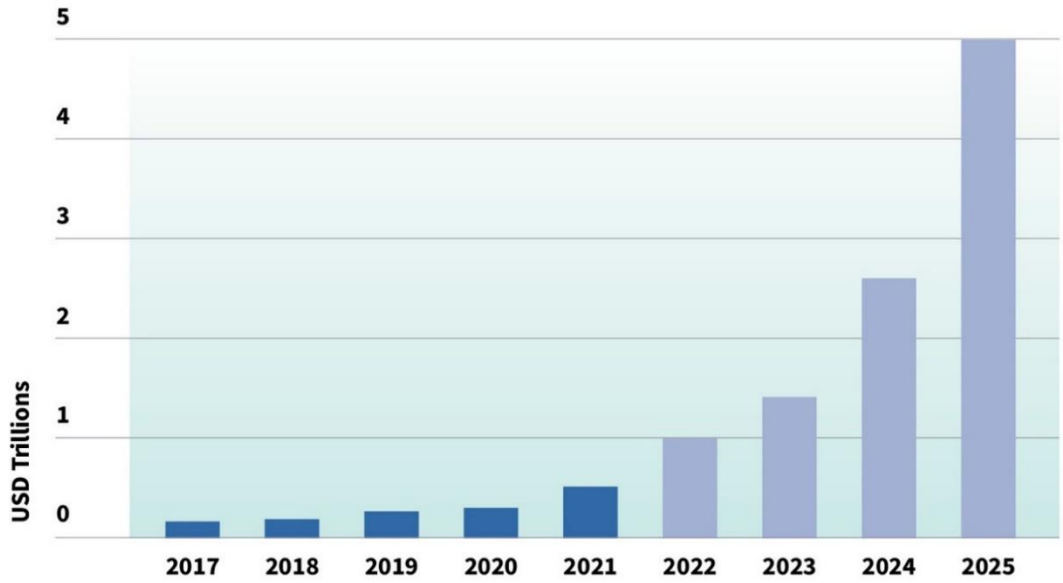

Figure 1. Green bond issuance over time (CBI, 2022, January 31)

The figure shows that the green bond market has grown rapidly during recent years, with an increase of more than 50% the last five years (Climate Bonds Initiative, 2022). In 2022, the market is expected to reach one trillion in issuance amount. This amount is expected to increase fivefold within 2025.

2.2 Corporate green bonds across countries

Some countries have larger financial markets than others. USA has in several decades been known as the largest, while the markets in China and Europe have expanded in more recent years. This development is also concerning the green bond market. Figure 2 shows the green bond issuance amount in the top twenty countries in 2021, given in USD billions.

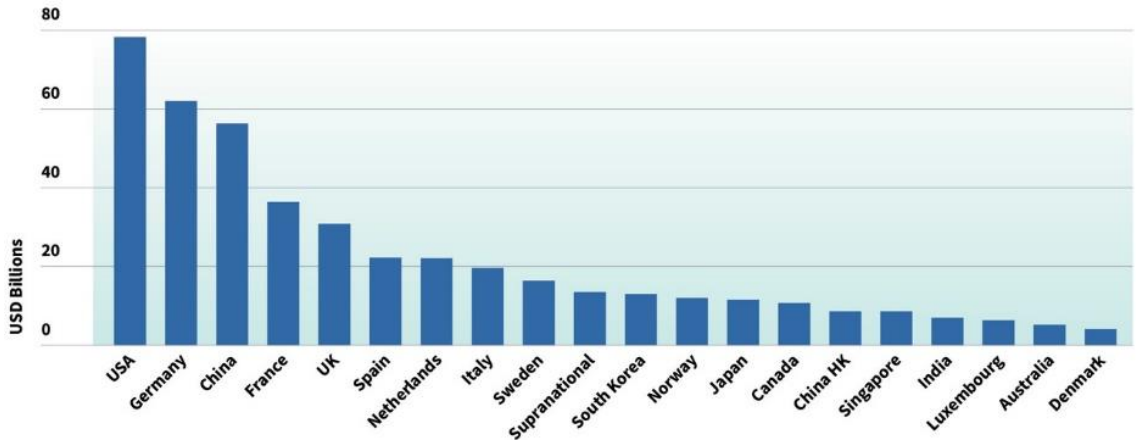

Figure 2. Top twenty countries of issuance in 2021 (CBI, 2022, January 31)

Compared to 2020, USA and Germany were still the largest issuing nations in 2021. In 2020, France was positioned as the third largest issuing nation, but in 2021 they were passed by China (Climate Bonds Initiative, 2022). The figure is aligned with Flammer (2021), claiming that green bond issuance is most common in USA, China, and Europe.

2.3 Corporate green bonds across sectors

The green bond market is more widespread in some sectors than others. According to Flammer (2021), green bond issuance is mainly done in sectors where the environment is financially material to the companies' operations. The energy and utility sector are among the ones highly represented. The energy sector is considered as the largest contributor to global greenhouse (GHG) emissions and are responsible for around 35% of total GHG emissions (Bocken et al., 2021). Replacing fossil fuels with renewable energy has become a common transformation towards a more sustainable business.

Finance and insurance are other sectors where green bond issuance is becoming increasingly common. The social and environmental footprint in the finance sector is related to investment and lending. The sector is highly linked to the increase in climate change as it is the provider of financial capital (Bocken et al., 2021). This has led to the development of sustainable finance, where green bonds are an instrument, as stakeholders have started to require a sustainable mindset.

3. Literature review

In this section, previous research that is relevant to the research question will be presented. This is necessary to create a foundation for the thesis. The literature review includes research on green bonds as a signaling tool, and stock price response to green bond issuance and ESG incidents.

3.1 Signaling of green commitment

As a foundation for the research question, we use the findings of Flammer (2021) that green bond issuance signal to the market that companies are committed to solving their environmental issues. She made this conclusion based on her findings that green bond issuance led to higher environmental score and reduced CO2 emissions.

The findings of Flammer (2021) are aligned with the signaling theory. Lyon & Maxwell (2011) find that investors often lack adequate information to be able to evaluate the company's environmental commitment. As a result of this, investors have a need to distinguish between those companies that credibly are committed to solving their environmental issues, and those that are not. A green bond issuance could therefore signal to the market that the company is committing to doing their part of the job. Green bond issuance may work as a credible signal because by issuing a green bond, the company commits a substantial amount of money meant for green projects. Further, green bond issuance requires a transparent reporting on how the proceeds are used and the development of the environmental issue. This leads to some companies wanting a third-party verification that can certify that the proceeds from the green bond are used for the intended purposes.

When conducting a study for the Chinese market, Zhang et al. (2021) found that green bond issuance contributes to lower information asymmetry between the company and the market. Lower information asymmetry implies that companies are more transparent in informing about their everyday operations, which is aligned with the signaling theory. Companies that have made a commitment toward the environment would likely desire to be more transparent to show the market that they are dedicated. However, a study conducted by Hummel et al. (2019) finds that companies with more upfront CSR information suffer from stronger negative response in the stock price after the occurrence of a negative CSR event. This is

aligned with the signaling theory in the way that the market can make more rational investment choices for higher level of disclosure.

Lyon & Maxwell (2011) argues that although many companies are reporting their environmental performance, some companies are hesitant to report on their environmental performance because activists stamp their contribution as “greenwash”. They further argue that activists react more angrily to companies that claim to be more environmentally friendly than those that do not communicate this, therefore wanting to punish them by embarrassing them in the media, or by encouraging consumers to boycott them. According to Flammer (2021), the background for the greenwashing concern is due to the lack of public governance. Green bonds are instead governed by private institutions, like Climate Bonds Initiative. These institutions do not have the same enforcement mechanisms as public institutions.

On the other side, there are companies that may engage in intentional greenwashing, wanting to paint a better picture of the company's impact. Flammer (2021) mentions that green bond issuance may be used as a tool for greenwashing, in the same way as companies may use selective disclosure, dubious eco-labels, misleading visual imagery, and misleading communication. However, she argues that issuing green bonds are costly for companies, therefore not representing a suitable greenwashing strategy. Some sceptics are questioning the value of green bonds and whether they *actually* make a difference for the environment. Flammer (2021) concludes that environmental performance increases after issuance, being inconsistent with the greenwashing argument. If companies issued green bonds to use it as a tool in greenwashing, their environmental score would likely not have increased after issuance.

3.2 Stock price response

Several studies on the stock price response to green bond issuance and CSR events has been conducted over the years. Flammer (2021) finds that the stock market responds positively to the announcement of a green bond issuance. Her findings are supported by the findings of Glavas (2018), concluding the same using a similar sample and time frame. This signals that the market perceives green bond issuance as a positive action, aligned with the belief of growing importance tied to CSR nowadays.

Gibson et al. (2017) provide evidence on the relationship between stock price and sustainability score. Their findings are aligned with the view that growth of sustainable investing increases the stock price for high sustainability companies. Their view is aligned with the findings of Flammer (2021).

Krüger (2015), Teng & Yang (2021), Kim (2020), Capelle-Blancard & Petit (2017) examines the relationship between stock price and CSR events. Krüger (2015) finds that investors respond strongly negative to negative events and weakly negative to positive events, and that this response is particularly pronounced for information regarding communities and the environment. He finds a median cost of negative CSR equal to $76 million. This is aligned with the view that there is a substantial cost associated with social irresponsibility. However, negative shareholder wealth effects regarding negative events provide no insights into the costs associated with implementing policies aimed at reducing the likelihood of negative events. Like Krüger (2015), Teng & Yang (2021) finds a negative CAR when negative CSR events occur, also more pronounced for incidents related to the environment, but also for safety issues and illegal violations.

Kim (2020) provides a similar insight, finding that investors respond short-term negative to negative CSR events. Capelle-Blancard & Petit (2017) supports these findings, who also find a negative response in stock price when negative events occur, representing an average loss of 0.1% in market value. Navarra (2021) finds a reduction in stock price of 1.47% on the day after the incident and 3.21% over the week after. This shows that stock price reductions are consistent with reputation losses after negative CSR events.

However, Kim (2020) finds that the negative effect is more substantial for companies with greater negative media tone and greater surprise. It may be the case that investors are more sensitive to the news of the companies with greater surprise. In addition, she finds that the negative effect of negative CSR events is smaller for companies with a positive CSR reputation, meaning that a negative CSR event is of less importance if the company performs well on CSR in general.

Engelberg & Parsons (2011), Hillert et al. (2015), and Capelle-Blancard & Petit (2017) show that media coverage affects how investors collect and process information. Therefore, media plays a crucial role as an information provider between the market and the companies. Highly visible, large companies tend to draw more media attention than small, neglected

companies. Fang & Peress (2011) find that stocks with no media coverage earn higher returns than stocks with high media coverage after controlling for well-known risk factors.

Klassen & McLaughlin (1996) provide further insights on the relationship between environmental performance and stock price response, where strong environmental performance is indicated by environmental performance awards and weak environmental performance is indicated by environmental crises. They found a significant positive response in the stock price for companies with strong environmental performance, and opposite for companies with weak environmental performance. An older study conducted by Flammer (2013) supports these findings, where she studies the announcement of corporate news related to the environment for US public companies. Her findings indicates that companies that reported to behave environmentally friendly experienced a significant increase in their stock price, whereas companies that reported to behave environmentally harmful experienced a significant decrease. The background for this is the view that CSR related to the environment creates a competitive advantage for companies. Flammer further finds that environmental CSR is an advantage with decreasing marginal returns, implying that the positive (negative) stock market reaction to environmentally friendly (harmful) incidents is smaller for companies that have higher levels of environmental CSR, which is aligned with Kim (2020).

3.3 Our contribution

The literature review highlights previous research regarding green bonds and stock price response to ESG (or CSR) incidents and provides a foundation for our research question. The previous research is consistent regarding how the market responds to ESG (or CSR) incidents. Aligned with previous research, we expect a negative response in the stock price when ESG incidents occur.

We contribute to the research on green bonds by examining the difference in stock price response to ESG incidents between green and conventional bond issuers. As far as we are concerned, studies comparing green and conventional bond issuers has not been conducted. This research question is interesting because it reveals how the market perceives a green bond issuance. If the market perceives green bond issuance as green commitment, we expect that there will be a more pronounced negative response in the stock price when environmental incidents occur for green bond issuers compared to conventional bond issuers.

The rationale behind this is the fact that environmental incidents should signal violation of green commitment. This is aligned with the belief of growing importance of CSR nowadays.

There are rationales for a lack of a more pronounced negative response for green bond issuers. According to Flammer (2021), it may be the case that the market does not perceive green bond issuance as green commitment due to suspicion of greenwashing. In that case, green bond issuers will be on equal footing with conventional bond issuers, leading to no more pronounced response in the stock price for green bond issuers. Flammer (2021) further finds that environmental performance has increased after issuance of a green bond. If we assume that Kim's (2020) finding on the relationship between stock price response and CSR performance is aligned with reality, this can be a possible explanation to the eventual lack of a more pronounced negative response for green bond issuers.

We assume that the efficient market hypothesis holds at least a semi-strong level, meaning that all historic and public information should be reflected in the stock prices. This will be violated if investors are not informed about the green bond issuance. If this is the case, there is no reason for why they should respond differently to green bond issuers compared to conventional bond issuers.

4. Hypotheses

This section presents the main hypothesis and a sub-hypothesis that is developed to answer our research question, both consisting of the null hypothesis and the corresponding alternative hypothesis. We have based our hypotheses on findings in previous research, which will be elaborated in the following.

4.1 Main hypothesis

We have developed our main hypothesis based on the findings of Flammer (2021), who found that green bond issuance credibly signals companies' commitment toward the environment. If this is the case, we find it reasonable to expect that the stock price response to environmental incidents is more pronounced negative for green bond issuers compared to conventional bond issuers. Consequently, we do not find it reasonable to expect a more pronounced negative response to social and governance incidents due to green bond proceeds being aimed at reducing environmental issues.

(i) H_0: There is no difference in stock price response to ESG incidents between green and conventional bond issuers

(ii) H_1: There is a more pronounced negative stock price response to *environmental* incidents for green bond issuers compared to conventional bond issuers

The rationale for the main hypothesis is the belief that the market emphasizes green commitment, and in that way, responds more negatively when an environmental incident occurs for green bond issuers. Green bond issuers are expected to have committed to the environment and is thus "punished" harder than conventional bond issuers. If green bond issuance is an instrument in committing to solving environmental issues as Flammer (2021) suggests, our main hypothesis should be reasonable. To test the main hypothesis, we conduct an DD estimation for each of the three dimensions to compare the stock price responses. If the response is only significantly negative for the environmental dimension, there is reason to believe that the market emphasizes violation of green commitment.

4.2 Sub-hypothesis

Due to the necessity of conducting an event study to obtain the CARs applied in the DD estimations, we developed a sub-hypothesis. Previous research conducted on stock price response to ESG incidents is consistent and shows a negative response regardless of dimension. We expect the same results in our analyses.

(i) H_0: There is no abnormal stock price response to ESG incidents for green and conventional bond issuers

(ii) H_1: There is a significantly negative abnormal stock price response to ESG incidents for green and conventional bond issuers

The sub-hypothesis is aligned with the belief of increasingly engagement regarding CSR, reflected by the market responding negatively to ESG incidents.

5. Data collection and sample construction

In this section, we will present the data used in the analyses and specifically from which sources they are obtained from, how the final sample is constructed, the selected matching criteria, and finally, summary statistics that sheds light on the diversity in the samples obtained.

5.1 Data sources

We obtained company data consisting of bond data, stock and market returns, and data on company characteristics from Refinitiv Eikon, and data on ESG incidents from RepRisk. In the following, these sources will be presented.

5.1.1 Company data

The data on bond issuers, stock and market returns, and company characteristics are obtained from Refinitiv Eikon, which is an open-technology solution for financial markets professionals, providing access to industry-leading data, insights, and exclusive and trusted news. We consider this a reliable database because it is of the world's largest providers of financial markets data and infrastructure (Refinitiv, n.d.). The green bonds in Refinitiv Eikon's fixed income database are based on the voluntary Green Bond Principles, implying that the bonds are not necessarily certified by a third-party verifier. However, the bonds should still be aligned with the four core components of the Green Bond Principles, which are guidelines for the use of proceeds, process for project evaluation and selection, management of proceeds, and reporting (GBP, 2021, p. 4).

5.1.2 ESG incidents

The data on ESG incidents are obtained from RepRisk, which provides transparency on business conduct risks to help drive responsible behavior of companies, thus creating positive change (RepRisk, n.d.). The research scope comprises 28 ESG issues, and every incident is related to at least one of these issues. The database consists of environmental issues like GHG emissions and waste issues, social issues like child labor and human rights abuses, and governance issues like corruption and tax evasion (Wrds, 2021). Leading organizations around the world rely on RepRisk as their solution to prevent and mitigate

ESG risks related to their operations, business relationships, and investments (Wrds, 2021). Due to this, we consider RepRisk a reliable provider of ESG incidents data.

The database from RepRisk is called News Data and contains the announcement date of the ESG incidents as well as the issues related to the incidents, the severity, novelty, and source reach of the incidents. Each announcement date represents one or more incidents related to either the environmental, social, or governance dimension, or several of them. These incidents can stem from print media, online media, social media, government bodies, regulators, and newsletters, and ranges from the international to the regional, national, and local level (Wrds, 2021). The database we have access to contains only data on public companies, thus not delivering any incidents for eventual private companies obtained by accident from Refinitiv Eikon. However, due to our aim of comparing stock price responses, we are comfortable by only having access to data on public companies.

5.2 Sample construction

We retrieved all green bonds issued between 01.01.2013 and 31.12.2019 which were labelled “Green Bond”. More specifically, we retrieved all bonds that had the label “Green Bond" equal to “Yes”. Further, we retrieved only public companies by filtering “Exchange Listed” equal to “Yes”. This resulted in a total number of 979 green bonds, issued by 508 unique issuers. When compiling the conventional bonds, we retrieved a sample of bonds between 01.01.2013 and 31.12.2019 which had the label “Green Bond” equal to “No” and “Exchange Listed” equal to “Yes”. In this way, we ensured that the bonds were not a green bond, which would in this case have invalidated our results. We retrieved in total 5,000 conventional bonds, issued by 1,617 unique issuers. For both bond issuers, we obtained the issue date in addition to the country and sector in which the companies operate.

In the obtained sample, there were companies that had issued both a green bond and a non-green bond in the same period. Due to this, we removed these companies from the conventional bond sample. This ensured that the companies in the conventional bond sample had not received the treatment, which in this case is green bond issuance. In addition, we chose the date of the first green bond the company had issued during the selected period. This implies that if a company has issued several green bonds in this period, we select the first as our basis. In this way, we ensure that the companies had not received the treatment

prior in time. In the analyses, we analyse the *first* incident related to environmental, social, and governance dimension after *first* issuance of a (green) bond.

After obtaining the data on bond issuers, we continued by obtaining the stock and market returns between 01.01.2012 and 31.12.2020. Stock returns are naturally company-specific, while we chose to apply country-specific market returns. In this way, we ensured that the market index reflected the economic situation in the specific country. Lastly, we retrieved the announcement date of the ESG incidents in addition to their related issues between 01.01.2012 and 31.12.2020. To our disadvantage, a substantial proportion of the sample had no ESG incidents reported, implying that our sample were minimised.

The final sample consists of 86 green bond issuers and 177 conventional bond issuers. This is relatively low compared to how many companies we originally retrieved. However, due to poor coverage of public companies in the RepRisk database, we ended up with this sample size.

5.3 Matching criteria

Choosing appropriate matching characteristics is crucial to avoid the problem of endogeneity in the analyses. We decided to apply the same company characteristics as Flammer (2021), which will be explained in the following.

Starting with the exact matching, we require that the companies operate in the same country as well as the same sector. In addition, the matches must have its first ESG incident in the same year. In this way, we ensure that the companies face similar economic conditions when the ESG incident occurs. The companies are classified by NAICS sector codes. We chose to match on sector in lieu of industry with the aim of achieving more matches. It will, however, be less precise since industry contains sub-categories of sectors.

Moving on to the characteristics applied in the nearest-neighbor matching, we apply seven company-specific characteristics. First, we match on *company size*. As an indicator of company size, we use the natural logarithm of the book value of total assets in US dollars. By converting total assets to US dollars, we ensure that we can compare the size between the companies regardless of reporting currency, and in this way obtain a small difference in company size between the matches.

Secondly, we match on *return on assets (ROA)*, which is the ratio of income after tax to the average book value of total assets. Thirdly, we match on *Tobin's Q*, which is the ratio of the market value of total assets to the book value of total assets. The market value is given as the market capitalization plus total debt minus total cash plus minority interests. Matching on both ROA and Tobin's Q ensures that there is small difference in profitability and growth opportunities between green and conventional bond issuers.

Fourthly, we match on *leverage ratio*, which is the ratio of total liabilities to the book value of total assets. This ensures that there is small difference in access to capital markets between green and conventional bond issuers.

Lastly, we include the companies' *environmental*, *social*, and *governance score*. In this way, we ensure that the companies' ESG performance is similar when the incidents occur. The ESG scores are measured on a scale between 0 and 100, where 100 is the best possible score. The scores are based on the performance of 10 categories within those three pillars. The environmental score is composed of the score on resource use, emissions, and innovation, the social score is composed of the score on workforce, human rights, community, and product responsibility, and the governance score is composed of the score on management, shareholders, and CSR strategy (Refinitiv, 2021).

In the matching, a total of 10 matching characteristics are applied. Our sample is fairly small compared to what would have been optimal for an empirical analysis, which will imply that there is less probability that we can draw inference from our analyses. In addition, several issues may arise. Firstly, there could be a problem that some variables that affect the stock price response are not accounted for in the matching, introducing an endogeneity problem. Secondly, the risk of not achieving fully comparable matches is present. It is a problem that some of the characteristics are missing for some of the companies, and therefore it is not possible to match companies based on these characteristics. This will result in less accurate matches, which will have implications for our results. However, an exact matching on all the applied characteristics will in most cases not be achievable without having to exclude most of the observations.

As mentioned above, we require our matches to operate in the same country, sector, and to have the first ESG incident in the same year. Exact matching on these variables will limit our matching samples to a great extent in the first place. Using the Mahalanobis distance will

ensure that we match the companies that have the closest value on all company characteristics. However, there is no guarantee that these values are highly similar given our small sample.

5.4 Summary statistics

In the following, summary statistics at the company level will be presented across countries and sectors in addition to the average number of ESG incidents across bond types. The data on both the full sample and the matching samples used in the analyses will be presented for comparison.

Table 1. Company characteristics across countries.

Notes: This table presents company characteristics across countries. The variables constitute the average for each country. *Company size in $B* is the total assets given in US billion dollars, *Return on assets* is the return on assets, *Tobin´s Q* is the ratio of book and market value, *Leverage ratio* is the leverage ratio, *E-score* is the environmental score, *S-score* is the social score, and *G-score* is the governance score.

Full sample

Country	Company size in $B	Return on assets	Tobin's Q	Leverage ratio	E-score	S-score	G-score
Australia	314.38	0.02	0.45	0.86	75.83	78.93	83.20
Austria	122.31	0.02	0.33	0.84	74.45	61.61	47.10
Belgium	157.27	0.01	0.26	0.81	71.33	63.58	58.20
Brazil	57.63	0.04	0.89	0.62	80.81	83.57	72.38
Canada	675.61	0.01	0.22	0.94	87.47	82.96	57.56
Chile	51.35	0.01	0.32	0.92	43.26	49.37	36.18
China	500.54	0.03	0.43	0.82	39.85	38.51	57.13
Denmark	142.24	0.01	0.46	0.87	54.62	48.68	54.31
Finland	196.78	0.02	0.62	0.75	76.26	60.65	56.23
France	425.48	0.02	0.53	0.75	82.36	76.23	63.24
Germany	447.28	0.03	0.72	0.78	78.43	81.03	73.08
Hong Kong	25.55	0.05	0.62	0.64	45.05	42.51	49.95
India	50.32	0.02	0.43	0.85	44.48	55.42	44.31
Italy	156.64	0.02	0.54	0.82	75.80	69.52	53.03
Japan	1 167.03	0.01	0.26	0.91	67.55	48.39	75.97
Luxembourg	7.77	0.05	1.26	0.67	42.55	68.94	62.94
Netherlands	283.30	0.02	0.49	0.89	79.04	73.60	69.61
New Zealand	6.20	0.03	1.01	0.42	42.30	46.09	52.64
Norway	118.84	0.03	0.69	0.76	82.60	74.07	53.58
Philippines	32.12	0.01	0.10	0.89	45.50	57.94	59.83
Portugal	72.57	0.02	0.42	0.87	77.12	85.65	62.45
Singapore	311.75	0.01	0.08	0.91	57.27	60.47	67.78
South Africa	79.41	0.01	0.12	0.92	81.94	81.84	52.25
South Korea	90.25	0.04	0.54	0.71	59.60	60.30	63.49

Spain	544.18	0.01	0.14	0.92	85.64	80.15	70.95
Sweden	162.32	0.03	0.82	0.80	80.47	75.64	60.50
Switzerland	209.56	0.02	0.31	0.82	57.42	52.81	63.23
Taiwan	21.10	0.02	0.52	0.75	57.94	61.96	58.02
Thailand	6.13	0.04	1.43	0.96	56.88	68.79	55.89
United Arab Emirates	140.50	0.01	0.14	0.88	47.71	58.26	48.65
United Kingdom	695.87	0.01	0.31	0.85	74.85	72.22	72.92
United States	373.68	0.06	1.46	0.74	59.55	64.13	63.02

Environmental sample

Country	Company size in $B	Return on assets	Tobin's Q	Leverage ratio	E-score	S-score	G-score
Brazil	57.63	0.04	0.89	0.62	80.81	83.57	72.38
Canada	834.33	0.01	0.24	0.94	88.94	89.78	61.71
China	20.91	0.03	0.79	0.71	17.96	15.56	27.50
Denmark	324.69	0.00	0.43	0.95	66.01	53.41	62.97
Finland	384.71	0.02	0.43	0.83	72.61	47.25	50.06
France	152.2	0.02	0.59	0.74	75.26	72.79	54.37
India	59.36	0.01	0.28	0.93	55.51	61.61	41.12
Italy	7.21	0.02	0.69	0.70	81.29	67.81	52.17
Japan	1 243.22	0.01	0.16	0.91	66.00	47.19	78.38
Netherlands	830.37	0.00	0.07	0.94	80.32	74.91	70.84
Philippines	42.36	0.01	0.10	0.89	45.50	57.94	59.83
Singapore	311.75	0.01	0.08	0.91	57.27	60.47	67.78
South Korea	17.96	0.06	0.94	0.38	65.74	66.94	57.22
United Kingdom	818.75	0.01	0.36	0.82	72.92	69.04	75.94
United States	388.60	0.08	1.77	0.71	71.14	74.74	71.61

Social sample

Country	Company size in $B	Return on assets	Tobin's Q	Leverage ratio	E-score	S-score	G-score
Brazil	57.63	0.04	0.89	0.62	80.81	83.57	72.38
Canada	834.33	0.01	0.24	0.94	88.94	89.78	61.71
China	115.25	0.02	0.37	0.84	25.52	22.00	52.86
Finland	8.84	0.02	0.81	0.67	81.73	80.76	65.50
France	152.2	0.02	0.59	0.74	75.26	72.79	54.37
Germany	26.95	0.04	1.52	0.59	73.82	87.48	81.76
Japan	1 243.22	0.01	0.16	0.91	66.00	47.19	78.38
Singapore	311.75	0.01	0.08	0.91	57.27	60.47	67.78
South Korea	17.96	0.06	0.94	0.38	65.74	66.94	57.22
Spain	442.84	0.01	0.14	0.90	86.15	86.64	65.09
Taiwan	12.25	0.02	0.60	0.70	58.03	62.70	57.23
United Kingdom	789.14	0.00	0.26	0.89	62.32	70.51	70.03
United States	467.29	0.09	1.95	0.74	73.34	77.65	76.48

Governance sample

Country	Company size in $B	Return on assets	Tobin's Q	Leverage ratio	E-score	S-score	G-score
Australia	361.63	0.01	0.31	0.89	71.15	77.56	82.56
Brazil	57.63	0.04	0.89	0.62	80.81	83.57	72.38
Canada	834.33	0.01	0.24	0.94	88.94	89.78	61.71
China	696.40	0.01	0.25	0.89	37.68	40.9	54.88
Denmark	324.69	0.00	0.43	0.95	66.01	53.41	62.97
Finland	384.71	0.02	0.43	0.83	72.61	47.25	50.06
France	152.2	0.02	0.59	0.74	75.26	72.79	54.37
Germany	18.45	0.04	1.28	0.61	74.24	81.98	72.83
India	63.98	0.01	0.44	0.90	43.84	54.36	53.29
Italy	404.40	0.00	0.13	0.94	69.79	64.69	48.88
Japan	1 243.22	0.01	0.16	0.91	66.00	47.19	78.38
Netherlands	428.62	0.01	0.60	0.81	79.17	76.38	76.24
Philippines	42.36	0.01	0.10	0.89	45.50	57.94	59.83
Singapore	311.75	0.01	0.08	0.91	57.27	60.47	67.78
South Africa	82.64	0.01	0.14	0.92	77.43	85.74	52.12
South Korea	17.96	0.06	0.94	0.38	65.74	66.94	57.22
Spain	850.01	0.00	0.18	0.94	87.14	76.62	87.33
Sweden	30.90	0.05	0.95	0.71	87.40	86.82	60.37
United Arab Emirates	135.90	0.02	0.06	0.88	51.81	56.62	45.95
United Kingdom	954.90	0.01	0.31	0.83	77.89	70.28	78.15
United States	475.06	0.06	1.34	0.73	67.29	71.97	69.74

All samples contain both developed and developing countries. China, Europe, and the US are highly represented, which are considered as the largest green bond markets in present time according to Flammer (2021). The countries included in the sample differ substantially when it comes to company size. South Korea is included in all samples and is among the countries of small size. The situation is the opposite for Japan, which differs from the remaining countries due to its large size. One remarkable characteristic is that Chinese issuers have substantially smaller ESG scores. It may be reasonable that this is a result of poorer ESG disclosure compared to other issuers in other countries.

Table 2. Company characteristics across sectors.

Notes: This table presents company characteristics across sectors. The variables constitute the average for each sector. *Company size in $B* is the total assets given in US billion dollars, *Return on assets* is the return on assets, *Tobin´s Q* is the ratio of book and market value, *Leverage ratio* is the leverage ratio, *E-score* is the environmental score, *S-score* is the social score, and *G-score* is the governance score.

Full sample

Sector	Company size in $B	Return on assets	Tobin's Q	Leverage ratio	E-score	S-score	G-score
Mining, quarrying, oil & gas extraction	93.90	0.03	0.76	0.68	61.50	48.67	66.07
Utility	42.92	0.03	0.77	0.69	65.90	59.23	54.39
Construction	51.82	0.03	0.53	0.77	51.67	43.65	71.46
Manufacturing	46.07	0.06	1.12	0.66	65.55	68.21	65.08
Wholesale trade	8.13	0.04	0.65	0.60	53.83	55.93	72.30
Retail trade	25.90	0.04	1.42	0.75	66.86	80.01	59.82
Transportation & warehousing	9.98	0.03	0.73	0.86	64.00	66.33	52.35
Finance & insurance	554.70	0.01	0.22	0.91	67.77	65.26	62.59
Real estate, rental & leasing	30.59	0.04	0.68	0.65	72.54	72.16	61.69
Professional, scientific, and technical services	5.41	0.07	1.76	0.65	38.49	57.02	47.29
Art, entertainment & recreation	17.61	0.04	4.10	0.78	5.94	22.82	24.34
Accommodation & food services	8.57	0.05	1.32	0.62	70.31	76.39	70.93

Environmental sample

Sector	Company size in $B	Return on assets	Tobin's Q	Leverage ratio	E-score	S-score	G-score
Utility	86.67	0.02	0.67	0.70	62.73	57.38	45.85
Manufacturing	80.03	0.07	1.52	0.63	70.93	74.33	69.28
Finance & insurance	793.92	0.01	0.19	0.92	69.71	63.20	68.21

Social sample

Sector	Company size in $B	Return on assets	Tobin's Q	Leverage ratio	E-score	S-score	G-score
Utility	261.49	0.00	0.35	0.80	78.24	72.24	50.00
Manufacturing	58.42	0.06	1.42	0.64	70.24	75.00	69.26
Transportation	7.57	0.01	0.69	0.73	61.77	64.43	47.18
Finance & insurance	857.46	0.01	0.18	0.91	68.92	65.14	70.76

Governance sample

Sector	Company size in $B	Return on assets	Tobin's Q	Leverage ratio	E-score	S-score	G-score
Utility	161.35	0.01	0.60	0.69	70.34	67.21	49.48
Manufacturing	64.64	0.05	1.23	0.63	73.83	76.61	69.29
Finance & insurance	635.51	0.01	0.21	0.91	64.84	62.04	64.40

All three matching samples contain companies within utility, manufacturing, and finance and insurance. According to previous research, green and conventional bond issuance is most widespread in these sectors. Among these, finance and insurance have a substantially larger company size. When it comes to Tobin's Q, manufacturing differs from the others as these issuers have higher market value than book value. This sector also contains the highest ESG scores in all matching samples. This may indicate that the issuers within this sector perform better and disclose more on sustainability than their competitors.

Table 3. Number of incidents across bond types

Notes: This table compares the average number of incidents across the bond types. This requires that the incidents occurred after issuance of a green or conventional bond.

Environmental sample

Bond type	N
Conventional	82
Green	32

Social sample

Bond type	N
Conventional	34
Green	35

Governance sample

Bond type	N
Conventional	29
Green	58

The difference in number of incidents between green and conventional bond issuers is not consistent for the three dimensions. Conventional bond issuers are more often linked to environmental incidents than green bond issuers. This can be aligned with the findings of Flammer (2021), stating that green bond issuance seems to result in higher environmental performance. Further, the issuers are equally linked to incidents for the social dimension. For the governance dimension, the number is substantially higher for green bond issuers. This strengthens the assumption that green bond issuance work as a tool in reducing environmental impact, not social or governance impact.

6. Methodology

This section presents the methodologies applied. Choosing a suitable methodology is crucial to be able to examine the difference in stock price response to ESG incidents between green and conventional bond issuers. In the following, we present the matching methodology, the event study methodology including the parametric and robustness tests applied, the difference-in-differences methodology, and finally, the parallel trend assumption, which is an important assumption for difference-in-differences.

6.1 Matching

To examine the difference in stock price response to ESG incidents between green and conventional bond issuers, we need to ensure that the companies follow similar trends prior to the incidents. Only in this way are we able to compare the effect of the incidents on the stock price response in a valid way. Similarity between green and conventional bond issuers is also necessary to ensure that unobserved factors do not affect the effect in question. Since random sampling is not a suitable option in our analyses, we will compare green bond issuers with eligible conventional bond issuers.

Peer-to-peer comparison between the bond issuers is required and will be ensured through exact and nearest-neighbor matching. Nearest-neighbor matching implies running through the list of treated observations and select the closest eligible control observation to be paired with each treated observation (Greifer, 2022). The matching will be one to one as one green bond issuer will be matched with one conventional bond issuer. Each conventional bond issuer can only be matched once as the matching will be conducted without replacement.

The matching requires a distance measure to define which control observation is closest to each treated observation. We apply the same distance as Flammer (2021), which is the Mahalanobis distance. The Mahalanobis distance is applied to determine whether a sample is an outlier, whether a process is in a control or whether a sample is a member of a group or not (Brereton, 2015). Low Mahalanobis distance implies that the matches are similar at the chosen characteristics. This will increase the probability of parallel pre-trends between the bond issuers, a crucial assumption for a valid difference-in-differences estimation.

6.2 Event study

The event study methodology will be applied to measure the stock price response around the announcement of the first incident related to environmental, social, and governance dimension occurring after (green) bond issuance. The variable of interest is the abnormal change in stock price related to the period around the incidents, also known as the abnormal return (AR). Connecting this return to an event window will give the cumulative abnormal return (CAR) for the specific time window, which will constitute the outcome variable needed for the main analyses.

Choosing the right event window is crucial to capture the stock price response to the incidents. If applying a too broad window, we could risk the fact that other events could affect the stock price response around the announcement date, or that an immediate response is not captured. On the other hand, if applying a too small window, we could risk not capturing the response that may be present due to the incidents in the time prior to or after the incident.

In this thesis, we have chosen to include one short-term event window and two long-term event windows around the incidents. The announcement date constitutes day 0. The main event window is set to be [-4, 4] because there is reason to believe that the response to the incidents is quite sudden due to the incidents being exposed in the media, which is a highly available source to the investors. However, we still account for the possibility that some information regarding the incidents can be leaked to the market prior to the announcement date, in addition to accounting for the possibility of a lagged response after the announcement date. We also apply the event windows [-10, 10] and [-20, 20] to capture eventual early or lagged responses related to the incidents.

The actual daily returns are retrieved from Refinitiv Eikon. However, the returns can be calculated as

$$\textbf{(1)}\ R_{i,t} = \frac{Closing\ price_{i,t} - Closing\ price_{i,t-1}}{Closing\ price_{i,t-1}}$$

Equation 1. Actual daily return

The abnormal return is calculated by using the market model. In this model, the coefficients of α_i and β_i are estimated by ordinary least squares (OLS) based on 200 trading days prior to

the first event window, corresponding to the estimation window [-220, -21]. This estimation will be based on daily returns for each company. The formula for the market model is given as

$$\textbf{(2)}\quad R_{i,t} = \alpha_i + \beta_i \times R_{m,t} + \varepsilon_{i,t},$$

Equation 2. The market model

where R_{it} is the return on the stock of company i on day t, $R_{m,t}$ is the daily, country-specific market return, and ε_{it} is the error term.

A predicted return based on this market model will be calculated. The predicted return on the stock of company i on day t will be given as

$$\textbf{(3)}\quad \widehat{R}_{i,t} = \hat{\alpha}_i + \hat{\beta}_i \times \hat{R}_{m,t}$$

Equation 3. Predicted return in the market model

The daily abnormal return (AR) of company i on day t can be found by subtracting the predicted return from the actual return for each company:

$$\textbf{(4)}\ AR_{i,t} = R_{i,t} - \hat{R}_{i,t}$$

Equation 4. Abnormal return

Finally, the cumulative abnormal return (CAR) for each time interval will be calculated. This will be done by summing up the abnormal returns within the specific event windows:

$$\textbf{(5)}\ CAR_{t2,t1} = \sum_{t=t1}^{t2} AR_{i,t},$$

Equation 5. Cumulative abnormal return

where t_2 and t_1 denote the beginning and the end of the event window. Finally, we report the average CARs for the chosen event windows.

6.2.1 T-test

The t-test is a parametric test that provides a test statistic for investigating the individual company i at time t. The purpose is to give an indication on whether the CARs are significantly different from zero. Given the sub-hypothesis presented in section 4, the t-test will be two-tailed, testing at the 95% confidence interval.

The formula of the test statistic for CAR for company i at time t is given by

$$\textbf{(6)}\ t_{CAR_{i,t}} = \frac{CAR_{i,t}}{S_{CAR_i}},$$

Equation 6. T-test

where $CAR_{i,t}$ is the estimated cumulative abnormal return for company i at time t, and S_{CAR_i} is the standard deviation of the cumulative abnormal return for company i during the estimation period, calculated as the square root of the variance given as

$$\textbf{(7)}\ S^2{}_{CAR_i} = \frac{1}{M_i - k} \sum_{t=T0}^{T1} (CAR_{i,t})^2,$$

Equation 7. Variance

where T_0 and T_1 denote the beginning and the end of the estimation window, M_i is the number of matched observations, and *k* is the number of parameters needed to compute the cumulative abnormal returns. For the market model, the number of parameters equal k = 2, implying one constant and one factor.

6.2.2 Robustness

Because we apply CAR[-4, 4] obtained from the event studies in the difference-in-differences estimation, we need to ensure that the CARs are robust such that they reflect a consistent abnormal return for green and conventional bond issuers. The robustness of the CARs will be examined by applying two tests. First, we apply the MSCI All Country World Equity Index in lieu of country-specific market indexes when estimating the abnormal returns. Second, we present the median CAR in lieu of the average CAR. If the tests yield similar CARs as in the event studies and the significance holds, the result of the event studies can be considered as robust.

6.3 Difference-in-differences

Difference-in-differences (DD) is the methodology applied to answer the main hypothesis. It is considered as the best option when looking at experiments that are not randomized. The methodology is applicable for the analyses as it compares the changes in outcomes over time between a population enrolled in a program (the treatment group) and a population that is not (the control group) (The World Bank, 2022). The changes, referred to as the differences, are

across time and space. In this analysis, the difference across time is related to ESG incidents and the difference across space is related to the grouping of green bond issuers and conventional bond issuers. In accordance with Flammer (2019), the problem with control variables will be removed due to the matching.

The model is specified as

$$\textbf{(8)}\ y_{it} = \alpha_i + \alpha_t + \beta \times Green \times Post_{it} + \varepsilon_{it},$$

Equation 8. Difference-in-differences specification

where i indexes company and t indexes days. y is the outcome variable of interest (e.g., the CAR), α_i are the company fixed effects, α_t are the time fixed effects, $Green$ is a dummy variable that equals one for green bond issuers and zero otherwise, $Post$ is a dummy variable that equals one after the incident occurs and zero otherwise, and ε is the error term. $\beta \times Green \times Post_{it}$ is the interaction term and the coefficient of interest, which measures the difference-in-differences in outcome variable y between green and conventional bond issuers. Avoiding serial correlation is done by clustering the standard errors.

6.3.1 Fixed effects

To minimize the problem with endogeneity, company and time fixed effects are added in the model. The company fixed effects take care of the differences across companies that are constant over time and the time fixed effect adds a fixed effect every day that is common across companies to account for special days in which companies have similar returns due to other events. These adjustments are done by subtracting each period from a mean.

6.3.2 The parallel trend assumption

The most important assumption for a valid DD estimation is the parallel trend assumption. In this case, the assumption requires that green and conventional bond issuers would have followed parallel trends in the absence of the treatment.

To test whether the parallel trend assumption holds, the pre-trends of green bond issuers and conventional bond issuers will be compared. The test will only include the trends prior to the incidents due to the trend after being counterfactual and not testable. The evaluation is based on a reverse position, meaning that the future equals the past. This is considered as a naive approach as observed and counterfactual trends may differ (Cunningham, 2021, chapter 9.4).

If the treatment is given at different points in time, as in our case, one way to examine the pre-trends is to plot the outcome mean for each trading day prior to the incident. If the bond issuers follow a parallel trend, it is expected that the means for each trading day are quite similar and move in the same direction.

The parallel trend assumption can be violated due to various reasons. One common explanation for non-parallel pre-trends is a treatment that is endogenous. This implies that characteristics relevant for whether an observation receives the treatment or not are excluded from the model. In this case, the estimate consists of an explanatory variable that is correlated with unobserved factors (Cunningham, 2021, chapter 9.4).

7. Results

In this section, we will present the results of the estimations and discuss the findings. We start by presenting descriptive statistics for the matched companies for the environmental, social, and governance sample. Further, we split the analysis into three sections, one for each dimension. In these sections, we present and discuss the results from the event study, the robustness tests, the DiD estimation, and a graphical examination of the trend in CAR.

7.1 Matching

In the following, we display descriptive statistics on each of the matching samples applied in the analyses to examine the similarity between green and conventional bond issuers.

Table 4. Matching.

Notes: These tables present descriptive statistics for companies that have issued a green bond (Green = 1) compared to companies that have issued a conventional bond (Green = 0). (***) (**) (*) represents significance at the (0,1%) (1%) (5%) level, respectively.

Environmental sample

	Mean Green = 1	Mean Green = 0	Diff. in means	Std. Error
Company size	25.6888	25.2947	-0.3941***	0.0323
ROA	0.0305	0.0386	0.0081***	0.0011
Tobin's Q	0.6451	0.7956	0.1505***	0.0168
Leverage ratio	0.7738	0.7853	0.0115***	0.0031
E-score	72.8842	69.7737	-3.1105***	0.3427
S-score	70.8196	63.7499	-7.0698***	0.3256
G-score	67.1442	61.4197	-5.7245***	0.3259
N	24	24		

Social sample

	Mean Green = 1	Mean Green = 0	Diff. in means	Std. Error
Company size	25.3681	25.0287	-0.3395***	0.0388
ROA	0.0372	0.0434	0.0062***	0.0013
Tobin's Q	0.7071	0.9208	0.2137***	0.0205
Leverage ratio	0.7509	0.7455	-0.0054	0.0035
E-score	70.8471	70.1873	-0.6598**	0.3255
S-score	70.8708	72.6793	1.8085***	0.3688
G-score	70.3411	62.8867	-7.4543***	0.3358
N	20	20		

Governance sample

	Mean Green = 1	Mean Green = 0	Diff. in means	Std. Error
Company size	25.9038	25.3832	-0.5206***	0.0241
ROA	0.0219	0.0275	0.0056***	0.0006
Tobin's Q	0.4549	0.6148	0.1599***	0.0095
Leverage ratio	0.8170	0.8059	-0.0110***	0.0025
E-score	74.2260	64.3650	-9.8610***	0.3156
S-score	72.7762	63.7599	-9.0162***	0.2979
G-score	66.6190	62.0819	-4.5372***	0.3145
N	35	35		

We observe that there is a significant difference in all characteristics between green and conventional bond issuers used in the environmental and governance sample. For the social sample, only leverage ratio is considered insignificantly different between the bond issuers.

The differences is especially substantial for Tobin's Q and the ESG scores. Flammer (2021) finds that green bond issuers improves their environmental performance after issuance. The differences in ESG scores can be due to the fact that green bond issuers may improve their overall ESG performance due to their commitment. This is supported by the fact that ESG scores seems to be averagely higher for green bond issuers compared to conventional bond issuers, except for S-score in the social sample.

On the other hand, it may be the case that companies performing well on ESG are more likely to issue a green bond. Since Flammer (2021) argues that green investments is costly, green bond issuance can therefore be associated with greater risk in the short run. Due to the fact that several of the incidents applied in the analyses are close to the green bond issue date, this can explain the substantial lower Tobin's Q for green bond issuers.

Based on the descriptive statistics, we must assume that the matched conventional bonds do not serve as optimal counterfactuals for the green bond issuers in all the samples.

7.2 Environmental dimension

In the following, the analyses on stock price response to environmental incidents will be presented. The environmental dimension is of main interest due to green bond issuance being aimed at reducing environmental issues. First, the event study results will be presented, giving an indication on whether the sub-hypothesis is supported, followed by a robustness test on the obtained CAR for the main event window. Thereafter, we will present the DD,

giving an indication on whether the main hypothesis is supported. Lastly, in the graphical examination the obtained results will be further examined.

7.2.1 Event study results

In this section, the sub-hypothesis will be tested. The stock price responses around the first reported environmental incident after bond issuance are displayed in table 5. This includes the CARs for the total environmental sample and separately for green and conventional bond issuers.

Table 5. CAR around environmental incidents.

Notes: This table presents the average cumulative abnormal return for the different event windows around the first reported environmental incident for total sample and separated for green and conventional bond issuers. The total sample consists of 48 unique event dates from 48 issuers, while the green and conventional sample consists of 24 unique event dates from 24 issuers. (***) (**) (*) represents significance at the (0,1%) (1%) (5%) level, respectively. Robust standard errors in parentheses.

Event window	[-4, 4]	[-10, 10]	[-20, 20]
Total	0.00228*	-0.000146	-0.00974***
	(0.00104)	(0.000936)	(0.00116)
Green	0.00228*	-0.000750	-0.00304
	(0.00108)	(0.00153)	(0.00185)
Conventional	0.00229	0.000459	-0.0164***
	(0.00179)	(0.00107)	(0.00136)

Main event window

We observe that the CAR for the main event window [-4, 4] is consistent across the samples. The CAR is significantly positive at the 5% level for total and green sample, while insignificant for the conventional sample. However, the CAR remains as good as identical to the other samples, resulting in a significant positive CAR for the total sample. The result indicates that the market responds positively to the announcement of an environmental incident. This result is unexpected given previous research and our sub-hypothesis, expecting a negative response. Several possible explanations to why we obtain a conflicting response will be presented in the following.

Firstly, it may be the case that the chosen main event window is too broad to catch some of the responses from the market when using an average CAR. This will be further examined by examining the trends in CAR later in this section.

Secondly, we do not consider the severity of the incidents. Krüger (2015) and Teng & Yang (2021) found that the response was more pronounced for environmental incidents and incidents related to illegal violations and safety issues. In our analysis, we analyze the response to the *first* environmental incident after issuance of a (green) bond, regardless of severity. It can be the case that the severity of some environmental incidents is low, thus affecting the stock price response. Investors will emphasize the severity of the incidents differently due to individual preferences. Thus, an incident tied to global emission can gain a more pronounced response in the stock price than an incident tied to waste issues, depending on investor preferences. Then it can be the case that investors do not emphasize the specific incidents used in the analysis, thus not responding to the announcement of the environmental incidents.

Thirdly, if a company is reluctant to disclose information regarding the environmental incidents, it may be that the market does not catch the severity of the incident, leading to an insignificant response in the stock price around the incidents. This can be in line with the findings of Lyon & Maxwell (2011), who found that investors often lack adequate information to evaluate the company's environmental commitment. If we believe this statement, it is likely that the response in the stock price does not reflect how the real response would have been if the market were fully informed. Thus, it may be the case that companies that discloses more regarding the impact of environmental incidents experience a more pronounced negative response in the stock price, aligned with Hummer et al. (2019). We are assuming that the efficient market hypothesis holds at least a semi-strong level, and if this is not the case, the CARs are not reflecting the whole truth.

Fourthly, we have noticed that some of the incidents are repeated several times for some companies, sometimes over short periods of time. There is reason to expect that the novelty of the incidents has an effect on the stock price response. Also this will be further examined later in this section.

Long-term event windows

The stock price response to environmental incidents does not have to be present in immediate proximity to the incident. For the event window [-20, 20], we obtain a significantly negative CAR at the 0,1% level for the total and conventional sample, while being insignificant for the green sample. This may indicate that information regarding the environmental incidents may have been leaked prior to the announcement date, resulting in a negative response at least 10 trading days prior to the incidents. It may also be the case that there is an information lag in the market tied to the incidents, or that the negative response is tied to reputation loss after the incidents as Navarra (2021) suggests, or both. Although this can be reasonable, we cannot say with certainty that the negative response is tied to the incidents. The risk that other events can have affected the stock price response is present. The corona pandemic for example, which had major consequences for the economy at the end of 2019 and until 2022, can have impacted the stock price response if the incidents occurred in this period of time. Although it may not be the case, it is important to have in mind when studying an event in specific periods of time.

For the event window [-10, 10], the CAR is insignificantly negative for total and green sample and insignificantly positive for conventional sample. Due to its insignificance, we cannot claim that our sub-hypothesis holds in this window. By accounting for up to 10 days prior to and after the incident, it does not seem like there is an abnormal response to environmental incidents.

7.2.2 Robustness

In the following, we aim at highlighting whether the CAR obtained in the main event window [-4, 4] is robust. In lieu of country-specific market indexes we present total CAR using MSCI, in addition to presenting median CAR in lieu of average CAR. The results are displayed in table 6.

Table 6. Robustness for environmental sample.

Notes: This table presents two alternative ways of computing total CAR[-4, 4] from table 5. . (***) (**) (*) represents significance at the (0,1%) (1%) (5%) level, respectively. MSCI is in column 1 and median CAR is in column 2. Robust standard errors in parentheses.

Robustness test	MSCI	Median
Total CAR[-4, 4]	0.00365**	0.00295**
	(0.00135)	(0.00112)

In table 5, we found a significantly positive CAR of 0,00228% at the 5% level. The robustness tests show that the positive CAR is still significant even if we apply another market index or apply the median CAR in lieu of the average CAR. In fact, the CAR is now significant at the 1% level in lieu of 5% level, meaning that the positive response is stronger. Importantly, the CAR seems to be robust given these tests. This indicates that CAR is neither greatly affected by which market index that is applied, nor that the results might be driven by a small number of issuers with extreme stock price responses.

7.2.3 Difference-in-differences estimation

The main hypothesis will be tested in the following. The DD estimation is based on total CAR for the main event window [-4, 4], estimated in the previously conducted event study. The result is displayed in table 7.

Table 7. Difference-in-differences estimation for environmental sample.

Notes: This table presents the results of a DD estimation using the environmental sample and the total CAR for event window [-4, 4]. *DD* represents the DD estimator, meaning the difference in CAR between green and conventional bond issuers when an environmental incident occur. (***) (**) (*) represents significance at the (0,1%) (1%) (5%) level, respectively. Robust standard errors in parentheses.

	(1) CAR
DD	-0.000763
	(0.00707)
Matches	24
N	432
R^2	0.630
adj. R^2	0.573

The DD estimator displays that, on average, the CAR is 0.000763% lower for green bond issuers compared to conventional bond issuers when an environmental incident occurs in the event window [-4, 4]. However, the result is not statistically significant, meaning that we cannot reject the null hypothesis that there is no difference in CAR between green and conventional bond issuers when an environmental incident occurs, although we obtain a

negative coefficient. From this estimation, we cannot claim that the market responds more pronounced negatively to green bond issuers when environmental incidents occur compared to conventional bond issuers. Thus, we cannot provide evidence in favor of our main hypothesis.

The DD estimation is based on the total CARs obtained for the main event window [-4, 4]. This implies that the event window is important for the further analysis to answer our main hypothesis. It may be the case that we have not captured a response to the environmental incidents due to the lack of a negative response in the main event window.

As discussed in section 3.3, one possible explanation for the insignificant CAR can be due to the fact that the market does not necessarily perceive green bond issuance as green commitment, leading to no more pronounced response in the stock price compared to conventional bond issuers. This can be due to suspicion of greenwashing. As explained by Flammer (2021), some sceptics are questioning the value of green bonds and whether they *actually* make a difference for the environment.

On the other side, it may be the case that the greater ESG performance for green bond issuers, as shown in table 4, affects how the market responds to the environmental incidents If we believe Kim (2020) and Flammer (2013), the response to the environmental incidents may not be as pronounced as we expect, resulting in an insignificant difference between green and conventional bond issuers.

We also assume that the efficient market hypothesis holds at least a semi-strong level, meaning that all historic and public information should be reflected in the stock prices. This can be violated if investors is not informed about the green bond issuance. If this is the case, there is no reason for why they should respond differently to green bond issuers compared to conventional bond issuers. However, as discussed above, the estimations may not give a correct picture of the difference in how the market responds to the incidents because we cannot say with certainty that the CAR used in the DD estimation capture a response to the incidents. Obviously, the insignificance can also be due to the small sample obtained.

7.2.4 Graphical examination

To examine in depth how the CAR moves in the time interval [-20, 20], we wish to visualize the trend for both green and conventional bond issuers. This allows us to

inspect the pre-trends in CAR prior to the environmental incidents. Aligned with the parallel trend assumption, CAR for green and conventional bond issuers should move in the same direction prior to the environmental incidents. The trend in CAR is shown in figure 3. The green line represents the trend line for green bond issuers, while the brown line represents the trend line for conventional bond issuers. T = 0 represents the announcement date of the environmental incidents.

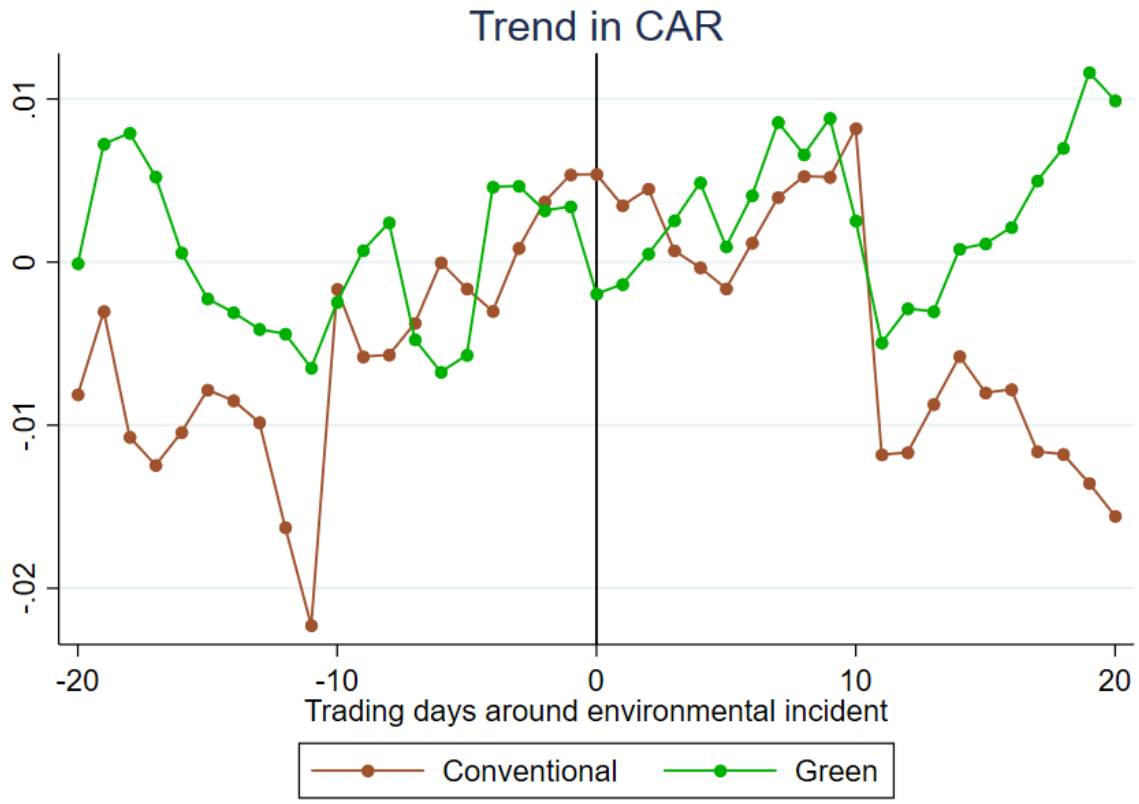

Figure 3. Trend in CAR for environmental sample

For the main event window [-4, 4], the trend line for both green and conventional lays almost solely above 0. This results in the positive CAR in this event window. Whether there are other events that affects the response in this window cannot be claimed with certainty. The opposite is the case for the event window [-20, 20]. The negative response is clearly displayed in the figure, aligned with the obtained significantly negative CAR. The figure strengthens the belief that there can be an information leak prior to the incident, in addition to either some information lag in the market that results in a lagged negative response, or that the negative response is tied to reputation loss, or even both. For event window [-10, 10], the insignificant CAR can be explained by the varying trend lines for this time window. Prior to the incident, CAR tends to lay mostly under 0, while it is mostly above 0 after the incident. Thus, there is no clear trend in this time window, and we cannot say with certainty

that there is an abnormal response in the stock price. However, it seems like there is a negative response prior to the incidents by examining the figure, which can be due to the incidents.

Interestingly, we observe a small decline in CAR for [-1, 0] for green bond issuers, while no decline for conventional bond issuers. This drop can be an immediate response to the environmental incidents, although we cannot claim that with certainty. The decline seems to be diluted because we present the average CAR over the event window [-4, 4]. One crucial element in event study is to choose a suitable event window. It may be the case that the event window is too broad such that the immediate response to the incidents is not captured in the average CAR presented. However, by examining the figure, it seems to be a consistent negative response in immediate proximity to the announcement date for green bond issuers, aligned with previous research and our sub-hypothesis.

We observe that especially for conventional bond issuers, the response is not very pronounced in the immediate proximity to the announcement date. By examining table 3 in section 5.4, we observe that conventional bond issuers have an averagely larger number of reported environmental incidents compared to green bond issuers. This strengthens the findings of Flammer (2021), stating that green bond issuance signals green commitment. However, a larger number of environmental incidents increases the probability of incidents repeating several times. Aligned with Kim (2020), it would be natural to expect that incidents repeating several times would be expected to the market, causing no significant negative response, which can be the case for conventional bond issuers here. If we would follow this rationale, we would naturally expect a more significant negative response for green bond issuers who has a lower number of environmental incidents reported, which seems to be the case here.

By examining table 4, we observe that the average company size is larger for green bond issuers compared to conventional bond issuers in the environmental sample. Capelle-Blancard & Petit (2017) claims that highly visible, large companies tend to draw more media attention than small, neglected companies. Aligned with Kim (2020), who finds that the stock price response is more substantial for companies with greater media exposure, this can be an explanation to the decline in CAR for green bond issuers in immediate proximity to the environmental incidents.

Table 4 further shows that green bond issuers have an averagely higher environmental score compared to conventional bond issuers in the environmental sample. This is aligned with the findings of Flammer (2021). The green bond issuers have no substantial negative response close to the announcement date. If better environmental performance is reflected in the environmental score provided by Refinitiv Eikon, our findings seem to be aligned with Kim (2020), claiming that the stock price response is smaller for companies that performs well on CSR in general. Thus, green bond issuers' better performance may be an explanation to the insignificant decrease in the stock price near the incidents. If we would believe this rationale, we would perhaps expect that conventional bond issuers should have a more pronounced response, which is not the case. Thus, this does not seem to be an explanation behind their response.

The figure displays why we obtain an insignificant CAR in the DD estimation. The trend lines are not very different from each other in the main event window [-4, 4], although we observe that green bond issuers lay averagely below conventional bond issuers, resulting in a negative CAR in the estimation. However, due to the trend lines varying in the main event window, we cannot say that the difference is significant, which also the DD estimation confirms.

When examining the figure, the small decline in CAR in immediate proximity to the incidents is neglected due to the average calculation of CAR over the window [-4, 4]. Like we discussed in section 7.2.1, it may be the case that the response to the incidents were present prior to or after the main event window, and in that case we were not able to capture this response in the DD estimation. However, we emphasized the risk of the response being due to other events the most, thus choosing a smaller main event window.

When examining the trend lines prior to the environmental incident, we observe that CAR in few cases move in the same direction. Due to this, we cannot say that the parallel trend assumption holds in this case. This implies that the DD estimation seems to not be valid and does not provide a basis for comparing CAR between green and conventional bond issuers. It is however difficult to obtain completely parallel trends since we are examining CAR, which can be very company specific.

7.3 Social dimension

In the following, the analyses on stock price response to social incidents will be presented. The aim is to compare the results from this dimension with the results from the environmental dimension. First, the event study results will be presented, giving an indication on whether the sub-hypothesis is supported, followed by a robustness test on the obtained CAR for the main event window. Thereafter, we will present the DD, giving an indication on whether the main hypothesis is supported. Lastly, in the graphical examination the obtained results will be further examined.

7.3.1 Event study results

In this section, the sub-hypothesis will be tested. The stock price responses around the first reported social incident after bond issuance are displayed in table 8. This includes the CARs for the total social sample and separately for green and conventional bond issuers.

Table 8. CAR around social incidents.

Notes: This table presents the average cumulative abnormal return for the different event windows around the first reported social incident for total sample and separated for green and conventional bond issuers. The total sample consists of 40 unique event dates from 40 issuers, while the green and conventional sample consists of 20 unique event dates from 20 issuers. (***) (**) (*) represents significance at the (0,1%) (1%) (5%) level, respectively. Robust standard errors in parentheses.

Event window	[-4, 4]	[-10, 10]	[-20, 20]
Total	-0.00145 (0.00122)	0.00159 (0.00132)	0.00344** (0.00118)
Green	0.00580** (0.00176)	0.0106*** (0.00154)	0.0118*** (0.00179)
Conventional	-0.00871*** (0.00151)	-0.00788*** (0.00208)	-0.00530*** (0.00146)

Main event window

To start with, we observe that the CARs across the bond types are conflicting for the main event window [-4, 4]. For green bond issuers, the CAR is significantly positive at the 1% level, while being significantly negative at the 0,1% level for conventional bond issuers. Due to the conflicting results, the total CAR ends up being insignificantly negative. Negative sign

is aligned with our sub-hypothesis, but due to the insignificance, we cannot claim that there is an abnormal response in the stock price for the main event window in total for social incidents. Given that the CAR conflicts previous research due to its insignificance, several possible explanations will be presented in the following.

Firstly, as for the environmental dimension, it may be the case that the main event window is either too broad or too small to catch some of the responses from the market when using an average CAR. Given that the CAR for conventional bond issuers is strongly negative, it will be natural to claim that this can be due to the incidents. For green bond issuers, it may be reasonable to believe that the positive response is a result of other factors. This will be further examined by examining the trends in CAR later in this section.

Secondly, the severity of the incidents may also be an explanation here. Teng & Yang (2021) found that the response was more pronounced for incidents related to illegal violations and safety issues, which can be tied to the social dimension. As for environmental incidents, it can be the case that the severity of several of the social incidents is low, thus impacting the stock price response. Thus, an incident tied to human rights abuses can gain a more pronounced response in the stock price compared to an incident tied to local participation issues, depending on investor preferences. If the incidents for green bond issuers are considered as low-severity incidents, this can be an explanation to why we obtain no negative response.

Thirdly, poor disclosure among green bond issuers may be an explanation to the lack of a negative response. If believing the statement of Lyon & Maxwell (2011), it can be the case that the response in the stock price does not reflect how the real response would have been if the market were fully informed. Due to green bond issuers' commitment toward the environment, it may be the case that they disclose more poorly for social incidents because the environmental dimension is considered more important. Thus, it may be the case that conventional bond issuers discloses to a greater extent regarding the impact of the social incidents, thus experiencing a more pronounced negative response in the stock price, which would be aligned with Hummer et al. (2019). In addition, if the efficient market hypothesis does not hold at least a semi-strong level, the CAR is not reflecting the whole truth.

Long-term event windows

The same pattern applies to the event windows [-10, 10] and [-20, 20], although the CAR for green bond issuers is significant at the 0,1% level for these windows. However, for [-20, 20], the total CAR ends up being significantly positive at the 1% level. This is due to a greater positive response for green bond issuers compared to the negative response for conventional bond issuers. Given the conflicting responses, it can be the case that the response to other events that affects green and conventional bond issuers differently can be present in these time windows. However, it can also be the case that the market responds differently when social incidents occur for green bond issuers compared to conventional bond issuers, although there is reason to believe that the positive response for green bond issuers is due to other events or factors than the social incident.

The negative response for conventional bond issuers in all event windows may indicate that information regarding the social incidents may have been leaked prior to the announcement date, resulting in a negative response prior to the incidents. It may also be the case that there is an information lag in the market tied to the incidents, or that the negative response is tied to reputation loss after the incidents as Navarra (2021) suggests, or both. Although this can be reasonable, we cannot say with certainty that the negative response is tied to the incidents. The risk that other events can have affected the stock price response is present, as mentioned in the discussion for the environmental dimension.

7.3.2 Robustness

In the following, we aim at highlighting whether the CAR obtained in the main event window [-4, 4] is robust. In lieu of country-specific market indexes we present total CAR using MSCI, in addition to presenting median CAR in lieu of average CAR. The results are displayed in table 9.

Table 9. Robustness for social sample.

Notes: This table presents two alternative ways of computing total CAR[-4, 4] from table 8. MSCI is in column 1 and median CAR is in column 2. (***) (**) (*) represents significance at the (0,1%) (1%) (5%) level, respectively. Robust standard errors in parentheses.

Robustness test	MSCI	Median
Total CAR[-4, 4]	-0.00479***	-0.00336**
	(0.00144)	(0.00124)

In table 8, we found an insignificant negative CAR of -0.00145%. This implies that when applying average CAR, we cannot claim that there is an abnormal return in stock price for main event window [-4, 4] when a social incident occurs. However, when applying MSCI market index or applying median CAR, we obtain significant negative CAR at the 0,1% and 1% level, respectively. The significant negative CARs from the robustness tests strengthens the assumption that CAR in the main event window is negative, which is aligned with our sub-hypothesis. However, due to the difference in CAR when applying MSCI in lieu of country specific indexes, it seems like choice of index plays a role here. Further, due to the difference in magnitude between average and median CAR, this can indicate that our data is skewed, thus deviating from the normal distribution. This has consequences when interpreting the results. To examine this difference in magnitude, we present a histogram of CAR[-4, 4] to illustrate the distribution in figure 4.

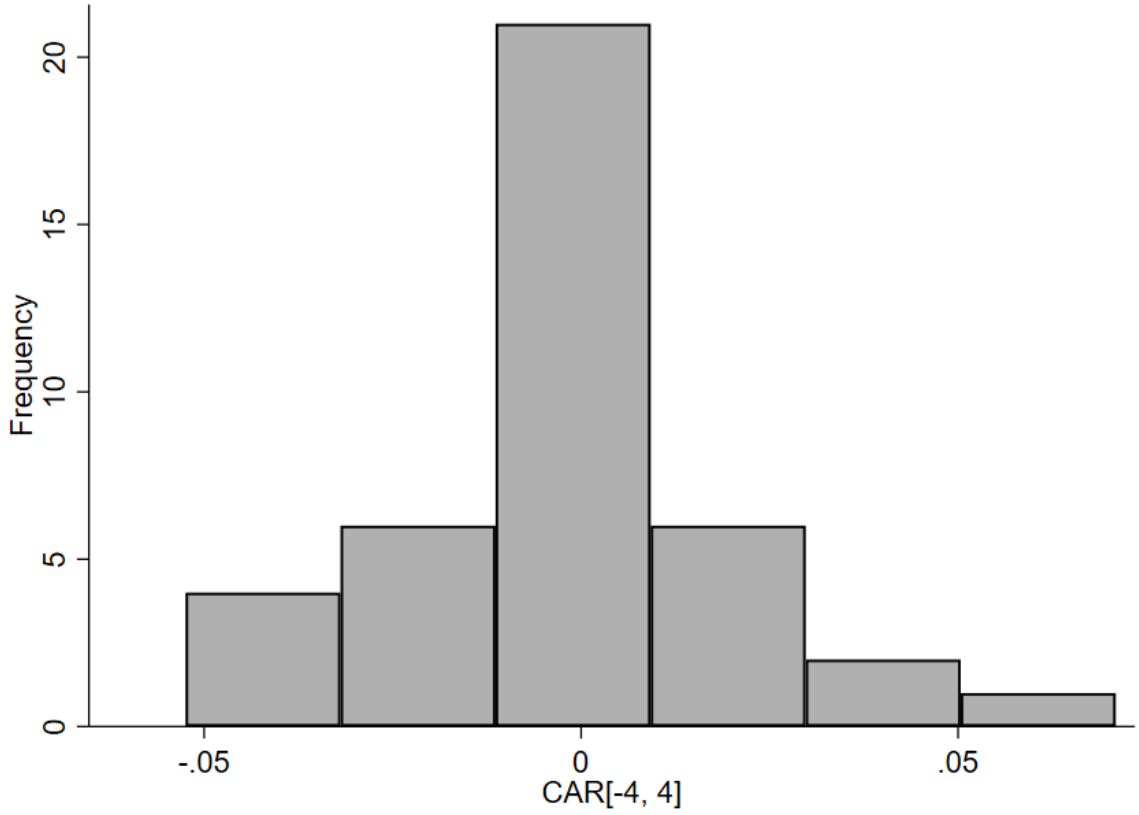

Figure 4. Distribution of CAR[-4, 4] for social sample. N = 40

From the histogram, we observe that the CARs seem to be relatively normally distributed. Although there is a small overweight of companies with a negative CAR, the single company that has a positive CAR above 0.05% neutralizes this, resulting in the insignificant coefficient for average CAR. For median CAR, the values of CARs are ranked according to

order, while the absolute magnitude is not considered. Due to one more company experiencing a negative CAR compared to a positive CAR, this seems to be the explanation in the differences in magnitude between average CAR and median CAR. Due to the uncertainty regarding the normal distribution of the CARs, we are reluctant to claim that the sub-hypothesis holds for social incidents.

7.3.3 Difference-in-differences estimation

The main hypothesis will be tested in the following. The DD estimation is based on total CAR for the main event window [-4, 4], estimated in the previously conducted event study. The result is displayed in table 10.

Table 10. Difference-in-differences estimation for social sample.

Notes: This table presents the results of a DD estimation using the social sample and the total CAR for event window [-4, 4]. *DD* represents the DD estimator, meaning the difference in CAR between green and conventional bond issuers when a social incident occur. (***) (**) (*) represents significance at the (0,1%) (1%) (5%) level, respectively. Robust standard errors in parentheses.

	(1) CAR
DD	0.00668 (0.00469)
Matches	20
N	360
R^2	0.780
adj. R^2	0.745

The DD estimator displays that, on average, CAR is 0.00668% higher for green bond issuers compared to conventional bond issuers when a social incident occurs in the event window [-4, 4]. However, the result is not statistically significant, meaning that we cannot reject the null hypothesis that there is no difference in stock price response between green bond issuers and conventional bond issuers when a social incident occurs. The result is aligned with our main hypothesis because we do not expect that the market responds differently to companies that have issued green bonds compared to conventional bonds, as the proceeds from green bonds are not aimed at reducing social issues.

As for the environmental dimension, the risk of not capturing a response to the social incidents in the applied event window is present. Thus, the estimation may not give a correct

picture of the difference in how the market responds to the incidents because we cannot say with certainty that the CAR used in the DD estimation capture a response to the incidents. Obviously, the insignificance can also be due to the small sample obtained.

Importantly, due to the CAR not being clearly robust as shown in table 9, it may be the case that the DD estimator is biased and does not reflect the true value of the differences in response to social incidents.

7.3.4 Graphical examination

As for environmental incidents, we wish to visualize the trend in CAR for the time interval [-20, 20]. Thus, we inspect the pre-trends in CAR prior to the social incidents. The trend in CAR is shown in figure 5. The green line represents the trend line for green bond issuers, while the brown line represents the trend line for conventional bond issuers. T = 0 represents the announcement date of the social incident.

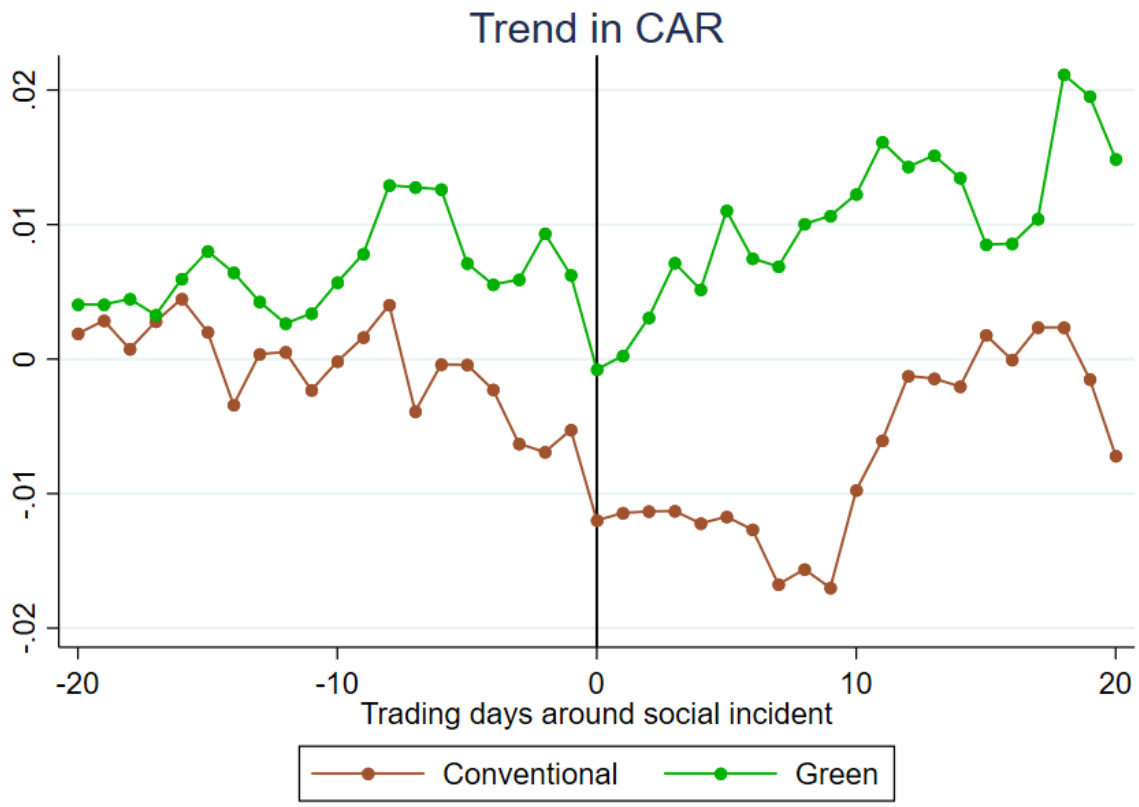

Figure 5. Trend in CAR for social sample

According to the figure, the insignificant CARs obtained in the event windows [-4, 4] and [-10, 10] is explained by the average difference between green and conventional bond issuers.

Green bond issuers lay solely above 0, while conventional bond issuers lay nearly solely below 0. Because there are equal number of green bond issuers and conventional bond issuers in the total sample, the weighted average ends up being insignificant, thus we cannot provide evidence of an abnormal response in total for this event window. For the event window [-20, 20], the significantly positive CAR is explained by the increase in CAR such that CAR lays around 0 in the time windows [-20, -10] and [10, 20].

Interestingly, we observe a significant decline in CAR for the time window [-1, 0] for both issuers, which may be an immediate response to the announcement of the social incidents, although we cannot claim that with certainty. This was also the case for the environmental dimension, although only for green bond issuers. The response seems to be diluted in the main event window [-4, 4] due to the fluctuations of the CAR. In this case, it seems like the event window is too broad such that the immediate response to the incidents is not captured in the average CAR presented. However, by examining the figure, it seems to be a consistent negative response in immediate proximity to the announcement date for both issuers, aligned with previous research and our sub-hypothesis.

By examining table 3 in section 5.4, we observe that green and conventional bond issuers have a similar number of reported social incidents. Aligned with Kim (2020), we would expect a similar negative response in the stock price for both issuers due to the number of incidents being nearly equal. This seems to be the case in immediate proximity to the social incidents. Thus, the responses for both the environmental and social dimension are rational given Kim's (2020) statement.

By examining table 4, we observe that the average company size is slightly higher for green bond issuers compared to conventional bond issuers in the social sample. This was also the case for the environmental sample. It does not seem like company size has affected the magnitude in the responses in immediate proximity to the social incidents between the issuers. However, it may be the case that the difference in company size are not substantial enough to create a significant difference in the responses. If this is the case, Capelle-Blancard & Petit (2017) and Kim's (2020) statements seem to be applicable due to the highly equal responses.

Table 4 shows that conventional bond issuers have an averagely higher social score compared to green bond issuers in the social sample. This is not surprisingly due to green

bond issuance aiming at reducing only environmental issues. However, there is no substantial difference in the score between the issuers. Thus, the similar negative response in immediate proximity to the social incidents seem to be applicable when considering social performance. Compared to the findings for the environmental dimension, we observe that the green bond issuers have similar environmental score compared to green and conventional bond issuers' social score. Thus, the similar responses in immediate proximity between the dimensions are reasonable. Thus, our findings seem to be aligned with Kim (2020), claiming that the stock price response is smaller for companies that performs well on CSR in general. Given this statement, the stock price response should naturally be similar when the CSR performance is similar. Given the similar social scores, there is no reason to expect a significant difference in response between the issuers, as is not the case.

The DD estimation indicates that green bond issuers have an averagely higher CAR than conventional bond issuers, which seems to be correct by examining the figure. However, the coefficient is not significant, which makes sense from the figure due to the CARs' similar movements in the main event window. Due to the trend lines not being parallel to an acceptable extent, we must in addition assume that the parallel trend assumption does not hold to obtain a valid DD estimation.

When examining the figure, the declines in CAR in immediate proximity to the incidents is neglected due to the average calculation of CAR over the main event window [-4, 4]. Like we discussed in section 7.3.1, it may be the case that the response to the incidents were present prior to or after the main event window, and in that case we were not able to capture this response in the DD estimation, like for the environmental sample. However, we emphasized the risk of the response being due to other events the most, thus choosing a smaller main event window.

7.4 Governance dimension

In the following, the analyses on stock price response to governance incidents will be presented. The aim is to compare the results from this dimension to the results from the other dimensions. First, the event study results will be presented, giving an indication on whether the sub-hypothesis is supported, followed by a robustness test on the obtained CAR for the main event window. Thereafter, we will present the DD, giving an indication on whether the

main hypothesis is supported. Lastly, in the graphical examination the obtained results will be further examined.

7.4.1 Event study results

In this section, the sub-hypothesis will be tested. The stock price responses around the first reported governance incident after bond issuance are displayed in table 11. This includes the CARs for the total governance sample and separately for green and conventional bond issuers.

Table 11. CAR around governance incidents.

Notes: This table presents the average cumulative abnormal return for the different event windows around the first reported governance incident for total sample and separated for green and conventional bond issuers. The total sample consists of 70 unique event dates from 70 issuers, while the green and conventional sample consists of 35 unique event dates from 35 issuers. (***) (**) (*) represents significance at the (0,1%) (1%) (5%) level, respectively. Robust standard errors in parentheses.

Event window	[-4, 4]	[-10, 10]	[-20, 20]
Total	-0.00371***	-0.00233**	-0.00561***
	(0.000874)	(0.000886)	(0.000859)
Green	0.00113	-0.000485	-0.00101
	(0.00120)	(0.00125)	(0.00120)
Conventional	-0.00855***	-0.00418***	-0.0102***
	(0.00121)	(0.00125)	(0.00122)

Main event window

We observe that the CAR for the main event window [-4, 4] is significantly negative for conventional bond issuers at the 0,1% level and insignificant positive for green bond issuers, resulting in a total CAR that is significantly negative at the 0,1% level. This is aligned with our sub-hypothesis and may indicate that the market responds negatively to the announcement of a governance incident. Although CAR for green bond issuers is not negative, the coefficient is not significant and thus we cannot claim that there is an abnormal response for green bond issuers. The strongly negative CAR for conventional bond issuers outperforms the insignificant CAR for green bond issuers when the total CAR is calculated. Although the total CAR for the main event window [-4, 4] is significantly negative as

expected, we wish to highlight possible explanations to the difference in magnitude between green and conventional bond issuers.

Firstly, it may be the case that the main event window is too broad to capture some of the responses from the market when using an average CAR, like for the environmental and social dimension. This will be further examined by examining the trends in CAR later.

Secondly, like for the other dimensions, the severity of the incidents may also be an explanation here. An incident tied to fraud can gain a more pronounced response in the stock price compared to an incident tied to tax optimization, depending on investor preferences. If the incidents for green bond issuers are considered as low-severity incidents, this can be an explanation to why we obtain no abnormal response.

Thirdly, as for the social dimension, poor disclosure among green bond issuers may be an explanation to the lack of a negative response. Due to green bond issuers' commitment toward the environment, the disclosure on governance incidents can be more poorly because the environmental dimension is considered more important. Thus, the response in the stock price does not reflect how the real response would have been if the market were fully informed, aligned with Lyon & Maxwell (2011) and the efficient market hypothesis. If conventional bond issuers discloses to a greater extent regarding the impact of the governance incidents, they will likely experience a more pronounced negative response in the stock price, aligned with Hummer et al. (2019).

Long-term event windows

For the event windows [-10, 10] and [-20, 20], we observe the same pattern as for the main event window, although we obtain insignificantly negative CARs for green bond issuers. In these event windows, the signs for green bond issuers are aligned with our sub-hypothesis, although not significant. The negative response for conventional bond issuers in both event windows may indicate that information regarding the governance incidents may have been leaked prior to the announcement date, resulting in a negative response prior to the incidents. It may also be the case that there is an information lag in the market tied to the incidents, or that the negative response is tied to reputation loss after the incidents as Navarra (2021) suggests, or both. Although this can be reasonable, we cannot say with certainty that the negative response is tied to the incidents. As for the environmental and social dimension, the

risk that other events can have affected the stock price response for conventional bond issuers is present.

If we believe that the response for the conventional bond issuers is caused by the governance incidents, the market responds stronger when governance incidents occur for conventional bond issuers compared to green bond issuers. For green bond issuers, it seems like neither the governance incidents nor other events affects the stock price response in this time window. However, regarding the main event window [-4, 4], it is reasonable to claim that the negative response can be due to the incident. Seen in the context of the other dimensions, the governance dimension is the only dimension with a significant negative response that is aligned with our sub-hypothesis.

7.4.2 Robustness

In the following, we aim at highlighting whether the CAR obtained in the main event window [-4, 4] is robust. In lieu of country-specific market indexes we present total CAR using MSCI, in addition to presenting median CAR in lieu of average CAR. The results are displayed in table 12.

Table 12. Robustness for governance sample.

Notes: This table presents two alternative ways of computing CAR[-4, 4] from table 11. MSCI is in column 1 and median CAR is in column 2. (***) (**) (*) represents significance at the (0,1%) (1%) (5%) level, respectively. Robust standard errors in parentheses.

Robustness test	MSCI	Median
Total CAR[-4, 4]	-0.00294**	-0.00442***
	(0.00107)	(0.000939)

In table 11, we found a significantly negative CAR of -0.00371% at the 0,1% level. The robustness tests show that the CAR seems to be robust when applying MSCI market index in lieu of country-specific indexes, and when applying median CAR in lieu of average CAR. This indicates that CAR is neither greatly affected by which market index that is applied, nor that the results may be driven by a small number of issuers with extreme stock price responses. The response is in fact stronger when applying median CAR.

7.4.3 Difference-in-differences estimation

The main hypothesis will be tested in the following. The DD estimation is based on total CAR for the main event window [-4, 4], estimated in the previously conducted event study. The result is displayed in table 13.

Table 13. Difference-in-differences estimation for governance sample.

Notes: This table presents the results of a DD estimation using the governance sample and the total CAR for event window [-4, 4]. *DD* represents the DD estimator, meaning the difference in CAR between green and conventional bond issuers when a governance incident occur. (***) (**) (*) represents significance at the (0,1%) (1%) (5%) level, respectively. Robust standard errors in parentheses.

	(1) CAR
DD	0.00365 (0.00535)
Matches	35
N	630
R^2	0.650
adj. R^2	0.600

The DD estimator displays that, on average, CAR is 0.00365% higher for green bond issuers compared to conventional bond issuers when a governance incident occurs in the event window [-4, 4]. However, the result is not statistically significant, thus we cannot reject the null hypothesis that there is no difference in stock price response between green and conventional bond issuers when a governance incident occurs. The result is aligned with our main hypothesis because we do not expect that the market responds differently to companies that have issued green bonds compared to conventional bonds, as the proceeds from green bonds are not aimed at reducing governance issues. Thus, the response to both social and governance incidents are aligned with our main hypothesis.

Unlike for the environmental and social dimension, the risk of not capturing a response to the governance incidents in the applied event window is likely not present due to the significantly negative CAR. Thus, we can with greater probability claim that the CAR applied in the DD estimation captures a response to the governance incidents, although there is some probability that the negative response can be a response to other events. We need to

have in mind that the coefficient can be insignificant due to the small sample obtained, although the sample is greater compared to the environmental and social sample.

7.4.4 Graphical examination

As done for the other dimensions, we visualize the trend in CAR for the time window [-20, 20], shown in figure 6. This allows us to inspect the pre-trends in CAR prior to the governance incidents. The green line represents the trend line for green bond issuers, while the brown line represents the trend line for conventional bond issuers. T = 0 represents the announcement date of the governance incidents.

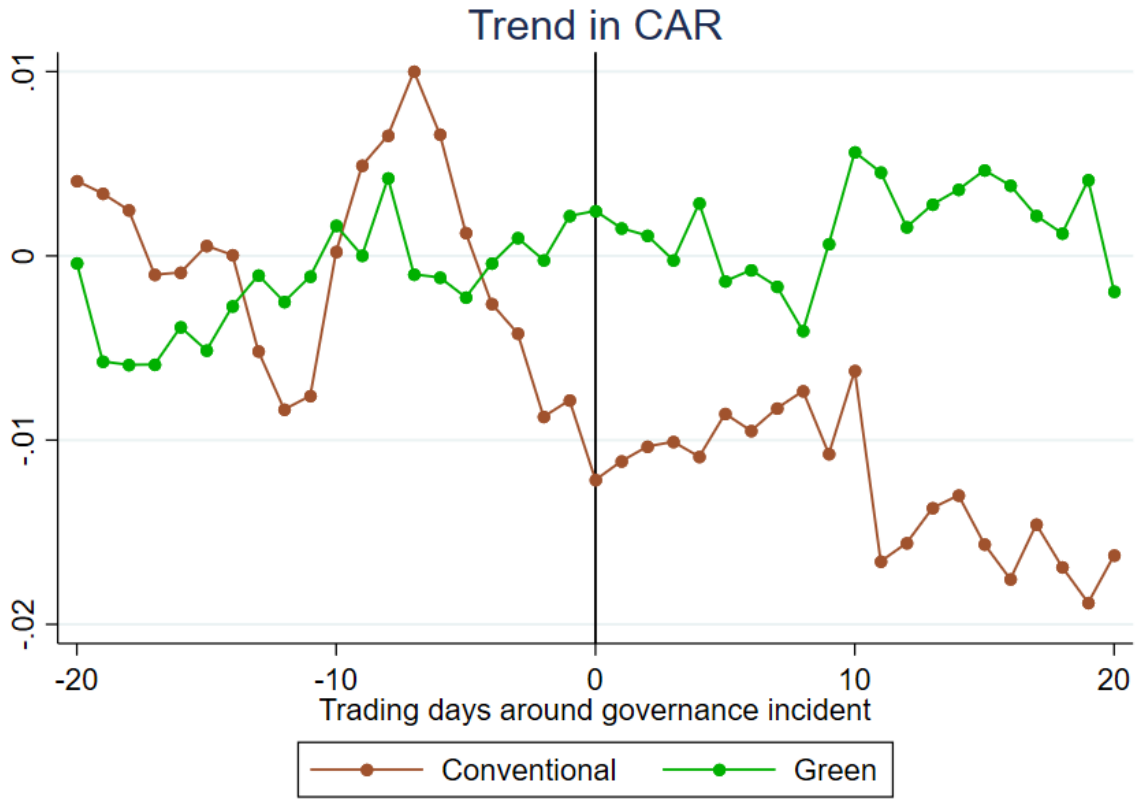

Figure 6. Trend in CAR for governance sample

For the main event window [-4, 4], we observe a negative response for conventional bond issuers, while no significant abnormal response for green bond issuers. This is aligned with the significantly negative CAR for conventional bond issuers and insignificantly positive CAR for green bond issuers. According to figure, the significantly negative CAR for the event windows [-10, 10] and [-20, 20] is mainly due to the conventional bond issuers. For the event windows [-4, 4] and [-10, 10], there can be reason to claim that the decline in CAR

prior to the incident can be due to the incident, and in that case involving an information leak to the market.

Interestingly, we observe a small decline in CAR for [-1, 0] for conventional bond issuers, while no substantial decline for green bond issuers. This is the opposite situation in relation to the environmental dimension. This drop can be an immediate response to the governance incidents, although we cannot claim that with certainty. However, the response is aligned with previous research and our sub-hypothesis and seems to be captured in the main event window, mainly due to a significant negative response for conventional bond issuers the trading days prior to the incidents. Although the CAR for the main event window is significantly negative for the governance dimension, it is still interesting to find a decline in CAR for all dimensions in immediate proximity to the incidents. However, which bond issuer that experiences the decline varies between the dimensions. Thus, there seems to be a lack of compliance between the dimensions.

We observe that especially for green bond issuers, there seems to be no decline in the immediate proximity to the announcement date. By examining table 3 in section 5.4, we observe that green bond issuers have an averagely larger number of reported governance incidents compared to conventional bond issuers. Larger number of governance incidents increases the probability of incidents repeating several times. Aligned with Kim (2020), it would be natural to expect that incidents repeating several times would be expected to the market, causing no significant negative response, which can be the case for green bond issuers here. If we would follow this rationale, the significant negative response for conventional bond issuers seem to be rational due to the lower number of incidents. Thus, the responses for all the dimensions are rational given Kim's (2020) statement.

By examining table 4, we observe that the average company size is larger for green bond issuers compared to conventional bond issuers in the governance sample. In this case, Capelle-Blancard & Petit (2017) and Kim's (2020) statements seem to not be aligned with our results due to the green bond issuers' absent response to governance incidents, in contrast to the other dimensions. Thus, it does not seem like larger company size consistently result in a more pronounced stock price response.

Table 4 further shows that green bond issuers have an averagely higher governance score compared to conventional bond issuers in the governance sample. Thus, the absent negative

response for green bond issuers can be explained by greater governance performance, aligned with Kim (2020). The significant negative response for conventional bond issuers will thus be rational given this rationale.

When examining the figure, it seems like the most significant negative response is present after the governance incident, in the time window [10, 20]. This strengthens the belief that the significant negative response can be due to information lag in the market, or the fact that there may be a reputation loss after the incident. However, we cannot say with certainty that the negative response is a response to the incident due to the risk of other events occurring in the same time window.

The DD estimation indicates that green bond issuers have an averagely higher CAR compared to conventional bond issuers in the main event window [-4, 4], which seems to be reasonable by examining the figure. However, the coefficient is not significant, which can make sense since the trend lines do not vary to a great extent between the groups.

There is a hint of parallel trends between the CARs prior to the governance incident, although this is not the case at any time. In addition, the stock price response for conventional bond issuers are more pronounced compared to green bond issuers. The trend lines cannot be claimed to be parallel and thus we cannot say with certainty that the parallel trend assumption holds to the extent we would have needed for a valid DD estimation.

8. Limitations of study and suggestions for further research

To our knowledge, this thesis is the first to examine the difference in stock price response to ESG incidents between green and conventional bond issuers. Due to this, we are not able to compare our results to others. This is not a problem for the event study results as this is a well-studied field.

An obvious weakness in the study is the small sample obtained. The green bond market is still evolving, and it seems to grow bigger in the coming years, as presented in section 2. Due to the importance of extracting stock returns for each company, we had to limit our sample to containing only public companies. We extracted the whole sample of companies that issued a green bond between 2013 and 2019 from Refinitiv Eikon. The number of publicly listed companies that issued a green bond in this period was limited. We restricted the issue year to maximum 2019 due to the importance of extracting ESG incidents after issuance. In RepRisk, we could only extract ESG incidents up to and including 2020 at that time. Due to the fact that the green bond market will develop further in the years ahead, we would recommend repeating this study later. At a later stage, it will most likely be possible to draw statistical conclusions based on a larger sample.

Another limitation is tied to the fact that a substantial proportion of the sample had no ESG incidents reported in the RepRisk database. According to RepRisk, the database on ESG incidents contains only 15% public companies while containing 85% private companies (Wrds, 2021). This restricted our sample in a substantial degree. RepRisk further states that their methodology is issues- and event-driven, rather than company-driven, which implies that they screen sources and stakeholders for ESG incidents, not a defined list of companies (Wrds, 2021). It may be a risk that RepRisk does not capture all the companies that have an incident related to the issues. As the database becomes more developed, it is interesting to repeat this study at a later stage. In addition, including data on the severity and novelty of the incidents to observe whether the response is stronger for high-severity and unexpected incidents, would be interesting in future research.

Due to the poor company data for several of the companies, we removed these companies from the sample. The rationale for this is the fact that they would not have been matched with a counterparty anyways. This was mainly the case for small companies. The matching

resulted in relatively few matches compared to what would have been optimal for drawing inference. Because we required exact matching on country, sector, and year of first incident after issuance, this restricted our matching sample to a great extent in the first place. In addition, we required matching on seven company-specific characteristics, being a lot for such a small sample. However, we did this to ensure that the matches were as similar as possible on relevant characteristics. Because we aimed at comparing companies with similar covariate distributions, this resulted in too few matches in our case. Due to this, we relaxed the mahalanobis distance between the matches, which resulted in more matches, but which also went at the expense of the similarity between the matches. This is highlighted in table 4. Thus, this is an important limitation in our study.

The relaxed matching will have implications for the results from the DD estimations. The examination of the pre-trends in the figures will lead us to the conclusion that our DD estimations seem to be biased due to the bond issuers not following parallel trends prior to the incidents. However, we found it difficult to obtain parallel pre-trends when applying CAR as the outcome variable. No matter how similar the companies were to each other, CAR did not become more parallel. This is not unexpected as CAR can fluctuate based on company-specific events. In addition, we cannot rule out the fact that the difference in trends can be due to the small sample. Thus, we recommend repeating this analysis at a later point with a greater sample.

In this thesis, we have studied companies that have issued a green bond regardless of whether the green bond is certified or not. Due to Flammer (2021) suggesting that certified green bonds reflect a stronger commitment toward the environment compared to non-certified green bonds, it may be the case that the stock price responses can be more pronounced for certified green bond issuers, especially for environmental incidents. This can be interesting to study in future research. There is a possibility that the market does not respond in a significant degree to environmental incidents because the non-certified green bonds does not provide assurance to the market that the proceeds are used to finance environmental projects. In other words, the market may stamp the green bond issuance as greenwash. In addition, it is more costly to obtain certification on a green bond, thus signaling to the market that they *actually* commit toward the environment.

9. Conclusion

This thesis contributes to the research on green bonds by studying a new area, namely the difference in stock price response to ESG incidents between green and conventional bond issuers.

In the main event window [-4, 4] we find a positive stock price response when environmental incidents occur, while the opposite is the case for governance incidents. For social incidents, we find no indication of an abnormal stock price response. We argue that the differences in the CARs between green and conventional bond issuers can be due to differences in company size, ESG performance, or degree of ESG disclosure between the bond issuers. Differences in severity or novelty of incidents applied in the analyses may be other explanations.

In the DD estimation, we find no indication of a difference in stock price response to ESG incidents between green and conventional bond issuers. We argue that the lack of a negative stock price response for environmental incidents can be due to the market's suspicion of greenwashing or higher ESG performance for green bond issuers, causing a less pronounced negative stock price response. The risk that information regarding green bond issuance is not reflected in the stock prices can be another rational. When examining the pre-trends, we observe that the CAR evolve differently for the bond issuers. This indicates that the parallel trend assumption is violated, meaning that we have no foundation for comparing the green and conventional bond issuers' stock price responses.

Since we are not able to draw a conclusion on the main hypothesis, further research on the area is recommended. Whether the market emphasizes violation of green commitment should be further examined when the green bond market has expanded and the information on ESG incidents are improved.

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