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Implications of Green Bond Issue Announcements on Equity Prices

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Abstract

In recent years, the green bond market has grown rapidly, and yet it remains an area of academia that has received little exploration. This paper furthers the understanding of green bond issue announcements through investigating their impact on equity prices in general, across the issuing firms' regions and sectors, and on firms' Environmental, Social and Governance (ESG) score. Using a sample of 205 green and 1995 traditional (non-green) bonds, we document that green bonds have larger abnormal returns upon issue announcements compared to traditional bonds. We further find differences in green bond abnormal returns across regions and sectors, showing that financial firms have larger abnormal returns than industrial firms and that European and American firms register larger abnormal returns than firms located in Asia. Moreover, we find that issuing a green bond can increase a firm's ESG score. Overall, we find that green bonds lead to positive stock market reactions.

Keywords

Green Bonds, Event Study, Abnormal Returns, Market Model, Constant Mean Return Model, Environmental Social and Governance (ESG)

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1. Introduction

The persistent problem of information asymmetries between investors and a firm's management means that bond issue announcements are often impactful on equity prices because of their high information content and their potential to signal a firm's prospects (Flannery, 1986). However, most of the literature to date has focussed on traditional (non-green) bond issues, and little is known about the implications of green bond issues. This paper aims to further the understanding of green bond issue announcements through investigating their impact on equity prices in general and across the issuing firms' regions and sectors.

Green bonds are a form of sustainable investment used by many investors, governments, and corporations to combat the challenges of climate change and sustainable development, that have become apparent in recent years (Kuna-Marszałek and Marszałek, 2017). Although climate change and its impacts are still somewhat debated amongst some politicians, the increasing amount of money injected into all kinds of sustainably labelled assets indicates that investors are more decisive on climate change (Landberg, Massa & Pogkas, 2019). Plus, this drive towards sustainable investments appears to be gaining momentum, as demonstrated by a 2018 report from the Global Sustainable Investment Alliance (2019), stating that sustainable investments, otherwise known as green investments, increased by 34% upon the 2016 figures.

The heightened demand for sustainable investments such as green bonds is likely to be a result of the stewardship and environmental dichotomy as set out in the Sustainable Development Goals (SDGs), under the United Nations Development Programme and the 2016 Paris Agreement from the United Nations Framework Convention on Climate Change (Kuna-Marszałek & Marszałek, 2017). The SDGs are goals that governments should strive towards achieving by 2030. One of those goals is for economic growth to be sustainable and environmentally friendly. Similarly, the Paris Agreement calls for governments to focus on financing low-carbon and more environmentally sustainable development, to ensure that global temperature rise is kept to within two degrees centigrade of the pre-industrial levels (United Nations Framework Convention on Climate Change, 2015). Despite the SDGs and Paris Agreement primarily focussing on the actions of governments, the corporate and financial sectors are also adding to the size of the green finance market, this is probably due to governments pressuring firms and individuals to invest in sustainable initiatives (Clapp, 2014). The involvement of corporates in the green market attracts investment from pension funds and

thus green finance is expanding further into markets that would have been otherwise unavailable (Landberg, Massa & Pogkas, 2019).

The green finance market comprises five broad investment types. Green bonds are the largest component of the green market, but there is no categorical definition of what constitutes a green bond (Wood & Grace, 2011). Nonetheless, the consensus is that green bonds are those bonds used exclusively to finance green projects (ICMA, 2015). The perceived need for sustainable financing to combat climate change has culminated in green bonds increasing in popularity and thus becoming ubiquitous within society. Furthermore, many expect green bonds to continue to increase in popularity and demand (Climate Bond Initiative, 2018) hence, understanding their characteristics and impacts are of great importance. Furthering the understanding of the implications of green bond issue announcements on firms' equity prices is especially important for the investors, firms, and the wider stakeholders associated with an issuing firm. Plus, the relative novelty of green bonds means that research into this field is limited, with only small samples available.

The literature shows that the announcement of a traditional (non-green) bond issue may result in an abnormal return, calculated by subtracting the firm's expected stock return from the actual observed return (MacKinlay, 1997). Different studies show that this announcement effect can be positive or negative depending on the type of bond issued, the sector or the country of issue (Dann & Mikkelson, 1984; De Roon & Veld, 1998; Eckbo, 1986; Fungáčová, Godlewski & Weill, 2020). Most green bond literature also identifies that green bond announcements result in positive abnormal returns (Flammer, 2018; Flammer, 2020; Glavas, 2018; Tang & Zhang, 2020). Flammer (2020) notes that this positive abnormal return is in response to the issuance of a green bond credibly signalling a firm's commitment to the environment. Correspondingly, green bond issues can be a good proxy for a firm's Environmental, Social and Governance (ESG) score (Tang & Zhang, 2020), and stock markets tend to reward firms for positive ESG events and news (Flammer, 2013; Krüger, 2015). Nonetheless, it is widely acknowledged that the green bond literature is limited (Banga, 2018; Berensmann, Dafe & Lindenberg, 2018; Nanayakkara & Colombage, 2019) and predominantly neglects to compare findings across specific sectors and regions or with traditional bonds, presenting a gap within the literature that this paper aims to fill. Moreover, a G20 Green Finance Synthesis Report determined that 74% of survey correspondents posit that a lack of understanding of green bond benefits is impeding green bond market growth (G20 Green Finance Study Group, 2016). Hence this gap in the

literature not only requires an examination to further this area of academia but also to enhance stakeholder green bond knowledge, to facilitate green bond market growth.

To fill this gap, this paper aims to identify how the abnormal returns differ between green and traditional bonds and across regions and sectors. From the literature it is expected that green bonds will have larger returns due to their environmental element (Flammer 2020). However, the traditional bond literature has also shown that abnormal returns differ across countries and sectors (Janjigian, 1987; Yaman, 2016), this is likely to be the case for green bonds too. Some green bond literature compares green bond abnormal returns across developed and emerging markets, yet no assessment of specific regions has previously been made (Lebelle, Jarjir & Sassi, 2020). This identifies another area this paper aims to explore. Additionally, Flammer (2020) concludes that firms issuing green bonds have improved environmental performance, leading one to hypothesise that firms following a green bond issuance have higher ESG scores, identifying a further area this paper aims to investigate.

This paper uses various methods to contribute to the literature. Firstly, the performance of an event study facilitates the identification and an initial comparison of abnormal returns following the announcement of a green or traditional bond issue. Secondly, the performance of three cross-sectional regressions identifies whether abnormal returns differ between green and traditional bonds and whether green bond abnormal returns differ between firms issuing in different regions and sectors. This paper uses three regions, Asia, Europe, and America, and three sectors, industrial, financial, and renewable energy. Finally, this paper uses a test of equality of two means to compare the changes in a firm's ESG score after a green and traditional bond issuance to investigate if the issuance of green bonds contributes to environmental improvement. The data sample covers the period between 2015 and 2019 and consists of 2200 bonds of which 205 are green.

The results highlight that firms earn larger abnormal returns upon the announcement of a green bond issue than a traditional bond issue, suggesting that stock markets reward firms that actively combat climate change through their engagement in sustainable development. Furthermore, European and American firms have significantly larger abnormal returns than firms located in Asia, indicating that firms located in Europe and America respond more positively to green bond issue announcements. Additionally, financial firms have a statistically significant and a comparatively more positive response to green bond issue announcements than industrial firms. However, the regression results for renewable energy firms are

insignificant, but this likely relates to the small sample. Lastly, the results of the ESG score tests insinuate that a green bond issue increases a firm's ESG rating.

Overall, this paper determines that responses to green bond issue announcements are more positive than traditional bonds, but this response does vary across regions and sectors. From the findings, it is appropriate to propose that future research considers how abnormal returns following a green bond issue announcement differ across specific countries and a broader array of sectors.

The remainder of this paper is structured as follows: Chapter 2 provides an overview of the green bond market. Chapter 3 details a review of relevant literature encompassing abnormal returns, ESG scores, and green bonds. Chapter 4 describes the process of variable selection and data collection and the methods used to analyse the data. Chapter 5 provides an overview of the empirical results and discusses these results considering the literature. Finally, chapter 6 concludes the paper.

2. Green Bond Market

This chapter is dedicated to give a general overview of the green bond market. The market overview scrutinizes the definition of green bonds, the trends in green bond issues in terms of volume, regions, sectors, the issuing organisations and explores the future of the green bond market.

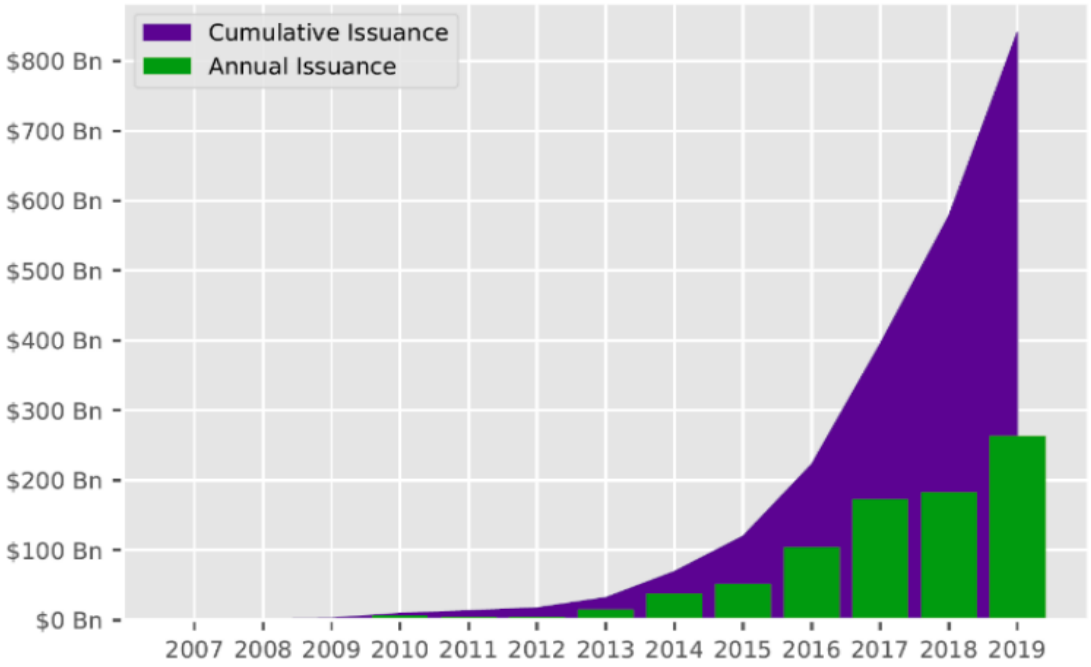
2.1. Overview

Green bonds are a comparatively new fixed-income asset-class that can be deemed similar to traditional bonds (non-green bonds) in their pricing, rating (Reboredo, 2018) and their potential to provide the issuer with a diversified financing source (World Bank, 2015). However, green bonds differ from traditional bonds in their due diligence process. This process necessitates compliance with certain frameworks that ensure the green bond's proceeds are used for financing environmentally friendly projects (Mercer, 2015), such as water efficiency, investing in renewable energy and low carbon transport (Campiglio, 2016). Furthermore, green bonds are distinct in that they can cater to an investor's ESG investment criteria (World Bank, 2015). This is significant as a study of investor priorities in 2016 found that 75% of mainstream institutional investors now ensure that their investment decisions are sustainable, as they believe this creates tangible value (Unruh, Kiron, Kruschwitz, Reeves, Rubel & Zum Felde, 2016).

To date, there is no definitive definition of a green bond and there is no universal framework to certify bond greenness. Furthermore, the green bond market is dispersed globally and there is no consensus nor harmonization in what constitutes a green bond across jurisdictions (Faske, 2018). Faske (2018) notes that whilst some jurisdictions such as the United States have made strict and legal requirements towards green bond market regulation, others have chosen to adopt the softer Green Bond Principles (GBP). For the purpose of this paper, the International Capital Markets Association (ICMA) definition of a green bond and the ICMA's GBP will be used. The ICMA defines a green bond as a fixed income security where the proceeds are designated for financing green projects which align with the GBP (ICMA, 2015). The GBP are voluntary guidelines aimed at promoting transparency, integrity and to limit greenwashing in the green bond market. The GBP has four core principles encompassing the use of proceeds, project selection, management of proceeds and reporting. The GBP do not define a green bond, but they provide recommendations on the greenness of the four core elements (ICMA, 2015).

There remain to be conflicting opinions regarding the date of the first green bond issue (OECD, 2015; World Bank, 2018), even so using the ICMA definition the first green bond issue was in 2007. Since then, the green bond market has experienced rapid year on year growth, Figure 1.

Figure 1. Accumulated and annual green bond issuance
This figure illustrates the increase in the USD bn volume of green bond issue from 2007 to 2019. The green bar chart represents the annual issue amount whereas the purple diagram illustrates the cumulative issue over years in USD bn (SEB, 2020).

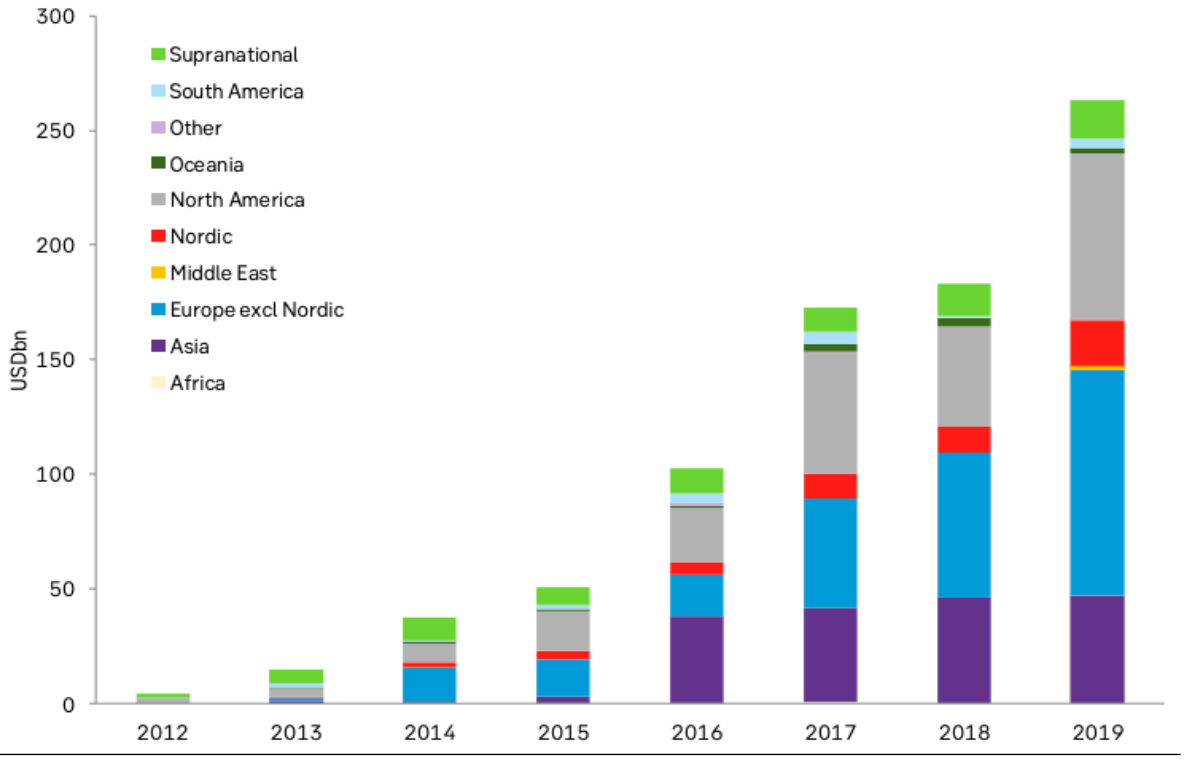


The volume of global green bond and loan issuances in 2019 increased 51% on the 2018 value (Climate Bond Initiative, 2020), reaching a new record of USD 263bn (SEB, 2020). In comparison, the 2012 green bond market value was only USD 2.8bn. This difference between the 2012 and 2019 figures is indicative of the rapid growth in the green bond market (Climate Bond Initiative, 2016), yet Moody's states that the 2018 green bond market only accounted for approximately 2% of the total global fixed income market (Allen, 2018). Still, Figure 1 shows the year on year increase from 2012 to 2019 has been tremendous. This growth is significant as it culminates in more green bond data and hence more evidence for empirical studies.

2.2. Regions, sectors and organisations issuing green bonds

As illustrated in Figure 2, Europe issued the largest volume of green bonds in 2019, accounting for 45% of the global issuance (Climate Bond Initiative, 2020).

Figure 2. Green bond issuances by Region
This figure illustrates the green bond issuance volume by region in USD bn from 2012 to 2019 (SEB, 2020).



Europe has dominated the green bond market in recent years with continuous growth whereas Asia and North America struggle to keep up in the green bond boom (Nauman, 2020). Despite this slowdown in North America and Asia, their share of the green bond market is still decisive, Figure 2. In contrast, the regions of South America, Africa, and the Middle East contribute little despite their large size. Nonetheless, Moody's predicts that these regions will soon require investment for sustainable growth; thus, the green bond market is expected to grow in these regions (Nauman, 2020). This regional expansion necessitates an understanding of whether the issuing firm's location affects how the green bond issue announcement impacts equity prices.

Green bonds can be issued by any firm so long as they fulfil the GBP requirements and the funds raised are used for an environmentally sustainable project (ICMA, 2015). As such, numerous different sectors have issued green bonds over the last decade. The Climate Bond Initiative 2016 and 2020 reports detail the 2015 and 2019 green bond proceeds by various sectors. The reports exhibit that the energy sector is prevailing in both 2015 and 2019,

accounting for a total of 46% and 31% of the green bond proceeds, respectively. However, this dominance decreases by 15% between 2015 and 2019. In contrast, the proceeds for transport and buildings increase by 7% and 10%, respectively (Climate Bond Initiative, 2016; Climate Bond Initiative, 2020). These changes in the proportion of proceeds took place over only four years, highlighting the novelty and dynamic nature of the green bond market. It also highlights that whilst some sectors are rapidly expanding into the green bond market others are declining. Even so, little is known about how an issuing firm's sector affects the stock market's response to a green bond issue announcement, thus compelling further investigation.

The organisations issuing green bonds include governments, corporates, financials, municipalities, and asset-backed securities (ABS). Banks were the first to issue green bonds and thus initially dominated the market. However, government-backed entities and other corporates (financial and non-financial) quickly engaged in the green bond market and have since increased their volume year on year (SEB, 2020). In 2019, corporates were the biggest group of green bond issuers (SEB, 2020). Due to the time constraints imposed on this paper and the accessibility of corporate firm data, this paper chooses to focus solely on the green bonds issued by the largest group of organisations, corporates, discussed further in section 4.1.

2.3. The future of the green bond market

The Climate Bond Initiative (2018) proposes that to meet the global emission targets, the green finance market must reach USD 1trn by the end of 2020 and continue to grow for each year in the following decade. Le Houérou (2019) suggests that most of this green financing will be in the form of green bonds. Nonetheless, some still question the relevance of green bonds. The Chief Investment Officer of Japan's Government Pension Investment Fund called green bonds a fad (Asgari, 2019). Furthermore, some highlight that the lack of regulations makes greenwashing more likely, misleading stakeholders on the environmental sustainability of the bond (Grene, 2015). Still, Grene (2015) proposes that as demand for green bonds scales up, it is probable that there will be consolidation in the market, and thus there will be one singular green bond definition with stricter regulation. Correspondingly, Deschryver and de Mariz (2020) suggest that the current unclear perceptions of green bond financial benefits, lack of standards, and risk of greenwashing, limit the growth of the green bond market. Notwithstanding the limited regulation, there remains to be investor appetite for green bonds, an investor poll performed by Morgan Stanley (2016) finds that 32% of high net worth individuals still view sustainable investing as the most appropriate forward-looking investments. Plus, the current climate crisis means there is a global requirement for investments

to be made into green projects, which should culminate in stricter regulation of the green bond market and hence an increase in size. Therefore, it is reasonable to assume that the green bond market will grow, necessitating further investigation into the impacts of green bond issues, including how their issue announcements impact equity prices.

3. Literature Review and Hypothesis Development

This chapter entails the review and synthesis of the literature that will yield in the hypothesis development for this paper. The review will start with an overall assessment of the literature related to ESG and Corporate Social Responsibility (CSR) activities of a firm, followed by an assessment of a firm's announcement of traditional bond and green bond issues and the resulting stock market reactions driven by these activities. The chapter will conclude with the hypothesis development.

The bond literature acknowledges that bond issue announcements impact a firm's stock price by conveying new information to investors about the firm's prospects (Eckbo, 1986; Flannery, 1986). In addition to (green) bond issue announcements signalling changes in capital structure, Flammer (2020) also notes that green bonds credibly signal a firm's commitment to the environment. Hence, following a green bond issue announcement, improvements in a firm's environmental performance are expected. In accordance, this literature review will draw upon two streams of literature. Firstly, we use an assessment of the literature on ESG and CSR, terms used synonymously in academia (Buniamin & Ahmad, 2015) and thus both drawn upon in this paper, to indicate how a firm's approach to environmental factors may impact a firm's value (market equity). It is appropriate to draw upon this literature, considering green bond issues are linked to positive increases in CSR/ESG since their proceeds finance green projects which address environmental issues (Li, Thang, Wu, Zhang & Lv, 2019). Moreover, Tang and Zhang (2020) find that green bond issuances are a good proxy for changes in a firm's ESG profile. Secondly, the relative novelty of green bonds and the subsequent lack of historical data means that academic research in this field is limited. Hence, to ultimately form the hypotheses, we review and draw upon the bond and available green bond literature.

3.1. CSR events and stock market reactions

There have been many empirical contributions to CSR/ESG effects on a firm's value. Krüger (2015) studies the link between CSR and the effect on shareholder value by analysing short-run shareholder reactions to positive and negative ESG events. Krüger concludes that CSR news with strong economic and legal information will result in a stronger response from shareholders. Furthermore, Krüger shows that news about negative CSR events result in a negative reaction from shareholders, especially events concerning the community or the environment. Similarly, Flammer (2013) uses an event study to investigate the impact of CSR announcements on firm value. The author stipulates that firms behaving irresponsibly towards

the environment face significant decreases in their firm value, whereas those firms behaving in an environmentally responsible manner encounter an increase. Further, Becchetti, Ciciretti, Hasan and Kobeissi (2012) use a sample of firms between 1994 and 2004 to conduct an event study on the impacts of entry and exit from the Domini 400 Social Index, a CSR benchmark. The authors find that an exit from the index, a decline in CSR, results in a significant and negative effect on the firm's stock price around the announcement date. Furthermore, a study by Ramchander, Schwebach and Staking (2012) concludes that the impact upon a firm's abnormal return following its addition or removal from the Domini 400 Social Index differs across sectors. The authors illustrate that amongst the sectors of finance, services, and technology, the financial sector has the lowest abnormal returns. The authors note that this finding is probably a result of the heavy regulation in the financial sector, reducing the signal value of a movement onto or off the index.

Remarkably, a large majority of the CSR literature neglects to distinguish between the elements of CSR. Albeit, Derwall, Bauer, Guenster and Koedijk (2005) focus solely on the environmental aspect of CSR by comparing two equity portfolios. One portfolio comprises stocks with a high eco-efficiency, representing the sustainability and environmental responsibility of a firm, the other portfolio contains stocks with a low eco-efficiency. The authors show that the high eco-efficiency portfolio earns higher average returns, implying environmental responsibility leads to higher returns. Moreover, Klassen and McLaughlin (1996) apply an event study to investigate the link between environmental management and the firm's stock market performance. The authors find significant positive returns for strong environmental management indicated by winning awards for a good environmental performance. Opposingly, they conclude that a weak environmental performance, indicated by environmental crises, causes significant negative returns of the firm's stock. The authors also find that firms operating in dirty industries, such as petroleum, have lower returns upon winning their first award than firms active in environmentally cleaner industries. Likewise, Karpoff, Lott and Wehrly (2005) note that violations of environmental laws result in a statistically significant loss of firm market value. The extent of this loss is equivalent to the legal or regulatory penalties the firm faces, thus implies that market-imposed reputational penalties are not the cause. Nonetheless, an analysis of 167 CSR studies between 1972 and 2008 finds no strong link between CSR and improved shareholder value (Margolis & Elfenbein, 2008). Conversely, Sharfman and Fernado (2008) determine that enhanced environmental risk management (an improved ESG) intensifies firm performance and

decreases the cost of capital. Chava (2014) and Goss and Roberts (2011) support this finding as the authors determine that poor CSR and environmental concerns lead to higher loan costs.

Additionally, the CSR literature has given some indication that responses may differ between countries. Zou, Wang, Xie and Zhou (2019) assess the recently launched socially responsible investment (SRI) indexes, containing firms with strong CSR performance, in China, Brazil, and South Africa. Zou et al. (2019) find a significant positive abnormal return for firms listed on the SRI index. Moreover, firms that expand into developing countries experience a greater stock market return than firms that expand into developed countries. Chollet and Cellier (2011) conduct a study to test the influence of CSR ratings on European stock returns. The authors stipulate that there are positive returns around the event day for firms with higher CSR ratings. However, a cross-sectional regression of the six underlying fields in the Vigeo CSR rating[1] shows that the environment field negatively affects stock returns, thus implying that European markets respond positively to CSR activities, but negatively to environmental activities.

The assessment of CSR/ESG literature indicates positive CSR/ESG events have a positive effect on firm values, especially events that posit strong economic and legal information (Krüger, 2015), yet Margolis and Elfenbein (2008) contradict this assumption of a positive CSR effect. Nevertheless, an assessment of the bond literature is required to supplement this CSR/ESG literature and enable the formation of a research question and hypotheses.

3.2. The impact of issuing debt announcements on firm value

The bond literature investigating the effect of bond announcements on firm value often produces inconclusive results that differ between debt types, countries, and sectors. The following section will discuss each of these areas, in turn, by drawing upon traditional bond literature, and when available, green bond literature.

3.2.1. Debt types

Numerous studies investigate the impact of debt announcements on firm value by assessing abnormal returns; the difference between the actual and expected stock returns, a negative abnormal return implies a negative stock market reaction. Eckbo (1986) establishes that straight bond announcements have a slight negative abnormal return, whereas convertible debt announcements are significantly negative. Accordingly, Dann and Mikkelson (1984) examine a sample of convertible debt issues between 1970 and 1979. The authors conclude that an

[1]Vigeo is a measure of ESG composed of six sub-scores, namely human resources management, environment, supplier relationship, corporate governance, community involvement and human rights (Meier, Saulquin, Schier & Soparnot, 2014).

announcement impacts firm value negatively. In contrast, a study of firms across 17 European countries by Fungáčová, Godlewski and Weill (2020) finds that bond announcements have a positive but lesser impact on firm value than loan announcements. Similarly, a study of convertible and warrant-bond announcements in the Netherlands between 1976 and 1994 concludes that the abnormal returns for both bond types are positive (De Roon & Veld, 1998). Markedly, the authors acknowledge that the positive abnormal returns contradict previous results and are likely a result of Dutch corporations releasing debt announcements in tandem with other positive news. Nonetheless, a study of 1436 convertible bond offerings by US firms between 1984 and 2008 concludes that the announcement abnormal returns for the period 2000 to 2009 are twice as negative as for 1984 to 1999, indicating that investor responses to announcements of convertible bond offerings are becoming more negative over time (Duca, Dutordoir, Veld & Verwijmeren, 2012). Opposingly, a UK study of loan announcements finds that since the financial crisis of 2008, abnormal returns following an announcement of bank loans have declined (Marshall, McCann & McColgan, 2019).

The literature shows that the type of debt is a significant determinant of a bond's abnormal return. Prominently, previous bond literature establishes that traditional and green bonds differ in their yield and premia. Hachenberg and Schiereck (2018) match the daily spreads of green and traditional bonds, concluding that green bonds have a tighter market than traditional bonds, thus implying that green bonds have a higher market premium. Similarly, a study of green and traditional bonds between July 2013 and December 2017 finds green bonds to have a lower yield than traditional bonds, also indicating that green bonds have a higher market premium (Zerbib, 2019).

Additionally, the limited green bond literature demonstrates that green bond announcements produce positive abnormal returns. Flammer (2018) finds significant abnormal returns for firms announcing a green bond issuance in a short two-day event window, containing the event day and one day prior. The event window is the period used to measure the impact of an economic event. Even so, Flammer (2018) does not compare these results to traditional bond announcements. Glavas (2018) uses a small sample of 780 bonds to test the abnormal return of green and traditional bonds using three different event windows: a pair of two-day windows and a one-day window. The author concludes that both bond types have positive significant abnormal returns and that on the event day, green bonds have more positive abnormal returns than traditional bonds. However, the author acknowledges that further exploration is necessary to determine if these findings are relevant across countries.

Notwithstanding, the reasons for the differences in abnormal returns between green and traditional bonds necessitates further exploration. The widely used Sharpe-Lintner Capital Asset Pricing Model stipulates that a firm's stock market return is affected by the firm's systematic risk (Chen, 2003). Yet, the information conveyed by a green bond issuance presents a further area to explore, that might have implications on the firm's returns. Flammer (2020) shows that a green bond issuance signals a firm's "commitment towards the environment" (p. 34) and that this signal results in a positive stock market response. Flammer (2020) insinuates that this positive response is a result of reduced information asymmetries facilitating identification of green firms, thus attracting more long-term and green investors, a suggestion that is in congruence with Tang and Zhang (2020). This positive response to an environmental signal is also consistent with the CSR/ESG literature review as the CSR/ESG literature supposes that positive environmental events improve a firm's CSR/ESG, which in turn leads to positive abnormal returns (Flammer, 2013; Klassen & McLaughlin, 1996; Krüger, 2015), justifying the use of the CSR/ESG literature in this paper. Moreover, Flammer (2020) finds that firms increase their environmental performance post green bond announcement.

Few papers explore the effect of green bond issue announcements on firm value. Furthermore, those papers that do draw comparisons use small samples, presenting a gap within the literature this paper aims to fill. Abnormal returns likely differ between green and traditional bonds since traditional bond issue announcements do not signal a firm's environmental strategy. Hence, this paper aims to fill this gap by exploring and comparing the effects of green and traditional bond issue announcements on firm value.

3.2.2. Country of issue

The bond literature further indicates that the impact of bond announcements on firm value may vary between countries and regions. A study of companies from 17 European countries finds that debt announcements lead to a positive stock market reaction (Fungáčová, Godlewski & Weill, 2020). Contrastingly, a study of 528 German firms supposes that the issuance of debt has a negative abnormal return (Kolari & Pynnönen, 2010). The research by Ammann, Fehr and Seiz (2006) supports these findings; the authors compare bond announcements in the German and Swiss markets between 1996 and 2003, finding both regions exhibit negative abnormal returns, yet German firms have far more negative abnormal returns. Chin and Abdullah (2013) study the Malaysian stock market's response to 100 bond issue announcements in Malaysia. Their findings indicate that the Malaysian market considers bond offerings to be favourable news. In contrast, a more recent study of 80 bond issuances that

comply with Islamic religious law in Malaysia concludes that the stock market response is significant but negative (Fauzi, Foo & Basyith, 2017). Wang (2017), similarly highlights that the Chinese stock market exhibits a negative response to the announcement of exchangeable bonds. A study of Chilean bond issue announcements also shows that there is a negative stock market response, yet the scale of this response is directly linked to the size of an issue (Castillo, 2004). Moreover, a study of American firms finds that common stockholders earn negative abnormal returns upon the announcement of a convertible bond (Dann & Mikkelson, 1984). This result is in congruence with the findings of Rahim, Goodacre and Veld (2014), who highlight that hybrid bond issues by American firms have significantly more negative abnormal returns than those issued by firms in other countries.

From the limited green bond literature, Baulkaran (2019) identifies green bond issues to have significant positive abnormal returns and acknowledges that these results may differ between countries due to differences in shareholder protection, yet the author does not detect any differences between countries with common or civil law. Lebelle, Jarjir and Sassi (2020) conduct an event study to observe the effect of a green bond issuance announcement on a firm's stock price. Contrasting other studies, the authors suppose that stock markets react negatively around the green bond announcement date. Moreover, the authors, through a cross-sectional analysis, establish that developed markets such as the American and European markets react more negatively to green bond announcements than emerging markets.

3.2.3. Sector

Previous studies of bond announcements also incorporate an analysis of the change in firm values across sectors. Janjigian (1987) assesses abnormal returns following bond announcements using a sample of utility, transportation, industrial and financial firms. The author finds that only industrial firms have significant negative abnormal returns. However, the author stipulates that the insignificant results for the other firm types are likely due to the small sample. Nevertheless, Yaman (2016) confirms the findings of the previous study. Yaman studies a sample of 231 bond issues by US financial, industrial, and utility firms between 1985 and 2011, concluding that announcement returns for industrial firms are negative and become more negative with every new issue, but this is not the case for financial or utility firms. The author stipulates that these results are likely due to the regulatory requirements in the financial and utility sectors reducing the information asymmetry between issuers and investors, hence limiting the value of a signal following a bond issue announcement.

A study of green bond issuances in 28 countries between 2007 and 2017 highlights that the announcement of bond issues from corporate firms, which in their study consist of industrial firms, have significant positive abnormal returns. Whereas, bond issues from financial firms have insignificant abnormal returns (Tang & Zhang, 2020). The authors postulate that only firms that are issuing green bonds to finance their green projects, such as industrial firms, receive positive abnormal returns. Financial firms, that issue green bonds to pay-out loans or invest in their customers' green projects, do not receive such positive abnormal returns (Tang & Zhang, 2020). Next to the regional assessment of green bond announcement effects, Lebelle, Jarjir and Sassi (2020) also compare financial corporations with non-financial corporations. They conclude that despite a significant negative abnormal return for financials and a non-significant negative abnormal return for non-financials, the size of this difference is very small, demonstrating a similar stock market reaction for both groups.

3.3. Synthesis of the literature and hypothesis development

The green bond market is rapidly evolving in terms of legislation and issuances. Despite this, there continues to be debate over the definition of a green bond and the literature still poses significant gaps. For instance, the review of the green bond literature brings to light the limited research into how green bond announcements affect the abnormal returns compared to traditional bonds. The CSR/ESG literature identifies that a positive CSR/ESG event enhances firm value (Flammer, 2013; Krüger, 2015), and a green bond can be seen as proxy for a firm's ESG profile since it signals a firm's environmental responsibility (Flammer, 2020; Tang & Zhang, 2020). Furthermore, the traditional bond literature shows that different debt types incur different abnormal returns (Eckbo, 1986), hence exhibiting no clear stock market reactions for debt issue announcements as such. The green bond literature also highlights that green bond issue announcements have positive abnormal returns (Flammer, 2020; Glavas, 2018; Tang & Zhang, 2020). Therefore, it is probable, due to the signalling effect of green bonds, that green bond issue announcements have larger abnormal returns than traditional bond issue announcements (Flammer, 2020), therefore the first hypothesis is:

H1: Green Bond issue announcements have more positive abnormal returns than traditional bonds issue announcements

Next to that, the bond and CSR/ESG literature highlights that abnormal returns are likely to differ across regions. Zou et al. (2019) find that firms expanding into developing countries experience a greater stock market return. Chollet and Cellier (2011) indicate that European

markets respond negatively to environmental activities, such as issuing green bonds. Moreover, the bond literature identifies that developed markets such as the European or American market may have negative abnormal returns upon the announcement of a bond compared to emerging markets (Lebelle, Jarjir & Sassi, 2020), whereas the Malaysian market, depending on the type of bond, may have a positive (Chin & Abdullah, 2013) or negative response (Fauzi, Foo & Basyith, 2017). Furthermore, according to Wang (2017), Chinese firms announcing a bond issue should register negative abnormal returns. Synthesizing the bond and CSR/ESG literature findings, there are differences in abnormal returns between regions, but few make explicit and direct comparisons. Furthermore, within the green bond literature, this area has received little exploration. The paper by Lebelle, Jarjir and Sassi (2020) defines the three largest green bond issuing regions to be Europe, Asia, and America, yet fail to make comparisons across these specific regions. Hence, this paper aims to explore the differences between these regions.

Furthermore, the literature studying the impact of traditional bond and green bond announcements on firm values across sectors exhibits mixed results. The bond literature finds that industrial firms have significant negative abnormal returns compared to financial and utility firms (Janjigian, 1987; Yaman, 2016). Conflicting, Tang and Zhang (2020) insinuate that only firms conducting projects suited for a green bond financing will benefit from the issuance, implying that financial firms will not gain from a green bond issuance. On the contrary, Lebelle, Jarjir and Sassi (2020) outline no large difference between financial and non-financial corporations in the stock market's reaction upon the green bond announcement. Additionally, the CSR/ESG literature finds that cleaner industries have higher returns than firms active in environmentally dirty industries (Klassen & McLaughlin, 1996). Most CSR/ESG and bond literature compare returns from financial and industrial firms, yet, some papers also incorporate dirty and clean industries. The green bond literature significantly lacks insight into how green bond announcements differ across sectors. This paper aims to bridge this gap in the literature by investigating whether following the announcement of a green bond, the abnormal returns for firms operating in different sectors significantly differ. This paper, in line with previous literature, explores the financial and industrial sectors, plus, it incorporates renewable energy firms to capture the clean industry element.

The literature concerned with the issuing firm's regional and sectoral elements shows that there are inconsistent and only few contributions, hence the second hypothesis combines the assumption that there are region and sector differences upon green bond issue announcements:

H2: A green bond issue announcement will lead to abnormal returns that differ between firms operating in various regions and sectors

Nonetheless, a further discussion of the reasons behind the expected larger abnormal returns for green bond announcements is needed. It is possible to hypothesise that while the traditional bond literature has split opinions about whether (conventional, convertible, warrant-bond) bond announcements yield positive and significant abnormal returns (Dann & Mikkelson, 1984; De Roon & Veld, 1998; Eckbo, 1986), the (limited) green bond literature seems to consistently find significant and positive abnormal returns for green bond announcements (Flammer, 2018; Flammer, 2020; Glavas, 2018; Tang & Zhang, 2020) with Lebelle, Jarjir and Sassi (2020) as an exception. These differences, albeit both traditional and green bonds are still debt issues, leads one to assume that it is a firm's engagement in a green and sustainable strategy that determines the abnormal returns, not the debt issue. Correspondingly, Tang and Zhang (2020) conclude that a green bond issue represents a change in a firm's ESG profile. Plus, Flammer (2020) finds that following a green bond issuance, firms improve their environmental stance and reduce CO2 emissions. Thus, one could hypothesise that a green bond issue announcement will lead on to a higher ESG score:

H3: Green bond issuances lead to higher ESG scores

4. Empirical Specification

The purpose of this chapter is to outline the selection criteria for data collection and detail how we interpret and analyse this data. The first section of this chapter, Data, details the sample collection and variable selection. The second section, Methods, outlines the techniques we use to test the hypotheses.

4.1. Data

The selection of data, also called selection criteria in event studies, is important to ensure the data collected is a representative sample and corresponds to the correct event (MacKinlay, 1997). The first process in the data selection is to identify traditional and green bond issue announcements. Following, we need to segment the bond issuances according to sector, region and type. Once the bond data is retrieved, we need to identify the issuing firms' stock returns, the underlying market return and the control variables.

4.1.1. Identifying and segmenting bonds by region, sector and type

We use the Bloomberg database to identify bonds and their announcement dates. Due to the time constraints imposed upon this paper, the investigation of bond data is limited to five years. The five-year sample period of 2015 to 2019 is selected on the basis that the green bond market has rapidly expanded over recent years, therefore there are more green bonds to investigate in the more recent years. Furthermore, this data is available and more complete on the Bloomberg Terminal plus, recent data is more relevant and applicable to furthering the research of green bonds. To narrow the sample further, we only include corporate firms that issue bonds between 2015 and 2019 and are publicly listed. This approach is suitable since corporates are the largest in terms of green bond issuances (SEB, 2020). The sample also excludes firms that do not meet the selection criteria, such as firms from sectors or regions that are outside the scope of this paper, discussed further below. Additionally, firms with recent mergers and acquisitions or substantial changes in the managerial structure are left out. Likewise, we exclude firms that are conservative, such as firms with limited or missing financial data, from the sample (Khotari & Warner, 2007).

To test the second hypothesis, we require the issuing firm's sector and country. Hence, the sample selection criterion limits the sample to include only bond issues from financial, industrial, or renewable energy firms and from firms located in Asia, Europe or America. To identify and segment bond issues from industrial or financial firms we use Bloomberg's high level 'macro sector' classification. To identify the bonds issued by renewable energy firms

requires the more granular ‘micro sector’ level identifier since the Energy ‘macro sector’ also includes oil and petrol firms (Di Clemente, Chiarotti, Cristelli, Tacchella & Pietronero, 2014). To segment bonds by region, we use the UN specialized agency for ICTs classification system to group the issuing firm’s country data into the regions of Asia, Europe, America, and Other (ITU, 2018). We omit bonds that are labelled with the Other region, and thus using these filters across the period identifies 3576 bonds.

To segment the bonds into green and traditional we use the Bloomberg green bond indicator. Bloomberg flags bonds with a green bond identifier, if the proceeds are self-labelled green by the issuer or Bloomberg identifies through statements about the use of funds that the bond is environmentally orientated (ICMA, 2017). Using the green bond flag, 524 of the 3576 bonds are green bonds.

4.1.2. Issuing firms’ stock returns, market returns and control variables

We use the Bloomberg Excel function along with the International Securities Identification Number (ISIN) and issuer name to retrieve each issuer’s stock returns. It is important to note, for future analysis, that returns are in percentage form. In addition to issuer stock return data the market model method of an event study requires the market index returns. We extract the market returns for each corresponding region from the Bloomberg database, using the Nikkei 225 for the Asian region, the FTSE 100 for the European region and the S&P 500 for the American region.

The use of control variables minimises the problem of endogeneity, a phenomenon that occurs when there is a correlation between an explanatory variable and the error term. Endogeneity can lead to inconsistent and biased Ordinary Least Squares (OLS) estimates (Roberts & Whited, 2013), and in this study, its presence is likely due to a firm’s ability to self-select the event day (Khotari & Warner, 2007). In self-selecting, a firm will anticipate the markets’ reactions and announce the event when the market conditions are most favourable, creating an omitted variable bias, which is a form of endogeneity caused by unobservable heterogeneity (Brooks, 2014; Roberts & Whited, 2013). The literature, on stock returns and bond issuances, highlights that endogeneity may result from some firm characteristics impacting investor reactions, and thus the findings (Glavas, 2018; Spiess & Affleck-Graves, 1999). An assessment of this literature identifies three control variables that we should include in this paper to minimise the endogeneity problem, namely, Operating Margin, Size, and Environmental, Social, and Governance (ESG) score.

Inclusion of the first control variable Operating Margin is necessary (Bradshaw, Richardson & Sloan, 2006; Glavas, 2018) since previous studies show that there is a correlation between profitability and financial distress, and firms are likely to announce bond issues when profits are high. Hence the inclusion of the Operating Margin, a measure of profitability, should minimize this potential source of self-selection and thereby reduce the likelihood of endogeneity (Roberts & Whited, 2013). To calculate Operating Margin, we divide each firm's operating income (earnings before interest and tax) by the total revenue for the year in which the bond is announced.

The second control variable of Size is the market capitalization of each firm for every year in this study (Bradshaw, Richardson & Sloan, 2006; Spiess & Affleck-Graves, 1999). Roberts and Whited (2013) suggest that including firm size will help to minimize the self-selection problem. Moreover, a study by Ashhari, Chun and Nassir (2009) stipulates that, upon the announcement of a bond, larger firms will receive larger abnormal returns, making it more probable that a larger firm will use this benefit and the public attention to self-select into announcing a bond issue. Including the control variable Size will reduce this probable source of endogeneity. To determine the Size variable, we multiply the year-end stock price by the number of outstanding shares at the end of each year. Both the Size and Operating Margin control variables require conversion to dollars. To convert the control values, we multiply each firm's value by their respective country's year-end exchange rate from Yahoo Finance. We collect data for operating income, revenue, shares outstanding, and share price from the Compustat database.

Next to that, we use the Sustainalytics database to determine each issuing firm's ESG score one month before and one year after the bond announcement. For firms issuing bonds in 2019 the one-year post announcement score is the most recent ESG score, and firms with no ESG score are excluded from the sample. Thus, the sample comprises 2200 bonds, of which 205 are green. We use the one month before announcement ESG scores as a control variable for the regression of the first hypothesis to control for the probable scenario that investors respond differently to a firm's ESG score (Tang & Zhang, 2020) as green bond issue announcements signal a firm's ESG score (Li et al, 2019; Tang & Zhang, 2020). We use the one month before and one year after bond issue announcement ESG scores to test the third hypothesis. The use of ESG scores rather than the environmental score or E-pillar is to replicate the study by Tang and Zhang (2020), and it enables comparisons with the CSR/ESG literature, considered further in section 4.2.

4.2. Methods

This paper uses an event study, a test of equality of two means and cross-sectional regressions to explore the implications of green and traditional bond issue announcements on equity prices, in general and across a firm's region and sector. We further use t-tests and a test of equality of two means to detect the changes in ESG scores post (green) bond issue announcements. MacKinlay (1997) delineates numerous aspects to an event study including selection criteria, event and estimation windows, abnormal returns, and the testing of abnormal returns. All sections, other than the selection criteria discussed in section 4.1, are considered below. Following, there is an explanation of the test of equality of two means, cross-sectional regressions and ESG score analysis.

4.2.1. Event study

This paper aims to observe the effect of green and traditional bond issue announcements on a firm's stock price. Previous literature indicates that event studies are the most appropriate methodology to assess the impact of an economic event such as a bond issue announcement on firm value (Flammer, 2013; Flammer, 2018; Flammer, 2020; Klassen & McLaughlin, 1996; Krüger, 2015; Lebelle, Jarjir & Sassi, 2020; Tang & Zhang, 2020).

An event study comprises two different windows, an event window, and an estimation window. The event window is the period around the event day. An assessment of the stock returns in the event window is used to identify any return abnormalities, discussed further in section 4.2.1.2. The estimation window is used to estimate the parameters of a chosen model for defining normal returns. These estimated parameters are used in the event window to calculate the expected normal return; the return expected had the event not taken place. The difference, in the event window, between the actual return and the expected normal return, is the abnormal return. This return is evaluated through statistical testing to determine if the economic event has a significant impact.

4.2.1.1. Estimation window

Two important decisions need to be made regarding the estimation window; firstly, the length of the window and secondly, the model(s) used to determine the expected normal return. Normally, the estimation window uses data before the event window, MacKinlay (1997) suggests using an estimation window of 120 days before the event date. Additionally, to eliminate the risk that the event window influences the estimates of the security's normal returns, the estimation window should not overlap with the event window (MacKinlay, 1997).

This paper, in line with the proposals of MacKinlay (1997), selects an estimation window of 120 observations before the event window since it is deemed sufficient to capture the relationship between the security and the underlying market.

The models selected to determine the expected normal return are the constant mean return model and the market return model. The simplicity of the constant mean return model warrants its use. However, this model is susceptible to variability in returns, hence the use of the market return model as it reduces the variance of the returns by controlling for the correlation between the market and the firm's return (MacKinlay, 1997). Moreover, the market model, through removing the fraction of a return that relates to market movements, will increase the chances to detect the economic effect of the event on the firm's stock (MacKinlay, 1997). Nonetheless, Brown and Warner (1980) argue that the constant mean return model often produces similar results to more precise models. Thus, we use the constant mean return model to verify the findings of the market return model.

i) Constant mean return model

The constant mean return model requires the calculation of the mean of the observed returns, for each security in the estimation window, the equation is as follows:

$$R_{it} = \mu_i + \varepsilon_{it} \quad (1)$$

R_{it} is the return of security i at time t, μ_i is the mean of the observations in the estimation window, and ε_{it} is an error term at time t. Since the expected value of the error term is zero, the expected normal return for the event window in the constant mean return model is the estimate of μ_i (equation 3).

The abnormal return is the difference between the actual observed return and the expected normal return in the event window. The generic abnormal return equation is:

$$AR_{it} = R^*_{it} - E[R^*_{it}|\Omega_{it}] \quad (2)$$

Where R^*_{it} is the actual return in the event window and $E[R^*_{it}|\Omega_{it}]$ is the expected normal return conditional on the method chosen to estimate the return. Thus, in the constant mean return model, the $E[R^*_{it}|\Omega_{it}]$ is as follows:

$$E[R^*_{it}|\Omega_{it}] = \hat{\mu}_i \quad (3)$$

The expected normal return is the estimated constant mean return ($\hat{\mu}_i$) calculated by taking the average of the returns of the estimation window.

ii) Market return model

The main difference between the market return model and the constant mean return model is that the market model incorporates market returns. To determine the corresponding market return for each firm, we use each firm's region to link the firms within the sample to one of this paper's three region market returns.

To estimate the *alpha* and *beta* values, we use the following model:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (4)$$

The return on security *i* at time *t* (R_{it}) is the firm's *alpha* (α_i) plus the firm's *beta* (β_i) multiplied by the corresponding market return at time *t*. To estimate *alpha* and *beta* we run regressions with each firm's returns in the estimation window on the corresponding market returns. The firm's *alpha* is the intercept, and the slope is the *beta* value. In the event window, we input these values into the market return model, along with the corresponding stock market return to determine the expected normal return. In line with MacKinlay (1997), the expected normal return of the market model is calculated as follows:

$$E[R_{it}^*|\Omega_{it}] = \hat{\alpha}_i + \hat{\beta}_i R_{mt}^* \quad (5)$$

The *alpha,* calculated in the estimation period, is added to the *beta,* also calculated in the estimation period, times the market return in the event window (R^*_{mt}). Substituting this estimated normal return ($E[R^*_{it}|\Omega_{it}]$) into equation (2), the difference between R^*_{it} and the market return model's $E[R^*_{it}|\Omega_{it}]$ is the Abnormal Return (AR_{it}).

4.2.1.2. Event window

Once an economic event of interest is known, estimation window and estimation model(s) determined, the event window requires defining, to enable the determination of the abnormal returns. The event window is the period where the stock prices of the firm are analysed (MacKinlay, 1997). MacKinlay (1997) suggests defining the event window before and after the event day to allow for a thorough analysis. Plus, we must assume that there is no clustering of different securities' event windows, meaning no overlap between windows, and the assumption of no correlation between abnormal returns must hold (MacKinlay, 1997).

However, there is no consensus on the exact length of the event window. To decipher the appropriate length of an event window we incorporate the approaches taken in previous literature. Flammer (2018) finds significant results only for a short two-day event window, containing the event day and one day prior. Similarly, Glavas (2018) assesses only short event

windows around the event day. Contrastingly, Krüger (2015), Tang and Zhang (2020) and Flammer (2020) use longer event windows to conduct their event studies. A longer event window can help to capture market reactions if, for instance, information leaks before the official announcement (McWilliams & Siegel, 1997). McWilliams and Siegel (1997) posit that information leakages are present in the financial market; thus, their presence is probable in this paper's sample, inferring the use of a long event window. Furthermore, Flammer (2020), following Krüger (2015), includes five days prior and ten days post the event day to capture possible information leaks and delays in stock market reaction. Nevertheless, Brown and Warner (1985) find that a longer event window will result in a lower power of the statistical tests. Consequently, this paper, in line with the previous literature, uses two event windows with different lengths. The different event windows are defined by [s1 s2] below, on account of their dissimilar starting (s1) and ending days (s2):

- [-2 1] This event window starts two days prior to the announcement and ends one day post announcement.
- [-5 20] This event window starts five days prior to the announcement and ends twenty days post announcement.

4.2.1.3. Testing the significance of results

Most event studies perform various significance tests to determine whether the abnormal returns are significant and thus identifying if the economic event is impactful. Nonetheless, for this paper the value of an average abnormal return (AAR) test is limited since this paper has more than one day in the event window and AAR fails to aggregate the days (MacKinlay, 1997). In contrast, the cumulative average abnormal return (CAAR) aggregates through time and across securities, hence it is appropriate to test CAAR for significance in this event study (MacKinlay, 1997). We use cumulative abnormal returns (CAR) in this paper to determine the CAAR and to perform the cross-sectional regressions. CAR provides a way to aggregate the abnormal returns through time, therefore it is useful when the event window is longer than one day (MacKinlay, 1997). Further the aggregation of the observations enables one "to draw overall inferences for the event of interest" (MacKinlay, 1997, p. 21). The following equation can then be used to calculate the CAR for a given security *i*:

$$CAR_i\ (s1, s2) = \sum_{t=s1}^{s2} AR_{it} \tag{6}$$

As indicated, the CAR for a given security *i*, *i=1…N,* is the sum of the abnormal returns for security *i* between s1 and s2. The CAAR extends the CAR by aggregating across time and securities. The AAR is equal to the CAAR when s1=s2. MacKinlay (1997) proposes that CAAR can be calculated as:

$$CAAR\ (s1, s2) = \frac{1}{N}\sum_{i=1}^{N} CAR_i\ (s1, s2) \tag{7}$$

To formally test the CAAR of both green and traditional bond issue announcements we use the following hypothesis:

$$H_o: CAAR = 0;\ \ H_1: CAAR \neq\ 0 \tag{8}$$

The abnormal returns are statistically significant if the null hypothesis is rejected. To be statistically significant, the consensus in financial literature is that the result must be at least significant at a 5% confidence level.

Furthermore, we use the test of equality of two means to compare the CAAR of green bond issue announcements with that of traditional bond issue announcements. This approach applies a two-sample t-test to determine whether two population means are equal (Snedecor & Cochran, 1989). We use Welch's t-test, an extension to the traditional t-test, that allows for unequal variances (Welch, 1947). Importantly for this paper, Welch's t-test method is more reliable when sample sizes are unequal (Fagerland & Sandvik, 2009). For this paper, the null hypothesis (Ho) is that the CAAR for both green and traditional bonds is equal, and thus the hypothesised difference between them is zero.

$$H_o: CAAR_{Green} - CAAR_{Traditional} = 0;\quad H_1: CAAR_{Green} - CAAR_{Traditional} \neq\ 0 \tag{9}$$

The difference tested is the green bond CAAR minus the traditional bond CAAR value. If the difference is statistically different from zero, the null hypothesis is rejected. If the difference is positive and statistically significant, this supports the paper's first hypothesis. Note, that we use this test of equality of two means to supplement the cross-sectional approach discussed below.

4.2.1.4. Cross-sectional regressions

To test this paper's first and the second hypotheses, we employ several cross-sectional regressions. We use the CAR obtained from the event study to estimate several regression models using OLS with robust standard errors to account for heteroscedastic residuals (White,

1980). This method is frequently used in the literature to detect the factors determining firms' abnormal return (Baulkaran, 2019; Khotari & Warner, 2007; MacKinaly, 1997).

The first hypothesis aims to highlight the differences in the abnormal returns between green and traditional bond issue announcements. To test this hypothesis, we analyse the *Green Dummy* in the following cross-sectional regression:

$$CAR_i(s1, s2) = \beta_0 + \beta_1 GreenDummy_i + \beta_2 Size_i + \beta_3 OM_i + \beta_4 ESG_i + \varepsilon_i \quad (10)$$

Where OM_i stands for Operating Margin. The *Green Dummy* variable takes on a value of zero for traditional bonds, and a one for green bonds. This variable's coefficient (β_1) is the coefficient of interest. This coefficient is used to test the first hypothesis' null that there is no difference between the abnormal returns following an issue announcement of either bond type. An insignificant coefficient fails to reject the null hypothesis. In contrast, a positive and significant coefficient rejects the null and supports hypothesis one as it implies that green bond issue announcements have more positive abnormal returns compared to traditional bond issue announcements. A negative coefficient implies that a green bond has lower abnormal returns compared to a traditional bond.

The second hypothesis investigates the effects of a firm's region and sector when announcing a green bond issue. To investigate this hypothesis the analysis is split into region and sector. To investigate the regional differences, we employ a regression with two dummy variables: *Europe Dummy* and *America Dummy*. These variables take on the value of one if the firms issuing the bonds are European or American, else the value is zero. To avoid perfect multicollinearity, the regression excludes the Asian Dummy. Consequently, Asia is the reference category for the two other dummy variables. The specification of the regression is as follows:

$$CAR_i(s1, s2) = \beta_0 + \beta_1 EuropeDummy_i + \beta_2 AmericaDummy_i + \beta_3 Size_i + \beta_4 OM_i + \varepsilon_i \quad (11)$$

To determine whether abnormal returns differ across regions, the coefficients of Europe (β_1) and America (β_2) require examination. These coefficients indicate how much larger or smaller the abnormal returns for European and American firms are compared to the reference firms from Asia. For instance, if the coefficient β_1 is significantly positive, it implies that European firms earn larger abnormal returns compared to Asian firms, the same result applies for the β_2 coefficient. If the coefficients are significantly negative, it implies that green bond announcements from both European and American firms respectively, have lower abnormal returns than Asian firms.

To investigate the impact of an issuing firm's sector on abnormal returns requires use of the following regression:

$$CAR_i(s1, s2) = \beta_0 + \beta_1 FinanacialDummy_i + \beta_2 RenewableDummy_i + \beta_3 Size_i + \beta_4 OM_i + \varepsilon_i \quad (12)$$

This regression follows the same intuition as the regional regression, the differences being this regression uses the sector dummy variables of *Financial Dummy* and *Renewable Dummy*, and a reference category consisting of industrial firms. The null hypothesis, in this case, is that there is no difference between the abnormal returns from issuing firms operating in different sectors. For this regression, the coefficients of interest are the *Financial Dummy* coefficient (β_1) and the *Renewable Dummy* coefficient (β_2). The interpretation is like the regional regression, and thus to reject the null hypothesis, β_1 or β_2 must be significant. If both β_1 and β_2 are positive and significant coefficients, this implies financial and renewable energy firms have more positive abnormal returns than industrial firms.

4.2.2. ESG scores analysis

The final hypothesis of this paper investigates whether green bond issues lead to higher ESG scores. The investigation of this hypothesis is outside the realm of an event study approach, as it does not require abnormal returns. Instead, it commands the use of t-tests to identify any statistical differences in the ESG scores after green or traditional bond issue announcements. To do this we use the firm's ESG score a month before and a year after a green or traditional bond announcement. The use of the one-year post-announcement ESG scores is to allow enough time to capture a more representative sample of ESG scores, acknowledging that ESG scores are slow to incorporate changes, and inconsistent and unreliable (Bloomberg, 2019). The t-tests input the differences between the average post-announcement and average pre-announcement ESG scores, for green and traditional bonds, separately. The null hypothesis of the t-test is that the change, the difference between post and pre bond issue announcement, equals zero. This t-test aims to show whether firms in this paper register ESG score improvements after an issue of a green or traditional bond.

To test if the green and traditional ESG score changes are statistically different, we use a test of equality of two means. To perform this test, we deduct the average ESG score change for firms issuing traditional bonds from the average ESG score change of firms issuing a green bond. This approach treats the traditional bond issue ESG scores as a variable that, to an extent, captures the general changes in ESG scores taking place in the period under study. The null hypothesis of this test is that there are no differences in the ESG score changes. If the difference

is positive and rejects the null hypothesis, it implies that it is significantly non-zero and that the green bond announcements increase a firm's ESG score more than traditional bond announcements.

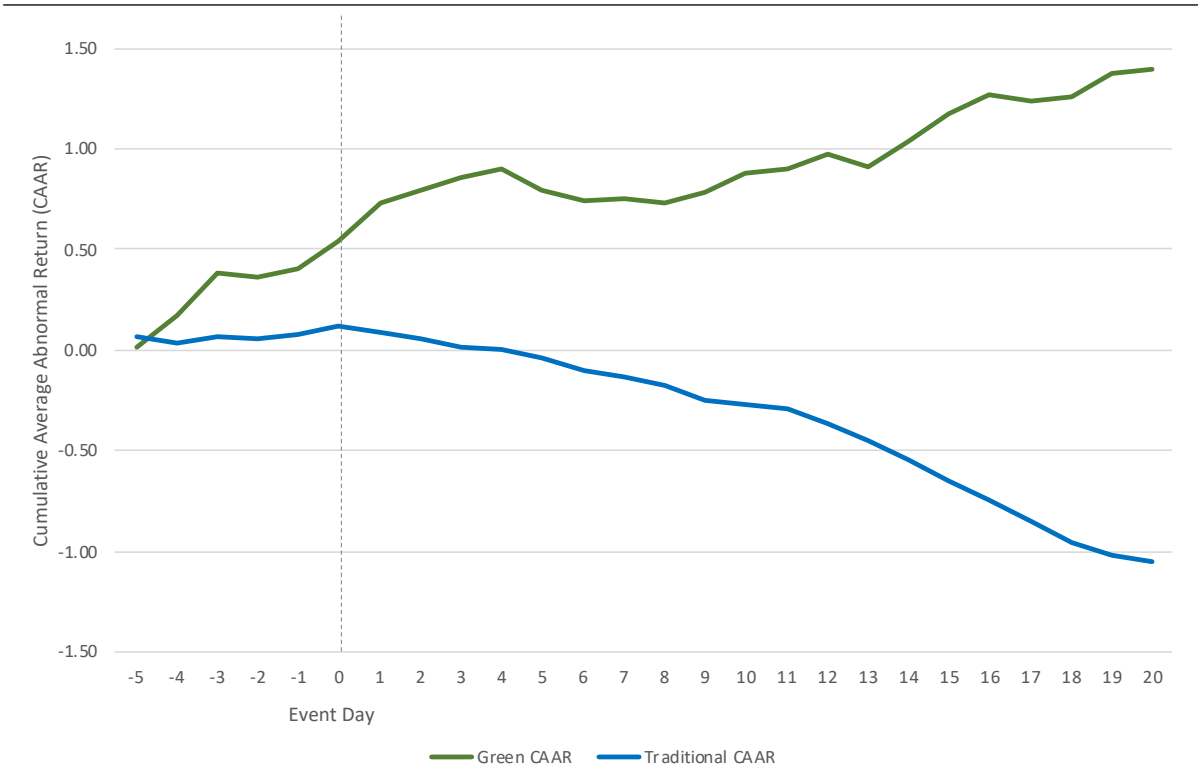
5. Results and Discussion

This chapter details the results from the event study, cross-sectional regressions and ESG score comparison. Initially, this chapter will give an overview of the event study results. Following, each hypothesis is considered in turn, allowing for a more comprehensive review and a discussion of the findings considering the academic literature reviewed.

5.1. Event study overview

Figure 3 shows the underlying trend in the CAAR for both bond types.

Figure 3. CAAR of Green and Traditional Bonds
This figure illustrates the Cumulative Average Abnormal Returns (CAAR) following traditional and green bond issue announcements in a 26-day [-5 20] event window. We construct this graph using the with the market model calculated abnormal returns and aggregate according to MacKinlay (1997).



The green bond CAAR starts rising before the event day and keeps steadily increasing until day 20, indicating a positive trend and thus a positive investor response to green bond issue announcements. Furthermore, the rise in the Green CAAR prior to the event day is indicative of possible information leakages within this market. In contrast, the Traditional CAAR, unlike the Green CAAR, peaks on the event day. Yet, the traditional bond CAAR exhibits a steady CAAR up to the event day and a decline after the event day, signifying a declining trend, which implies that investors respond negatively to traditional bond announcements.

To further test the CAAR of both green and traditional bond announcements and to identify significant differences, several significance tests require performance. Table 1, below, shows an extract of the green and traditional bond CAAR values; the CAAR values are calculated for the two event windows using the market model. The table also exhibits the difference between the green and the traditional bond CAAR values.

Table 1. Significance tests for CAAR

This table presents the results of the significance tests for both green and traditional bond announcement CAAR for different event windows and the test of equality of 2 means with the CAAR difference between green and traditional bond announcements. T-statistics are in brackets. The *,**,*** denote the 10,5 and 1% significance level, respectively.

	Green	**Tradtional**	**Difference**
Event Window	Coefficient (T-stat)	Coefficient (T-stat)	Coefficient (T-stat)
Panel A: Event Window [-5 20]			
[-5]	0.02 (0.16)	0.07 (2.06)	-0.05 (-0.42)
[-5 -3]	0.39** (2.14)	0.07 (1.19)	0.32* (1.66)
[-5 -1]	0.41 (1.69)	0.08 (1.07)	0.33 (1.29)
[-5 0]	0.54** (2.03)	0.12 (1.49)	0.42 (1.49)
[-5 1]	0.73** (2.55)	0.08 (1.07)	0.65** (2.14)
[-5 20]	1.40** (2.74)	-1.06*** (-6.34)	2.46*** (4.56)
Panel B: Event Window [-2 1]			
[-2]	-0.02 (-0.19)	-0.01 (-0.26)	-0.01 (-0.11)
[-2 -1]	0.02 (0.12)	0.01 (0.21)	0.01 (0.06)
[-2 0]	0.15 (0.74)	0.05 (0.90)	0.1 (0.48)
[-2 1]	0.35 (1.49)	0.02 (0.28)	0.33 (1.36)

Panel A of Table 1 illustrates that the positive green bond CAAR becomes significant when including the event day and remains significant in all succeeding event windows. Markedly, the [-5 -3] event window shows significant positive CAAR for green bond announcements, indicating possible information leaks prior to the announcement day which coincides with a large increase in green bond CAAR, Figure 1, three days prior to the event. On the contrary, the traditional bond CAAR is not significant when including the event day, plus it exhibits a negative trend and only becomes significant from the event window [-5 9] onwards, illustrating negative stock market reactions upon traditional bond announcements (Appendix 1). The difference between green CAAR and traditional CAAR, shown in the difference column, tests

for the first hypothesis, that green bond issue announcements have larger abnormal returns than traditional bond issue announcements. The difference column illustrates significant positive differences between the green and traditional bond CAAR values from the [-5 1] to [-5 20] event window. Pointedly, the [-5 1] event window coincides with a steep increase of the green bond CAAR around day one. The [-5 20] CAAR difference of 2.46 is significant and hence indicates that abnormal returns upon announcement are 2.46% points larger for firms announcing a green bond compared to firms announcing a traditional bond. These results demonstrate that firms announcing a green bond issuance have larger abnormal returns than firms announcing a traditional bond issue, thereby supporting hypothesis one in this paper.

Panel B of Table 1 indicates that neither green nor traditional bond CAAR are significant in the [-2 1] four-day event window, meaning one cannot easily draw significant conclusions from comparing the CAAR of firms announcing a green or traditional bond in the short event window. Thus, the positive but insignificant difference in the [-2 1] event window delivers no evidence to support hypothesis one.

5.2. Comparison of green and traditional bond announcement effect

To confirm the results from the test of equality of two means and to control for the variables of firm Size, Operating Margin, and ESG score, we run cross-sectional regressions using the green and traditional CAR of each firm as the dependent variable. The regressions are run for the two event windows, using the two models; Table 2 illustrates the results.

Table 2. Stock Market Reaction to Bond Issue Announcement

This table presents the results of the cross-sectional regressions with the CAR for both green and traditional bond announcement returns as dependent variable. The CAR is calculated using the Market Model and the Constant Mean Return Model for two event windows of different length. Robust t-statistics are in brackets. The *, **, *** denote the 10, 5 and 1% significance level, respectively.

	Market Model				**Constant Mean Return Model**			
	Window [-2 1]		**Window [-5 20]**		**Window [-2 1]**		**Window [-5 20]**	
Variable names	Coefficient (T-stat)	Coefficient (T-stat)	Coefficient (T-stat)	Coefficient (T-stat)	Coefficient (T-stat)	Coefficient (T-stat)	Coefficient (T-stat)	Coefficient (T-stat)
Intercept	0.03	-0.23	-1.1***	-0.83	0.11	-0.32	-0.66***	-1.85
	(0.39)	(-0.57)	(-6.92)	(-0.80)	(1.58)	(-0.78)	(-3.74)	(-1.11)
Green Dummy	0.3	0.31	2.06***	2.35***	0.21	0.21	1.33**	1.55***
	(1.32)	(1.17)	(3.74)	(2.86)	(0.79)	(0.74)	(2.00)	(2.64)
ESG Score		0.002		-0.02		0.01		0.02
		(0.43)		(-0.69)		(1.01)		(1.11)
Size		0.00		0.00 **		0.00		0.00**
		(0.32)		(2.39)		(0.57)		(2.45)
Operating Margin		0.19		0.16		0.02		-1.05
		(0.59)		(0.16)		(0.06)		(0.95)

Table 2 demonstrates that for both estimation windows, irrespective of which model, the *Green Dummy* coefficient has a positive value. Nonetheless, only the *Green Dummy* coefficients for the [-5 20] event windows are statistically significant, and thus the interpretation of the insignificant [-2 1] event window results are not required. The result of the market model excluding controls in the [-5 20] window is significant at the 1% level and shows that green bond issue announcements have 2.06% points larger abnormal returns than traditional bond issue announcements. Moreover, the constant mean return model of the same window length excluding controls confirms these findings with a *Green Dummy* coefficient of 1.33 that is statistically significant at the 5% level.

Controlling for firm specific variables, the market model *Green Dummy* coefficient for the [-5 20] event window increases by 0.29 to a highly significant value of 2.35. Similarly, the results of the constant mean return model *Green Dummy* coefficient for the [-5 20] event window increase to 1.55 and become significant at the 1% level. The marginal difference between the *Green Dummy* coefficients for the [-5 20] models can be explained by the simplicity of the constant mean return model. Yet, the results for the [-5 20] window are positive and highly significant, thereby the null hypothesis of no difference in abnormal returns between the different bond type announcements can be rejected. Hence these results confirm the findings of the previous test of equality of two means and support the first hypothesis of this paper, namely that green bond announcements lead to larger abnormal returns than traditional bond announcements.

The event study overview identifies that the announcement of a traditional bond issue has negative abnormal returns in the longer event window. This finding supports the research of Dann and Mikkelson (1984) and Eckbo (1986) and contradicts De Roon and Veld (1998). Further, the overview finds that the abnormal returns for green bonds are positive, which corresponds with the findings of Flammer (2018), Flammer (2020), and Tang and Zhang (2020). Furthermore, the finding that the green bond CAAR exhibits a large increase three days before and one day after the announcement is conducive to the literature that identifies information leakages before and increased media coverage after the announcement day which culminates in positive market reactions (McWilliams & Siegel, 1997; Tang & Zhang, 2020).

The test of the equality of two means and the regression of CAR on green and traditional bonds also confirms that green bond issue announcements have more positive abnormal returns than traditional bond issue announcements, supporting hypothesis one of this paper. These results

mirror and extend the recent literature on green bond issue announcements in finding larger abnormal returns for longer event windows (Glavas, 2018). Yet this paper's findings of insignificant abnormal returns for a short four-day event window is unexpected and contradicts Flammer (2018) and Glavas (2018) who identify significant abnormal returns in short event windows. Nonetheless, significant abnormal returns for green bonds are found in a larger event window which is congruent with the findings of Flammer (2020) and Tang and Zhang (2020).

Still, to explicitly discuss the driving forces causing the large abnormal returns for green bond announcements further, analysis of the firm's sector and region is required. Plus, there needs to be a discussion of hypothesis one considering ESG scores and existing CSR/ESG literature, section 5.5.

5.3. Impact of an issuing firm's region on abnormal returns

The impact of an issuing firm's region on the abnormal returns following a green bond announcement are shown in Panel A of Table 3.

Table 3. Abnormal Returns Relating to Green Bond Issue Announcements

This table reports the cross-sectional regressions using the CAR for green bond issue announcement returns as the dependent variable. The CAR is calculated using the Market and the Constant Mean Return Models for two event windows of different length. Robust t-statistics are in brackets.The *,**,*** denote the 10, 5 and 1% significance level, respectively.

	Market Model				**Constant Mean Return Model**			
	Window [-2 1]		**Window [-5 20]**		**Window [-2 1]**		**Window [-5 20]**	
Variable	Coefficient (T-stat)	Coefficient (T-stat)	Coefficient (T-stat)	Coefficient (T-stat)	Coefficient (T-stat)	Coefficient (T-stat)	Coefficient (T-stat)	Coefficient (T-stat)
Panel A: Region								
Intercept	-0.25 (-0.62)	-0.06 (-0.08)	-0.29*** (-0.33)	-1.92 (-1.14)	-0.24 (-0.55)	-0.48 (-0.55)	-0.13 (-0.14)	-0.138 (-0.06)
Europe Dummy	0.86* (1.68)	1.02** (2.03)	1.04 (0.93)	1.31 (1.18)	0.90* 1.71	1.07** (2.05)	0.81 (0.68)	0.94 (0.79)
America Dummy	0.62 (0.68)	0.43 (0.46)	3.92** (2.36)	5.06*** (2.64)	0.35 (0.35)	0.07*** (0.06)	2.05 (0.82)	2.19*** (0.66)
Size		0.00 (112.36)		0.00 397.09		0.00 (1.11)		0.00 (-0.69)
Operating Margin		-0.38 (-0.40)		2.54 (1.18)		-0.52 (-0.45)		0.61 (0.17)
Panel B: Sector								
Intercept	-0.09 (-0.11)	-0.10 (-0.12)	-3.29 (-1.24)	-2.93 (-1.10)	-0.05 (-0.06)	-0.07 (-0.08)	-3.34 (-1.14)	-2.76 (-0.94)
Financial Dummy	0.42 (0.48)	0.29 (0.24)	4.33** (1.60)	6.52** (2.09)	0.39 (0.44)	0.23 (0.18)	4.19 (1.39)	7.63** (2.17)
Renewables Dummy	0.50 (0.42)	0.2 (0.16)	5.02 (1.63)	4.72 (1.50)	0.33 (0.27)	0.06 (0.05)	4.24 (1.21)	4.42 (1.24)
Size		0.00 (1.34)		0.00 (-0.04)		0.00 (0.86)		0.00 (-1.43)
Operating Margin		-0.45 (-0.28)		-4.14 (-1.28)		-0.33 (-0.20)		-5.56 (-1.53)

Excluding controls, both the market and constant mean return models with [-2 1] event windows produce *Europe Dummy* coefficients with p-values greater than 0.05, hence fail to support the second hypothesis that there are differences in abnormal returns between issuing firms located in various regions. Furthermore, the [-5 20] event window for the market and constant mean return models have insignificant positive coefficients for the *Europe Dummy*, confirming that hypothesis two cannot be supported. Including controls, all *Europe Dummy* coefficients remain positive, but neither of the [-5 20] event window models are significant. Contrastingly, the *Europe Dummy* coefficients for the market and constant mean return models for the [-2 1] event windows are positive and statistically significant with values of 1.02 and 1.07, respectively. Thus, the null hypothesis is rejected. The positivity of the coefficients indicates that European firms issuing green bonds have more positive abnormal returns than Asian firms in the short event window, which is in congruence with the traditional bond literature that finds positive abnormal returns upon debt announcements for European firms (Fungáčová, Godlewski & Weill, 2020). Still, it contradicts Chollet and Cellier (2011) who, in the CSR literature, find that European firms respond negatively to environmental activities and it also refutes a study by Kolari and Pynnönen (2010), who conclude that European markets respond negatively to debt issue announcements.

Excluding controls, the *America Dummy* coefficients are insignificant for the two constant mean return windows and the [-2 1] market model. However, for the market model with a [-5 20] event window, the *America Dummy* coefficient is positive and statistically significant, and thus supports hypothesis two in showing that there are differences in abnormal returns between firms issuing in different regions. Including controls, the *America Dummy* coefficients remain positive and insignificant for the market model [-2 1] event window. However, it is significant for the market model [-5 20] event window, thus the *America Dummy* is significantly different and larger than the reference dummy (Asian firms) in the longer event window, supporting hypothesis two. This finding contradicts the green bond literature study by Lebelle, Jarjir and Sassi (2020) who conclude that developed markets react more negatively than emerging markets, as many classify America as a developed market whereas a great number of markets situated in Asia are classified as emerging (MSCI, 2019). It also contradicts the traditional bond literature that suggests American common stockholders earn negative abnormal returns upon bond announcement (Dann & Mikkelson, 1984) and that American firms have more negative abnormal returns than other countries (Rahim, Goodacre & Veld, 2014).

Remarkably, the *America Dummy*, unlike the *Europe Dummy*, exhibits large differences between the two different event windows. For example, the results of the market model including controls show that the *America Dummy* is 0.43 in the short event window and 5.06 in the long window, a difference of 4.63. Comparatively, for the *Europe Dummy* coefficient, the difference is only 0.29. Furthermore, the longer event window results show that the *America Dummy* coefficients are always larger than the *Europe Dummy* coefficients. This contrasts the results for the short event window, where the *America Dummy* coefficients are always smaller and coincides with the *America Dummy* coefficients being significant in the long event window whilst the *Europe Dummy* coefficients are significant in the short window. This may be indicative of economic trends and information leakage in the American market, but further research is required to certify this finding. Overall, the results support hypothesis two in showing that, following green bond issue announcements, there are differences in abnormal returns between issuing firms that are operating in various regions, identifying another area this paper adds to academia.

5.4. Impact of an issuing firm's sector on abnormal returns

The results from the exploration of an issuing firm's sector on the abnormal returns following a green bond announcement are shown in Panel B of Table 3.

Excluding controls, the *Financial Dummy* coefficients are all positive, however only the market model with a [-5 20] event window has a statistically significant *Financial Dummy* coefficient of 4.33, indicating that abnormal returns in the financial sector are statistically different and more positive than abnormal returns in the industrial sector. Including controls, the *Financial Dummy* coefficient for the [-5 20] market model event window substantially increases to 6.52 and remains statistically significant. This is mirrored in the result for the constant mean return model in the same event window, as the *Financial Dummy* coefficient increases to 7.63 and is statistically significant at the 5% level. These results infer that the abnormal returns for financial firms are statistically different from industrial firms, supporting hypothesis two, that there are differences in abnormal returns between issuing firms operating in different sectors. This finding, that financial firms have larger abnormal returns, supports the traditional bond literature of Janjigian (1987) and Yaman (2016). Yet, this result contradicts the green bond literature findings of Lebelle, Jarjir and Sassi (2020), who conclude that the differences between financial and non-financial firms are very small. Furthermore, this paper contradicts

the work of Tang and Zhang (2020), who find industrial firms have significantly positive abnormal returns while financial firms exhibit insignificant abnormal returns.

The results for the *Renewables Dummy* coefficients, including and excluding controls, are positive yet insignificant for all models. This lack of significant results provides insufficient evidence to support the hypothesis that there are differences in abnormal returns between issuing firms operating in different sectors. Markedly, the *Financial Dummy* coefficient is larger than the *Renewables Dummy* coefficient for all models, tentatively indicating that financial firms have larger abnormal returns than renewable energy firms. This contradicts the CSR literature, highlighting that financial firms have lower abnormal returns due to heavy sector regulation (Ramchander, Schwebach & Staking, 2012).

Nonetheless, the results for renewable energy firms are insignificant and thus it is not possible to draw a solid conclusion. These insignificant results may imply that this paper encounters the same limitation as Janjigian (1987), who posits that the insignificant results for some sectors are due to small sample sizes. Even so, previous literature shows that green bond announcements credibly signal a firm's commitment to the environment (Flammer, 2020). As a result, it may be hypothesised that investors perceive renewable energy firms as already environmentally strong (green), and thus the green bond's signal is weak (Flammer, 2020), which identifies another area for future research. Overall, the exploration of sectors extends the current literature by highlighting the importance of a firm's sector in determining the size of expected abnormal returns upon the announcement of the green bond issue.

5.5. Impact of green bonds on the issuing firm's ESG score

The literature review suggests that firms, following the issuance of green bonds, encounter higher ESG scores. To investigate this hypothesis, the difference between the average ESG scores for a firm one-year post and one-month prior bond issue announcements, for both bond types, is taken and shown in Table 4 below. The table also illustrates the significance of the difference between green and traditional bonds in the changes of the firm's ESG score.

Table 4. ESG Scores for Green and Traditional Bond Announcements

This table illustrates the pre and post ESG scores for both bond types. The use of the test of equality of 2 means allows formal testing of the differences for each bond, pre and post-event day, as well as formal testing of the difference between the bonds pre and post-event day. T-statistics are in brackets. The *, **, *** denote the 10, 5 and 1% significance level, respectively.

	Green	**Traditional**	**Difference**
Time Period	μ ESG Score	μ ESG Score	Δ
Pre-Event Day	65.54	64.21	1.33 (1.17)
Post-Event Day	68.59	64.40	4.19*** (3.72)
Difference (Post - Pre Event Day)	3.05*** (5.41)	0.19 (1.59)	2.86*** (4.96)

The difference between green and traditional bond issue announcements in their average *Pre-Event Day ESG* scores indicates that green bond issue announcements on average come from firms with higher ESG scores. Moreover, firms announcing green bond issues on average receive a statistically significant increase of 3.05 in their ESG score. Comparatively, a traditional bond announcement leads to an insignificant average ESG score increase of only 0.19. These results indicate that firms issuing green bonds have higher ESG scores and these firms, following the green bond issue announcement, register a significant increase in their ESG score.

Comparing the changes in the ESG scores for firms issuing a green bond to firms issuing a traditional bond, the test of equality of two means produces a statistically significant difference of 2.86, suggesting that the ESG score increase that firms encounter is likely due to the green element of a bond issue. This is consistent with a paper that investigates the link between interest costs and various bond factors, including green bond certification, finding that issuing green bonds is a signal of a firm's CSR/ESG (Li et al., 2019). Plus, Tang and Zhang (2020) state: "[g]reen bond issuance can be viewed as a proxy for firms to make environmentally friendly investments and change their ESG profiles" (p. 17). Moreover, in finding evidence to support the hypothesis that green bond issue announcements lead to higher ESG scores, justifies this paper's use of the CSR/ESG literature and tentatively endorses Flammer (2020) who concludes that firms increase their environmental performance post green bond announcement.

However, this paper only tentatively explores the relationship between green bond issue announcements and ESG scores as these ESG scores could be influenced by other ESG events which we do not control for, therefore identifying another area for future research. Nonetheless, combining this paper's results that green bond issue announcements exhibit larger abnormal

returns and higher ESG scores than traditional bond issue announcements, supports the CSR/ESG literature that largely shows that positive CSR/ESG events or news have positive effects on the value of the firm (Flammer, 2013; Klassen & McLaughlin, 1996; Krüger, 2015). Hence, this paper tentatively shows that there is a relationship between an ESG event, such as a green bond issue, and positive abnormal returns. We hypothesise that these links between higher ESG scores, higher abnormal returns and green bond issues are a result of the positive investor response to the environmental signalling effect of a green bond issue announcement (Flammer, 2020).

6. Conclusion

Many firms use bond issues to raise funds to invest in a broad range of projects. Consequently, outside investors deem bond issue announcements to be a credible signal of a firm's prospects. More recently, green bonds have surged in popularity, but they have received little attention in academia. This paper furthers the understanding of green bonds through assessing abnormal returns of a firm's stock upon green and traditional bond announcement in a sample covering green and traditional bond issuances across three major regions, namely America, Europe and Asia and in the financial, industrial and renewable energy sectors between 2015 and 2019. This paper, by concluding that firms announcing a green bond see positive abnormal returns, supports the available green bond literature (Flammer, 2018; Flammer, 2020; Tang & Zhang, 2020). This paper also stipulates that firms announcing green bonds have significantly larger abnormal returns than firms announcing a traditional bond, supporting the results of Glavas (2018) and further extending the literature. This paper also tentatively supports the role of green bond issues as a proxy for ESG scores (Li et al., 2019; Tang & Zhang, 2020) and the signalling effect of green bond issue announcements (Flammer, 2020). However, this paper also contradicts studies by Lebelle, Jarjir and Sassi (2020) and Tang and Zhang (2020) in finding green bonds have positive abnormal returns, and that there are statistically significant differences between financial and industrial firms.

Nevertheless, this paper also extends the green bond literature and provides insights for the wider stakeholders; the finding of larger abnormal returns for green bond issue announcements emphasises that most firms would benefit from choosing to issue a green over a traditional bond. It also suggests that the stock markets and investors respond positively to firms engaging in activities to combat climate change. Hence, firms could focus more on these activities to enhance firm value. Furthermore, this paper's analysis of a firm's region and sector extends an area of literature that has received little exploration. This paper shows that both European and American firms have larger abnormal returns than Asian firms and that financial firms have significantly larger abnormal returns compared to industrial firms. For the wider stakeholders, these findings indicate that American and European markets appear more responsive to environmental signalling (Flammer, 2020).

Nonetheless, this paper does acknowledge that the time constraints limit the scope of the research. More time would facilitate a more comprehensive review of the differences across regions and sectors, specifically assessing the reasons why these differences occur. The scope

of this paper also neglects to include the size of the issue, yet this has been shown to have a significant influence over the size of the abnormal return (Castillo, 2004). Furthermore, the investigation consists of only three regions and sectors, even though previous literature has shown that other regions and sectors may respond differently to bond issue announcements.

Future research could incorporate factors to overcome the limitations of this paper and it could also expand upon the findings made, but tentatively explored. For instance, American firms, compared to European firms, have much larger differences between their abnormal returns in the different event windows. This is probably due to there being more economic trends and information leakages within the American market, future research could potentially explore this area. Furthermore, the results show that abnormal returns for renewable energy firms are insignificantly different from industrial firms. This insignificant result insinuates that renewable energy firms are already perceived to be green, thus the signal given by an announcement of a green bond issue from this type of firm is limited, providing a further area for future research. Plus, this paper tentatively detects a relationship between green bond issues and an increase in ESG scores. However, future research with more specific analysis is warranted to establish this relationship as fact.

Overall, this paper suggests that, upon the announcement of a green bond issue, firms register an increase in their ESG score and record larger abnormal returns than traditional bonds, yet these abnormal returns differ across regions and sectors.

List of References

Allen, K. (2018). Green bonds start conversation in the market, Financial Times, 09 October, Available Online: https://www.ft.com/content/37db6f9c-ad35-11e8-8253-48106866cd8a [Accessed 2 April 2020]

Ammann, M., Fehr, M., & Seiz, R. (2006). New evidence on the announcement effect of convertible and exchangeable bonds, *Journal of Multinational Financial Management*, vol. 16, no. 1, pp. 43-63

Asgari, N. (2019). World's top pension fund warns against risk of green bond 'fad', Financial Times, 03 July, Available Online: https://www.ft.com/content/f844f1c2-998e-11e9-8cfb-30c211dcd229 [Accessed 3 April 2020]

Ashhari, Z. M., Chun, L. S., & Nassir, A. M. (2009). Conventional vs Islamic Bond Announcements: The Effects on Shareholders' Wealth, *International Journal of Business and Management*, vol. 4, no. 6, pp. 105-111

Banga, J. (2018). The green bond market: a potential source of climate finance for developing countries, *Journal of Sustainable Finance & Investment*, vol. 9, no. 1, pp. 17-32

Baulkaran, V. (2019). Stock market reaction to green bond issuance, *Journal of Asset Management*, vol. 20, no. 5, pp. 331-340

Becchetti, L., Ciciretti, R., Hasan, I., & Kobeissi, N. (2012). Corporate social responsibility and shareholder's value, *Journal of Business Research*, vol. 65, no. 11, pp. 1628–1635

Berensmann, K., Dafe, F., & Lindenberg, N. (2018). Demystifying green bonds. In Boubaker, S., Cumming, D., & Nguyen, D. K. (Eds.) *Research Handbook of Investing in the Triple Bottom Line*. Cheltenham, UK: Edward Elgar Publishing, pp. 333-347

Bloomberg (2019) As demand for ESG investing grows, so too does the need for high-quality data, Available Online: https://www.bloomberg.com/professional/blog/demand-esg-investing-grows-need-high-quality-data/ [Accessed 1 May 2020]

Bradshaw, M. T., Richardson, S. A., & Sloan, R. G. (2006). The relation between corporate financing activities, analysts' forecasts and stock returns, *Journal of Accounting and Economics*, vol. 42, no.1-2, pp. 53-85

Brooks, C., (2014.) Introductory Econometrics For Finance, 3rd edn, Cambridge: Cambridge University Press.

Brown, S. J., & Warner, J. B. (1980). Measuring Security Price Performance, *Journal of Financial Economics*, vol. 8, no. 3, pp. 205–258

Brown, S. J., & Warner, J. B. (1985). Using Daily Stock Returns: The Case of Event Studies, *Journal of Financial Economics*, vol. 14, no. 1, pp. 3–31

Buniamin, S., & Ahmad, N. N. N. (2015). An Integrative Perspective of Environmental, Social and Governance (ESG) Reporting: A conceptual paper. International Conference on Accounting Studies (ICAS) Proceedings, Available Online: http://repo.uum.edu.my/17547/1/009-ICAS2015%209-16.pdf [Accessed 15 April 2020]

Campiglio, E. (2016). Beyond carbon pricing: The role of banking and monetary policy in financing the transition to a low-carbon economy, *Ecological Economics*, vol. 121, pp. 220-230

Castillo, A. (2004). The announcement effect of bond and equity issues: evidence from Chile, *Estudios de Economía*, vol. 31, no. 2, pp. 177-205

Climate Bond Initiative (2016). 2015 Green Bond Market Roundup, Available Online: https://www.climatebonds.net/files/files/2015%20GB%20Market%20Roundup%2003A.pdf [Accessed 15 April 2020]

Climate Bonds Initiative (2018). Bonds and Climate Change: The State of the Market, Available Online: https://www.climatebonds.net/files/reports/cbi_sotm_2018_final_01k-web.pdf [Accessed 15 April 2020]

Climate Bond Initiative (2020). 2019 Green Bond Market Summary, Available Online: https://www.climatebonds.net/files/reports/2019_annual_highlights-final.pdf [Accessed 15 April 2020]

Chava, S. (2014). Environmental externalities and cost of capital, *Management Science*, vol. 60, no. 9, pp. 2223-2247

Chen, M. H. (2003). Risk and return: CAPM and CCAPM, *The Quarterly Review of Economics and Finance*, vol. 43, no. 2, pp. 369-393

Chin, S. K., & Abdullah, N. A. (2013). Announcements effect of corporate bond issuance and its determinants, *Contemporary Economics*, vol. 7, no. 1, pp. 5-18

Chollet, P., & Cellier, A. (2011). The Impact of Corporate Social Responsibility Rating Announcements on European Stock Prices. International Conference of the French Finance Association 2011 Proceedings, Available Online: http://ssrn.com/abstract=1836902 [Accessed 27 April 2020]

Clapp, C. (2014). Climate finance: capitalising on green investment trends, *The Way Forward in International Climate Policy*, vol. 44, pp. 47-52

Dann, L. Y., & Mikkelson, W. H. (1984). Convertible debt issuance, capital structure change and financing-related information: Some new evidence, *Journal of Financial Economics*, vol. 13, no. 2, pp. 157-186

De Roon, F., & Veld, C. (1998). Announcement effects of convertible bond loans and warrant-bond loans: An empirical analysis for the Dutch market, *Journal of Banking & Finance*, vol. 22, no. 12, pp. 1481-1506

Derwall, J., Bauer, R., Guenster, N., & Koedijk, K. G. (2005). The Eco-Efficiency Premium Puzzle, *Financial Analysts Journal*, vol. 61, no. 2, pp. 51–63

Deschryver, P., & de Mariz, F. (2020). What Future for the Green Bond Market? How Can Policymakers, Companies, and Investors Unlock the Potential of the Green Bond Market? *Journal of Risk and Financial Management*, vol. 13, no. 3, p. 61

Di Clemente, R., Chiarotti, G. L., Cristelli, M., Tacchella, A., & Pietronero, L. (2014). Diversification versus specialization in complex ecosystems. *PloS one*, vol. 9, no. 11, pp. 1-8

Duca, E., Dutordoir, M., Veld, C., & Verwijmeren, P. (2012). Why are convertible bond announcements associated with increasingly negative issuer stock returns? An arbitrage-based explanation, *Journal of Banking & Finance*, vol. 36, no. 11, pp. 2884-2899

Eckbo, B. E. (1986). Valuation effects of corporate debt offerings, *Journal of Financial Economics*, vol. 15, no. 1-2, pp. 119-151

Fagerland, M. W., & Sandvik, L. (2009). Performance of five two-sample location tests for skewed distributions with unequal variances, *Contemporary clinical trials*, vol. 30, no. 5, pp. 490-496

Faske, B. (2018). Turning Billions into (Green) Trillions: Tracking the Growth and Development of the Green Bond Market in China, France, India, and the United States, *Tulane Environmental Law Journal*, vol. 31, no. 2, pp. 293-325

Fauzi, F., Foo, D., & Basyith, A. (2017). Islamic bond announcement: Is there any effect on returns? *Global Business Review*, vol. 18, no. 2, pp. 327-347

Flammer, C. (2013). Corporate social responsibility and shareholder reaction: The environmental awareness of investors, *Academy of Management Journal*, vol. 56, no. 3, pp. 758-781

Flammer, C. (2018) Corporate Green Bonds, Working Paper, Boston University

Flammer, C. (2020). Corporate Green Bonds, *Journal of Financial Economics*, forthcoming

Flannery, M. J. (1986). Asymmetric Information and Risky Debt Maturity Choice, *The Journal of Finance*, vol. 41, no. 1, pp. 19–37

Fungáčová, Z., Godlewski, C. J., & Weill, L. (2020). Does the type of debt matter? Stock market perception in Europe, *The Quarterly Review of Economics and Finance*, vol. 75, pp. 247-256

G20 Green Finance Study Group (2016). G20 Green Finance Synthesis Report, Available Online: http://unepinquiry.org/wp-content/uploads/2016/09/Synthesis_Report_Full_EN.pdf [Accessed 19 April 2020]

Glavas, D. (2018). How Do Stock Prices React to Green Bond Issuance Announcements? PhD thesis, ESCP Europe, Paris, Available Online: https://papers.ss rn.com/sol3 /papers.cfm?abstract_id=3279069 [Accessed 28 April 2020]

Global Sustainable Investment Alliance (2019) 2018 Global Sustainable Investment Review, Available Online: http://www.gsi-alliance.org/wpcontent/uploads/20 19/03/GSIR_ Review20 18.3.28.pdf [Accessed 2 April 2020]

Goss, A., & Roberts, G. S. (2011). The impact of corporate social responsibility on the cost of bank loans, *Journal of Banking & Finance*, vol. 35, no. 7, pp. 1794-1810

Grene, S. (2015). The Dark Side of Green Bonds, Financial Times, 14 June, Available online: https://www.ft.com/content/16bd9a48-0f76-11e5-b968-00144feabdc0 [Accessed 30 March 2020]

Hachenberg, B., & Schiereck, D. (2018). Are Green bonds priced differently from conventional bonds?, *Journal of Asset Management*, vol. 19, no. 6, pp. 371-383

ICMA (2015). *Green Bond Principles: Voluntary Process Guidelines for Issuing Green Bond*, March, Available Online: https://www.icmagroup.org/assets/documents/Regulatory /Green-Bonds/ GBP_2015_27-March.pdf [Accessed 30 March 2020]

ICMA (2017). The GBP Databases and Indices Working Group – Summary of Green Fixed Income Indices Providers, Available online: https://www.cbd.int/financial/greenbonds/icma-databases2017.pdf [Accessed 27 March 2020]

ICMA (2018) Green Bonds The State of the Market, Available online: https://www.icmagroup.org/assets/documents/Regulatory/Green-Bonds/Public-research-resources/CBIGBMFinal032019-120319.pdf [Accessed 30 March 2020]

ITU (2018) Country Classifications. Available Online: https://www.itu.int/en/ITU-D/Statistics/Pages/definitions/regions.aspx [Accessed 3 April 2020]

Janjigian, V. (1987). The leverage changing consequences of convertible debt financing, *Financial Management*, vol. 16, no. 3, pp. 15-21

Karpoff, J. M., Lott, J. R., & Wehrly E., W. (2005). The Reputational Penalties for Environmental Violations: Empirical Evidence, *The Journal of Law and Economics,* vol. 48, no. 2, pp. 653-675

Khotari, S. P., & Warner, J. B. (2007) in Eckbo, B., E. Econometrics of Event Studies (eds) *Handbook of Corporate Finance: Empirical Corporate Finance*, North-Holland pp. 3-53

Klassen, R. D., & McLaughlin, C. P. (1996). The Impact of Environmental Management on Firm Performance, *Management Science*, vol. 42, no. 8, pp. 1199-1214

Kolari, J. W., & Pynnönen, S. (2010). Event study testing with cross-sectional correlation of abnormal returns, *The Review of financial studies*, vol. 23, no. 11, pp. 3996-4025

Kuna-Marszałek, A., & Marszałek, J. (2017). Some considerations on the green bonds market development, 14th International Scientific Conference 2017 proceedings, Available Online: https://www.researchgate.net/profile/Jakub_Marszalek2/publication/320216590_Some_considerations_on_the_green_bonds_market_development/links/5c3e98e3a6fdccd6b5b050cf/Some-considerations-on-the-green-bonds-market-development.pdf [Accessed 4 April 2020].

Krüger, P. (2015). Corporate goodness and shareholder wealth, *Journal of Financial Economics,* vol. 115, no. 2, pp. 304-329

Landberg, R., Massa, A., & Pogkas, D. (2019). Bloomberg: Green Finance Is Now $31 Trillion and Growing, Available Online: https://www.bloomberg.com/graphics/2019-green-finance/ [Accessed 2 April 2020]

Le Houérou, P. (2019). A Bigger Role for Green Bonds, Financial Times, 05 June, Available online: https://www.ft.com/content/acb2c94c-86cd-11e9-a028-86cea8523dc2 [Accessed 30 March 2020]

Lebelle, M., Jarjir, S. L., & Sassi, S. (2020). Corporate Green Bond Issuances: An International Evidence, *Journal of Risk and Financial Management*, vol. 13, no. 2, pp. 1-21

Li, Z., Thang, Y., Wu, J., Zhang, J., & Lv, Q. (2019). The Interest Costs of Green Bonds: Credit Ratings, Corporate Social Responsibility, and Certification, *Emerging Markets Finance and Trade*, pp. 1-14

MacKinlay, A. C. (1997). Event Studies in Economics and Finance, *Journal of Economic Literature*, vol. 35, no. 1, pp. 13–39

Margolis, J. D., & Elfenbein, H. A. (2008). Do Well by Doing Good? Don't Count on It, *Harvard Business Review,* Available online: https://hbr.org/2008/01/do-well-by-doing-good-dont-count-on-it [Accessed 31 March 2020]

Marshall, A., McCann, L., & McColgan, P. (2019). The market reaction to debt announcements: UK evidence surrounding the global financial crisis, *The British Accounting Review,* vol. 51, no.1, pp. 92-109

McWilliams, A., & Siegel, D. (1997). Event Studies in Management Research: Theoretical and Empirical Issues, *The Academy of Management Journal*, vol. 40, no. 3, pp. 626-657

Meier, O., Saulquin, J. Y., Schier, G., & Soparnot, R. (2014). Visiting the Corporate Social Performance-Financial Performance Link in Europe, Available Online: http://www.vigeo-eiris.com/wp-content/uploads/2016/11/2014_FBS_Schier_Visiting-the-corporate.pdf [Accessed 2 May 2020]

Mercer (2015). Investing in Times of Climate Change mercer citation, Available online: https://www.mercer.com/content/dam/mercer/attachments/global/investments/mercer-climate-change-report-2015.pdf [Accessed 29 March 2020]

Morgan Stanley (2016) Behind the Green Bond Boom, Available Online: https://www.morganstanley.com/ideas/green-bond-boom [Accessed 23 April 2020]

MSCI (2019). MSCI Global Market Accessibility Review, MSCI, Available Online: https://www.msci.com/documents/1296102/1330218/MSCI_Global_Market_Accessibilty_Review_June_2019.pdf/511b8357-58a5-4992-3774-47f60baa1505 [Accessed 20 April 2020]

Nanayakkara, M., & Colombage, S. (2019). Do investors in Green Bond market pay a premium? Global evidence, *Applied Economics*, vol. 51, no. 40, pp. 4425-4437

Nauman, B. (2020). North America and Asia fail to keep pace in green bond boom, Financial Times, 17 February, Available Online: https://www.ft.com/content/e9644cbc-4d83-11ea-95a0-43d18ec715f5 [Accessed 6 April 2020]

OECD (2015) Green Bonds: Country Experiences, Barriers and Options, Available Online: https://www.oecd.org/environment/cc/Green_Bonds_Country_Experiences_Barriers_and_Options.pdf [Accessed 9 April 2020]

Rahim, N. A., Goodacre, A., & Veld, C. (2014). Wealth effects of convertible-bond and warrant-bond offerings: a meta-analysis, *The European Journal of Finance*, vol. 20, no. 4, pp. 380-398

Ramchander, S., Schwebach, R. G., & Staking, K. I. M. (2012). The informational relevance of corporate social responsibility: Evidence from DS400 index reconstitutions, *Strategic Management Journal*, vol. 33, no. 3, pp. 303-314

Reboredo, J. C. (2018). Green bond and financial markets: Co-movement, diversification and price spillover effects, *Energy Economics*, vol. 74, pp. 38-50

Roberts, M. R., & Whited, T. M. (2013). Endogeneity in empirical corporate finance, in Constantinides, G. M., Harris, M., & Stulz, R. M. (Eds.). *Handbook of the Economics of Finance*, Amsterdam: Elsevier. pp. 493-572

SEB (2020) The Green Bond, January 2020, Available online: https://sebgroup.com/siteassets/large_corporates_and_institutions/markets/image-green-bonds/thegreenbond_january2020.pdf [Accessed 6 April 2020]

Sharfman, M. P., & Fernando, C. S. (2008). Environmental risk management and the cost of capital, *Strategic Management Journal*, vol. 29, no. 6, pp. 569-592

Snedecor, G. W., & Cochran, W.G. (1989). Statistical Methods, 8th edn, Iowa: Iowa State College Press

Spiess, D. K., & Affleck-Graves, J. (1999). The long-run performance of stock returns following debt offerings, *Journal of Financial Economics*, vol. 54, no. 1, pp. 45-73

Tang, D. Y., & Zhang, Y. (2020). Do shareholders benefit from green bonds? *Journal of Corporate Finance*, vol. 61, no. 1, pp. 1-18

United Nations Framework Convention on Climate Change (2015) Adoption of the Paris Agreement, Available Online: https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf [Accessed 2 April 2020]

Unruh, G., Kiron, D., Kruschwitz, N., Reeves, M., Rubel, H., & Zum Felde, A. M. (2016). Investing for a sustainable future, *MIT Sloan Management Review*, Available Online: https://sloanreview.mit.edu/projects/investing-for-a-sustainable-future/ [Accessed 3 April 2020]

Wang, X. (2017). The Announcement Effect of Exchangeable Bonds in China, *Technology and Investment*, vol. 8, pp. 96-107

Welch, B. L. (1947). The Generalization of "Student's" Problem When Several Different Population Variances Are Involved, *Biometrika*, vol. 34, no. 1-2, pp. 28-35

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity, *Econometrica: journal of the Econometric Society*, vol. 48, no. 4, pp. 817-838

Wood, D., & Grace, K. (2011). A brief note on the global green bond market. *Initiative for Responsible Investment at Harvard University*, Available Online: http://iri.hks.harvard.edu/files/iri/files/iri_note_on_the_global_green_bonds_market.pdf [Accessed 3 April 2020]

World Bank. (2015). What are Green Bonds?, World Bank, Available Online: http://documents.worldbank.org/curated/en/400251468187810398/pdf/99662-REVISED-WB-Green-Bond-Box393208B-PUBLIC.pdf [Accessed 3 April 2020]

World Bank. (2018). From Evolution to Revolution: 10 Years of Green Bonds, 27 November, Available Online: https://www.worldbank.org/en/news/feature/2018/11/27/from-evolution-to-revolution-10-years-of-green-bonds [Accessed 3 April 2020]

Yaman, D. (2016). Industry Effects and Convertible Bond Sequence, *Global Journal of Business Research*, vol 3. no. 1, pp. 9-20

Zerbib, O. D. (2019). The effect of pro-environmental preferences on bond prices: Evidence from green bonds, *Journal of Banking & Finance*, vol. 98, pp. 39-60

Zou, P., Wang, Q., Xie, J., & Zhou, C. (2019). Does doing good lead to doing better in emerging markets? Stock market responses to the SRI index announcements in Brazil, China, and South Africa, *Journal of the Academy of Marketing Science*, pp. 1-21

Appendix

Appendix 1. Signficance Tests for CAAR

This table presents the results of the significance tests for both green and traditional bond announcement CAAR for different event windows and the test of equality of 2 means with the CAAR difference between green and traditional bond announcement returns. T-statistics are in brackets. The *, **, *** denote the 10, 5 and 1% significance level, respectively.

	Green	**Tradtional**	**Difference**
Event Window [-5 20]	Coefficient (T-stat)	Coefficient (T-stat)	Coefficient (T-stat)
[-5]	0.02 (0.16)	0.07** (2.06)	-0.05 (-0.42)
[-5 -4]	0.18 (1.10)	0.04 (0.85)	0.14 (0.81)
[-5 -3]	0.39** (2.14)	0.07 (1.19)	0.32* (1.66)
[-5 -2]	0.36 (1.75)	0.06 (0.90)	0.30 (1.38)
[-5 -1]	0.41 (1.69)	0.08 (1.07)	0.33 (1.29)
[-5 0]	0.54** (2.03)	0.12 (1.49)	0.42 (1.49)
[-5 1]	0.73** (2.55)	0.08 (1.07)	0.65** (2.14)
[-5 2]	0.80** (2.63)	0.05 (0.59)	0.75** (2.33)
[-5 3]	0.86** (2.82)	0.01 (0.15)	0.85*** (2.63)
[-5 4]	0.90** (2.84)	0.00 (0.03)	0.90*** (2.68)
[-5 5]	0.79** (2.38)	-0.04 (-0.37)	0.83*** (2.34)
[-5 6]	0.74** (2.17)	-0.10 (-0.88)	0.84** (2.32)
[-5 7]	0.76** (2.14)	-0.13 (-1.11)	0.89*** (2.37)
[-5 8]	0.73** (1.96)	-0.18 (-1.49)	0.91** (2.30)
[-5 9]	0.79** (2.09)	-0.25** (-2.03)	1.04*** (2.60)
[-5 10]	0.88** (2.31)	-0.28** (-2.15)	1.16*** (2.83)
[-5 11]	0.90** (2.36)	-0.29** (-2.22)	1.19*** (2.91)
[-5 12]	0.98** (2.49)	-0.37** (-2.67)	1.35*** (3.19)
[-5 13]	0.91** (2.24)	-0.45*** (-3.15)	1.36*** (3.13)
[-5 14]	1.04** (2.51)	-0.55*** (-3.85)	1.59*** (3.59)
[-5 15]	1.17** (2.62)	-0.65*** (-4.29)	1.82*** (3.82)
[-5 16]	1.27** (2.77)	-0.75*** (-4.85)	2.02*** (4.12)
[-5 17]	1.24** (2.61)	-0.85*** (-5.38)	2.09*** (4.13)
[-5 18]	1.26** (2.54)	-0.95*** (-5.97)	2.21*** (4.19)
[-5 19]	1.38** (2.78)	-1.02*** (-6.24)	2.40*** (4.52)
[-5 20]	1.40** (2.74)	-1.06*** (-6.34)	2.46*** (4.56)