UNIVERSITY OF GOTHENBURG

SCHOOL OF BUSINESS, ECONOMICS AND LAW

Does size matter?

Analysis of stock price reaction to green bonds announcements

Bachelor Thesis, Financial Economics

Yasmine Ben Rouha

Khaled Khouja

Supervisor: Mussa Hussaini

Spring 2021

Abstract

The recent large growth in the green bond market has been shown in previous studies to yield abnormal returns as the market value of the stock reacts to the announcement of green bond issuance. This study uses a sample of 90 observations, of which 61 are from the Swedish market and the remaining 29 from the American market. The sample is used to answer the following hypotheses (i) whether there is room for abnormal returns in these markets attributed to green bonds and (ii) whether there is a correlation between the market reaction and the size of the green bond. To answer the hypotheses, the average cumulative abnormal returns are calculated and further analyzed by regressions and t-tests for significance. The results shows that there are abnormal returns on both markets, the CAAR for the Swedish sample is computed to 0.34% and 0.98% for the American sample. However, no significance could be denoted, which is assumed to be due to the low number of observations included in the study. The difference in the market reaction may be explained by the varying efficiency between the bond and the stock market between the countries. Regarding the second hypothesis, none of the regressions in the study displayed a significant relationship between the bond size and the market reaction measured in CAAR over a 5-day window.

Keywords: *Green Bonds, Sustainability, Efficient Market Hypothesis, Signaling Theory, Abnormal Return, Cumulative Abnormal Return, Amount Issued.*

Acknowledgment

We want to express our sincere gratitude to our supervisor Mussa Hussaini. We thank you for taking the time and sometimes your free time to help us move forward with our work. Your guidance, knowledge and patience enabled us to write the best possible thesis. Furthermore, we would like to extend our gratitude to our fellow students for their constructive criticism and insightful comments all along the journey.

Table of Contents

1. Introduction

1.2 Background Description

In the short term, the share price in a market is affected by the information available to its participants, as such new information causes a reaction that is reflected on the share price which marks a response to investors' expectations. This argument finds its theoretical support in the effective market hypothesis (Fama, 1970) which presupposes that in an efficient stock market all available information is reflected on the share price. One question is however how quickly the market adapts; does it adapt immediately or successively? There are different types of information that can affect differently the price of a stock. The information around a debt offering can be of such nature to indicate that a firm is in great financial distress with a great need for capital for its own survival, or that it has successively identified growth possibilities or green projects it could contribute to but at the time being there is insufficient capital to maneuver with.

One of the latest financial innovation in debt offering of the latest decennia are green bonds which in their design facilitate sustainable investments (Maltais & Nykvist, 2020). Green bonds are an investment tool that gives investors an opportunity to directly finance green projects. The financing is transparent as it is already known prior to the investment for what usage the capital is for, in most of the cases. For example, in 2017 the American high-tech company Apple issued a $ 1 billion green bond to finance "renewable energy and energy, efficiency at its facilities and in its supply chain" (Flammer, 2018). Although, the market for green bonds is not yet regulated in forms of international regulations nevertheless common practices determined as “green” are perceivable between companies operating in different countries. The two most common practices are Climate Bonds Initiative (CBI) and Green Bonds Principles (GBP), which are approved by a financial association such as the International Capital Market Association (ICMA) (Maltais & Nykvist, 2020). The mentioned standards aim at legitimizing the “greenery” of the bonds. The GBP standard is a voluntary guideline that requires four main principles of the issuer for transparency and disclosure. These components represent the core framework of GBP; the use of funds; how the project is selected and evaluated; how the fund is managed; and finally reporting of the project.

Such standard is appreciated by the market as it increases the credibility, since all projects require an environmental benefit that will be estimated and eventually measured by the issuer
(Deschryver & de Mariz, 2020). On the other hand, there is CBI, which is a not-for-profit organization, that focuses on investors. The standard establishes criteria's' that must be achieved together with a detailed taxonomy applicable for different sectors. Such criteria enable a third party to assess how eligible a green bond is (Tang & Zhang, 2020).

The largest investors in green bonds are impact and institutional investors such as pension funds, insurance companies, corporate and bank treasuries, retail investors and asset managers (Deschryver & de Mariz, 2020). In the study by Deschryver et al. (2020), it is suggested that institutional investors invest in green bonds mainly at the request of their retail investors. Being able to communicate and showcase your brand associated with green bonds give rise to benefits. According to the same study this same applies to corporations that invest in green bonds as well, as they signal that they have a strong environmental commitment.

However, there are not only who investors are benefiting in investing in the green bond market, but also issuers. It is debatable whether issuers are active in this market for greenwashing purposes, by misleading claims about corporate environment commitments. Companies can indeed present themselves as environmentally responsible
without contributing (Flammer, 2018). Here we turn to the fact that there is room to use the image of being environmentally responsible. This as the market lacks public regulation. However, studies written by Flammer (2018) and Glavas (2018) show that green bonds are considered effective for the market despite this phenomenon.

Notwithstanding the fact that the market is unregulated, it has enjoyed a great growth, and more issuers are entering the green bond market. In today's market, the issuers are mainly financial institutions, municipalities to private companies and organizations with binding authority (Glavas, 2018). To put it in a historical context the first green bond was issued by the World Bank back in 2008 in collaboration with the Swedish bank SEB and the market has since increased substantially, from $ 11 billion in 2013 to $ 167 billion in 2018 and $ 269.5 billion in 2020 (Maltais & Nykvist, 2020). The largest growth took place after the Parisagreement in 2015, it was a forward-looking agreement with a climate goal set by 2030. The goal is to keep the global average temperature below previous industrial levels by

reducing the effects of climate change. The study conducted by Glavas (2018) demonstrates that equity investors gained increased interest in the green market after the Paris Agreement and therefore the demand for green financial products rose. Green bonds provide the opportunity to finance projects such as sustainable water management, clean transport, pollution, and solar panel facilities that are made possible by freeing up private capital.
For the market to further grow and expand, a global definition and norm is needed to unite issuers and investors worldwide (Deschryver & de Mariz, 2020), especially with the presence of a great number of international issuers. The largest issuer country is the US with $ 51.1 B followed by Germany, France, China, and Sweden, although developing countries like Chile are also major issuers (Deschryver & de Mariz, 2020). For these to be united, a definition of what is green and what criteria a green bond should meet needs to be introduced and formally defined to the market. Furthermore, for green bonds to reach their fullest potential, Deschryver and de Mariz (2020) suggest in their study that the most important characteristics are a wide range of applications; a high degree of granularity; bonds that respond to future technical and scientific changes in regulation; integrate the entire value chain for an activity; and that the standard should potentially be universal. For this to be achieved, it is further proposed that both private and public actors should merge, as the public sector can maintain strict regulations while the private volunteers can offer flexibility. This strengthens the possibility of a standardization and verification process that can be applied to all green bonds to achieve a more reliable and growing market.

1.2 Problem definition

Since green bonds are a relatively new financial tool in simplifying the process of raising capital for corporations with an environmental and green agenda. The existing literature is sparse, although a few studies (Ehlers & Packer 2017, Hachenberg & Schiereck 2018) have investigated the green bond pricing as opposed to conventional bonds. More specifically, if green bonds benefit from a market premium in terms of lower bond yield, which seems to be the case as evidence is found that green bond issuers borrow at a lower rate than their conventional counterparts. Whether green bonds deliver on their promise on meeting the climate challenges on firm level is not obvious as there is no legal enforcement mechanism today to ensure that the use of proceeds from green bond issuances are compliant with the bond prospectus. Despite the above-mentioned concerns, studies examining the credibility of the signal a green bond signalizes to the market have found that equity investors react

positively to such announcements (Flammer 2018, Glavas 2018, Thang & Zhang 2020). For which different explanations have been brought forward, could it be the cheaper cost of capital as previously mentioned, the green bond momentum after the Paris trade agreement (Glavas 2018) or the greater media exposure which green bond announcements accomplishes (Thang & Zhang 2020). This paper advances another possible explanation by examining if it is the size of the green bond that matters and whether there are any geographical differences between two well-established green bond markets, namely the Swedish and American market.

1.3 Purpose and hypothesis of the study

One of the goals of this study is to analyze whether announcement of a green bond issuance cause abnormal returns measured in stock returns for American and Swedish companies. Therefore, the following hypotheses are formulated:

$$H_0: CAR = 0$$

$$H_1: CAR \neq 0$$

Literature in behavioral economics regard attention as a scarce cognitive resource (Tversky & Kahneman, 1973), and firms are aware of this aspect of the human nature. Boulland and Dessaint (2015) argue that this drive firms to strategically pre-announce the report date of their earnings as it's argued that investors are more attentive to earning news when such details are disclosed well ahead of time.

As a matter of fact, firm's visibility matters to stock market investors (Grullon et al. 2004). Due to the green label green bonds possess, it is argued that media exposure will increase dramatically compared to conventional corporate bond issuances (Tang & Zhang, 2020). In practice, green bond issuers will issue formal press releases which is then relayed by the media to different degrees depending on what company it is. A declaration of bond issuance, labelled as green implies that the green projects and the sustainable projects a firm plans to undertake, have been verified and certified by a second party. Considering that a "green certificate" has been given, it will play a significant role in gaining the attention of bond investors but also stock investors which can potentially expand the investor base for the issuers, which translates to good news for the firms (Tang & Zhang, 2020).

If there were abnormal returns that could be attributable to a green bond issuance announcement, then this study's primarily aim is to investigate whether the bond size is influencing the market reaction; this study will include several regressions to investigate the matter. The hypotheses are expressed as the following:

$H_0 = There\ is\ no\ relationship\ betwen\ the\ green\ bond\ size\ and\ the\ market\ reaction.$

$H_A = There\ is\ a\ relationship\ between\ the\ green\ bond\ size\ and\ the\ market\ reaction.$

2. Theoretical Framework

2.1 Efficient Market Hypothesis

The Efficient market hypothesis is a financial theory developed by Fama (1970). The theory describes the market as efficient and that the pricing of assets reflects all available information. Fama (1970) distinguishes three different forms of efficiency in the theory: weak, semi-strong and strong. The weaker form implies that all historical price patterns are reflected and that the prices move across periods very much like a random walk. The semistrong efficiency form assumes that the price of the current stock adjusts rapidly to release of all new market information. In the strong efficiency form, stock prices suggest that all available value-relevant information is already reflected as the market is efficient thus making it impossible for investors to buy or sell fast enough to benefit, eliminating the possibility of earning excess return. The theory's relevance to the study is based on the fact that the price and return according to the theory should be based on all available information on the market, so an announcement on the issuance of green bonds should contribute to changing the market value of the issuers' stocks.

Fama (1970) assumes that investors are both rational and informed. Consequently, when new information arises or when an announcement is being made that directly relates to one or more factors affecting the core value of the stock will result in an instantaneous reevaluation of the expected value of the stock in question. The hypothesis states that investors are always up to date when it comes to all company information regarding the future cash flows and its riskiness, factors that are considered when determining the fundamental value of the company. Thus, a stock price always reflects fully the value of the company.

With an event study this paper aims to investigate the efficiency of the American and Swedish markets in regard to the issuance of green bonds, if any information is leaked before the event, and if the market underreacts or overreact and overshoot.

2.2 Signaling Theory

Signaling theory originates from contract theory. Spence (1973) formulated the theory through a job-market model where employees signal their abilities and skills to employers by obtaining degrees of education and thereby reducing the information asymmetry between the parties.

The signaling theory postulates that one party, often referred to as the agent, conveys some information about itself to another party, termed the principal. Suggesting there is asymmetric information between the two parties where "one group of participants has superior or more timely information than other groups" (Copeland et al., 2005).

This notion is important to understand when studying stock price movements as less informed parties as for example the shareholders use signals from well-informed parties when making decisions. Thereby, the market reaction to various information is based on its assumptions concerning the information a message conveys. If the information is assumed to be positive the market is expected to react positively and vice versa if the information were to be negative. According to the hypothesis in a study by Tang and Zhang (2020), green bonds contain mandatory information about valuable investment opportunities, reduced information symmetry and leads to a positive effect in the announcement. In this study, the theory will be able to explain the effect on the asymmetry when announcing green bonds issuance.

In the context of this study a company taking on debt signals that the lender believes in the company's ability to make the interest and the repayments that the lender requires for the loan to be given in the first place, while using the means for a green project that is not necessarily lucrative at first. Hence, a signal of strength.

Both companies and investors have an interest in portraying themselves as environmentally and socially responsible. Green projects could attract more institutional investments and green investments could attract more capital for the investment firms. A problem that regularly occur is that the receiving party has to decipher how credible the exposed information is.

In the case of the companies, the fact that green bonds have been in high demand should mean that a green bond issuance signals accessibility to cheaper debt. This would be a positive sign that could lead to abnormal returns.

3. Literature Review

Green bonds are described as a financial instrument with the goal of improving environmental impact and social welfare (Tang & Zhang, 2020). They are structured in the same way as conventional investment grade bonds (Maltais & Nykvist, 2020), but grade bonds are usually used for general corporate purposes (Glavas, 2018) meanwhile green bonds are expected to have a use of proceeds that states that the financing will be used for green investments (Maltais & Nykvist, 2020). The market for green bonds is not directly regulated, it lacks public control, which can provide space for greenwashing (Flammer, 2018). It can give companies the power to make misleading claims about their commitments to the environment (Flammer, 2018), this raises an issue about the effectiveness of green bonds. Instead, the market relies on private government systems as voluntary certification standards (Flammer, 2018).

The most common standards are GBP and CBI, GBP tracks the emission to ensure that the issuer fulfill their purpose (Glavas, 2018). The standard requires transparency and disclosure of the use of revenue, the process of evaluation and selection of projects, revenue management and requires the issuer to post a report to ensure that proper investments have been made, similar standards exist for CBI and enable third parties to take part in the qualification assessment for the bond’s "greenness" (Tang & Zhang, 2020).

Flammer (2018) examines green bonds and their effectiveness, the study is based on companies that have great incentives to appear environmentally friendly, such as firms in the energy industry. Furthermore, she has analyzed the European market and compared with markets such as the US and China. In measuring the efficiency of green bonds, one can examine how the share price changes when green bonds are issued. This was completed through an event study with multiply windows, in an interval between two and nine window days. Flammer (2018) concludes that the cumulative average abnormal return for the two-day window is 0.67%. For which in the scope of her study indicates that green bonds are valueadding, Flammer (2018) also finds more positive aspects and concludes that green bonds are effective and create value for the company in the long term. Flammer (2018) found significance for the two-day window but could not denote significance for all other windows at the significance 10%, 5% and 1%. In another study by Glavas (2018), a CAAR of 1.4% is

calculated, however, the study done is only based on the day of the event. Another result of the research shows that the CAAR increases from 0.7% to 1.9% after the Paris agreement, and gives the same conclusion as Flammer (2018), a display of endorsement to the issuer by the shareholders. Which variable is then driving the market reaction? Further a regression analysis was performed by Glavas (2018) with the following control variables i) Size ii) Capital to assets iii) Return on assets iii) Operating margin and iv) EBIT to interest expenses, set to CAAR as a dependent variable. The study also revealed an increase in value, but also that the issues constitute positive value-creating information for equity investors. Thus far, these two studies have identified the issuers' benefits of the green market, but does it also provide benefits to shareholders? In the study by Tang and Zhang (2020), an event study was done on companies from 28 different countries with the following time frame: 2007 to 2017. To see how the market reacts to corporate ESG characteristics. Issuing green bonds can, as previously mentioned, give companies the authority to appear more engaged in environmental aspects and further rise to better ESG profiles. In their study (Tang & Zhang, 2020), an event study was done with two different set of windows, one with 21-days and the other consisting of 15 days, where both gave significant CAR results of 1.39% and 1.04% respectively.

Their study also noticed a difference in CAR in the first issue of green bonds and the subsequent issues of the companies. For the subsequent issues, CAR was calculated to 0.12% in contrast to 0.61% for first time issues. The study investigated the green bond reaction on corporations as well as financial institutions. Other than positive returns, the authors (Tang & Zhang) discovered an increased equity liquidity after issuing green bonds and that green bonds enlarge the investor base in which investors can fulfill their investment mandates, as it is not primarily private individuals who invest in green bonds but rather institutional investors that includes pension funds, insurance companies and asset managers (Deschryver & de Mariz, 2020). The study shows that shareholders benefit from the investment, but since there is no significant premium shown, it is concluded that the return is not entirely driven by lower debt costs. To further estimate how value-adding green bonds are, various studies have examined how pricing works in the bond market. A study by Liaw (2020) examines green bond pricing with vanilla conventional bonds as a control group, the results turned out to be varying in relation to, among other things, selection, time-period and issuer and no evidence of green premium could be denoted. On the question if the nature of the issuers could have a certain effect on abnormal returns has been examined in the study by Tang and Chang (2020), where public issues such as financial institutions and companies showed a greater abnormal

return than non-public issues despite fewer issues, however, the amount issued were higher for public issuers. In a study done by Fatica et al. (2019) the price at the issuance of green bonds for different issuers was examined. In which the regression results revealed the existence of a green premium for supranational institutions and corporates, while no premium was found for financial institutions (Fatica et al., 2019).

Table 1:

Study	Performance measure (dependent variable)	Event window	Sample size and setting	Findings
Flammer Caroline (2018)	CAAR, and other performance measure	[-1,0], [-5, -2], [-10, -6]	217, International	Positive
Glavas Dejan (2018)	CAAR, and other performance measure	[-1,1], [0,1], [1,0], [0,0]	157, International	Positive
Tang Dragon & Zhang Yupu (2020)	CAR, and other performance measure	[-10,10], [-5,10]	132, International	Positive
Wang J, Chen X, Li X & Zhong R. (2020)	CAAR, and other performance measure	[-1,1], [-3, 3], [-10, 10]	48, International	Positive
Zhou X & Cui Y (2019)	CAAR, and other performance measure	[-10,-2], [-1,1], [2,5], [6,10]	44, China	Positive for all event windows except [6,10]
Cioli V, Colonna L.A, GiannozziA, Roggi O (2020)	CAAR, and other performance measure	[-5, -2] [-2, 2], [-1, 1], [-1,0], [2, 5]	280, International	Positive for all event windows except [2, 5]

Table 1 provides a summary of the main results for studies that have investigated the market reaction to green bond issuances.

4. Method and Data Sampling

4.1 Event study methodology

To examine and investigate how an issuance of a green bond affects a firm's share price a possible procedure would be to conduct an event study. An event study is a convenient method to measure the impact of a specific economic event on the value of the firm (MacKinlay, 1997). The usefulness of conducting an event study relies on the assumptions that the market is rational and efficient, if such assumptions holds then the economic

information an event contain will immediately be reflected in the security prices (Mackinlay, 1997).

Therefore, an event study constructed around the announcement of a green bond issuance would reveal how the market and investors react to such announcements. In constructing an event study there are basic steps to follow (Campbell & MacKinlay, 1998). The steps can be summarized by the following: i) event definition, ii) event and estimation window and iii) estimations of normal and abnormal returns, which will be further described in the following sections.

4.1.1 Event definition

An important part of conducting a successful event study is to identify and define the event date precisely (Campbell & MacKinlay, 1998). In this study, the event of interest is the announcement of a green bond issuance rather than the actual issuing of the bond. Bloomberg's database enables to differentiate between the two dates and in our sample the actual issuance of the green bond occurs on average two weeks after its announcement. In fact, none of the companies included in the sample reversed and retracted from its initial position to issue a bond and raise capital. Selecting the announcement day rather than the issuance day derives from the arguments formulated by Fama (1970) where "at any point in time actual prices of individual securities already reflect the effects of information based both on events that have already occurred and on events which, as of now, the market expects to take place in the future. In other words, in an efficient market at any point in time the actual price of a security will be a good estimate of its intrinsic value". (Fama 1965b) As previously mentioned, when a company releases a statement of green bond issuance it's rare that the decision is revoked thus selecting the announcement day as the event is fair to the extent that the market can expect it to take place in the future. Furthermore, if one were to use the issuance day as the event instead, the share price might already reflect the economic information prior to the issuing.

4.1.2 Event and estimation window

In this study two event windows are defined, in which cumulative abnormal returns (CAR) will be computed for each. The first and smaller window consists of 5 days in total [-2, +2], two days prior, the actual event and two days after the event. Not relying exclusively on the

event day but multiple days around the event hail from the possible scenario where there could be an information leakage to certain market participants such as insiders that trade on that information, commonly referred to as insider trading. Additionally, it can also be seen as a foresight measurement to capture the full effect as the market might suspect debt financing before it happens. The same logic can be applied to why include two days after the event as well. It's considered to capture the full magnitude of the announcement on the market prices (MacKinlay, 1997). Using a 5-day event window is common practice in scholarly event study methodology. Chang and Chen (1989) discovered that the period of the event window should consist of a few days added to the event day, that includes a short period after the actual event, so the market has enough time to respond to the event as it keeps continuously responding to the news. Masulis and Wang (2007) state in their paper that a 5-day window captures most, if not all, of the announcement effect, without introducing substantial noise into the analysis. An alternative and additional event window consisting of a total of 11 days [-5, +5] will also be constructed for the sake of comparison, to test whether the size of the window would affect the results.

Event window and estimation window refers to two different time periods and each window has its own set of purpose. As mentioned, the event window is comprised of the actual event of interest and additional days prior and after that together form a timeline which will be used to compute CAR. Whereas the estimation window refers to another period or timeline that will be used to determine the parameter estimates needed to compute CAR. The length of these estimation windows differs between papers, MacKinlay (1997) suggests 120 days meanwhile other academics have used 1 year period as an estimation window (Patton et al., 2003). Though, it is important to note that the event window should not include the estimation window. Avoiding an overlap between the two windows prevents the event from influencing the normal performance parameter estimates by affecting the "normal" returns (MacKinlay, 1997). For the purpose of this study, an estimation window of 210 days is set. Too few days might lead to unsatisfactory and poor parameter estimates and too many obsolete, making the data irrelevant and obsolete.

4.1.3 Estimation of abnormal returns

To estimate the abnormal returns, one need to first compute the expected returns also referred as "normal" returns. The abnormal returns are thus the returns that diverges from the returns that one would expect. However, a benchmark model is needed to specify how the normal

returns are determined (Brown & Warner, 1980). There is simpler model such as the singleindex model where one constant mean return is kept constant during the period (Ma et al., 2009) to more elaborate models such as the market model and the CAPM model. In this research, the market model will be used to estimate the normal returns in the estimation window, as it has been proven to perform well under a wide variety of conditions (Brown & Warner, 1980). It assumes a linear relationship between the security return and market return and can be presented by the following equation:

$$ER_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_i \qquad (1)$$

Where,

ER_{it} = Expected daily rate of return of firm i on day t.

α_i = expected value of $(R_{it} - R_{mt})$

$\beta_i =$ measurement of stock performance correlated to some benchmark, in this research S&P 500 market index will be used for US firms and the OMX index for Swedish firms.

R_{mt} = daily rate of return of the market index on day t.

ε_i = model error term with expected value equal to zero.

The abnormal returns represent the idiosyncratic part of the stock returns that is attributable to the green bond issuance announcement while "normal" returns can be seen as the returns if the issuance were not to be announced. In other words, the abnormal return is the difference between the actual return of a security and the normal return estimated from the estimation window, which give the expression of the following equation:

$$AR_{it} = R_{it} - ER_{it} \qquad (2)$$

Where AR_{it}, R_{it} and ER_{it} represent the abnormal, actual, and normal returns respectively for firm *i* at time *t.*

Once the abnormal returns computed, one can proceed to determine the CAR which is simply the summation of all daily abnormal returns over a specific event window. This aggregation of returns is given by the following formula:

$$CAR_{i,\tau,\tau+k} = \sum_{t=\tau}^{\tau+k} AR_{it} \qquad (3)$$

Where,

$CAR =$ cumulative abnormal return for firm *i* over the whole event window (τ, k).

$k =$ numbers of days in the event window, in this research two different windows will be used consisting of 5 and 11 days as previously mentioned.

$\tau =$ first day in the event day.

4.2 Data Sampling

The sample used in this study was collected through Bloomberg Terminal. With the help of the search function inside Bloomberg's database one can conveniently adjust one's search by including or excluding certain criterions of interest.

In compiling the sample of this study, all corporate bonds labelled as "green bonds" was first extracted. Then, bonds whose issuers was either "Government" or "Municipal" were excluded, as these securities are not comparable to corporate bonds to the extent that the issuer is not listed on a financial market and thus not suitable for this study.

The above criteria yield a search result total of 728 green bonds whose issuances were made by either a Swedish or American company, between 2013 and 2021Q1. This represents the initial sample from which we've extracted an additional number of green bonds based on criteria's that can be found in the following table.

Table 2:

Country	USA	Sweden
Initial sample	327	401
Less non-listed companies	-103	-281
Less no coupon yield data	-4	-3
Less companies without ESG score	-82	-47
Less companies without EBITDA data	-7	-7
Less missing maturity dates	--	-2
Less volume < 10 millions of US dollars	-102	--
Final sample of green bond securities	29	61

Table 2 shows the elimination process for the observations in the sample by the number of eliminations per requirement.

All corporate green bonds were not issued from listed companies, in fact a big portion of the Swedish bond market are represented by real estate corporations that are owned by the Swedish government or other authorities and often these corporations are not traded which explains their elimination from our initial sample which represented a rather large number. Bloomberg contains a wealth of information for each bond, including the announced date, issue date, coupon yield, credit rating of the issuer, ESG score, maturity etc. The previously

mentioned criterions will play an important role in the next part of the study, as they will used as control variables in the regressions. However, some of the criterions were missing for a few companies causing them to get eliminated from the sample.

As a next and final step, we have extracted green bonds with a new issue volume inferior to 10 millions of US dollars. This practice can be seen in Hachenberg and Schiereck's (2018) study and is a way of avoiding obtaining distorted results. Since liquidity of a bond affects its pricing (Amato & Remolona 2003; Bao et. al 2011). Smaller and more liquid green bonds might get a liquidity premium that the market charges (Hachenberg et al. 2018) which will have an impact on the bond's coupon. Furthermore, to the exception of a handful, the smaller green bonds were in majority issued by the same company, namely Tesla Inc. during a short period of time in 2015. Thus, this extraction from the initial sample is further justified as the issuances from Tesla could possibly act as outliers in our data set.

5. Empirical Results

5.1 Descriptive Statistics

On a bond level, there are some differences between the two samples. Namely, the coupon rate which averages at 2.71% in the USA, in contrast to the average rate of 1.44% in Sweden. A coupon rate is the annual interest paid out to the bondholder by the issuer, based on the face value of the bond. The interest payments are paid to the holder until the maturity of the bond. In terms of maturity, which is measured in years in the table, one can note that the green bonds included in the USA sample take on average more time to mature, respectively 7.79 years in USA and 4.98 years in Sweden. Although on a closer look, one can notice that the maturity data is more widespread in Sweden even though the number of securities included in that sample is slightly more.

The amount issued by the companies is noted in the same currency, for facility of comparisons, namely in millions of US dollars. As can be observed, there is an important difference in the terms of amount of issuance between the two countries, a possible explanation could be that the firms in the USA sample are larger in size and need more capital for their green projects. A considerable issuer of green bond in terms of amount is Apple with

two issuances of 1.1B dollars each in 2017 and 2019 to finance "renewable energy and energy efficiency at its facilities and in its supply chain" (Forbes 2017).

Another striking difference between the two countries present in the samples were the bonds relationship to maturity. The contractual debt a bond implies can have conditions that are specific for each bond, these conditions are specified and communicated at the time of the issuance. One such condition can be the redeemable nature of the bond, meaning they can be paid off by the issuer prior to the bond's maturity date. In the sample, we observe that there are 34.85% callable green bonds of the total US sample in contrast to the relatively small portion of 9.78% in the Swedish sample. A call option gives the issuer more room to maneuver during different market seasons and to take advantage of bondholders by repaying the debt in advance when market yields decline (Booth, et al 2014). If the interest rate decreases in the market, the call price is less than what the fair value of debt would have been absent the call option (Booth, et al 2014).

While more US issuers enjoy this advantage over the Swedish issuers in our sample, there are a few Swedish bonds that are of the convertible type namely 4.55%. Such bonds have been proven to be optimal for firms that do not have an established record of strong historical performance when facing uncertainties about the timing of a project (Liu & Switzer 2013). Convertible bonds are bonds that that gives the possibility to the issuer to exchange them for common stock in the issuing company. It is argued that they possess signaling properties that investors can derive direct benefits from, by specifically signaling a notion of credibility on the expected prospects of the firm (Liu & Switzer, 2013).

Table 3:

Bond Characteristics: Sweden

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Amount	61	88.82	110.40	10.84	40.96	53.86	81.38	588.60

Maturity	61	4.98	7.47	2	3	4	5	61
Coupon	61	1.44	1.17	0.48	0.88	1.12	1.58	8.50

Table 4:

Bond Characteristics: USA

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Amount*	29	518.40	302.47	10	340.8	500	714.5	1,11
Maturity**	29	7.79	3.08	3	5	7	10	15
Coupon	29	2.71	1.07	0	2	2.7	3.8	4

Table 3 and 4 presents the descriptive statistics for all corporate green bonds included in the final sample for Sweden and USA respectively. *Amount* is the issuance amount in $m. *Maturity* is the maturity of the bond in years. *Coupon* is the coupon rate in percentage.

On a firm level, even if the number of issuances is nearly twice as much in the Swedish sample, the number of companies is similar between the two countries, respectively 19 and 17 for Sweden and US. On a first look, there seems to be a trend for Swedish real estate companies, this is expressed by the Swedish company Fabege AB totaling 16 issuances. Another frequent issuer is Atrium Ljungberg AB who is also operating in the real estate market. With a closer look on both firm's sustainability reports, we learn that the proceeds of the green bonds are intended for the same objective notably to improve the efficiency in energy consumption of buildings included in their portfolio and to cut carbon dioxide emissions when building new ones. As both firms actively purchase and sells properties as their main pillar of business operation, new projects, and buildings are added frequently to their portfolio which result in frequent bond issuances. Even though the number of issuances varies considerably between the two samples, it would be inaccurate to state that the difference is due to issuer's country as observations from the initial sample have been

eliminated for different reasons. It still suggests there is an industry trend that can be attributable to real estate companies who actively manages several buildings.

Another observation worth mentioning is the company size measured by total assets in millions of dollars. The companies included in the US sample are significantly larger than the Swedish companies. This difference is worthy of mention as it is argued that larger companies benefit from a larger media exposure due to their greater impact in society, while receiving more public attention they are also put under greater pressure to demonstrate social responsibility and to disclose environmental information (Cowen et al., 1987). This pattern is further emphasized by Bansal (2005) that showed more media exposure will increase the visibility of the company, pushing companies to become more transparent as they are objects of attention and public scrutiny to a greater extent in comparison to smaller companies. Press releases, and green bond announcements are thus being reached to a wider audience by the works of the media, which according to Wang et al. (1992) plays an important role in influencing the decisions of stakeholders. Tang and Zhang (2020) demonstrates this publicity in their work by plotting Apple's google search volume, which skyrocketed when they announced $1 billion green bond issuance on June 13, 2017, just after Trump's exit from the Paris Climate Accord.

The ESG disclosure score presented in table are not to be mistaken as proper ESG scores that are given by third parties such as MSCI, Sustainalytics and ISS. Instead, they're interpreted as a rate by which companies bring to light these scores and disclose them to the public which are given by Bloomberg. They are to a certain degree a "measurements of signaling" of their ESG performance, measured on a scale from 0-100.

Table 5:

Firm Characteristics: USA

Statistic	Mean	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max

Leverage	38.75	9.42	25.37	30.42	37.75	45.36	58.31
EBITDA	10,142.52	20,632.98	-535.47	535.94	1,590.50	7,146.50	78,844.00
ESG	38.16	17.70	14.05	20.45	41.15	50.20	75.21
Assets	117,328.20	261,298.10	936.80	9,115.50	27,006.84	66,533.50	1,120,000.00
Issuances	1.53	0.77	1	1	1	2	3

Table 6:

Firm Characteristics: Sweden

Statistic	Mean	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Leverage*	38.63	12.57	13.46	36.24	42.88	46.33	54.12
EBITDA**	931.55	1,209.81	-6.07	207.62	332.03	1,234.49	4,141.68
ESG***	36.49	11.07	20.40	27.45	38.64	43.97	54.13
Assets****	12,410.04	8,995.31	63.18	6,356.08	10,302.19	14,282.98	31,844.68
Issuances	4.36	4.73	1	1	2	6.8	16

Table 5 and 6 presents the descriptive statistics at the issuer level, for US companies and Swedish companies respectively. *Leverage* is the ratio of debt divided by total assets. *EBITDA* is the Earnings Before Interest and Tax, Depreciation and Amortization in $M. *ESG* is the ESG Disclosure Score retrieved from Bloomberg. *Assets* is the total assets in $M. Lastly, *Issuance*s is the number of issuances issued by the companies from 2013 to April 2021.

5.2 Event study results

We find that there is a positive CAR for both the Swedish and American companies although they are statistically insignificant. In the Swedish sample consisting of 61 announcement observations the average CAR over a 5-day window is computed to 0,34%. In the American sample consisting of 29 observations, we find a relatively higher average CAR number which is computed to 0.98%. The results have been subject to t-tests to measure their significance for evaluating the hypotheses for which we cannot reject the first null hypothesis that articulate "there is no abnormal return measured by a 5-day CAR attributable to a green bond issuance ". The significance levels have been tested with a one sample t-test for each country individually as well as two-sample t-test including all observations where each country has been represented by a dummy variable. T-tests have also been performed on CAR results derived from different event windows such as [-2, -5], [0.2] and [2.5]. The skewness has also been examined for the two samples, in all cases skewness is positive. Indicating that mean for the observed samples is greater than the median, as a greater number of observations are to the right of the median in the distributions.

Table 7:

Sweden				
Event Window	[-5,-2]	[-2,2]	[0,2]	[2,5]
CAAR	0.79	0.34	0.18	0.03
Test	0.008 (0.155)	0.002 (0.571)	0.002 (0.571)	0 (0.922)
Skewness	0.12	0.65	0.70	0.10

Table 7 shows CAAR for each Swedish event window. Test shows the mean of the t-test performed for CAR. In parentheses, the p-value for the completed test is displayed. Skewness indicates the skewness of the sample distribution. *n=61*, p>0.05.

Table 8:

US				
Event Window	[-5,-2]	[-2,2]	[0,2]	[2,5]
CAAR	0.78	0.98	0.84	0.77
Test	0.008 (0.249)	-0.001 (0.810)	0.011 (0.153)	0.010 (0.210)
Skewness	0.84	0.35	0.63	0.43

Table 8 presents CAR for each US event window. Test presents the mean of the t-test performed for CAR. In parentheses, the p-value for the completed test is displayed. Skewness indicates the skewness of the sample distribution. *n=29*, p>0.05.

Table 9:

Sweden and US

Event Window	[-5,-2]	[-2,2]	[0,2]	[2,5]
CAAR	0.8	0.66	0.5	0.3
Test Sweden				
	0.008	-0.001	0.001	0
	(0.972)	(0.687)	(0.269)	(0.270)
Test US	0.008	-0.001	0.011	0.010
	(0.972)	(0.687)	(0.269)	(0.270)

Table 9 presents the significance levels for the different event windows that has been performed by a two tailed test, with p>0.05.

Figure 1:

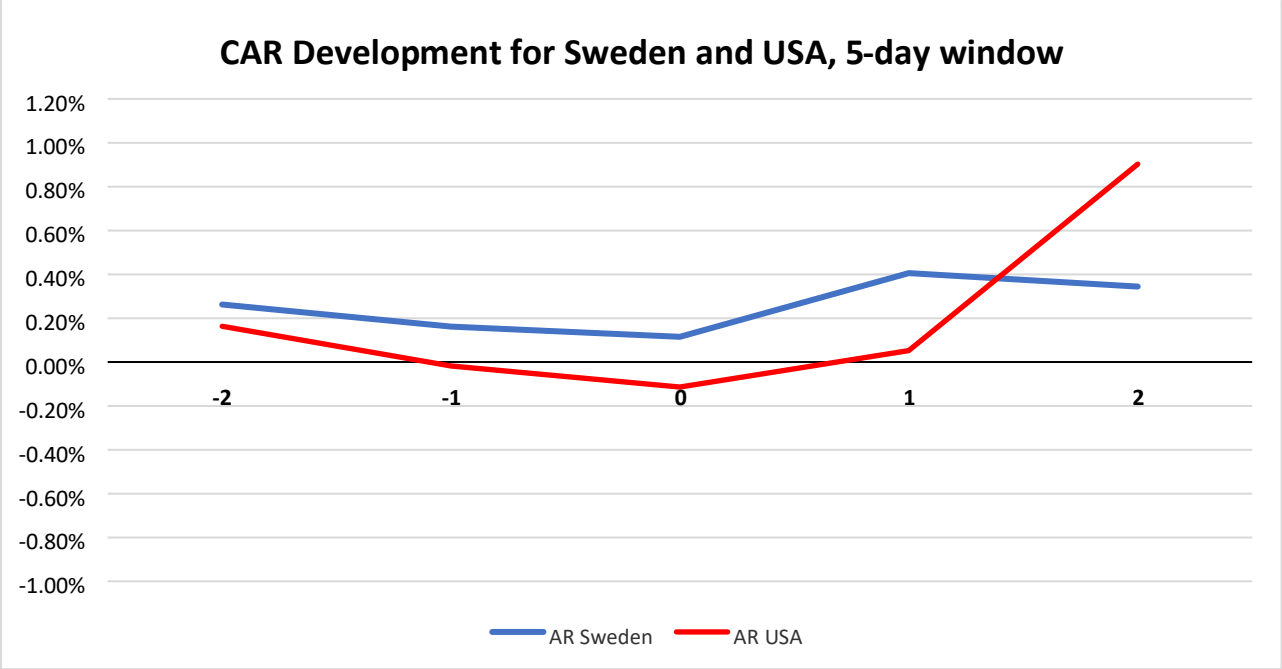


Figure 1 displays a graphic representation of the 5-day CAR development of the Swedish observations as well as the American.

With a larger event window, one can further study the volatility of the abnormal returns (AR) over time for the two samples. Through this procedure one can distinguish when the positive

or negative reaction takes place and what magnitude it has in terms of stock market response. The results of abnormal return and cumulative abnormal returns over a 11-day event window for USA and Sweden are displayed in figure 2 and 3 respectively.

The solid line representing the abnormal returns can be interpreted as the average reaction of all the green bond issuance announcement included in the samples on each day in the event window that encompasses 11 days. The days are located on the x-axis and the returns are expressed in percentages on the y-axis. The dotted line on the other hand represents the cumulative abnormal return which can be interpreted as the collective market reaction to a green bond announcement.

Figure 2:

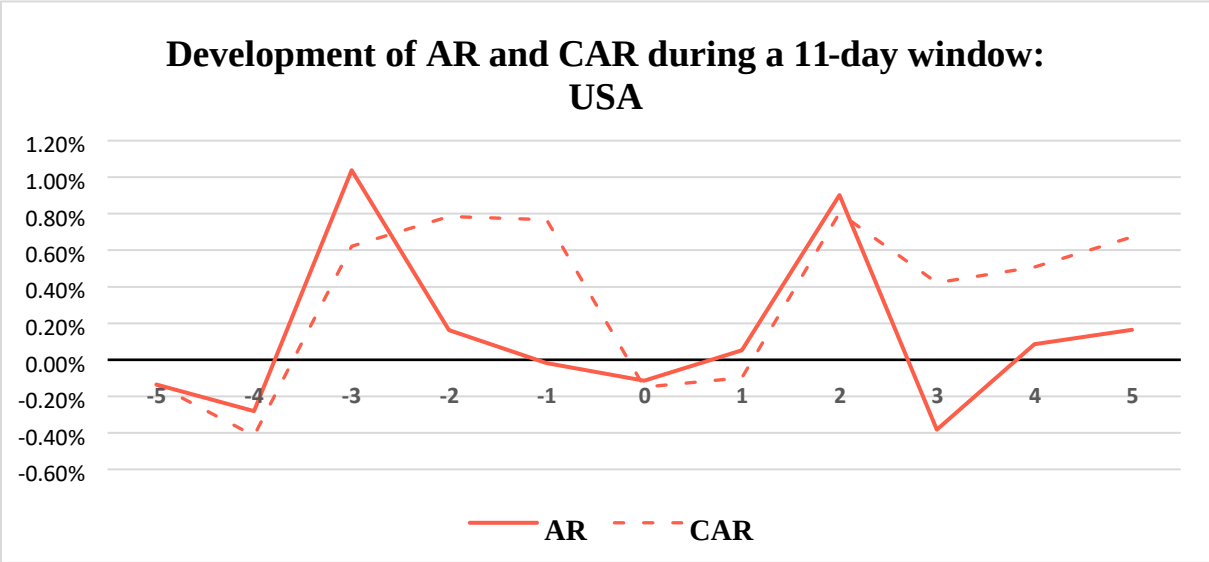
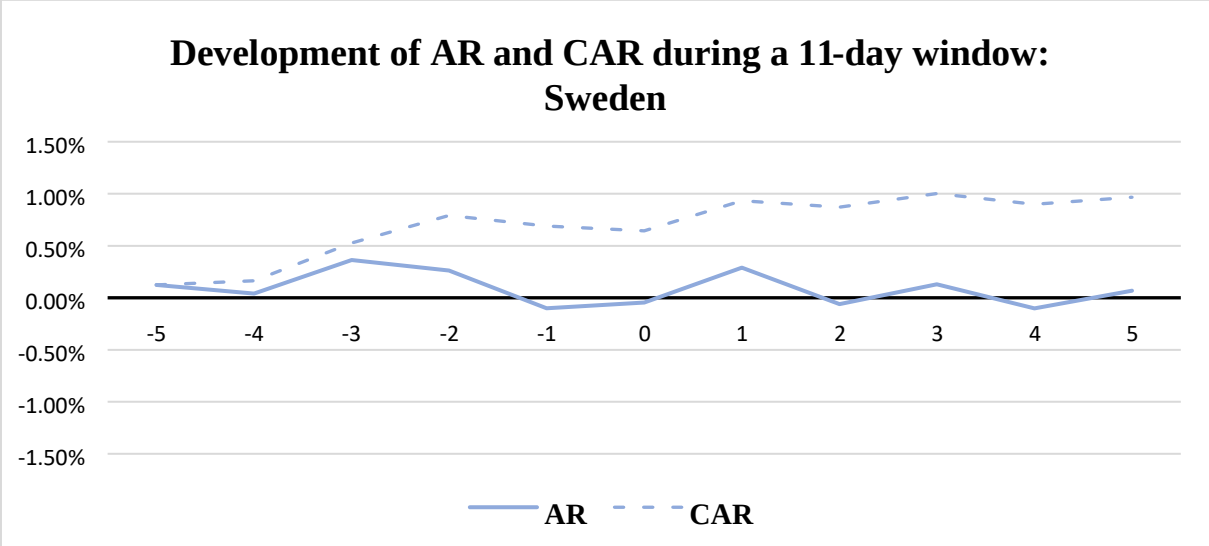


Figure 3:



Figures 2 and 3 display a graphic representation of the 11-day AR and CAR development of the Swedish observations as well as the American.

Between the two figures, one can observe the higher volatility of the abnormal returns in the US sample compared to the Swedish sample over the event window. This phenomenon can coincide with the fact that the numbers of observations included varies noticeably between the two samples, leading outliers to skew the data. Although, upon closer examination on the event day we observe a similar pattern between the two samples, a green bond announcement triggers on average a positive reaction from the stock market investors. For the Swedish companies, there seems to be modest reaction when looking at the [-1,0] window. From an abnormal return of -0,101% on the day before the announcement AR increase slightly to -0.047% to the day after the announcement. The reaction is more significant on the day after the announcement was reported where the abnormal return increases from -0,05% to 0,29% between the [0,1] day window.

For the American companies, the market reaction is more distinct in terms of magnitude. On the event day window [-1,0] there is a negative market reaction where the average abnormal return decreases from -0,017% to -0,11%. Although, from the event date to the last day of 5day event window, [0,2], we observe a sharp increase of the abnormal return result which increases from -0,11% to 0,903% which is consistent with results obtained for the 5-day CAR for the American companies.

5.3 Multivariate analysis

The following section includes the regressions that will serve as the basis for the multivariate analysis of CAR results computed in the event study. The main event window of this study is the 5-day window [-2,2] which includes the announcement day and consequently the CAR computed over this window will be the dependent variable. The main independent variable in the regression is the amount issued and will be controlled for variables that potentially influences the stock market reaction to a green bond announcement. Before presenting the regression results an overview of the control variables will be provided as well as a short regression methodology.

5.3.1 Regression Methodology

To study the relationship between the 5-day CAR and the announced amount of issuance for a green bond, the following econometric model has been run in the statistical software program Studio R using an Ordinary Least of Squares (OLS) regression:

$$CAR_{i,j} = \beta_0 + \beta_1 Amount_{i,j} + \beta_2 Maturity_{i,j} + \beta_3 Coupon_{i,j} + \beta_4 Size_{i,t-1} + \beta_5 Leverage_{i,t-1} + \beta_6 EBITDA_{i,t-1} + \beta_7 ESG_{i,j} + \varepsilon_{ij}$$

Where i indexes for each firm on announcement j and where ε_{ij} is the error term with an expected value of zero. The data for the firm specific variables have been acquired from fullyear accounting data confirmed by the firm's yearly reports as they are more reliable to the extent that they undergo a thorough auditing procedure which is not necessarily the case for quarterly data. Thus, the yearly report data prior to the green bond announcements have been used in determining the firm specific data, which further explains the following notation $t - 1$.

The OLS regression's function is to estimate the coefficients of the model above by determining the sum of the squares that minimizes the distance between each observation point and a straight line, that is predicted by the linear function of the independent variable. Therefore, the coefficient for each variable describes the direction and strength of the

relationship between a dependent variable (CAR) and independent variables with the aim to infer a casual effect between the two (Wooldridge, 2016).

In determining the statistical significance of each coefficient, it is measured against a statistical threshold expressed by a probability value that measures the probability an obtained results could have occurred at random. Significance levels of 0.1, 0.05 and 0.01 have been applied to the regressions included in this study, to determine the coefficients' pertinence. Another measurement of interest is the R-squared value that represents the proportion of the variance for a dependent variable that's explained by the variance of the independent variables, which can be further extended by the adjusted R-squared measure that accounts for the sample size and the number of variables (Wooldridge, 2016).

5.3.2 Variables

The main parameter of interest in the regression is the β_1 coefficient. If the coefficient is significant with either a negative or positive sign, it would suggest that the announced amount of issuance plays a role in explaining the stock market abnormal return of the company during a green bond announcement. In a case where we find a significant positive β_1-coefficient, it would imply that equity investors consider that the amount is containing information of positive value for the company and is value enhancing. However, if the coefficient was to be found not statistically significant, it would convey that the bond size is not considered to be substantial importance by the equity investors, in terms of value adding information.

The regressions will be performed by including control variables that has been selected from literature that examine the debt issuance's link to equity markets.

The first parameters we control for are bond characteristics that are specific for each green bond. In their research on conventional bonds and Islamic sukuks Godlewski et al. (2013) control for issuance maturity and the coupon as they may affect the perception of firm value by the equity investors. This procedure is further followed by Glavas (2018) that examines the relationship between green bonds and stock prices. In this regression the maturity is set in years and the coupon is measured as the annual coupon rate of the green bond.

Other than bond characteristics, firm characteristics may also affect the stock market reaction to green bond announcement. Firm size has been used as a control variable in studies examining debt offerings and market reaction as it is recognized to be a potential driver of such reaction (Spiess et al. 1999). For the regression models, firm size is computed as the total assets of each firm. Second, risk factors related to firm's financial health may also impact the equity investor reaction as firms exhibiting high leverage ratios are more indebted and essentially closer to default (Merton 1974). In the regression models, the leverage is measured by the total debt and total assets ratio for each firm. Third, a firm's profitability may also have a role and thus to control for the financial performance of each firm, EBITDA will be used which is to some degree different to EBIT which is used in studies by Godlewski et al. (2013). Lastly, we add Bloomberg's ESG score to the list which conveys to some extent how devoted the firms are to their environmental practices.

5.3.3 Regression results

The regressions main aim was to shed light on whether the bond size has an effect on CAR. Although there seems to be a positive relationship, the results are not statistically significant. For the Swedish model we read that the amount coefficient is measured to 0.0053 and for US model the relationship seems to be even weaker with a coefficient measured to 0.0005. Since the results are not statistically significant, the second null hypothesis *"There is no relationship between green bond size and CAR"* cannot be rejected with confidence. These results are further reinforced with the third model (3), which includes all the observations,

both Swedish and American where we read that the amount coefficient is measured to 0.0010 and not statistically significant. The only significant coefficient obtained in the regressions is the coupon coefficient which is measured to -1.3641 and -1.2179 for the Swedish and aggregated model respectively, both significant at 1%. These results may make economic sense in so far as a greater wealth transfer from the firms to the bondholders, in the form of coupon payments, signalizes a higher cost of debt to which the market reacts negatively.

In assessing the degree of fit of the presented regression models, we observe that the first model (1) is the best fit with an adjusted R^2 value of 0.1110 compared to -0.2486 and 0.0548 for the second and third model. Although there is no specific consensus on what value measure marks a valid regression model as it can vary between different fields of studies. For example, Falk et al. (1992) argue that values equal or greater to 0.10 are to be deemed adequate while Hair et al. (2011) recommend 0.50 as a rule of thumb. Overall, the three models present modest values and are arguably poor fits which is further illustrated by only one significant F-statistic value at 10% for model (1).

Table 10:

Regression Models

	Dependent variable:		
	CAR		
	(1) Sweden (T-stat)	(2) USA (T-stat)	(3) All (T-stat)
Intercept	3.9067	4.2774	3.8068
	(0.9193)	(0.5031)	(1.1491)
Amount	0.0053	0.0005	0.0010
	(0.7756)	(0.0750)	(0.4065)

Coupon	-1.3641***	-1.0919	-1.2179***
	(-3.3270)	(-0.7586)	(-2.9517)
Maturity	-0.0009	-0.1001	0.0145
	(-0.0134)	(-0.1784)	(0.1928)
Assets	0.00004	0.00001	0.00001
	(0.2659)	(0.5033)	(1.0154)
Leverage	-0.0316	-0.0367	-0.0250
	(-0.6230)	(-0.2461)	(-0.5628)
EBITDA	0.0005	0.0001	0.0001
	(0.4043)	(0.5769)	(0.5277)
ESG	0.0126	0.0022	0.0142
	(0.2192)	(0.0185)	(0.3417)
Observations	61	29	90
R^2	0.2147	0.0635	0.1291
Adjusted R^2	0.1110	-0.2486	0.0548
Residual Std. Error	2.9572 (df = 53)	6.4361 (df = 21)	4.0480 (df = 82)
F Statistic	2.0706* (df = 7; 53)	0.2036 (df = 7; 21)	1.7368 (df = 7; 82)

Table 10 presents the OLS regressions results are displayed in the table above, with 61 observations for the Swedish model and 29 observations for the US model. As previously mentioned, the dependent variable is the 5day cumulative abnormal return (*CAR*) for both regressions. The independent variable of interest is the *Amount* to which is controlled for the remaining variables. *p<0.1; **p<0.05; ***p<0.01 indicates significance at 10%, 5% and 1% respectively.

6. Discussion and Conclusion

The purpose of this paper was to decipher on how the equity market interpret the signal of the relatively new instrument in sustainable finance, namely the green bond in terms of its issuance announcement and its bond size. By applying the event study methodology, we have examined the stock market reaction to green bond announcements from 2013 to the first quarter of 2021 from firms that are listed on the American stock market as well as the Swedish stock market.

Consistent with other papers on the topic (Flammer 2018, Tang & Zheng 2020), we find in the main event window [-2,2] of this study, encompassing the day the green bond is announced, a positive CAAR for both the American and Swedish sample. In the Swedish sample, consisting of 61 announcement observations, the average CAR is computed to 0,34%, while the American sample consisting of 29 observations average CAR is computed 0.98%. Despite of the low significance levels obtained for the CAR results, there seems to be a positive market reaction from both the American and Swedish firms as stock investors are rewarding the companies for their commitment in improving their environmental footprint which further strengthen the signaling argument. In such manner, the act of materializing a green bond issuance companies appear to send credible signals on their sustainable commitment towards the environment and the climate challenges the world is facing. These results add to the discussion on whether eco-friendly behavior affect the stock market for which a positive link have been presumed in previous studies (Flammer 2013, Kreuger 2015).

For the difference of the CAR results between Sweden and USA, a possible explanation may be the varying efficiency in the link between the bond and the equity market in the two countries. A link that is characterized by value signals that stem from the bond market, and thereafter transmits to the stock market where equity investors discern meaningful information from the surrounding noise of a green bond announcement. In this study, we found no evidence that the bond size constitutes as a compelling signal that could explain the positive market reaction as we found a weak positive relationship in our regression without any significance, between the bond size and CAR.

The low significance levels of this study are arguably due to the low number of observations included in the samples. Due to the elimination of a few observations for different reasons brought forward in the data sampling section, the study has been conducted on the remaining observations that were further split in two separate samples varying in size. Upon deciding to examine Swedish and American firms, it may have had a role in increasing the probability of obtaining a company size bias. As the Nordic market is significantly smaller than its American counterpart in terms of market capitalization. Furthermore, it should be noted that the Swedish sample for a vast majority consists of firms operating in the same line of industry namely the real estate business while the American sample includes high-tech and energy

company which the Swedish sample is lacking. To this, it can be added that the industrial structure can have a role in explaining stock price behavior (Roll 1992). Including a dominating sector can thus influence the results in a way that no longer present the market entirely.

Nonetheless, this study calls for future research on how green bonds are perceived by equity investors and its implications for the firms. Green bonds being a relatively new financial instrument but with an anticipated market growth, more data will become available to support evidence on a larger scale with even more rigorous characterization. Further investigation examining less established green bond market with more well-established could have implications for how firms perceive green bonds and encourage them to commit to environmental practices and shift the gears in meeting the climate goals by 2030.

References

Aaron Maltais & Björn Nykvist (2020): Understanding the role of green bonds in advancing sustainability, Journal of Sustainable Finance & Investment, DO

Amato, Jeffery D. and Remolona, Eli M., The Credit Spread Puzzle (December 1, 2003). BIS

Quarterly Review, December 2003, https://ssrn.com/abstract=1968448 (Retrieved 2021-0512)

Bansal, Tima. (2005). Evolving sustainably: A longitudinal study of corporate sustainable development. Strategic Management Journal. 26. 197 - 218. 10.1002/smj.441.

Bao Jackc & Pan, Jun & Wang, Jiang. (2011). The Illiquidity of Corporate Bonds. Journal of Finance. 66. 911-946. 10.2139/ssrn.1106852.

Booth, L., Aivazian, V., Demirguc-Kunt, A. and Maksimovic, V., (2001). Capital Structures in Developing Countries. The Journal of Finance, 56(1), pp.87-130.

Boulland, R. and Dessaint, O., (2013). Announcing the Announcement. SSRN Electronic Journal,.

Brown, S. and Warner, J., (1980). Measuring security price performance. Journal of Financial Economics, 8(3), pp.205-258.

Campbell, J., Lo, A., MacKinlay, A. and Whitelaw, R., (1998). The Econometrics Of Financial Markets. Macroeconomic Dynamics, 2(4), pp.559-562.

Chang and Son-Nan Chen, “Stock-Price Adjustment to Earnings and Dividend Surprises,” Quarterly Reviewof Economics and Business (1989)

Copeland, T.E., Weston, J.F. and Shastri, K. (2005) Financial Theory and Corporate Policy. 4th Edition, Addison-Wesley, Boston.

Cowen, S., Ferreri, L. and Parker, L., 1987. The impact of corporate characteristics on social responsibility disclosure: A typology and frequency-based analysis. Accounting, Organizations and Society, 12(2), pp.111-122.

Ehlers, Torsten and Packer, Frank, Green Bond Finance and Certification (September 17, 2017). BIS Quarterly Review September 2017, Available at SSRN: https://ssrn.com/abstract=3042378

Falk, R. & Miller, Nancy. (1992). A Primer for Soft Modeling. The University of Akron Press: Akron, OH.

Fama, E. F. (1965). The Behavior of Stock-Market Prices. The Journal of Business, 38(1), 34. doi:10.1086/294743

Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. The Journal of Finance, 25(2), 383. doi:10.2307/2325486

Fama, Eugene F. "The Behavior of Stock-Market Prices." The Journal of Business 38, no. 1 (1965): 34-105. Accessed May 25, 2021. http://www.jstor.org/stable/2350752.

Fatica, S., Panzica, R., & Rancan, M. (2020). The Pricing of Green Bonds: Are Financial Institutions Special? SSRN Electronic Journal. doi:10.2139/ssrn.3623146

Flammer, C. (2018). Corporate Green Bonds. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3125518

Forbes. 2017. Should you invest in ‘green bonds?’ Forbes, June 29.

Glavas, D. (2018). How Do Stock Prices React to Green Bond Issuance Announcements? SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3279069

Godlewski C., Rima Turk-Ariss, Laurent Weill. Sukuk vs. conventional bonds: A stock market perspective,Journal of Comparative Economics,Volume 41, Issue 3,Pages 745-761,

.

Grullon, G., Kanatas, G., & Weston, J. P. (2003). Advertising, Breadth of Ownership, and Liquidity. Review of Financial Studies, 17(2), 439-461. doi:10.1093/rfs/hhg039

Hachenberg, B. and Schiereck, D., 2018. Are green bonds priced differently from conventional bonds?. Journal of Asset Management, 19(6), pp.371-383.

Hair, & Ringle, Christian & Sarstedt, Marko. (2011). PLS-sem: Indeed a silver bullet. The Journal of Marketing Theory and Practice. 19. 139-151. 10.2753/MTP1069-6679190202.

Liaw, K. T. (2020). Survey of Green Bond Pricing and Investment Performance. Journal of Risk and Financial Management, 13(9), 193. https://doi.org/10.3390/jrfm13090193

Liu, Jinlin & Switzer, Lorne. (2013). Convertible bond issuance, risk, and firm financial policy: A new approach. International Journal of Business. 18. 1-25.

Krivin, D., Patton, R.T., Rose, E., & Tabak, D. (2003). Determination of the Appropriate Event Window Length in Individual Stock Event Studies. Forensic Economics eJournal.

Krüger, Philipp. (2014). Corporate Goodness and Shareholder Wealth. Journal of Financial Economics. 115. 10.2139/ssrn.2287089.

Ma, L., Johns, L. and Allen, M., (2009). A modifier screen in the Drosophila eye reveals that PKC interacts with Glued during central synapse formation. BMC Genetics, 10(1), p.77.

MacKinlay, A. (1997). Event Studies in Economics and Finance. Journal of Economic Literature, 35(1), 13-39. Retrieved May 25, 2021, from http://www.jstor.org/stable/2729691 .

Masulis, R., Wang C. and Xie, F., 2007. Corporate Governance and Acquirer Returns. The Journal of Finance, 62(4), pp.1851-1889.

Merton, R.C. (1974), On the pricing of corporate debt: The risk structure of interest rate. The Journal of Finance, 29: 449-470. https://doi.org/10.1111/j.1540-6261.1974.tb03058.x

ROLL, R. (1992), Industrial Structure and the Comparative Behavior of International Stock Market Indices. The Journal of Finance, 47: 3-41. https://doi.org/10.1111/j.15406261.1992.tb03977.x

Pauline Deschryver & Frederic de Mariz, 2020. "What Future of the Green Bond Market? How Can Policymakers, Companies, and Investors Unlock the Potential of the Green Bond Market?," Journal of Risk and Financial Management, MDPI, Open Access Journal, vol. 13(3), pages 1-26, March.

Spence, M. (1973). Job Market Signaling. The Quarterly Journal of Economics, 87(3), 355. doi:10.2307/1882010

Spiess, D. Katherine and Affleck-Graves, John, (1999), The long-run performance of stock returns following debt offerings, Journal of Financial Economics, **54**, issue 1, p. 45-73.

Tang, D. Y., & Zhang, Y. (2020). Do shareholders benefit from green bonds? Journal of Corporate Finance, 61, 101427. https://doi.org/10.1016/j.jcorpfin.2018.12.001 (Retrieved 2021-05-12)

Tversky, A. and D. Kahneman. "Availability: A heuristic for judging frequency and probability." Cognitive Psychology 5 (1973): 207-232.

Wang, Jianling & Song, Lin & Yao, Shujie. (2013). The Determinants Of Corporate Social Responsibility Disclosure: Evidence From China. Journal of Applied Business Research. 29. 1833-1847. 10.19030/jabr.v29i6.8220.

Textbook

Wooldridge, J., (2016). Introductory Econometric: A Modern Approach (6th Ed.).

Appendix

Issuer	Number of issues	Announcement date
Atrium Ljungberg AB	12	2017-03-13
		2017-10-19
		2017-10-19
		2018-04-11
		2018-07-03
		2018-08-29
		2019-03-19
		2019-05-13
		2019-07-02
		2020-09-22
		2020-11-16
		2020-12-17
		2021-01-27
Castellum AB	1	2016-09-26
Electrolux AB	1	2019-03-20

Fabege AB	16	2016-05-13 2016-11-21 2017-02-08 2017-04-05 2017-06-01 2017-08-22 2018-02-21 2018-04-03 2018-08-23 2019-03-15 2019-09-03 2020-06-09 2020-08-17 2020-09-17 2021-01-26 2021-03-10
Fastighets AB Balder	2	2019-10-28 2019-11-29
Klövern AB	3	2018-03-26 2020-10-12 2021-02-03
Kungsleden AB	7	2018-03-09 2018-06-05 2019-02-27 2019-11-29 2020-01-17 2020-08-20 2021-01-08
Midsummer AB	1	2019-04-11
Sagax AB	1	2019-12-09
Samhallsbyggnadsbolaget i Norden AB	7	2019-02-01 2019-02-01 2019-06-25 2019-08-30 2020-01-22 2020-07-02 2020-08-25
SKF AB	1	2019-11-06
Telia Co AB		2020-02-04 2020-06-03
Volvo Car AB	1	2020-09-28
Wallenstam AB		2015-03-18 2016-05-20 2019-05-15 2020-09-10 2020-11-19 2021-02-19 2021-04-15

Issuer	Number of issues	Announcement
Alexandria Real Estate E. Inc	3	2018-06-12 2019-03-12 2021-02-03
Apple Inc	2	2017-06-13 2019-11-07
Avangrid Inc	3	2017-11-16 2019-05-14 2020-04-07
Bloom Energy Corp	1	2020-08-06
Digital Realty Trust LP	1	2020-08-06
Equinix Inc	2	2020-09-23 2021-02-24
Federal Realty Investment Trust	1	2020-10-08
Kimco Realty Corp	1	2020-07-07
Livent Corp	1	2020-06-22
Morgan Stanley	1	2015-06-03
NextEra Energy Capital Holdings Inc	1	2019-11-18
Owens Corning	1	2019-07-29
Plug Power Inc	1	2020-05-13
Tesla Energy Operations Inc/DE	3	2015-04-20 2015-05-26 2015-06-29
UDR Inc	2	2019-10-02 2020-11-30
Verizon Communications Inc	2	2019-02-05 2020-09-16
Visa Inc	1	2020-08-10
Welltower Inc	1	2019-12-09
Xylem Inc/NY	1	2020-06-24

Figure 4:

Correlation matrix Swedish sample

	Amount	*Maturity*	*Coupon*	*Leverage*	*EBITDA*	*ESG*	*Assets*	*CAR*

Amount	1							
Maturity	0,59960277	1						
Coupon	0,21446206	0,0369108	1					
Leverage	0,42682004	0,22545359	-0,2475901	1				
EBITDA	0,75125243	0,42480733	0,06322538	0,41105891	1			
ESG	-0,3423801	0,01766266	-0,3934001	-0,2329183	-0,1727192	1		
Assets	0,703267	0,38764482	-0,0253294	0,48087861	0,95568534	-0,1768323	1	
CAR	0,0139684	0,03309368	-0,4451386	0,09315364	0,0042439	0,13721527	0,03888435	1

Figure 5:

Correlation matrix US sample

	Amount	*Maturity*	*Coupon*	*Leverage*	*EBITDA*	*ESG*	*Assets*	*CAR*
Amount	1							
Maturity	0,41102299	1						
Coupon	0,30062828	0,09153517	1					
Leverage	-0,3284227	0,06290382	-0,4606435	1				
EBITDA	0,66670738	0,1804519	0,05252667	-0,2864927	1			
ESG	-0,0409245	0,0652862	-0,1326003	0,03939077	-0,2605859	1		
Assets	0,53365218	0,09386959	0,07247252	-0,3348757	0,72579425	-0,2528201	1	
CAR	0,1086919	-0,0253534	-0,3162239	0,10382978	0,0993586	0,03840044	0,00365155	1

Figure 4 and 5 displays the correlation matrix between the variables used in this study for the Swedish and American sample.