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Does the valuation effect of a green bond issuance differ between industries?

Evidence from the United States

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ABSTRACT:
Green bond is a rather new financial instrument that aims towards more sustainable use of proceeds. In this thesis, I examine the stock market reaction a green bond issuance creates by using a data sample from 2013 to March 2021 consisting of 154 US corporate green bonds from 44 companies and 7 different industries.

The theoretical framework behind the event study is mostly based on the market model, the CAPM developed by Sharpe (1964) and others, in addition to the efficient market hypotheses by Malkiel & Fama (1970) which are tested in the event study methodology. Green bonds and sustainability have been examined more and more since the first one was issued in 2013, with the most notable green bond research being conducted by Flammer (2021), Tang & Zhang (2020), Baulkaran (2019), and Wang et. al. (2020). This research is based on the methodologies used in those studies with the exception of using industry dummy variables in the regression model. Previous studies on sustainability, and more specifically on ESG and CSR show that investors tend to value sustainability and the firm's sustainable actions lead to higher firm value (Fatemi et. al., 2018; Bajic & Yurtoglu, 2018; Dimson et. al., 2015; Buchanan et. al., 2018).

The event study analysis based on the expected returns set by the market model shows that during (-10,10) and (-5,5) event windows, the average CARs are 1.19% and 0.76% respectively. The results are positive and statistically significant using both parametric t-tests and nonparametric Wilcoxon signed-rank tests. This is a similar finding to most of the previous research on the topic. The shortest event window of (-1,1) does not provide statistically significant results.

The OLS regression analysis shows that the CARs are not statistically significantly driven by selected bond or firm characteristics. Finally, the study shows that automotive industry firms show on average larger and statistically significant positive CARs related to the green bond issuances than financial sector firms.

The practical implications of this study are that investors react abnormally positive to the issuance of the green bond, indicating the value increase of the sustainable actions of the firm. Also since there are some differences between the industries, the investors seem to value sustainable actions in some industries over the others which could be studied further in the future.

KEYWORDS: green bonds, stock market reaction, sustainable finance, impact investing, event study

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TIIVISTELMÄ :
Vihreä joukkovelkakirjalaina on melko uusi rahoitusväline, jonka avulla pyritään käyttämään rahoitus kestävämmin. Tässä tutkielmassa tarkastelen vihreän joukkovelkakirjalainan liikkeeseenlaskun aiheuttamaa osakemarkkinoiden reaktiota käyttämällä vuosien 2013 ja maaliskuun 2021 välistä aineistoa, joka koostuu 154 yhdysvaltalaisesta vihreän joukkovelkakirjalainan liikkeeseenlaskijasta, joita on 44 yritystä 7 eri toimialalta.

Tutkimuksen teoreettinen viitekehys perustuu pääasiassa Sharpen (1964) ja muiden kehittämän markkinamallin, CAP-mallin, lisäksi Malkielin & Faman (1970) tehokkaiden markkinoiden hypoteeseihin, joita testataan tapahtumatutkimusmenetelmää hyödyntäen. Vihreitä joukkovelkakirjoja ja vastuullisuutta on tutkittu yhä enemmän sen jälkeen, kun ensimmäinen vihreä joukkovelkakirja laskettiin liikkeeseen vuonna 2013, ja merkittävimmät vihreitä joukkovelkakirjoja koskevat tutkimukset ovat Flammerin (2021), Tang & Zhangin (2020), Baulkaranin (2019) ja Wangin et. al. (2020) tekemiä.

Tämä tutkimus perustuu kyseisissä tutkimuksissa käytettyihin menetelmiin lukuun ottamatta toimialamuuttujien käyttöä regressiomallissa. Aiemmat tutkimukset vastuullisuudesta ja erityisesti ESG- ja CSR-toiminnasta osoittavat, että sijoittajat arvostavat sitä ja että yritysten kestävät toimet johtavat korkeampaan yrityksen arvoon (Fatemi et. al., 2018; Bajic & Yurtoglu, 2018; Dimson et. al., 2015; Buchanan et. al., 2018).

Markkinamallin asettamiin tuotto-odotuksiin perustuva tapahtumatutkimusanalyysi osoittaa, että (-10,10) ja (-5,5) tapahtumaikkunoiden aikana keskimääräiset CAR:t ovat 1,19 % ja 0,76 %. Tulokset ovat positiivisia ja tilastollisesti merkitseviä niin parametristen t-testien että ei-parametristen Wilcoxonin signed-rank-testien avulla. Tämä on samankaltainen havainto kuin useimmissa aiemmissa aihetta koskevissa tutkimuksissa. Lyhin tapahtumaikkuna (-1,1) ei tuota tilastollisesti merkittäviä tuloksia. OLS-regressioanalyysi osoittaa, että valitut joukkovelkakirjalainan tai yrityksen ominaisuudet eivät vaikuta tilastollisesti merkittävästi CAR:iin.

Lopuksi tutkimus osoittaa, että autoteollisuuden yritykset osoittavat keskimäärin suurempia ja tilastollisesti merkitseviä positiivisia CAR-arvoja vihreiden joukkolainojen liikkeeseenlaskujen yhteydessä kuin rahoitusalan yritykset. Tutkimuksen käytännön vaikutukset ovat, että sijoittajat reagoivat poikkeuksellisen myönteisesti vihreän joukkovelkakirjalainan liikkeeseenlaskuun, mikä on osoitus yrityksen kestävien toimien luomasta arvonnoususta. Koska toimialojen välillä on myös joitakin eroja, sijoittajat näyttävät arvostavan joidenkin toimialojen kestäviä toimia enemmän kuin muiden, jota voitaisiin tutkia tarkemmin tulevaisuuden tutkimuksissa.

AVAINSANAT: vihreä joukkovelkakirjalaina, osakemarkkinareaktio, vastuullinen rahoitus, vaikuttavuussijoittaminen, tapahtumatutkimus

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Abbreviations

CAPM = Capital asset pricing model
CAR = Cumulative abnormal return

CSR = Corporate social responsibility
ESG= Environmental, social, governance
OLS = Ordinary least squares
SML = Security market line
US = United States

1 INTRODUCTION

Sustainability has been one of the most popular themes in public for the past few decades. Whether it is due to increasing awareness through things such as the Al Gore documentary in the mid-2000s or the reported damages in the Great Barrier Reef or the worldwide climate protests orchestrated by young swede Greta Thunberg, sustainability is certainly here to stay. The topic became rapidly part of the business strategies in the 2000s, when companies like Subaru took an aim of sustainability in their strategy and ESG was mentioned for the first time in the United Nation's PRI report (United Nations, 2021). Since then, sustainability has taken its permanent place in business and also in finance.

This thesis focuses on green bonds, a fixed-income financial instrument that was developed and first-time issued in 2007. After a quiet start, the market has grown promptly since the first corporate green bond issuance in 2013. The market size is currently (1 trillion dollars) and the number is expected to continue its exponential growth as green bonds seize new markets and become more and more popular (Jones, 2020)**.** Defined by the World Bank (2015): "A green bond is a debt security that is issued to raise capital specifically to support climate-related or environmental projects" (World Bank, 2015).

Sustainable activities of companies have been studied for a rather long time. The first study is perhaps the one from the renowned Milton Friedman who claims in his doctrine that the sustainable activities only add the costs of the firm and thus reduces its value (Friedman, 1970). Also, there are other studies from the early days claiming the same such as Vance (1975) who claims that the more precise reason to reduction in the firm value is that the benefits from the sustainable business actions do not exceed the costs related to them (Vance, 1975). Since then, most of the studies have found a positive relationship between sustainability and firms' financial performance (Edmans, 2011; Guenster et al., 2011; Klassen & McLaughlin, 1996; Krüger, 2015). The results of the more recent research in addition to the growing need for sustainable activities and attention to global warming implicate that there has been a change in the way of how people and

business see sustainability and value it. This is also the main motivation for this study; if sustainability has become one of the core values for both firms and individuals, it must have an impact on how people value the companies issuing a sustainability-friendly financial instruments such as green bonds.

1.1 Purpose of the study

The purpose of this study is to examine if the issuance of a green bond has any effect on the stock price of the corporation. There have been some studies on the matter such as Baulkaran (2019), Tang, & Zhang (2020), & Flammer (2021) which focus on the global green bond market, in addition to the other studies which have had a focus on a certain submarket such as China or the United States. The previous literature is discussed more on chapter three.

The topic is very relevant since not only the green bond is a rather new fixed-income instrument but also because the recent pandemic. Even the most recent research by Flammer (2021) uses data from 2013-2018 meaning that the possible effect of the covid-19 pandemic has not been considered in the study (Flammer, 2021). For example, Pastor et. al. (2021) examine that the investors are willing to give up in their returns on eco-friendly financial instruments, in other words, accepting the green premium when there are climate-related shocks like the Los Angeles wildfires. However, when the climate-related shocks are taken into consideration, the green bonds do not perform better to the conventional bonds (Pastor et al., 2021). Does this mean that green bonds only positively affect the financial performance of the firms when there is a focus on these matters? If so, could it be possible that during a global pandemic the focus has not been in climate as much as it was before?

Additionally, most of the studies have been made in the 2010s, meaning that the effect has been studied mostly during a bull market period. Nonetheless, there are some studies on ESG that focus on the financial crisis such as Nofsinger & Varma (2014) who

discover that during crisis periods, the funds with high SRI (Socially Responsible Investment) values perform better than the low SRI funds (Nofsinger & Varma, 2014). This could implicate that also a fixed-income instrument with ESG orientation such as a green bond, could outperform the conventional bond when the times are tough.

1.1.1 Formulation of hypotheses

Based on the purpose of the study and the implications of the previous literature, the main research question of this study is whether the issuance of the green bond has an effect on the stock price of the issuing company. The null hypothesis of this study is:

H0: The issuance of a green bond does not affect the stock price of the company

The contradictive hypotheses are as follows:

H1: The issuance of a green bond has a positive effect on the stock price of the company
H2: The issuance of a green bond has a negative effect on the stock price of the company

For example, Lebelle et. al. (2020) finds significant negative returns during the issuance supporting the H2 while both Flammer (2021) and Tang & Zhang (2020) find significant positive returns supporting the H1 (Flammer, 2021; Lebelle et al., 2020; Tang & Zhang, 2020). These hypotheses of this study are later examined and analyzed in chapter five.

1.2 Contribution of the study

The intended contribution of the study is to see whether the green bond issuance has a different effect on the stock price in different industries. Most of the studies on green bonds' valuation effect focus on either only to the comparison between green and conventional bonds or to the green bond pricing premium or solely on one country such as

the United States or China. There are only very few studies that make any comparison between different industries such as Tang & Zhang (2020) and even those studies focus on difference of the valuation effect between financial institutions and other industries rather than comparing for example utilities, energy, and healthcare. This might be due to lack of data on some of the industries but as the green bond market expands as rapidly as it has, there is a need of an examination for a cross-industrial analysis. If different industries have different risk levels (betas), different other characteristics, and different orientation of the ESG matters, there could also very well be a difference how the stock price reacts to the issuance of the green bonds. This leads to our intended contribution and consequently to our final hypothesis:

H3: The green bond issuance has a different effect on the stock price between industries

The expected results based on Tang & Zhang (2020) is that there is difference between the industries, at least between financials and non-financials as they conclude (Tang & Zhang, 2020).

1.2.1 Limitations and assumptions

There are some possible limitations to the study concerning the data availability. The data is mainly collected from Bloomberg for green bond related data, and from Refinitiv Eikon for stock market and firm related data. However, according to previous studies, it is possible that all of the green bond data cannot be found and thus retrieved from these sources. For example, Wang et.al. (2020) collect data from CSMAR database and notice that it has more data than Bloomberg and CBI have together (Wang et al., 2020). In comparison with earlier studies, they gather total issue amount of approximately 12 billion dollars for only 2017 while Flammer (2021) has about the same amount for the whole inspection period of 2013-2017 (Flammer, 2021; Wang et al., 2020). From this perspective, we assume that the data that can be gathered from Bloomberg is large enough sample to conduct a study that is precise.

1.3 Structure of the study

The structure of the study is as follows; after introduction, we move on to the theoretical background that builds the foundation to this research. The focus of the theoretical background is in three main topics: stock market theory, bond characteristics, and green bond market and its unique characteristics. Then, a broad literature review is examined. The literature review is divided roughly into two different sections: previous studies on sustainability and ESG, and previous studied on green bonds. Both of these are extremely important to examine in order to form hypothesis, for comparison between them and this study, and to form a full spectrum of the topic and thus get a broad insight into the market of green bonds.

The data and methodology are examined after the literature review and is the starting point of the empirical analysis of this study. After that, we test our hypotheses on green bonds in the empirical results chapter, and finally conclude our findings in conclusions chapter.

2 THEORETICAL BACKGROUND

2.1 Equilibrium in capital markets

The equilibrium in capital markets was highly examined topic during the 1960s and its main theory, the capital asset pricing model, also known by its abbreviation CAPM, was developed by the research of Sharpe (1964), Lintner (1965), Mossin (1966) based on the preceding Markowitz's (1952) portfolio theory (Lintner, 1965; Markowitz, 1952; Mossin, 1966; Sharpe, 1964). The CAPM builds a fundament to all subsequent financial theory and thus is essential to this research.

Markowitz (1952) finds that it is possible to achieve better returns for the portfolio with less risk through diversification. This can be accomplished until the minimum variance portfolio is found. Subsequently, the efficient frontier is formed based on all possible combinations of this optimal portfolio. In other words, the efficient frontier is a combination of all optimal portfolios which represent the highest possible return given a certain level of risk or vice versa, the lowest possible risk for every level of return (Markowitz, 1952).

Sharpe (1964), Lintner (1965) and Mossin (1966) then developed the idea of a model that could demonstrate the relationship between expected return and risk even more precisely. The capital asset pricing model is based on Markowitz's (1952) portfolio theory. Because the minimum variance portfolio is considered to be well diversified, there should not be any firm-specific risk. Therefore, the expected return should only be determined by the systematic risk, known as beta (Sharpe, 1964). Sharpe (1964) examines that a capital market line which is placed on the slope of a risk-free asset and the efficient frontier defines the different mixes of both the risk-free asset and the optimal portfolio. He argues that the best reward-to-variability, in other words the best combination of return and risk, is achieved in the tangent of the capital market line and the efficient frontier (Sharpe, 1964). This measurement of a risk-adjusted return is later developed

into one of the best-known financial formulas known as the CAPM which can be used to define a risk premium of a single stock depending on its beta coefficient and the market risk premium.

The security market line displays the relationship between a stock's risk, the beta, and its risk premium (Sharpe, 1964). The slope of the security market line is the market risk premium. The assets that are priced correctly are plotted right in to the SML, the under-priced assets are found below the SML while the overpriced assets are lying above it (Sharpe, 1964). In perfect market conditions and in the equilibrium of the market, all assets should be on the security market line (Sharpe, 1964).

$$\frac{E(r_i)-r_f}{\beta_i} = [E(r_M) - r_f] \quad (1)$$

This equation of the SML can be rearranged to the common form of the CAPM which then can be utilized in stock performance calculation later in this thesis. The price differences between the SML and individual stocks, called the stock's alpha, are considered to be abnormal and are analyzed with the cumulative abnormal return method.

$$E(r_i) = \alpha + r_f + \beta_i[E(r_M) - r_f] \quad (2)$$

Sharpe (1964) states assumptions for the CAPM; first, the market conditions are perfect, there are no taxes, no insider information nor transactions costs. Investors can take short positions on assets and are able to borrow and lend with the same risk-free rate (Sharpe, 1964). The investors are also considered to be rational, have the same expectations of the market and have only one-period investment horizon (Sharpe, 1964). The CAPM is criticized in more recent studies such as Fama & MacBeth (1973) but the CAPM still remains as one of the most used models in performance calculations (Fama & MacBeth, 1973).

Pástor et. al. (2021) develops the idea of equilibrium in capital markets in their study where they create an equilibrium model that takes sustainability in account. They have four implications based on their model that differ from the original capital asset pricing model of Sharpe (1964). Pástor et. al. (2021) concludes that firms with better ESG classifications have lower, negative alphas of their CAPM than the firms that do not load on sustainability since the sustainable firms are less risky to, for example global warming and more desired by the investors. Their second result is that when the overall risk aversion for investors is lower, the investors that value sustainability are accepting lower expected returns which is also noted in the studies addressed later in this thesis concerning the green premium (Pástor et al., 2021). Finally, Pástor et. al. (2021) concludes that since there are differences in investors' sustainability preferences, the amount of sustainable investing grow and overall, this increase in investing in ESG friendly firms makes all the firms go more sustainable.

Another development of the idea of equilibrium in capital markets is presented by Pedersen et. al. (2021) who create "an ESG-efficient frontier" which combines the Sharpe ratio with each ESG score. Additionally, they propose a capital asset pricing model which takes the ESG into account (Pedersen et al., 2021). This model could be used in further research instead of the classic market model. Finally, they conclude that with the ESG-Sharpe efficient frontier, the benefit or disadvantage of choosing a more sustainable portfolio can be quantified by analyzing how much it increases or decreases the Sharpe ratio when choosing the more ESG-orientated portfolio (Pedersen et al., 2021).

2.2 Efficient market hypotheses

Efficient market hypotheses developed by Malkiel & Fama (1970) is a theory which states that the stock prices reflect all information available and if so, it is impossible for a single investor to make excessive returns on a stock (Malkiel & Fama, 1970). If this is true, stock prices should only follow a random walk and are not predictable as Kendall & Hill (1953) shows (Kendall & Hill, 1953). This theory is also very essential to this study since its highly

related to the stock performance analysis. According to Malkiel & Fama (1970) stock prices should only react when new information is published to the investors (Malkiel & Fama, 1970). In this case, the stock prices should change only after the announcement of a green bond issuance (Malkiel & Fama, 1970).

There are three different tests for the efficient markets which are weak form tests, semi-strong form tests, and strong form tests (Fama, 1991). The weak form of market efficiency is achieved when the stock prices reflect all past information of their prices and volumes (Fama, 1991). This form can be easily tested with return predictability; is it possible to make excessive returns with old stock market data. The semi-strong form of market efficiency is obtained when the stock prices correspond to all public information and investors cannot utilize any fundamental nor technical analysis in order to make any excessive returns (Fama, 1991). In this thesis, we are most interested in the semi-strong form of the efficient market which is tested with an event study analysis like Fama (1991) suggest. The strong form of market efficiency is very rarely achievable since it requires that also the inside information is found in the stock prices (Fama, 1991).

Combining this with the previous theory of market equilibrium, we can conclude that a CAPM test is also a test of the semi-strong efficient market hypothesis. If the efficient market hypothesis is accepted, the price changes of stocks that occur with the new information will follow random walks, in other words have zero means (Bodie et al., 2018: 334).

2.3 Bond characteristics

A bond is a debt security which has different characteristics. Those securities often provide an income that is either fixed or set by a certain formula agreed by both parties (Bodie et al., 2018: 425). The borrower issues a bond to the lender and receives some agreed amount of cash, then the borrower must make payments from time to time called coupons according to the affirmative covenants defined in the bond indenture (Fabozzi,

2007: 2). When the agreement reaches its maturity, the borrower must pay back the face value to the lender.

Often, bonds have coupon rates that persuades lenders to pay the face value to the borrower at the beginning so that the loan and the final amortization are equal (Bodie et al., 2018: 426). Sometimes, the bond can be callable meaning that the issuer can call the bond before its maturity when its price can be determined on that day or fixed no matter what the call day is (Fabozzi, 2007: 9). There is also an option to either cap or floor the coupon rate meaning that a floating rate has either a cap that it cannot cross or a floor it cannot fall below (Fabozzi, 2007: 14).

Even though the focus of the research in this thesis is on the green bonds, it is crucial to understand the basics of these fixed-income securities since they are not very different to the green bonds, green bonds are just a special type of a bond. Additionally, the two different types of bonds are compared in the empirical part of this thesis.

2.3.1 Bond pricing and yield

The price of a bond depends on the present value of the coupon payments and the face value of the bond. Present value means that the nominal amount is discounted to present with a certain interest rate, often the real risk-free rate plus a risk premium (Bodie et al., 2018: 432). The risk premium consists of all possible risks considering the bond characteristics, for example liquidity risk, interest rate risk and most importantly default risk (Bodie et al., 2018: 432). The riskier the bond is to an investor, the higher the risk premium.

Looking at the equation determining the value or price of a bond, we note that risk has a negative correlation to the value while coupon payment and face value have a positive correlation (Bodie et al., 2018: 433-434). Consequently, bond price and yield have an inverse relationship because if the interest rate rises an investor gets better return

elsewhere, so the bond price has to fall in order to attract investors again (Bodie et al., 2018: 435-436). Usually, corporate bonds are issued so that coupon rate is close to the market yield meaning that the bond is issued at its face value (Bodie et al., 2018: 435). Par value is another term for face value.

$$Value\ of\ bond = \sum_{t=1}^{T} \frac{Coupon\ payment_t}{(1+interest\ rate)^t} + \frac{Face\ value}{(1+interest\ rate)^T} \quad (3)$$

There are two main ways to measure bond returns: the holding period return and the yield to maturity. The latter is the most used measurement because it represents most closely the average return of a bond selling at a certain price (Bodie et al., 2018: 446). The yield to maturity is the interest rate which makes the discounted coupon payments and face value equal to the price of the bond, in other words the formula is equal given the certain price, coupons, face value and time-period of a bond (Bodie et al., 2018: 438). The rate is equal to the return gained if the bond is bought at present and held to maturity (Bodie et al., 2018: 438).

2.3.2 Bond risks and ratings

The price of a bond depends also on its riskiness. There are multiple different risk factors that affect bonds, most important one is default risk. Default risk is a risk that the issuer of the bond cannot pay the investor either agreed coupon payments or the principal (Bodie et al., 2018: 449). This can be due to a bankruptcy or other form of insolvency. The default risk, often called also credit risk, divides bonds into two main categories: investment-grade bonds and junk bonds (Bodie et al., 2018: 449). The first group is a name to a bond that can be seen to be safe, and the issuer is able to pay the coupons and principal to the investors while the latter have an issuer that has higher risk of insolvency (Bodie et al., 2018: 449).

The three largest credit raters are Standard & Poor's, Moody's and Fitch all of whom have different ways to measure the default risk. If the rating is lower than BBB or Baa, the bond is considered to be speculative, in other words a junk bond while a higher rating means that the bond is an investment grade bond (Bodie et al., 2018: 449). The ratings classes have different limits for financial ratios that must be met by the issuer in order to achieve it (Bodie et al., 2018: 451). Those ratios consider the firm's liquidity, profitability, cash flow to debt, leverage, and coverage. Z-score test by Altman (1968) is the most-known test for the appropriateness of those metrics (Altman, 1968).

There are ways for investors to be convinced that the issuer is creditworthy. Covenants can be added to the indenture meaning that for example if a firm's solvency ratio goes below a certain limit, the coupon rises, or the bond becomes callable. Other, maybe more mortgage loan-related way is placing a collateral meaning that if the issuer cannot pay either coupons or fair value, the investor claims the ownership of that collateral (Bodie et al., 2018: 454).

The riskiness of the bond is directly related to its yield-to-maturity. Because yield-to-maturity depends on the assumption that the issuer meets the agreement and pays coupons and the bond back, it will always rise if the issuer has more for example default risk (Bodie et al., 2018: 454-455). This automatically means that if the bond becomes riskier, the price of the bond will fall. In order to achieve the same desired price to a junk bond compared to an investment grade bond, the issuer must either increase the coupon payments or decrease the time to maturity because the investors demand better return for their investment (Bodie et al., 2018: 456). In the same manner, an issuer with a better credit rating gets a cheaper loan than the one with a worse credit rating.

Sometimes companies tend to buy a credit default swap to deal with the default risk. A credit default seller gets a fixed amount of money, and in exchange pays the buyer the loss of the bond if the issuer goes bankrupt (Bodie et al., 2018: 456-457). Those credit default swaps were one of the main factors behind the financial crisis in 2008 when large

financial institutions sold those contracts on subprime mortgages. Other reminiscent contract is an interest rate swap where the seller gets a fixed interest rate payments while pays back an amount defined by a floating interest rate (Bodie et al., 2018: 456). These contracts are very common among the bond market.

There are two very common factors related to the risk of a bond that need to be addressed: convexity and duration. Convexity is a product of interest rate risk and means that the price curve of a bond is convex: if the yields decrease, the bond prices rise more than the prices decrease when the yields go up (Malkiel, 1962). Because the bond pricing is product of discounting future cash flows as seen in bond valuation equation, the prices of longer-term bonds react more to the interest rate changes than the short-term ones (Malkiel, 1962). In addition, interest rate risk is less proportional to the maturity of a bond and coupon rate has a negative relationship with the interest rate risk (Malkiel, 1962).

Duration means the average maturity of the cash flows of the fixed-income security (Bodie et al., 2018: 499). The shorter the duration, the quicker the investor gets their investment back. The duration is important concept of fixed-income securities because it helps when the investor is hedging against the interest rate risk. It measures the sensitivity of the bond to interest rate risk, shows its effective maturity, and thus helps to hedge against the risk (Bodie et al., 2018: 499-505). Higher coupon rate of a bond lowers the duration since a higher proportion of the cash flow is earned through those payments. Additionally, higher yield to maturity decreases the bond's duration, and if bond has a price higher to its par value, the duration grows (Bodie et al., 2018: 499-505).

2.3.3 Term structure of interest rates

The term structure of interest rates is a defines the relationship between the discount rates and cash flows of a bond for different maturities (Bodie et al., 2018: 467). If the market conditions are considered to be efficient and so the efficient market hypotheses

hold, there should not be any arbitrage between different maturities of a bond (Bodie et al., 2018). The yield curve is often used to describe the relationship between bond maturity and its yield to maturity. A yield curve with an upward-slope reckons that future short-term interest rates are going to increase and thus the economy is in bull market and vice versa (Bodie et al., 2018: 467-468).

Considering that the term structure of interest rates should mean that a longer-period interest rate should equal the sum of a short-term interest rate and a forward interest rate, otherwise there is an arbitrage opportunity (Bodie et al., 2018: 468-469). However, since there is always a liquidity risk in the fixed-income instruments and so the forward rate is often larger than the expected value of a short rate. This liquidity premium often leads to a situation where the yield curve slopes up even though the rates are not to be expected to rise in the future (Bodie et al., 2018: 476).

Expectations hypothesis is the most used theory of the term structure of interest rates. In short, it expects that the forward rate equals the future short interest rate and there is no liquidity premium (Bodie et al., 2018: 477-484). With this expectations hypothesis, it is possible to interpret the term structure of interest rates and assume that the equation below holds.

$$(1 + r_2)^2 = (1 + r_1) * (1 + f_2) \quad (4)$$

In expectations hypothesis, the yield to maturity can be determined from this equation and only the current and expected future interest rate defines it (Bodie et al., 2018: 477-484). However, because there is liquidity premium and inflation among else, these factors should be added to the forward rate. This makes the term structure of interest rates very hard to interpret in a correct manner. Later, in chapter 2.4 we discuss green bonds which tend to have another premium, so-called green premium which makes the interpretation even more difficult since the rates do not seem to fall into the same yield curve as conventional bonds.

2.4 Green bond

Green bond is a special type of bond that has its proceeds used to an environmentally friendly project (ICMA, 2021). In order to maintain transparency, the project should comply with the green bond principles defined by ICMA. There are four core components that must be met in order to define the fixed-income instrument as a green bond: the use of proceeds, the process for project evaluation and selection, the management of proceeds, and the reporting. In many cases, to highlight the transparency of the progress, the issuer has also its own green finance framework which defines all those core components of their projects (ICMA, 2021). In addition, the issuers often obtain a second opinion that categorizes the issuer's greenness and makes it easier to compare the firms. For example, Cicero offers a second opinion service.

The use of proceeds is maybe the most important component of those four. The issuer must clearly state the projects where the proceeds of the green bond are used. There are multiple categories that are recognized as eligible projects, but they all have of course one thing in common; the projects must contribute to a common goal of more climate-friendly environment (ICMA, 2021). For example, the most common categories are clean energy solutions, climate change adaption, sustainable construction, and pollution preventive actions (ICMA, 2021).

The second component of the green bond principles is the process for project evaluation and selection. This component states that the issuer should transparently communicate the sustainability objectives, the project process, and other environmental impacts of the financed projects to all stakeholders, especially to the investors (ICMA, 2021). The component of the management of proceeds indicates that the proceeds should be kept in a different account to make sure the funds are used only to green projects and sub-accounts make the whole process more transparent (ICMA, 2021). In addition, the principles suggest that an external auditor should keep record of the management of

proceeds. Finally, the last component of the principles, the reporting suggests that the issuer should keep record of the use of green bond proceeds at least on annual basis. The reports must include a list of all the projects funded by the green bond proceeds, descriptions of those, allocation of funds, and the environmental impact of the projects (ICMA, 2021).

European Union has also its own proposal to align green bond issuances to the EU taxonomy which aims to more sustainable economic activities by the companies in EU countries (European Union, 2020). The EU taxonomy has been in force since the beginning of 2022, and in addition to the Paris climate agreement, it is one of the main legislative actions the EU companies must follow. The European Green Bond Standard (EUGBS) is the European version of the green bond principles, and it is very similar to the ICMA one, although it is aligned with the EU taxonomy.

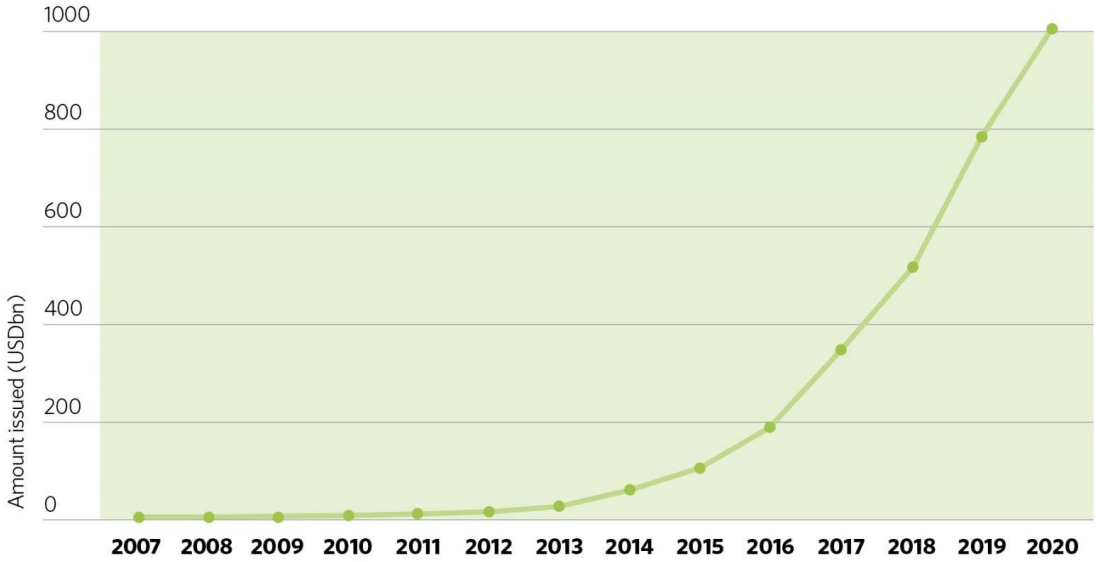

Figure 1. Cumulative progression of green bond issuances (Jones, 2020)**.**

All in all, all the components of the green bond principles are designed to help the issuers to remain as transparent to their investors as possible. There are typically three reasons to issue a green bond; to show stakeholders that the company is pursuing for sustainability, to "greenwash" in other words trying to mislead stakeholders into believing that company is more sustainable than it really is, and finally to get cheaper financing through the idea that investors might be keen to trade off some of their returns in order to invest

in something more sustainable (Flammer, 2021). The best way to tackle the doubt of shareholders towards greenwashing is transparency and disclosure.

Gianfrate & Peri (2019) compare the convenience of the green bonds with the conventional bonds with a propensity score to show that the green bonds are truly an effective way to pursue towards the Paris climate agreement targets. They conclude that based on their study, a green bond is a convenient financial instrument that can be utilized in order to reduce global warming and there is no sign of greenwashing (Gianfrate & Peri, 2019). Ghitti et. al. (2022) analyzes the aspects behind greenwashing and conclude that firms that have good governance and limits its agency problems have also lower chance to greenwashing and also larger size of the corporate board reduces the amount of greenwashing. Also, if the board is independent there is a larger chance that there might be also greenwashing experienced in the company (Ghitti et al., 2022). Finally, Ghitti et. al. (2022) conclude the inevitable that companies that have tendency towards greenwashing also experience decrease in the firm value.

Green bonds are rather new financial instrument even though the first of its kind was issued by European Investment Bank and World Bank in 2007. Six years later, the first corporate green bond was issued in Sweden by Vasakronan and after the end of 2013, the green bond market expanded rapidly as more and more financial institutions became aware of the new form of fixed-income security. The first certified green bond was issued

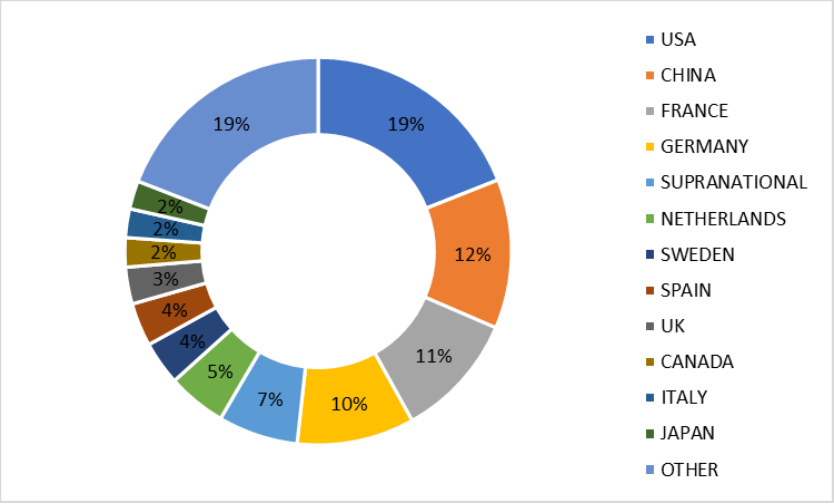

Figure 2. Volume of issued green bonds (CBI, 2021).

in 2014, and since then a majority of the green bonds have been certified by an external reviewer (ICMA, 2021). The green bond issuance volume reached a milestone of one trillion US dollars in December 2020 (see figure 1) (Jones, 2020). Year 2015 can be seen as an important year for sustainability since all United Nations countries signed the Agenda 2030, which defined goals for the next 15 years. The Agenda 2030 is often mentioned in the green finance frameworks of the green bond issuing companies.

The United States has been the most active green bond issuer country measured by the volume of issued capital (figure 2) by over 300 billion dollars (19%), followed closely by China (199 billion, 12%), France (167 billion, 11%), and Germany (157 billion, 10%) (CBI, 2021).

Considering industries, the use of proceeds distribution can be seen from figures 3 and 4. Most of the use of proceeds, 81%, is for energy, buildings and transport (CBI, 2021). This is probably due to the fact that those are perhaps the easiest projects to be implemented with a sustainability aspect such as renewable energy in wind power, geothermal heating, and electrical cars, respectively. This can also be seen from the descriptive statistics of the final data sample.

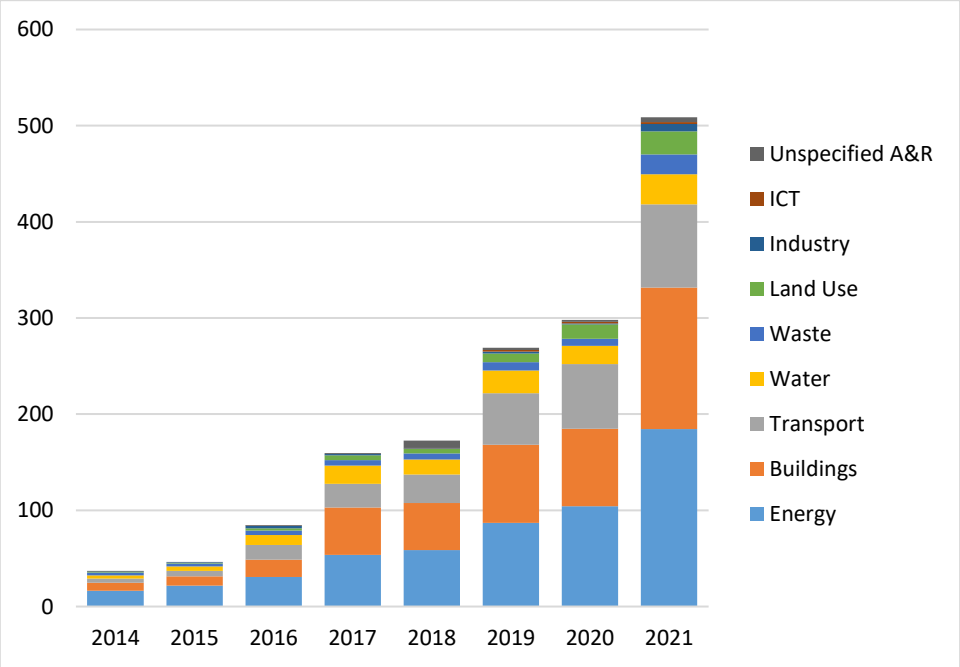

Figure 3. Use of proceeds 2014-2021 (CBI, 2021).

All in all, green bond is a sustainable fixed-income instrument that complies with the Green Bond Principles, and through external, second party review try to be as transparent as possible. So, the final questions are why a company would issue a green bond, and why would an investor consider it. First of all, there is research about the green bond premium, meaning that the green bonds are priced differently to the conventional bonds. If a company gets cheaper green financing than through conventional bonds, there is an incentive towards green bond financing and consequently to more sustainable business solutions and projects. Even though the process of issuing a green bond is more demanding and costly, the companies seem to choose the green bond option more and more often as seen from figure 1.

What about investors? The main driver behind the motive to invest in green bonds might be examined better returns from ESG-friendly companies, and an urge to tackle global warming together. Some companies also have sustainability-related funds that need eco-friendly investments, or the companies have their own sustainability strategies. Later in this study, I will take a look at the prior literature and through the empirical research of this study, I try to find answers that might also explain while green bonds are attractive to stakeholders.

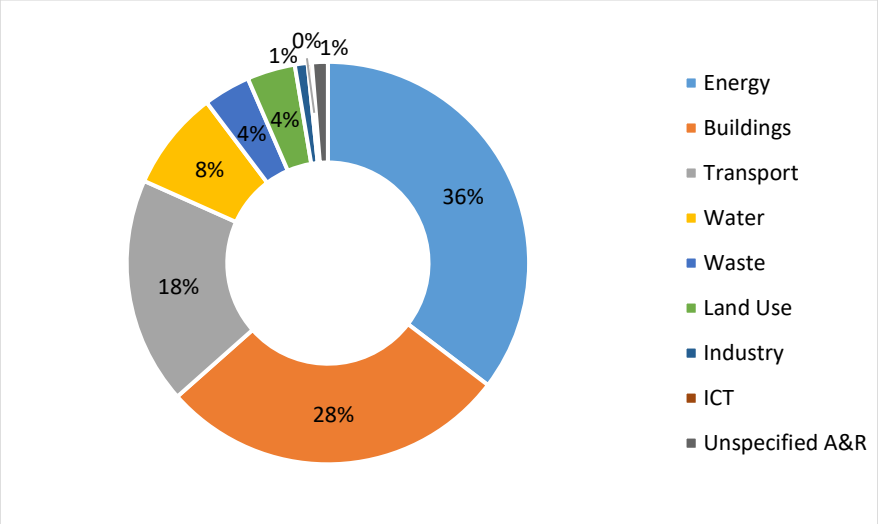

Figure 4. Use of proceeds per industry (CBI, 2021).

3 LITERATURE REVIEW

The literature review of this study consists of two different sections: the previous research on sustainability and ESG, and the previous research on green bonds. The previous research on sustainability and ESG is essential since it forms a wider picture of the topic and a basis on the idea whether sustainability and later green bonds are valued in the stock market or not. There is a lot of previous literature on both sustainability and ESG, so the focus on the first section is in the firm value perspective.

The main literature review focuses on the previous research on green bonds. Most of the previous research has been conducted quite recently since the amount of green bond issuances has risen during the past few years. Since the growth has been quite dramatic over the years, there are some differences between the amount of data used in the previous literature, and thus in some the results. This needs to be considered when comparing the studies. The research on green bonds forms the basis of this study and the hypotheses are formed based on the results of the previous research. In addition, the intended contribution: to see whether there is difference in stock market reactions for bonds issued in different industries, has been formed based on the lack of research on that question.

3.1 Research on sustainability

The research on sustainability in finance arises often from one common question: do the firms benefit from making sustainable actions? This idea is then developed into match different aspects of sustainability or field of finance depending on the research target. In this chapter, we take a look at the previous research on sustainability and try to find an answer to the question whether it is profitable to invest in sustainability. Logically, this should also mean that green bonds, as they are sustainable fixed-income instruments, would have the same outcome as the other sustainability actions.

The earliest studies on sustainability agreed quite commonly that sustainability does not lead to any profit for the firm since the actions cost more than they make for the firm (Friedman, 1970; Vance, 1975). This might have been a consequence of two things: the stakeholders do not value sustainability and thus the profits do not increase, or the resources or processes are fairly new and thus more costly to the firm. One might think that this is due to the fact that sustainability as a topic has risen into daily conversation only recently and thus the stakeholders have begun to value sustainability as late as during the 2000s at the earliest. However, there are also more recent studies on sustainability claiming that it either affects negatively to the firm's performance or does not have a significant effect to it. In addition to Vance (1975) and Friedman (1970), Brammer et. al. (2006) finds a negative correlation between corporate social performance and firm's stock returns in the UK (Brammer et al., 2006). They notice that the firms with lowest scores in SRI matters manage to outperform the market while the firms with highest scores, especially the ones with great environmental and community indicators, are constantly negatively associated with the financial performance (Brammer et al., 2006). The results might be affected by their method that focuses on disaggregate measures of the environmental and community indicators instead of the more typical aggregate measurements (Brammer et al., 2006).

Moreover, Boyle et. al. (1997) discovers in their study that there is a negative correlation between socially sustainable actions and stock price (Boyle et al., 1997). They compare a group of defense contractors that signed a social responsibility initiative together with a group of defense contractors who did not sign the initiative. Against expectations, both groups experienced losses in both stock prices and future cash flows even though the reaction was larger for the non-signers (Boyle et al., 1997). Nonetheless, they argue that this could be a consequence of the common fear of increasing regulation through the initiative rather than increasing costs related to more sustainable behavior (Boyle et al., 1997).

It seems to be more common that the researchers find a non-significant relationship between sustainability and firm's financial performance than a significant negative relationship. The ones that find the significant negative association are almost without exception a bit older research but what comes to the non-significant association, there are some pretty recent studies claiming that sustainable actions do not have impact on firm value.

Horváthová (2010) finds no significant connection between environmental and financial performance and argues that it depends on the empirical method that might have some omitted variable bias (Horváthová, 2010). Additionally, McWilliams & Siegel (2000) examine the relationship between CSR and firm performance. They test the model and conclude that earlier results of correlation between CSR and firm performance is rather a misinterpretation and a consequence of not controlling for research and development investments factor which seems to have a fairly large effect on firm performance (McWilliams & Siegel, 2000). When taking this factor into account, they find that there is no significant association between sustainability and firm's financial performance (McWilliams & Siegel, 2000).

Renneboog et. al. (2008) examines the performance of socially responsible funds and find that depending on the country, the SRI-orientated fund either underperforms or does not differ from the conventional ones (Renneboog et al., 2008). They argue that the higher costs of these funds and the overpricing of the SRI responsible firms invested in by those funds is the main reason behind the underperformance (Renneboog et al., 2008). In addition, they conclude that sustainability screening leads to worse performance. All in all, since the results between countries are contradictory, they cannot make a conclusion that there is a significant relationship between SRI score and fund performance (Renneboog et al., 2008).

Another viewpoint has risen during the recent years, and most likely explains at least some of the reasons behind is that sustainable actions take time to really make profit to

companies, in other words the actions do not have an instant impact like for example change of capital structure. Jensen (2002) addresses that based on the stakeholder theory, the companies can only focus on one dimension of value maximization and thus they will not focus on increasing social responsibility since it does not realize fast enough (Jensen, 2002). Also, Krüger (2015) argues that in short term the investors react negatively to news on increase of company's CSR or sustainability policies since that kind of news are expected to bring additional costs to the firm (Krüger, 2015). Ferrell et. al. (2016) concludes that since the sustainability actions are aimed to all stakeholders, the firm's shareholders see those actions as both cash diversion and an agency problem (Ferrell et al., 2016). However, the realized returns from those actions benefit also the shareholders meaning that there is a positive association between sustainability and firm value, at least in a long run (Ferrell et al., 2016).

Nevertheless, most of the research on sustainability and its effect on firm's financial performance conclude that there is a significant positive association between those. Even though there is or has been a fear that sustainable actions lead to higher costs or reduce the shareholder value, almost all recent studies argue that the effect is positive since more sustainable firms are seen to provide a higher long-term value to its stakeholders. The sustainable actions are often seen as a result of future-orientated, innovative, and workforce enhancing, meaning that the company is more likely to thrive also in future and stand against the increasing amount of competition.

Fatemi et. al. (2018) finds a positive correlation between ESG and firm value using a sample from listed US companies from 2006-2011 (Fatemi et al., 2018). They also try to tackle the greenwashing theme by attaching disclosure element into their research. Fatemi et. al. (2018) concludes that the disclosure of the ESG related information weakens both the positive effect and the negative effect (Fatemi et al., 2018). This seems to be a consequence of information asymmetry, and they argue that the disclosure might lead to situation where stakeholders think that "things are not that well or bad as was thought"

(Fatemi et al., 2018). As mentioned before, the best way to tackle the doubt of shareholders towards greenwashing is transparency and disclosure.

Bajic & Yurtoglu (2018) examine the effect of different CSR aspects into the firm value. They conclude that CSR correlates positively with the firm value and social aspect is the only thing that significantly affects the firm valuation (Bajic & Yurtoglu, 2018). Additionally, Ghoul et. al. (2017) investigates large sample of 11,672 firm-year observations from 53 different countries and find positive relationship between CSR and firm value (Ghoul et al., 2017). They also conclude that the positive effect is larger in those countries that lack market institutions which ultimately leads to higher transaction costs (Ghoul et al., 2017).

Dimson et. al. (2015) shows that improving ESG leads to an abnormal increase in the firm value (Dimson et al., 2015). They argue that a possible explanation to the reaction might be the active-ownership that seems to go hand-in-hand with the ESG activity (Dimson et al., 2015). This result is reminiscent with the one by Buchanan et. al. (2018). They examine institutional ownership and CSR together in terms of effect on firm value and focus on time-period around the financial crisis (Buchanan et al., 2018). Buchanan et. al. (2018) show that high CSR is associated with higher firm value but due to overinvestment those firms suffer more from the crisis. However, their main finding through difference-in-difference methodology is that the institutional ownership guides the CSR effect on firm valuation, and the influence is positive (Buchanan et al., 2018). This means that institutional ownership strengthens the positive effect in bull markets and mitigates the negative overinvestment related effect in bear markets (Buchanan et al., 2018).

3.2 Research on green bonds

The research on green bonds is a bit newer as a topic than sustainability research, one might argue that green bond research has developed from prior sustainability research after the first green bonds were issued. While examining green bonds, we must bear in

mind that green bonds are a specific type of a fixed-income instrument and since they have the same basic characteristics such as maturity, coupon rate et cetera, the differences in research results between green and conventional bonds are most often based on their sustainability characteristics. Sometimes, the sustainability aspects can be valued unambiguously, for example when green bonds have significantly lower coupon rate than conventional bonds but very often the valuation is based on things such as indication of better returns in future. In this subchapter, we focus on previous literature on green bonds and the research is roughly divided into two different viewpoints: whether green bonds are priced differently than conventional bonds, and whether the issuance of a green bond is affecting the firm's stock price. The latter is the most essential part for this study since the purpose of this study is to examine whether the effect is consistent with previous studies with a more recent data set and to contribute by examining whether there are differences between different industries.

Green bond premium, often called "greenium" means that a green bond has a lower yield than a conventional bond, in other words priced below the conventional bond with similar features. For example, Goss & Roberts (2011) show that companies with lower CSR pay significantly higher coupons, between 7-18 basis points, and El Ghoul, Guedhami, Kwok, & Mishra (2011) examine that CSR leads to significantly cheaper equity financing (el Ghoul et al., 2011; Goss & Roberts, 2011).

Hachenberg, & Schiereck (2018) examine the pricing effect on 63 bonds and use Wilcoxon rank sum and t-tests. Their results indicate that there is pricing difference in A-rated bonds but not for AA and BBB-rated bonds (Hachenberg & Schiereck, 2018). They also show that there is a significant difference between industries, especially between financial sector green bonds and other sectors' green bonds which must be noted also in this study (Hachenberg & Schiereck, 2018). Zerbib (2019) uses matching method and fixed-effects panel regression in order to find a pricing difference in green bonds. He concludes that there is a significant, 2 basis points price difference and the effect is larger for financial green bonds with lower credit rating (Zerbib, 2019).

Fatica et. al. (2021) study a large sample from 2007-2018 and find a green bond premium for both supranational institutions and corporations but not for financials (Fatica et al., 2021). They also show that second opinion increases the premium, and that also subsequent issues tend to have larger green bond premium than the first-time issues (Fatica et al., 2021).

The main prior literature consists of studies regarding the green bond issuance and its effect on stock price. Tang & Zhang (2020) use a data sample of 1510 observations from 2007-2017 from 28 countries and conduct an event study by using different kinds of factor models. They use the market model, the Fama French three factor model, and the Fama French five factor model with purpose to find significant cumulative abnormal returns on both 15 and 20 days around the issuance date (Tang & Zhang, 2020). They find a significant positive reaction in abnormal returns with all the models and then try to examine which might explain this result (Tang & Zhang, 2020). First-time issues are statistically significant while subsequent issues are not, and corporates have statistical significance while financials do not (Tang & Zhang, 2020). Tang & Zhang (2020) conduct several different regressions with greenium, institutional ownership, and liquidity. They show that lower cost of debt is not the reason behind the effect, rather the institutional ownership and liquidity increase after the issuance, indicating a better outcome for the shareholders (Tang & Zhang, 2020).

Lebelle et. al. (2020) finds contradictory results from green bond issuances. They have a data sample of 475 corporate green bonds from 2009-2018, and conduct an event study with the market model, 3-factor Fama French, and 4-factor Carhart with a 2-day time frame around the issuance date (Lebelle et al., 2020). Lebelle et.al. (2020) find a negative CAR for the issuances, especially first-time issuances in developed markets (Lebelle et al., 2020). This might be due to their significantly smaller sample than Tang & Zhang (2020). They also have different event study window which might have an effect even though Lebelle et. al. (2020) records negative CARs for all their time periods. They explain the

negative reaction as consequence of investors' fear of firm's increasing costs through sustainability actions (Lebelle et al., 2020).

Flammer (2021) uses a data sample of 1189 corporate green bonds from 2013-2018 and conducts an event study on cumulative abnormal returns and then matching technique on firm-level characteristics (Flammer, 2021). She has a 15-day event window and shows a significant positive CARs for green bond issuances (Flammer, 2021). In addition, Flammer (2021) examines cross-sectionally that certified, first-time issuers have higher positive effect. Finally, she shows that companies' environmental performance enhances after the issuance, indicating that there is no greenwashing aspect linked to the issuance (Flammer, 2021).

Baulkaran (2019) is one of the first studies on the topic. He has a rather small data sample of 54 observations from mostly European companies on which he conducts an event study with 20-day window and the market model to see whether there are significant cumulative abnormal returns (Baulkaran, 2019). Baulkaran (2019) shows that the CARs are positive and statistically significant, and then he tries to explain these results with a regression analysis on both bond and firm characteristics. The regression results indicate that higher coupon rate leads to weaker reaction, and size, Tobin's Q and asset growth affect positively, and ultimately operating cash flow has a negative impact on the CARs (Baulkaran, 2019).

Wang et. al. (2020) examines the green bond issuance effect solely on Chinese stock market since China is currently the largest green bond market in the world. They gather a data sample of 159 bonds from which 48 are green bonds from 2016-2019 and conduct both a univariate analysis with yield spread and then a multivariate regression model with yield spread, a dummy variable for green bond and some firm characteristics (Wang et al., 2020). They first show that yield spread is significantly 34 basis points lower for the green bonds, and that higher corporate social responsibility leads to higher yield spread (Wang et al., 2020). Finally, the stock reactions are stronger for the green bonds

and the cumulative abnormal returns are positive and statistically significant for time periods of 6 and 20 days around the event (Wang et al., 2020).

Russo et. al. (2021) examines corporate green bonds from 2013-2016 and focus on three different points of interest; specific characteristics of projects that the proceeds are used, the sustainability strategy of the issuing firm, and country-specific fundamentals that may determine the performance after the issuance (Russo et al., 2021). Their final sample consists of 306 issues from around the world. They discover that for example, projects of pollution prevention and sustainable water management have significant positive effect on green bond performance (Russo et al., 2021). Russo et.al. (2021) also conclude that sustainability strategies have positive effect on the green bond performance, and that the country conditions have partially significance to the performance (Russo et al., 2021).

4 DATA AND METHODOLOGY

The data of this study comprises corporate green bond issuances by US companies from 2013-2021 and is collected from the Bloomberg database. The total sample includes 213 corporate green bonds from the United States. The green bonds are sorted by issuer name, issuer ticker, issue date, issuer's country, amount of the bond, maturity, coupon rate, and three different credit ratings (Fitch, Standard & Poor's and Moody's). Additionally, this study needs stock and firm data from the examination period. The stock market and firm data is collected from Refinitiv Eikon and Yahoo Finance and consists of daily prices of the stocks as well as daily prices of the S&P 500 market index.

The firm characteristics acquired include market capitalization, net income, earnings before interest and tax (EBIT), total assets, total equity, total debt, and return on equity (ROE). Also, Tobin's Q, is calculated based on that data, and added to the firm characteristics. The firm characteristics are gathered from a fiscal year before the bond issuance date.

Similarly, to Baulkaran (2019), the green bond sample needs to be trimmed in order to have a suitable final sample for the empirical testing. Unlisted firms are dropped from the sample since they do not have a stock reaction to conduct the study. In addition, small firms, with market capitalization under 2.0 billion, are dropped from the sample to reduce low volume stock price effect. Then, corporate green bonds with amount under 500,000 dollars are excluded from the final sample since the effect of such small bond does not have a major impact on the firm's financials. Finally, after calculating the CARs, the firms that have had a major non-bond issue related confounding event, such as earnings announcement, that have a strong effect on the stock price development during the event window, are excluded from the final sample. Those data outliers increase the standard deviation of the sample and affect the statistical analysis of the data.

The final sample comprises 154 corporate green bonds from 44 companies and 7 different industries. The descriptive statistics are presented in chapter 4.2.

4.1 Methodology

I have chosen a quantitative research method to this thesis. This study has two different quantitative econometric methodologies; first I conduct an event study with a market model which is utilized in order to find the possible abnormal returns around the green bond issuance. The market model is based on the capital asset pricing model by Sharpe (1964). Then with an OLS regression, this study examines the effect of different bond and firm characteristics on the cumulative abnormal returns, and also the industry-effect is examined by using industry dummy variables.

Almost all previous studies on green bond issuance effect use an event study approach and define the cumulative abnormal returns per stock (Baulkaran, 2019; Flammer, 2021; Tang & Zhang, 2020). First, the market model is estimated for the expected returns for each stock. The market model uses the daily returns from period [-250, -30] as an estimation period, and the corresponding daily returns of the S&P 500 market index. The market model is as follows (Sharpe, 1964):

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \epsilon_{i,t} \quad (5)$$

where:

$R_{i,t}$ = return of the firm i on day t ($(r_{t+1} - r_t)/r_t$))

β_i = beta of the firm i

$R_{m,t}$ = return of the domestic market index (S&P 500 index) on day t

$\alpha_{i,t}$ = return of the firm-specific characteristics

$\epsilon_{i,t}$ = error term

This market model gives an estimate for the firm-specific return which parameter estimates are then utilized to calculate the abnormal returns for the three event study windows [-10,10], [-5,5], and [-1,1]. These event study windows are around the issuance date unlike in e.g., Tang & Zhang (2020) since the announcement dates are not available

for all green bond issuances. In addition, in most of bond issuances the announcement date tends to be extremely close to the issuance date or there is not even a separate announcement date so the lag in information is not substantial. For example, in 2017 Apple announced its green bond on 13th of June which was then issued five days later on 20th of June. Also, the well-known anomaly of post-earnings-announcement drift, first shown by Ball & Brown (1968), counters the idea of market efficiency by indicating that a positive earnings announcement is not immediately seen in efficient market pricing of the firm's stock (Ball & Brown, 1968). They suggest that there is a rising drift in positive abnormal returns, and vice versa downward drift for negative earnings announcement, that follows after the announcement for several weeks (Ball & Brown, 1968).

This indicates that the abnormal returns are expected to be encountered also during the issuance in addition to the announcement date. Finally, the usage of three different event study windows enhances robustness since in most cases it includes the announcement date to the event window. The equation for abnormal return is as follows:

$$AR_{i,t} = R_{i,t} - \hat{\alpha}_i + \hat{\beta}_i R_{m,t} \quad (6)$$

The cumulative abnormal return is the sum of daily abnormal returns on each event study window:

$$CAR_{[t1,t2]} = \sum_{t_{(1)}}^{t_{(2)}} AR_t \quad (7)$$

To test the hypotheses of this study, I need to calculate the average cumulative abnormal returns for the whole sample:

$$\overline{CAR}_{[t1,t2]} = \frac{1}{N} \sum_{i=1}^{N} CAR_i \quad (8)$$

These averages are calculated for each three event study windows. The averages are then used in hypotheses testing which are

H0: The issuance of a green bond does not affect the stock price of the company ($\overline{CAR}_{[t1,t2]} = 0$)

And the contradictive hypotheses are as follows:

H1: The issuance of a green bond has a positive effect on the stock price of the company ($\overline{CAR}_{[t1,t2]} > 0$)

H2: The issuance of a green bond has a negative effect on the stock price of the company ($\overline{CAR}_{[t1,t2]} < 0$)

In order to test those hypotheses, a significance test must be conducted. Most of the previous research use a t-test to see whether the CARs are statistically significant, but for example, Tang & Zhang (2020) perform also a Wilcoxon signed-rank test on the sample. By conducting both of those tests, the results can be considered to be more precise, and since there are a couple of bonds issued by same company during the same date or year, this can help to tackle statistical errors such as cross-sectional correlation those might cause. Additionally, as a nonparametric test the Wilcoxon signed-rank test does not depend on the distribution of the data sample so it would be an appropriate test method for the CAR analysis regardless of the standard deviation of the sample.

Corrado & Zivney (1992), Cowan et. al. (1990), Cowan (1992), and Wilcoxon (1945) propose that since an event study easily suffers from clustering that inevitably leads to cross-sectional correlation of the abnormal returns, especially in this study where there are some green bonds issued on the same day, a parametric test such as t-test might not be the suitable test-statistic (Corrado & Zivney, 1992; Cowan, 1992; Cowan et al., 1990; Wilcoxon, 1945). Corrado & Zivney (1992) compare a t-test, a sign test, and a rank test to each other. They conclude that sign test is superior to the t-test but inferior to a rank test, at least on a short estimation period of 89 days (Corrado & Zivney, 1992). On contrary,

Cowan et. al. (1990) proposes a corrected, non-parametric test statistic as a sign test which, in short, compares the positive CARs with the negative CARs and under their null hypothesis, the ratio does not differ from 0.5 (Cowan et al., 1990).

$$t_{sign} = \sqrt{N}\,(\frac{CAR_{\%\,of positive} - 0.5}{\sqrt{0.5(1-0.5)}}) \quad (9)$$

Cowan (1992) improves this idea by generalizing the sign test. In generalized sign test, the positive CARs are expected to be consistent in the whole event study period, and the null hypothesis expects that the amount of the positive CARs in the sample in event window does not differ significantly from the fraction of positive CARs in the estimation period (Cowan, 1992). Cowan (1992) concludes that rank tests are more prone to error if the event window is longer or stock have a low volume or there is an increase in the stock return variance, and thus the (generalized) sign test should be preferred (Cowan, 1992).

Wilcoxon (1945) proposes a nonparametric signed-rank test which was used in Tang & Zhang (2020) which considers both sign and rank of the CARs (Wilcoxon, 1945). This can be seen as the most superior test statistic since it combines both nonparametric tests, and thus is tested for the data sample in this study. If the CARs of the data sample are statistically significant for both cross-sectional t-test (parametric test), and Wilcoxon signed-rank test (nonparametric test), it can be concluded that the cumulative abnormal returns related to the green bond issuances are truly statistically significant.

To analyze which firm and bond characteristics affect the cumulative abnormal returns, I will conduct a regression analysis on the cross-sectional data. The regression technique that I am utilizing is called the ordinary least squares (OLS) method. When interpreting the results and the causality of variables, one must remember the “ceteris paribus” principle, that the effect is experienced with other relevant variables being equal at the same time (Wooldridge, 2013: 12). Under the Gauss-Markov assumptions, which indicate that the model is linear in parameters, has a random sample, there is no linear relationship

between variables, error term has a zero conditional mean and is homoscedastic, the OLS estimators of the model are the "best linear unbiased" estimators (Wooldridge, 2013: 104-105).

After testing the cumulative abnormal returns, I run a few different regressions with CARs as the dependent variable and different bond and firm characteristics, and finally with industry dummy variables as dependable variables. The regression technique is the ordinary least squares (OLS) method. The regression model is based on Baulkaran (2019), but it is modified to serve the purpose of this study, and thus there are industry dummy variables added to the regression model as follows:

$$CAR_i = \alpha + \gamma' X + \delta' Y + \beta_1 Industry + \beta_2 Issue + \beta_3 Rating + \varepsilon \qquad (10)$$

where:

CAR_i = cumulative abnormal return of stock

α = intercept term

$\gamma' X$ = vector for firm characteristics

$\delta' Y$ = vector for bond characteristics

$\beta_1 Industry$ = dummy variable for industry

$\beta_2 Issue$ = dummy variable, 1 if a first-time issue, 0 if a subsequent issue

$\beta_3 Rating$ = dummy variable, 1 if investment grade, 0 if high yield (Standard & Poor's, Fitch or Moody's)

ε = error term

The firm characteristics vector includes:

- Size (log of market capitalization)
- ROA (EBIT/total assets)
- Leverage (total debt/total assets)
- Tobin's Q (total market value of firm/total assets)

The bond characteristics vector includes:

- Issue size (log of amount)
- Coupon rate
- Maturity (log to maturity)

Those characteristics are used in the previous studies, such as Baulkaran (2019). The industry dummy includes dummy for the seven industries: retail, utilities, real estate, financial, miscellaneous, construction and automotive. These industries are defined by the industry group codes in Refinitiv Eikon. The results from the regression model help to analyze which factors influence the cumulative abnormal returns but also the dummy variable shows if there are any industry related differences. Therefore, the third hypothesis can be answered:

> H3: The green bond issuance has a different effect on the stock price between industries

We can expect, based on Tang & Zhang (2020), that there is difference between the industries, at least between financials and non-financials as they conclude that companies in financial sector do not provide significant positive stock return while non-financials do at 0.05 significance level (Tang & Zhang, 2020).

4.2 Descriptive statistics

The final data sample comprises 154 corporate green bonds from 44 companies and 7 different industries. The bonds were issued between 2013 and March 2021, most of them being issued since 2015. The Covid-19 pandemic did not seem to affect the desire to issue green bonds even though it hit some industries very hard. This needs to be considered when analyzing the results as we know that the stock market plummeted during spring of 2020. The issue distribution can be seen from table 1 where the annual sum of amount issued and number of issued bonds per year is shown.

Table 1. Issued bonds per year.

Year	Sum of Amount, $	# of bonds
2013	2,000,000,000	2
2014	260,000,000	2
2015	775,000,000	43
2016	3,983,794,433	7
2017	3,276,944,419	5
2018	7,475,000,000	11
2019	22,538,580,182	33
2020	21,855,479,213	38
2021	7,908,285,590	13
Grand Total	**70,073,083,838**	**154**

The bonds are divided to seven industries as seen from table 2, based on their industry group code in Refinitiv Eikon. Most of the green bonds have been issued by companies operating in automotive, financial, real estate and utilities industries. As mentioned earlier the most popular use of proceeds are energy, buildings and transport which is in line with the most popular industries in the data sample. This means that those industries are the most comparable between each other when testing the hypothesis 3.

Table 2. Issued bond per industry.

Industry	Sum of Amount, $	# of bonds
Automotive	1,861,944,419	45
Construction	450,000,000	1
Financial	16,329,404,895	21
Miscellaneous	3,908,285,590	6
Real estate	11,932,593,555	24
Retail	8,826,513,128	10
Utilities	26,764,342,251	47
Grand Total	**70,073,083,838**	**154**

The descriptive statistics of CARs can be found from table 3. The means of each of the event windows are positive with the largest window of 21 days (-10,10) being also the largest mean CAR with 1.19%, followed by 0.76% of 11 days (-5,5) and 0.29% of 3 day-window (-1,1). The medians for the two largest event windows are also clearly positive while the shortest event window has a negative median CAR with -0.12%. This indicates that the Wilcoxon signed-rank test for CAR (-10,10) and CAR (-5,5) are positive while for CAR (-1,1) it is negative. As seen from the maximum and minimum CARs of each sample, and more precisely from their standard deviations, the CARs are fairly widely distributed even though the largest outliers were trimmed from the final data sample. This might affect the statistical significances of the results since it is the denominator in t-tests.

Skewness and kurtosis measure the tails of the distribution. Skewness of the distribution defines how the majority of the data is lined up around the mean. Skewness of both CAR (-10,10) and CAR (-5,5) are small and easily acceptable while the skewness of the 3-day event window is seemingly large indicating that the data is perhaps not normally distributed. Kurtosis on the other hand measures how much of the sample is in the tails of the distribution. Since the normal distribution has a kurtosis of 3.0, the CAR (-10,10) and CAR (-5,5) seem to be normally distributed also in that manner (Wooldridge, 2013).

Finally, the Jarque-Bera test shows that the CAR (-10,10) and CAR (-5,5) are normally distributed since the null hypothesis of it cannot be rejected. On the other hand, for the

CAR (-1,1), the test statistic is high and leads to rejecting the null hypothesis meaning that it is not normally distributed.

Table 3. Descriptive statistics of CARs.

	CAR (-10,10)	CAR (-5,5)	CAR (-1,1)
Mean	1.19	0.76	0.29
Median	0.93	0.52	-0.12
Maximum	14.32	10.72	12.11
Minimum	-13.36	-12.83	-8.00
Std. Dev.	5.55	4.32	3.07
Skewness	0.06	-0.07	1.05
Kurtosis	3.39	3.06	6.20
Jarque-Bera	1.05	0.13	94.12
Probability	0.59	0.94	0.00
Sum	183.09	117.03	44.21
Sum Sq. Dev.	4712.43	2854.00	1445.20
Observations	154	154	154

The stock market data is collected from Refinitiv Eikon and Yahoo Finance databases. I use three different event study windows (days) around the issuance: (-10,10), (-5,5) and (-1,1). The CAR analysis is conducted with a market model approach where S&P 500 index is used as the market return.

The descriptive statistics of the green bond characteristics are represented in table 4. Mean of the coupon rate is approximately 3.34% which is close to one in Flammer (2021) sample. Maturity is approximately 12 years on average in the data sample, which can be considered quite high actually even though the longest maturity in the sample is 31 years. The average amount issued is 455 million dollars, the range being from 1.13 million dollars up to 2,250 million dollars. The green bonds that have issue amount of under 500,000 dollars were excluded from the sample.

Dummy variable for credit rating is 1 and indicates whether the issuer has been credited with an investment grade rating by either Standard & Poor's (BBB- or higher), Moody's (Baa3 or higher) or Fitch (BBB- or higher). If the issuer is considered to be high yield, the dummy variable is 0. In the data sample, the mean value is 0.662 indicating that 66.2% of the green bonds have been issued by a company that has an investment grade credit

rating. Of course, since the credit rating indicates the issuer's risk, the investors will demand higher return from bonds issued by firms with worse credit rating, in other words a bad credit rating leads to higher coupon.

Finally, the dummy variable of issue defines whether the green bond issue was the first-time issue or a subsequent one. This is tested in order to see if the investors react fundamentally to the green bond issuance or is the effect driven more by behavioral aspects such as overreacting to sustainability announcements. Tang & Zhang (2020) conclude that the subsequent issuance does not lead to statistically significant CARs meaning that the investors do not react similarly to every green bond issuance and thus the reaction cannot be considered "fundamental" (Tang & Zhang, 2020). In the data sample of this study, there are 33.8% of first-time issues while approximately other two thirds are subsequent issues.

Table 4. Descriptive statistics of green bond characteristics.

	COUPON	MATURITY	AMOUNT	RATING DUMMY	ISSUE DUMMY
Mean	3.34	12.34	455.00	0.66	0.34
Median	3.50	10.00	400.00	1.00	0.00
Maximum	5.45	31.00	2250.00	1.00	1.00
Minimum	0.00	2.00	1.13	0.00	0.00
Std. Dev.	1.54	7.45	4.23E+08	0.47	0.47
Skewness	-0.39	1.44	1.08	-0.69	0.69
Kurtosis	2.22	4.13	4.89	1.47	1.47
Jarque-Bera	7.89	61.29	52.80	27.09	27.09
Probability	0.02	0.00	0.00	0.00	0.00
Sum	514.61	1901.00	7.01E+10	102.00	52.00
Sum Sq. Dev.	362.59	8502.76	2.74E+19	34.44	34.44
Observations	154	154	154	154	154

The green bond statistics are gathered from Bloomberg database. Coupon rate is presented as percentage, maturity as years to maturity, and amount as issue amount in millions. Rating is a dummy variable which is 1 for investment grade and 0 otherwise. Issue is a dummy variable which is 1 for first time issue and 0 otherwise.

The descriptive statistics of firm characteristics are presented in table 5 below. The firm characteristics are gathered from the fiscal year before the green bond issuance. Market

capitalization and total assets are expressed by their logarithm which modifies their distribution closer to a normal distribution and also helps the analysis since the figures are very large without taking a logarithm. Mean leverage in the data sample is approximately 40% while the average ROA is around 1.16%. Mean Tobin's Q is circa 2.22.

Table 5. Descriptive statistics of firm characteristics.

	LOG (MARKET CAP)	LOG (ASSETS)	LEVERAGE	ROA	TOBIN'S Q
Mean	24.25	10.44	40.12	1.16	2.22
Median	24.05	10.34	42.54	2.08	1.11
Maximum	27.34	12.43	81.70	18.38	7.66
Minimum	21.48	9.38	6.02	-5.03	0.06
Std. Dev.	1.25	0.75	12.00	4.92	1.99
Skewness	0.50	1.01	0.42	0.87	0.57
Kurtosis	3.35	3.42	4.91	4.88	1.68
Jarque-Bera	7.10	27.23	27.95	42.01	19.43
Probability	0.03	0.00	0.00	0.00	0.00
Sum	3734.32	1607.01	6179.09	179.24	342.49
Sum Sq. Dev.	238.07	85.62	22042.97	3710.77	607.40
Observations	154	154	154	154	154

The firm characteristics are gathered from Refinitiv Eikon database. Market capitalization and total assets are presented as their respective logarithms. Leverage and Return on assets (ROA) are presented as percentages.

5 EMPIRICAL RESULTS

The empirical results of this study are roughly divided to two different parts: an event study on cumulative abnormal returns analysis, and the regression analyses on cross-sectional data. The CARs are utilized in the latter and thus their results are discussed first. The results are based on analysis methodology that is discussed in chapter four.

5.1 Event studies on cumulative abnormal returns

The results for event studies for each event time window are shown in tables 6, 7 and 8. The purpose is to see whether there are cumulative abnormal returns associated to the stock of the firm around the green bond issuance. Every CAR mean, and median is reported as a percentage, so for example the mean for CAR (-10,10) is 1.19%. The statistical values are reported for the both t-test and Wilcoxon signed rank test, and in addition the median test summary is shown below those. Both magnitude and the sign of the cumulative abnormal return must be analyzed since there has been results indicating both positive CARs (Baulkaran, 2019; Flammer, 2021; Tang & Zhang, 2020) as well as negative CARs (Lebelle et al., 2020).

For the largest, 21-day (-10,10) event window both the parametric t-test and nonparametric Wilcoxon signed rank test show that the average CAR of 1.19% is statistically significant at the 1% confidence level. This is a similar result as in most of the previous research which conclude positive and statistically significant cumulative abnormal returns, most notably Flammer (2021), Baulkaran (2019), Tang & Zhang (2020) and Wang et. al. (2020). Additionally, this contributes to country-level since none of those studies had a data sample solely from the United States. Tang & Zhang (2020) reports 1.39% cumulative abnormal return on the same period which is slightly higher than in this data sample. Additionally, Baulkaran (2019) shows 1.48% cumulative abnormal return for the same time period when domestic market indices are used and 1.42% cumulative abnormal return when the MSCI World index is used which are even more higher results.

Finally, Wang et. al. (2020) concludes 1.2% positive abnormal return for the Chinese green bonds.

Table 6. Stock reaction to green bond issuance in event time window of (-10,10).

%	CAR (-10,10)	
Mean	1.1889	
Median	0.9324	
Std. Dev.	5.5498	
Std. Error	0.4472	
Method	Value	Probability
t-statistic	2.6585	0.0087***
Wilcoxon signed rank	2.7978	0.0051***
Median Test Summary		
Category	Count	Mean Rank
Obs > 0.000000	96	78.3229
Obs < 0.000000	58	76.1379
Obs = 0.000000	0	
Observations	154	

The cumulative abnormal returns are gathered from Refinitiv Eikon and Yahoo Finance. The sample consists of 154 green bond issuances. For t-statistic the null hypothesis is that the sample mean does not differ from zero while for Wilcoxon signed rank the null hypothesis is that the sample median does not differ from zero. The statistical significance level of each variable coefficient is denoted by: *** = 1%, ** = 5% & * = 10%.

Likewise, the 11-day (-5,5) event window gives statistically significant results for average CAR of 0.76%. Only, this time it is statistically significant at the 5% confidence level and thus not as significant as the (-10,10) event window average CAR. However, both t-test and Wilcoxon signed rank test give the same result, it can also be considered robust. This result can be compared to the (-5,10) event window used by both Flammer (2021) and Tang & Zhang (2020), and to the (-3,3) event window used by Wang et. al. (2020). Flammer (2021) shows 0.49% statistically significant cumulative abnormal return on her time window, while Tang & Zhang (2020) show 1.04% on their study. Wang et. al. (2020) shows 0.5% cumulative abnormal return on their study on Chinese green bonds.

Table 7. Stock reaction to green bond issuance in time window of (-5,5).

%	CAR (-5,5)	
Mean	0.7599	
Median	0.5213	
Std. Dev.	4.3190	
Std. Error	0.3480	
Method	Value	Probability
t-statistic	2.1836	0.0305**
Wilcoxon signed rank	2.0850	0.0370**
Median Test Summary		
Category	Count	Mean Rank
Obs > 0.000000	88	80.9546
Obs < 0.000000	66	72.8939
Obs = 0.000000	0	
Observations	154	

The cumulative abnormal returns are gathered from Refinitiv Eikon and Yahoo Finance. The sample consists of 154 green bond issuances. For t-statistic the null hypothesis is that the sample mean does not differ from zero while for Wilcoxon signed rank the null hypothesis is that the sample median does not differ from zero. The statistical significance level of each variable coefficient is denoted by: *** = 1%, ** = 5% & * = 10%.

Finally, the stock reaction for the shortest event window of 3 days (-1,1) shows no statistically significant results in neither t-test nor Wilcoxon signed rank test. This indicates that markets are efficient in the shortest event window and an investor cannot make excessive returns. However, considering that there are significant results for the two longer event windows meaning that there is some information asymmetry before and possibly after the event. This is a similar finding to Wang et. al. (2020) who find positive but not statistically significant result for the three-day period. Other previous studies did not have such a small event window.

Since the announcement dates are just before the issuance date, one could argue that a possible explanation for the insignificance for the CARs in the shortest window is that the information not asymmetrical and rather efficient markets work near the announcement date. This could lead to the result that CARs are statistically significant in the larger time windows that likely include the announcement date and days close to that but

statistically insignificant in the short time window because on larger probability it does not always include the announcement date. However, since Wang et. al. (2020) examines similar results in their study, and other relevant previous research do not test shorter time windows, the findings stay inconclusive.

Table 8. Stock reaction to green bond issuance in time window of (-1,1).

%	CAR (-1,1)	
Mean	0.2871	
Median	-0.1169	
Std. Dev.	3.0733	
Std. Error	0.2477	
Method	Value	Probability
t-statistic	1.1593	0.2481
Wilcoxon signed rank	0.2399	0.8104
Median Test Summary		
Category	Count	Mean Rank
Obs > 0.000000	74	82.4459
Obs < 0.000000	80	72.9250
Obs = 0.000000	0	
Observations	154	

The cumulative abnormal returns are gathered from Refinitiv Eikon and Yahoo Finance. The sample consists of 154 green bond issuances. For t-statistic the null hypothesis is that the sample mean does not differ from zero while for Wilcoxon signed rank the null hypothesis is that the sample median does not differ from zero. The statistical significance level of each variable coefficient is denoted by: *** = 1%, ** = 5% & * = 10%.

Considering the hypotheses of this thesis, I tested the null hypothesis on alternative hypotheses 1 and 2 with these event studies. In all event windows, the findings are that the issuance of a green bond has a positive effect on the stock price of the company. During the 21-day event window and 11-day event window the results are statistically significant at 1 % and 5% level respectively. During the shortest event window, the result is not statistically significant. All in all, my findings are similar to most of the previous research, most notably Wang et. al. (2020), Flammer (2021), Baulkaran (2019), and Tang & Zhang (2020). Based on the results presented in this chapter, the null hypothesis below can be rejected.

H0: The issuance of a green bond does not affect the stock price of the company ($\overline{CAR}_{[t1,t2]} = 0$)

Additionally, considering the alternative hypotheses below, the hypothesis 1 can be accepted for event windows (-10,10) and (-5,5), and the hypothesis 2 is rejected since there is no negative stock reaction associated with the green bond issuance.

H1: The issuance of a green bond has a positive effect on the stock price of the company ($\overline{CAR}_{[t1,t2]} > 0$)

H2: The issuance of a green bond has a negative effect on the stock price of the company ($\overline{CAR}_{[t1,t2]} < 0$)

Since green bonds are a rather new fixed-income security, it could be possible to get different results in future research and as for further research it would be beneficial to examine the short time event window with a global green bond data sample.

5.2 Regression analyses on bond and firm characteristics

The regression analyses are conducted as ordinary least squares method as described in subchapter 4.1. The purpose of the regression analyses is to try and find variables that might explain the cumulative abnormal returns associated with the green bond issuance. Based on earlier studies, most notably Baulkaran (2019), I apply certain bond and firm characteristics to the regression model as control variables. Those variables are coupon, maturity, log of issued amount, leverage, return on assets and Tobin's Q. Additionally, I use some dummy variables such as rating dummy, issue dummy and industry dummy variables. The industry dummy variables are used when testing the third hypothesis of this study which is also the intended contribution of this thesis:

H3: The green bond issuance has a different effect on the stock price between industries

The regressions are run to both CAR (-10,10) and CAR (-5,5) since they produced statistically significant results in the event study before. For the first regression, only the bond characteristics are chosen as independent variables while the cumulative abnormal returns are the dependent variable. Additionally, the dummy variables for both rating and first-time issue are added to the regressions to analyze the market effect an investment grade credit rating and first-time issue have.

Table 9. Regression analysis of CARs (-10,10) on bond characteristics.

	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	12.0701	6.3885	1.8893	0.0608
COUPON	-0.2629	0.4422	-0.5945	0.5531
MATURITY	0.0879	0.0684	1.2866	0.2002
LOG (AMOUNT)	-1.2048	0.8136	-1.4809	0.1408
RATING DUMMY	-1.9924	1.8042	-1.1043	0.2712
ISSUE DUMMY	0.1640	1.0703	0.1532	0.8785
R-squared	0.0985	Mean dependent var		0.0119
Adjusted R-squared	0.0681	S.D. dependent var		0.0555
S.E. of regression	0.0536	Akaike info criterion		-2.9773
Sum squared resid.	0.4248	Schwarz criterion		-2.8589
Log likelihood	235.2484	Hannan-Quinn criter.		-2.9292
F-statistic	3.2349	Durbin-Watson stat		1.4849
Prob(F-statistic)	0.0084			
Observations	154			

The cumulative abnormal returns are gathered from Refinitiv Eikon and Yahoo Finance. The sample consists of 154 green bond issuances. The bond characteristics are gathered from Bloomberg. Dependent variable is cumulative abnormal returns for event window (-10,10). Maturity is the number of years until the bond's maturity. Log (amount) is the logarithm of amount issued. Rating dummy is a dummy variable that is 1 if firm is investment grade, 0 otherwise. Issue dummy is a dummy variable that is 1 if it is first-time issue, 0 otherwise. The statistical significance level of each variable coefficient is denoted by: *** = 1%, ** = 5% & * = 10%.

Considering only the bond characteristics, there is no statistically significant control variables in the regression analyses represented in tables 9 and 10. For both of the CARs, the first-time issues seem to have a positive correlation to the cumulative abnormal returns even though it is not statistically significant. This is a somewhat similar result to

Tang & Zhang (2020) who reported larger and statistically more significant CARs associated with the first-time issue than a subsequent issue. However, the rating dummy is negatively correlated with the CARs. There can be two explanations to this; the investors react more positively to the high yield issuance since it indicates that the firm has been able to issue more sustainable and likely cheaper financing since there is likely a green premium (el Ghoul et al., 2011; Pastor et al., 2021).

Additionally, there might be a data-related explanation since Tesla Motors (TSLA) has issued many green bonds during the period. While being able to create abnormal returns around its green bond issuance due to both rational reasons such as goal to reform the automotive industry and getting financing for that and behavioral reasons such as being some kind of “hype stock”, Tesla is classified as a high yield firm that has fairly large effect on the regression analyses. Nonetheless, Baulkaran (2019) shows also negative correlation between investment grade credit rating and CARs and Tang & Zhang (2020) report positive correlation between high yield credit rating and yield spread confirming the first explanation of the results (Baulkaran, 2019; Tang & Zhang, 2020).

Table 10. Regression analysis of CARs (-5,5) on bond characteristics.

	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	6.8147	4.9170	1.3859	0.1678
COUPON	0.3514	0.3403	1.0327	0.3034
MATURITY	-0.0011	0.0526	-0.0211	0.9832
LOG (AMOUNT)	-0.8286	0.6262	-1.3232	0.1878
RATING DUMMY	-0.8694	1.3886	-0.6261	0.5322
ISSUE DUMMY	0.3458	0.8237	0.4198	0.6753
R-squared	0.1183	Mean dependent var		0.7600
Adjusted R-squared	0.0885	S.D. dependent var		4.3190
S.E. of regression	4.1235	Akaike info criterion		5.7095
Sum squared resid	2516.49	Schwarz criterion		5.8278
Log likelihood	-433.63	Hannan-Quinn criter.		5.7575
F-statistic	3.9700	Durbin-Watson stat		1.4944
Prob(F-statistic)	0.0021			
Observations	154			

The cumulative abnormal returns are gathered from Refinitiv Eikon and Yahoo Finance. The sample consists of 154 green bond issuances. The bond characteristics are gathered from Bloomberg. Dependent variable is cumulative abnormal returns for event window (-5,5). Maturity is the number of years until the bond's maturity. Log (amount) is the logarithm of amount issued. Rating dummy is a dummy variable that is 1 if firm is investment grade, 0 otherwise. Issue dummy is a dummy variable that is 1 if it is first-time issue, 0 otherwise. The statistical significance level of each variable coefficient is denoted by: *** = 1%, ** = 5% & * = 10%.

In alternative model, represented in tables 11 and 12, the rating dummy is removed from the regression model since it is an external review. Now, the logarithm of amount issued becomes statistically significant at 5% confidence level in both event windows. The negative coefficient indicates that a 1 percentage increase in amount issued decreases CARs by 1.72% in event window of (-10,10) and 1.05% in event window of (-5,5). Additionally, the constant term is significant in both of the models.

Table 11. Alternative regression model of CARs (-10,10) on bond characteristics.

	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	14.5823	5.9742	2.4409	0.0158**
COUPON	-0.0168	0.3822	-0.0440	0.9649
MATURITY	0.0609	0.0638	0.9533	0.3420
LOG (AMOUNT)	-1.7258	0.6633	-2.6018	0.0102**
ISSUE DUMMY	-0.0480	1.0537	-0.0455	0.9637
R-squared	0.0911	Mean dependent var		0.7600
Adjusted R-squared	0.0667	S.D. dependent var		4.3190
S.E. of regression	5.3615	Akaike info criterion		5.7095
Sum squared resid	4283.17	Schwarz criterion		5.8278
Log likelihood	-474.58	Hannan-Quinn criter.		5.7575
F-statistic	3.7332	Durbin-Watson stat		1.4944
Prob(F-statistic)	0.0063			
Observations	154			

The cumulative abnormal returns are gathered from Refinitiv Eikon and Yahoo Finance. The sample consists of 154 green bond issuances. The bond characteristics are gathered from Bloomberg. Dependent variable is cumulative abnormal returns for event window (-10,10). Maturity is the number of years until the bond's maturity. Log (amount) is the logarithm of amount issued. Issue dummy is a dummy variable that is 1 if it is first-time issue, 0 otherwise. The statistical significance level of each variable coefficient is denoted by: *** = 1%, ** = 5% & * = 10%.

In earlier studies, Tang & Zhang (2020) show that larger issue size leads to statistically significant smaller yield spread meaning that the investors are not willing to pay such high green premium in larger issuances (Tang & Zhang, 2020). This could also be an indication that for larger issue sizes, the cumulative abnormal returns are lower since the investors expect a lower yield spread, in other words more expensive financing.

Table 12. Alternative regression model of CARs (-5,5) on bond characteristics.

	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	7.9108	4.5853	1.7252	0.0866*
COUPON	0.4588	0.2934	1.5639	0.1200
MATURITY	-0.0129	0.0490	-0.2637	0.7924
LOG (AMOUNT)	-1.0559	0.5091	-2.0741	0.0398**
ISSUE DUMMY	0.2533	0.8087	0.3132	0.7546
R-squared	0.1159	Mean dependent var		0.7600
Adjusted R-squared	0.0922	S.D. dependent var		4.3190
S.E. of regression	4.1151	Akaike info criterion		5.6991
Sum squared resid	2523.1540	Schwarz criterion		5.7977
Log likelihood	-433.8326	Hannan-Quinn criter.		5.7392
F-statistic	4.8844	Durbin-Watson stat		1.5078
Prob(F-statistic)	0.0010			
Observations	154			

The cumulative abnormal returns are gathered from Refinitiv Eikon and Yahoo Finance. The sample consists of 154 green bond issuances. The bond characteristics are gathered from Bloomberg. Dependent variable is cumulative abnormal returns for event window (-10,10). Maturity is the number of years until the bond's maturity. Log (amount) is the logarithm of amount issued. Issue dummy is a dummy variable that is 1 if it is first-time issue, 0 otherwise. The statistical significance level of each variable coefficient is denoted by: *** = 1%, ** = 5% & * = 10%.

Next, the regression models with both bond and firm characteristics are represented in tables 13 and 14. As seen, none of the independent variables are statistically significant even though they seem to be the same sign in both, except for coupon rate which has a negative correlation in event window (-10,10) and positive in (-5,5). Rating dummy has the largest coefficient between -2 and -3, where maturity has largest t-statistic in the event window (-10,10). Even though the single independent variables are not statistically significant, the regression model seems to work rather fine since the F-statistic is statistically significant at 5% level in (-10,10) and at 1% level in event window of (-5,5).

The F-statistic indicates that the model coefficients are statistically significant together and R-squared is not equal to zero although t-tests do not show statistical significance of them. The R-squared levels of the regression models including only bond characteristics and also firm characteristics are slightly low which could mean that there could be

better independent variables that might explain the CARs. However, the other and more likely explanation might be that there are explanatory variables that are not numerically expressed such as values, which is very usual in sustainable finance research. For example, Baulkaran (2019) shows that a lot of the bond control variables in his sample are not statistically significant except for coupon rate. Many studies show that firm value increases after better ESG performance, since it also indicates a long-term commitment to sustainable business behavior and likely to more sustainable competitive advantage in addition to the cheaper financing (Bajic & Yurtoglu, 2018; Dimson et al., 2015; Fatemi et al., 2018). Those behavioral aspects are hard to measure, and it could be a great idea for further research to find and examine emotion-based factors' effect on the CARs around the green bond issuance.

Table 13. Regression analysis of CARs (-10,10).

	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	8.5201	13.4248	0.6347	0.5267
COUPON	-0.3548	0.4660	-0.7615	0.4476
MATURITY	0.1106	0.0700	1.5791	0.1165
LOG (AMOUNT)	-0.5396	1.0354	-0.5211	0.6031
RATING DUMMY	-2.9588	2.2199	-1.3329	0.1847
ISSUE DUMMY	0.3171	1.1148	0.2845	0.7764
LOG (SIZE)	0.1273	1.1356	0.1121	0.9109
LEVERAGE	-0.0484	0.0440	-1.0996	0.2734
ROA	-0.1859	0.1483	-1.2539	0.2119
TOBIN'S Q	-0.1988	0.4134	-0.4808	0.6314
R-squared	0.1168	Mean dependent var		0.0119
Adjusted R-squared	0.0616	S.D. dependent var		0.0555
S.E. of regression	0.0538	Akaike info criterion		-2.9458
Sum squared resid	0.4162	Schwarz criterion		-2.7486
Log likelihood	236.83	Hannan-Quinn criter.		-2.8657
F-statistic	2.1163	Durbin-Watson stat		1.5016
Prob(F-statistic)	0.0317			
Observations	154			

The cumulative abnormal returns are gathered from Refinitiv Eikon and Yahoo Finance. The sample consists of 154 green bond issuances. The bond characteristics are gathered from Bloomberg

and firm characteristics from Refinitiv Eikon. The firm characteristics are acquired from the fiscal year before the green bond issuance (t-1). Dependent variable is cumulative abnormal returns for event window (-10,10). Maturity is the number of years until the bond's maturity. Log (amount) is the logarithm of amount issued. Rating dummy is a dummy variable that is 1 if firm is investment grade, 0 otherwise. Issue dummy is a dummy variable that is 1 if it is first-time issue, 0 otherwise. Firm size is logarithm of market capitalization. Leverage is total debt divided by total assets. ROA is EBIT divided by total assets. Tobin's Q is the ratio between total market value and total asset value of the firm. The statistical significance level of each variable coefficient is denoted by: *** = 1%, ** = 5% & * = 10%.

Table 14. Regression analysis of CARs (-5,5).

	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	3.0620	10.2673	0.2982	0.7660
COUPON	0.3644	0.3564	1.0224	0.3083
MATURITY	0.0215	0.0535	0.4018	0.6884
LOG (AMOUNT)	-0.5092	0.7919	-0.6431	0.5212
RATING DUMMY	-2.4376	1.6978	-1.4358	0.1532
ISSUE DUMMY	0.5185	0.8526	0.6082	0.5440
LOG (SIZE)	0.4466	0.8685	0.5143	0.6078
LEVERAGE	-0.0463	0.0336	-1.3765	0.1708
ROA	-0.0996	0.1134	-0.8785	0.3811
TOBIN'S Q	-0.4151	0.3162	-1.3131	0.1912
R-squared	0.1470	Mean dependent var		0.7600
Adjusted R-squared	0.0937	S.D. dependent var		4.3190
S.E. of regression	4.1116	Akaike info criterion		5.7283
Sum squared resid	2434.41	Schwarz criterion		5.9255
Log likelihood	-431.08	Hannan-Quinn criter.		5.8084
F-statistic	2.7578	Durbin-Watson stat		1.9087
Prob(F-statistic)	0.0053			
Observations	154			

The cumulative abnormal returns are gathered from Refinitiv Eikon and Yahoo Finance. The sample consists of 154 green bond issuances. The bond characteristics are gathered from Bloomberg and firm characteristics from Refinitiv Eikon. The firm characteristics are acquired from the fiscal year before the green bond issuance (t-1). Dependent variable is cumulative abnormal returns for event window (-10,10). Maturity is the number of years until the bond's maturity. Log (amount) is the logarithm of amount issued. Rating dummy is a dummy variable that is 1 if firm is investment grade, 0 otherwise. Issue dummy is a dummy variable that is 1 if it is first-time issue, 0 otherwise. Firm size is logarithm of market capitalization. Leverage is total debt divided by total assets. ROA is EBIT divided by total assets. Tobin's Q is the ratio between total market value and total asset value of the firm. The statistical significance level of each variable coefficient is denoted by: *** = 1%, ** = 5% & * = 10%.

In the final two regression models, I test if there are differences between certain industries in CARs of a firm. The regression model includes dummy variables for each industry except for one which can be interpreted from the constant term. This is done in order to tackle the “dummy variable trap”, a perfect collinearity issue caused by including dummy variables for the regression model in addition to the constant term (Wooldridge, 2013: 230). In addition to the industry dummy variables, the bond and firm characteristics are included in the regression model as control variables to enhance the model’s predictability. Tang & Zhang (2020) compared financial sector firms against other corporate sectors in their research since financial sector often issues green bonds in order to fund other firms with green loans while firms in other sectors issue green bond to their own use of proceeds. They conclude that financial firms have statistically significant lower CARs than other corporations (Tang & Zhang, 2020).

It is hard to prove the statistical significance between all industries with the same regression model, since the coefficients of the dummy variables are calculated against the benchmark group (Wooldridge, 2013: 236). In the regression models, represented in tables 15 and 16, the benchmark group is chosen based on the lowest coefficient produced in the model since when the other dummy variables are compared to the benchmark group, the likelihood to get statistically significant results are highest when comparing against either the lowest or the highest coefficient. In larger event window of (-10,10), the lowest coefficient is produced by dummy variable of retail and in event window (-5,5) by dummy variable of financial.

Table 15. Regression analysis of CARs (-10,10) on industries.

	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	7.9942	16.3703	0.4883	0.6261
AUTOMOTIVE_D	8.0573	6.1987	1.2998	0.1958
CONSTRUCTION_D	1.2576	6.1118	0.2058	0.8373
FINANCIAL_D	2.0440	4.6086	0.4435	0.6581
MISCELLANEOUS_D	4.7242	4.4067	1.0721	0.2855
REAL ESTATE_D	1.7343	3.6356	0.4770	0.6341
UTILITIES_D	3.2802	3.8885	0.8436	0.4004
COUPON	-0.1431	0.4818	-0.2971	0.7669
MATURITY	0.0784	0.0696	1.1272	0.2616
LOG (AMOUNT)	-0.2595	1.1054	-0.2348	0.8147
LOG (SIZE)	-0.6071	1.4762	-0.4112	0.6815
LEVERAGE	-0.0587	0.0452	-1.2980	0.1964
ROA	0.0921	0.3465	0.2658	0.7908
TOBIN'S Q	-0.2855	0.4938	-0.5782	0.5641
R-squared	0.1434	Mean dependent var		1.1889
Adjusted R-squared	0.0639	S.D. dependent var		5.5498
S.E. of regression	5.3696	Akaike info criterion		6.2859
Sum squared resid	4036.53	Schwarz criterion		6.5620
Log likelihood	-470.01	Hannan-Quinn criter.		6.3980
F-statistic	1.8033	Durbin-Watson stat		1.8836
Prob(F-statistic)	0.0480			
Observations	154			

The cumulative abnormal returns are gathered from Refinitiv Eikon and Yahoo Finance. The sample consists of 154 green bond issuances. The bond characteristics are gathered from Bloomberg and firm characteristics including industries from Refinitiv Eikon. The firm characteristics are acquired from the fiscal year before the green bond issuance (t-1). Dependent variable is cumulative abnormal returns for event window (-10,10). Dummy variables are expressed with an underline followed by letter D and are 1 if the firm is classified for certain industry and 0 otherwise. Maturity is the number of years until the bond's maturity. Log (amount) is the logarithm of amount issued. Firm size is logarithm of market capitalization. Leverage is total debt divided by total assets. ROA is EBIT divided by total assets. Tobin's Q is the ratio between total market value and total asset value of the firm. The statistical significance level of each variable coefficient is denoted by: *** = 1%, ** = 5% & * = 10%.

When controlling the bond and firm characteristics, none of the industry dummy variables are statistically significant, even though for example firms in automotive and miscellaneous industries provide 8.06% and 4.72% higher CARs on average than the firms in retail industry. In this event window, the results are not aligned with the one in Tang &

Zhang (2020), since the firms in financial sector seem to create larger CARs than construction firms (by 0.79%), and real estate firms (by 0.31%).

Table 16. Regression analysis of CARs (-5,5) on industries.

	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	-0.9405	13.6122	-0.0691	0.9450
AUTOMOTIVE_D	4.5848	2.3457	1.9546	0.0526*
CONSTRUCTION_D	2.5564	4.8533	0.5267	0.5992
FINANCIAL_D	3.6933	2.2519	1.6401	0.1032
MISCELLANEOUS_D	0.5137	2.0423	0.2515	0.8018
REAL ESTATE_D	1.7339	3.4911	0.4967	0.6202
UTILITIES_D	1.5994	1.6603	0.9633	0.3370
COUPON	0.5280	0.3650	1.4467	0.1502
MATURITY	0.0073	0.0527	0.1382	0.8903
LOG (AMOUNT)	-0.1244	0.8374	-0.1486	0.8821
LOG (SIZE)	0.2076	1.1182	0.1856	0.8530
LEVERAGE	-0.0537	0.0342	-1.5671	0.1193
ROA	-0.0811	0.2625	-0.3091	0.7577
TOBIN'S Q	-0.5659	0.3740	-1.5129	0.1326
R-squared	0.1884	Mean dependent var		0.7600
Adjusted R-squared	0.1131	S.D. dependent var		4.3190
S.E. of regression	4.0675	Akaike info criterion		5.7305
Sum squared resid	2316.27	Schwarz criterion		6.0065
Log likelihood	-427.25	Hannan-Quinn criter.		5.8426
F-statistic	2.5002	Durbin-Watson stat		1.9920
Prob(F-statistic)	0.0042			
Observations	154			

The cumulative abnormal returns are gathered from Refinitiv Eikon and Yahoo Finance. The sample consists of 154 green bond issuances. The bond characteristics are gathered from Bloomberg and firm characteristics including industries from Refinitiv Eikon. The firm characteristics are acquired from the fiscal year before the green bond issuance (t-1). Dependent variable is cumulative abnormal returns for event window (-10,10). Dummy variables are expressed with an underline followed by letter D and are 1 if the firm is classified for certain industry and 0 otherwise. Maturity is the number of years until the bond's maturity. Log (amount) is the logarithm of amount issued. Firm size is logarithm of market capitalization. Leverage is total debt divided by total assets. ROA is EBIT divided by total assets. Tobin's Q is the ratio between total market value and total asset value of the firm. The statistical significance level of each variable coefficient is denoted by: *** = 1%, ** = 5% & * = 10%.

For the smaller event window of (-5,5), there are statistically significant results at the 10% level for the automotive industry against the benchmark group of financial industry. The automotive firms provide on average 4.58% larger CARs in the event window of (-

5,5) than the financial sector firms. This is somewhat similar results than in Tang & Zhang (2020). Additionally, it is notable that miscellaneous industry dummy variable and leverage control variable are nearly statistically significant at the 10% level. Miscellaneous industry firms create approximately 3.69% higher CARs than financial sector firms on average. In the data sample, firms classified as miscellaneous are hard to classify to other, more traditional industries for example data center provider Equinix Inc, meaning that the industry group has firms with most distinct products or services between each other.

All in all, since there is a statistically significant difference in cumulative abnormal returns in event window of (-5,5), the third hypothesis:

H3: The green bond issuance has a different effect on the stock price between industries

can be accepted but it must be noted that a statistically significant difference does not exist between most of the industries in the data sample. It can be suggestion for further research to conduct this study in other countries or using a larger data sample since more and more green bonds are issued every year.

The possible explanation of the industry differences is perhaps the same that Tang & Zhang (2020) propose. Investors seem to react more positively to an automotive company's issuance of green bonds to use the proceeds on hybrid or electric cars rather than a bank's issuance of green bonds to use the proceeds on lenders' green-labeled projects. Those industry-level differences might either increase or decrease in the future when the reporting standards become more transparent so that investors are even more aware of where the proceeds are spent.

6 CONCLUSIONS

The purpose of this thesis was to examine whether the issuance of a green bond has an effect on the stock price of the firm. As a recent fixed-income instrument, the green bond has come here to stay due to the urge for more sustainable projects and consequently more sustainable world. There has been previous research on the topic, the most notable being Flammer (2021), Baulkaran (2019), Tang & Zhang (2020) and Wang et. al. (2020). This thesis has contributed by examining solely the US green bond market and by studying the industry differences.

The research was conducted on broad theoretical framework, previous studies on green bonds and with quantitative research on extensive data sample that was gathered from both Bloomberg and Refinitiv Eikon. There were two main research methods that were chosen based on earlier studies and their econometrical adequacy. Firstly, the cumulative abnormal returns were analyzed in an event study and calculated using a market model based on Sharpe (1964). The average cumulative abnormal returns were then statistically tested with both a parametric and nonparametric test, those being a t-test and a Wilcoxon signed rank test, respectively. Then, those cumulative abnormal returns were used as a dependent variable in ordinary least squares regression while bond and firm characteristics acted as independent variables in the equation. Finally, to address the industry-specific differences, the industry dummy variables were added to the regression function.

From the obtained results, it can be concluded that for the time windows of 21 and 11 days, there are a positive and statistically significant abnormal returns for the firm's stock price around the green bond issuance. This is a similar remark than in Flammer (2021), Baulkaran (2019), Tang & Zhang (2020) and Wang et. al. (2020). For the shortest time window of three days around the issuance, the results are not statistically significant even though still positive.

The regression analyses on bond and firm characteristics show no statistical significance for the independent variables except for issued amount when testing for an alternative regression model without a dummy variable for credit rating. This leaves an opportunity for further research since the market is still quite new and there are not so many green bonds issued in the United States, it is possible to obtain statistically significant results later when the number of bonds increases.

The intended contribution was to see whether there are differences between the industries related to the possible cumulative abnormal returns around the green bond issuance. The regression analyses on industry dummy variables show that there is a statistically significant difference in CARs between automotive industry firms and financial sector firms in the event window of (-5,5) days. Additionally, miscellaneous industry has nearly the same results as the automotive industry.

The practical implications of this study are that the investors still value the sustainable actions of the firms by showing abnormally positive reaction to the green bond issuance as they were according to the previous studies. However, it seems that the investors value industries differently since there are notable differences in the reactions between green bond issuances of firms in different industries. This could indicate that for some industries, like in automotive industry in this study, the sustainable actions such as green bond issuance have a larger effect on the firm's value in the future than in other industries.

All in all, the results are similar to most of the earlier research on the topic considering the positive and statistically significant cumulative abnormal returns in event windows of (-10,10) and (-5,5) days. The contribution of this study considering the differences between industries provides a basis to further research on green bond issuances. Another proposal for further research is to conduct the study on different countries and in future when there are more green bonds issued to be analyzed.

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Appendices

Appendix 1. List of green bonds issued companies in the sample

Company	**Ticker**
Apple Inc	AAPL
Analog Devices Inc	ADI
Union Electric Co	AEE
AES Corp/The	AES
Avangrid Inc	AGR
Alexandria Real Estate Equities Inc	ARE
Bank of America Corp	BAC
MidAmerican Energy Co	BRKHEC
Solar Star Funding LLC	BRKHEC
Boston Properties LP	BXP
Citigroup Global Markets Holdings Inc/United States	C
Citigroup Inc	C
Clearway Energy Operating LLC	CWENA
Digital Euro Finco LLC	DLR
Duke Realty LP	DRE
DTE Electric Co	DTE
Duke Energy Carolinas LLC	DUK
Duke Energy Florida LLC	DUK
Duke Energy Progress LLC	DUK
Equinix Inc	EQIX
ERP Operating LP	EQR
NSTAR Electric Co	ES
Evergy Kansas Central Inc	EVRG
Federal Realty Investment Trust	FRT
Hannon Armstrong Sustainable Infrastructure Capital Inc	HASI
HAT Holdings I LLC / HAT Holdings II LLC	HASI
Host Hotels & Resorts LP	HST

JPMorgan Chase & Co	JPM
Kilroy Realty LP	KRC
Interstate Power and Light Co	LNT
Metropolitan Life Global Funding I	MET
NextEra Energy Capital Holdings Inc	NEE
Owens Corning	OC
Piedmont Operating Partnership LP	PDM
PepsiCo Inc	PEP
Prologis Euro Finance LLC	PLD
Prologis LP	PLD
Prologis Yen Finance LLC	PLD
PNC Financial Services Group Inc/The	PNC
Arizona Public Service Co	PNW
Regency Centers Corp	REG
Regency Centers LP	REG
Georgia Power Co	SO
Southern Power Co	SO
Toyota Motor Credit Corp	TOYOTA
Tesla Energy Operations Inc	TSLA
UDR Inc	UDR
Visa Inc	V
VF Corp	VFC
Verizon Communications Inc	VZ
Welltower Inc	WELL
Northern States Power Co/MN	XEL
Public Service Co of Colorado	XEL
Southwestern Public Service Co	XEL
Xylem Inc/NY	XYL