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Green bonds and cumulative abnormal return implications for corporations around green bond announcements

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ABSTRACT

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Green bond is a financial debt instrument where the use of proceeds are allocated to green investments. Despite of being one of the most prominent securities for addressing global climate warming and decarbonization of economy, they are little studied. Thus, elaborated studies on green bonds would potentially encourage decision makers to act upon global climate warming. So far, the contemporary literature has mostly focused on searching the so-called green bond premium, which reduces the cost of debt.

This thesis tests cumulative abnormal returns around green bond announcements. The main research question of this thesis sought to examine whether the green bonds are value enhancing decisions for corporate managers or not. This question is evaluated in multiple currencies and industry segments. Moreover, to address the research question accordingly the thesis incorporates all green bonds incorporated in Bloomberg database between years 2014 and 2018 issued in six currencies: USD, CAD, EUR, GBP, NOK and SEK. In total 169 observations, which are studied through three hypotheses that were formed based on the existing green bond literature. The hypotheses are tested with event study methodology.

Results show that the cumulative abnormal returns around green bond announcements outperform conventional bonds. Furthermore, the results point out significant market differences between European and Non-European markets in favor of European market. However, compared to previous studies on this topic the results show erosion of positive cumulative abnormal returns between years 2014 and 2018. Thus, the results provided in this thesis do not solely make green bonds drastically more attractive than conventional bonds but summing up them with other green bond benefits, such as cost of debt, then green bonds become value enhancing decisions for corporate managers.

Keywords:
Green bonds, Cumulative abnormal returns, Greenwashing, Pecking order of debt

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Vihreä velkakirja on arvopaperi minkä kautta kerätyt varat allokoidaan vihreisiin investointeihin. Vihreitä velkakirjoja on tutkittu vähän siitä huolimatta, että ne ovat yksi merkittävimmistä arvopapereista, jotka pyrkivät sekä ilmaston lämpenemisen ehkäisemiseen että fossiilisten poltto- ja raaka-aineiden käytön vähentämiseen**.** Tästä syystä aiheeseen liittyvät jatkotutkimukset saattavat kannustaa yritysten päätöksentekijöitä toimenpiteisiin, jotka pienentävät ilmastonmuutosta.

Tämä diplomityö tutkii epänormaaleja kumulatiivisia tuottoja vihreiden velkakirjojen julkistusten ympärillä. Päätutkimuskysymys pyrkii selvittämään, onko vihreät velkakirjat arvoa luovia päätöksiä yritysten päätöksentekijöille. Tutkimuskysymystä selvitellään useissa valuutoissa ja toimialoilla vuosien 2014 ja 2018 välillä. Tämä tarkoittaa yhteensä 169 havaintopistettä, joita on tutkittu kolmen hypoteesin kautta, mitkä ovat johdettu kirjallisuudesta. Näitä hypoteeseja tutkitaan tapahtumatutkimuksen metodologialla.

Tulokset osoittavat vihreiden velkakirjojen aiheuttamien epänormaalien kumulatiivisten tuottojen olevan suurempia kuin tavallisilla velkakirjoilla. Lisäksi tulokset myös osoittavat merkittäviä markkinaeroja eurooppalaisen ja ei-eurooppalaisen markkinan välillä. Kuitenkin verrattuna aikaisempiin tutkimuksiin epänormaalit kumulatiiviset tuotot ovat pienentyneet vuosien 2014 ja 2018 välillä. Tästä johtuen epänormaalit kumulatiiviset tuotot eivät tee vihreistä velkakirjoista yksinään merkittävästi kiinnostavampia tuotteita yrityksille kuin tavalliset velkakirjat, mutta kun huomioidaan muut hyödyt, kuten vihreä velkakirja preemio, niin vihreistä velkakirjoista tulee arvoa luovia arvopapereita yrityksille.

Avainsanat:
Vihreät velkakirjat, epänormaalit kumulatiiviset tuotot, viherpesu, velan nokkimisjärjestys.

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Helsinki, May 2019

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1. Introduction

1.1 Background and motivation

Green bond is a financial debt instrument where the use of proceeds are allocated to green investments (OECD 2016). Green bonds sought to increase transparency around bond issuances and reduce economy decarbonization, which faces immense political pressure due to global climate warming. It seems that market favors these aspects because the green bond market has growth exponentially since its inception 2008. Due to short history of green bonds, the academic research on the corporate green bonds is limited. Nonetheless, the few conducted studies on the topic have pointed out significant results that favor the corporate green bonds over conventional bonds (Febi and Schäfer et al. 2018, Flammer 2018, Tang & Chang 2018 and Zerbib 2017).

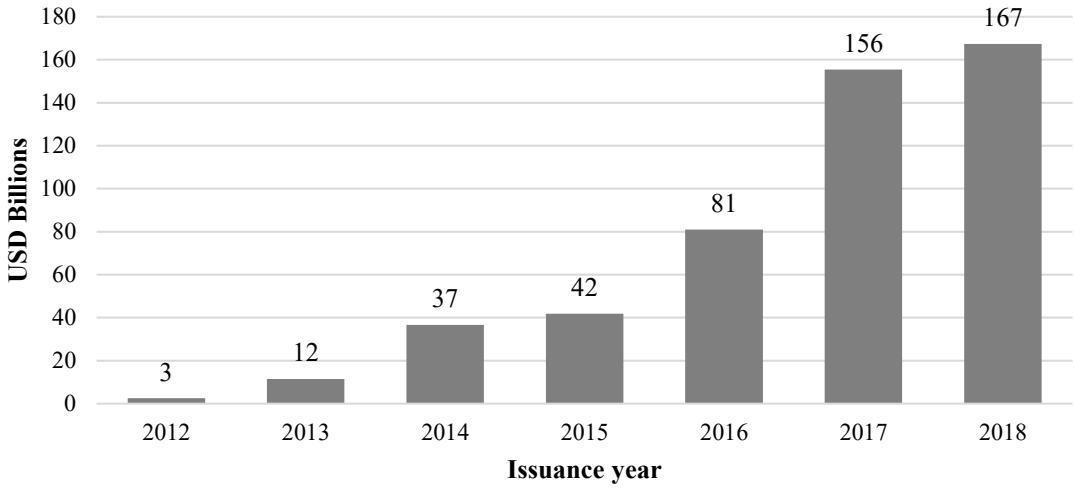

Figure 1: Nominal value of labeled green bonds per issuance year

Green bonds can increase corporate value by three significant ways. First, by improvement of environment ratings that are positively linked with improvement of financial performance, such as ROA (Flammer 2018). Second, the corporate green bonds can reduce the overall cost of debt because investors are willing to invest in bonds that are transparent and address sustainability. Both Zerbib (2017) and Febi and Schäfer et al. (2018) found that the cost of debt depending on the investment-grade or speculative-grade

credit rating could be reduced by utilizing green bonds, ranging between -2 to -9 and -5 to -20 bps, respectively. The key reason for this positive implication is increased investor demand that causes improved bond liquidity. Bond liquidity reduces expected bond return due to a lower risk. Third, the corporate green bond announcements increase corporate valuation. Both Flammer (2018) and Tang & Chang (2018), found a significant cumulative abnormal return (CAR) around green bond announcements during 41-day 1.14 % (Flammer 2018) and 21-day event window 1.39 % (Tang & Chang 2018). In addition, Flammer (2018) found a positive relation between green bond announcements and improvement of Tobin's Q.

Despite of the reported positive green bond implications, there is skepticism toward green bonds. First, many academics proclaim a negative connection between corporate environmental performance and Corporate Financial Performance (CFP) (Bromiley & Marcus 1989 and Friedman 1970). Second, Karpf & Mandel (2017) found a positive green bond premium of 7.8 bps. Third, the market has no unambiguous taxonomy for green bonds. These reasons cast the fear of greenwashing. In greenwashing, companies are marketing positive environmental policies to deceptively promote organizations environmental footprint.

The negative green bond implications and fear of greenwashing casts also skepticism toward CAR around the corporate green bond announcements, which have been positive for so far (Flammer 2018 and Tang & Chang 2018). However, these positive CAR results among CFP will be neglected in the future if it is revealed that green bonds are just a product of greenwashing. Subsequently, green bonds would not have any difference with conventional bonds. Thus, to preserve robustness of current CAR and CFP results companies must preserve a high level of transparency toward investors.

Robust positive corporate green bond implications would have major consequences for corporate behavior. First, they would be an immense help, particularly, for national companies that are facing political pressure to reduce decarbonization of economy. It both makes green actions transparent and allows an avenue for affordable financing. Second, positive implications would encourage companies to undertake green investments over conventional investments.

1.2 Research questions

Green bond is an exponentially growing fixed income debt instrument that sought to encourage both companies and investors to address climate change. The exponential growth in green bond issuances during recent years indicates that there are either investors who are encouraging companies to act upon sustainability or companies are eager to fulfill their social responsibility. Each way around or both, it is interesting to examine whether these sustainable investments are value enhancing or just moral investments for the companies.

This thesis aims to examine whether green bonds issuances are value enhancing decisions for corporate managers or not. The study is executed through stock price development analysis around the corporate green bond announcement. If investors value sustainability, sustainable investments should have a positive impact on the stock price. And what would be a better way to advertise the sustainable investments for corporations than green bonds, where use of proceeds are allocated into green investments. Hence, it is important to study whether the green announcements cause a positive stock market reaction or not. In addition, to facilitate corporate managers' decision making the positive stock market reaction should be consistent over time in different markets.

This thesis has a research question that is divided into three sub-research questions:

Is green bond issuance a corporate value enhancing activity for corporate managers in terms of stock market implications?

Are the stock market implications consistent over time and in different markets?

What are the green bond implications for corporations?

Should corporations prefer green bonds over conventional bonds?

1.3 Research design, methodology and structure

1.3.1 Research design and methods

This research has both a theoretical and empirical part. The theoretical part is a literature review that sheds light on the green bond taxonomy, market and implications. The overall aim of the chapter is to provide an essential background to both comprehend the green bond implications for corporations and test hypotheses that are studied in the empirical part. The empirical part is a quantitative study that investigates CAR around green bond announcements. The quantitative study is conducted by using Stata in terms of sample analysis and linear regression.

1.3.2 Data sources

The green bond data form 2014 till 2018 is retrieved from the Bloomberg database, which is the most comprehensive database in terms of fixed income securities. Together with the Bloomberg data, the CAR calculations require historical stock and indices values. These values are retrieved from Thomson Reuters Eikon.

1.3.3 Scope and limitations

Prior research in green bonds is somewhat limited due to short history of the financial fixed security. The first academic studies on green bonds have sought to differentiate the green bond implications from the conventional bond implications to examine the positive effects. The limitation of this methodology has been that few of these studies have taken insight into cause-effect relations behind the green bond implications. Most of the recent green bond studies have focused on assessing the debt investors' appetite to finance green investments, which may cause premium differences. Compared to the debt investors' appetite, stockholder's appetite and its implications for corporate managers to encourage for green bond announcements is little studied. Both Flammer (2018) and Tang & Chang (2018), who are the only studies on this topic, found a positive reaction by stock investors

to green bond announcements. These findings are both significant and interesting and they encourage new studies to be conducted in order to both test these findings and study the cause-effect relations behind the positive stock market reactions. Findings on these topics would help corporate managers to choose the optimal source of financing in terms of company valuation.

Whereas the scope of theoretical part is wide, the empirical part of this study solely focuses on stock market reactions around the green bond announcements. Outside of the green bond implications the purpose of the wide theoretical literature review is to examine the green bond characteristics and drivers. Both green bond characteristics and drivers are important to comprehend in order to objectively and critically assess the empirical green bond implications.

To ensure reliability and objectiveness in the theoretical part, articles have been also chosen outside of green bond literature to assess the effects of sustainability. In addition, to have a comprehensive view on the green bond implications all current accessible green bond literature is incorporated in this research. The articles are sourced systemically by using Google Scholar. To find all articles that address green bonds, the list of article references are thoroughly viewed.

In the empirical part, this thesis solely has focus on CAR around green bond announcements. The scope of research includes all issued corporate bonds by public companies in six currencies, USD, CAD, EUR, GBP, NOK and SEK, from 2014 till 2018. The currency and research period scope both excludes and includes some green bond announcements, what are studied or not studied in previous studies. To increase comparability with previous studies, the green bond data is collected from the Bloomberg database together with a Bloomberg database expert.

1.3.4 Structure

This thesis incorporates 5 chapters. First chapter, introduction, motivates and introduces the topic, methodology and thesis structure to the reader. Second chapter, literature review, presents the theoretical background behind the thesis. The literature review has

three goals. First goal is to provide comprehensive knowledge how green bonds differentiate from conventional bonds in terms of characteristics, taxonomy and market. Second goal is to form a theoretical background for the green bond implications to understand, what is the relation in the pecking order of debt among green and conventional bonds. Third goal is to construct a theoretical background that motivates to study CAR around the green bond announcements. The second and third goals are connected in the literature review synthesis.

Third chapter presents data and sample of the study. Furthermore, the third chapter clarifies variables and methodology that are applied in the empirical part of this master thesis. Fourth chapter presents results and robustness test of the study. The goal of the fourth chapter is to find empirical evidence whether green bond announcements cause a positive CAR or not. These results and their practical implications as well as limitations, validity, reliability and conclusions are presented in the fifth chapter.

2. Literature review

2.1.1 Fundamentals of corporate bonds

Corporate bonds are a certain type of debt instruments that are issued by companies and then sold to investors. The corporate bonds pay interest – coupon payments – to investors until maturity. At the maturity the investor receives the invested money, par value, if the company has not gone into default before the maturity. Hence, the investor obtains a credit risk, which is the most important determinant of bond yield – expected return for an investor and cost for a company. As the yield of the bond decreases the bond becomes less risky; and therefore, the investor expects smaller return and company must pay less in interest expenses, which leads to bond price increase for the investor. Smaller yield correlates with smaller credit spread, which is the difference between corporate yield and treasury yield. The credit risk level is either measured by three independent credit rating agencies Standard & Poor's, Moody's and Fitch or by banks that act as advisors in the bond issuance (Berk & DeMarzo 2014). Bonds that have a smaller credit rating than BB, S&P, or Ba, Moody's, are called as speculative-grade bonds (Investopedia 2017). However, the risk level of the bond is not solely determined by the company level risk – unsystematic risk – or by the market risk – systematic risk – because companies may have covenants included in the bonds that reduce the risk and cost of borrowing. Bonds that include covenants are called secured bonds (Berk & DeMarzo 2014).

Conventional corporate coupon bond price is presented by its discounted value of future cash flows. Below is the formula for annual corporate coupon bond:

$$Bond\ price = \frac{C}{1+i} + \frac{C}{(1+i)^2} + \cdots + \frac{C}{(1+i)^n} + \frac{M}{(1+i)^n}$$

The C represents the annual coupon and i the annual interest rate or yield to maturity if the bond is sold at no premium or at no discount. In year n the bond matures, and investor receives both final coupon and the par value, M. The par value M is equivalent with invested money. Usually, the interest rate is fixed but it can also be tied to fluctuating interest rate, which makes the bond to float (Berk & DeMarzo 2014).

Credit risk is not the only factor that affects to bond yield. Recent academic literature has acknowledged the effect of liquidity – how easily the bonds are converted into cash – on bond prices. Literature shows that the credit spreads increase when bonds have lower liquidity (Dick-Nielsen et al. 2012, Friewald et al. 2012 and Bao et al. 2011). According to Friewald et al. (2012), illiquidity accounts 14 % of the credit spread changes for investment-grade bonds and 38 % of the credit spread changes for speculative-grade bonds. Meaning that speculative-grade bonds have higher price volatility for changes in liquidity. Subsequently, low liquidity correlates with the low credit rating (Bao et al. 2011) and high liquidity correlates with the high credit rating (Ericsson & Renault 2006).

2.1.2 Pecking order of debt (corporate bond versus bank loan)

Do companies favor corporate bonds or bank loans? For this question the academic literature does not provide conclusive evidence. In terms of company characteristics, Denis and Mihov (2002) noted that when it comes to the final choice of a debt instrument, there is a pattern that both companies with highest and lowest credit quality tend to choose public debt over bank loans. This means that the investment-grade bonds come before bank loans and speculative-grade bonds after bank loans in the pecking order of debt. Contradicting with this view, Altunbas et al. (2009) argued that in the European market syndicated bank loans – large bank loan that has multiple lenders – are favored by large companies before bonds in the pecking order of debt.

There are multiple reasons why companies tend to favor bonds over bank loans and vice versa. Bolton and Freixas (2000), note that bank lending is more flexible and expensive than bonds because of intermediation costs – reserve and capital requirements, operating and monitoring costs. Subsequently, companies that favor flexibility over price choose bank lending i.e. it's a trade-off between lower risk premium and intermediation costs. Reason for lower flexibility among bonds is that compared to bank lending bond issues are more dispersed; and therefore, bank loans are easier to restructure than dispersed bond issuances (Hart & Moore 1994). However, this can be seen as other way around. According to Diamond (1994), the flexibility comes with price because banks bear the intermediation costs, which in the end are borne by the borrowers. When it comes to tax,

Diamond (1994) empirically shows that the tax advantage of debt increases when borrowers prefer bank debt. In his prior article, in line with Denis and Mihov (2002), Diamond (1991) suggests that the choice of credit instrument is a function of borrower's creditworthiness. Companies with low creditworthiness issue speculative-grade bonds, middle rated companies utilize bank lending and companies of high creditworthiness tend to issue bonds. Different way to identify the pecking order of debt than creditworthiness is to comprehend the company's operating environment. Companies in competitive and developed environments have more growth options. Hence, these companies are facing a lower credit supply from banks, which increases the likelihood of bond issuance (Hale 2003 and Morellec et al. 2014). In a summary, according to the academic literature companies tend to incline investment-grade bonds over traditional bank loans (Table 1).

Table 1: The pecking order of debt according to priority

Priority	*1st*	*2nd*	*Source*
Flexibility	Bank loan	Bond	Bolton and Freixas (2000)
Price	Bond	Bank loan	Diamond (1994)
Tax advantage	Bank loan	Bond	Diamond (1994)
Creditworthiness	Bond	Bank loan	Diamond (1991)
Market competitiveness	Bond	Bank loan	Morellec et. al 2014
Country and political risk	Bond	Bank loan	Hale (2003)

2.1.3 Bond announcements and abnormal shareholder returns

Corporate issuers tend to prefer debt over equity because it is safer security in terms of no asymmetric information. Asymmetric information increases the risk of unfavorable stock price movements (Myers & Majluf 1984). This notion is empirically supported by Mikkelson & Partch (1986), who found that common stock announcements and convertible debt – debt that can be transferred into equity – reduced stock price by 3.56 % and 1.97 %, respectively, whereas straight debt announcements – debt that cannot be changed to something else, such as regular bonds – reduced stock price just only by 0.23 %. Subsequently, the difference among common stock and convertible debt

announcements support the theory of reduced information asymmetry among security announcements are in line with improved stock price movements. Consistent with this notion, according to Mikkelson & Partch (1986) and Dutordoir et al. (2016), the straight debt announcement has a negative effect to stock price during a two-day window – starts one day prior to announcement ends on the day defined as announcement [-1, 0]. This finding is in line with the empirical background of CAR around conventional bond announcement. The empirical background points out slightly negative abnormal shareholder returns around straight debt announcements. For instance, Espen (1986) found that straight bond announcements caused stock prices to fall by 0.06 %, during a two-day window.

2.2 Green bonds

2.2.1 Green bond definition

Green bonds are financial instruments that are developed for improving environmental benefits and social welfare. They are relatively new instruments that sought to make financial industry as the sustainability driver. In detailed level, green bonds sought to reduce CO_2 emissions and prevent pollution. Similarly, as conventional bonds the pricing of green bonds follows equivalent principles as conventional bonds. However, some studies have pointed out a green bond premium compared to conventional bonds (Baker and Bergstresser et al. 2018, Barclays 2015, CBI 2017, Ehlers & Packer 2017, Febi and Schäfer et al. 2018, I4CE 2016, OECD 2016, Tang & Zhang 2018 and Zerbib 2017).

According to The Organization for Economic Co-operation and Development the green bonds are defined followingly:

"*Green bonds are debt instruments used to finance green projects that deliver environmental benefits. A green bond is differentiated from a regular bond by its commitment to use the funds raised to finance or refinance green projects, assets or business activities. Green bonds can be issued either by public or private actors up front to raise capital for projects or refinancing purposes, freeing up capital and leading to increased lending.* "

2.2.2 Green Bond Principles

The major differences between conventional and green bonds are the 4 Green Bond Principles (GBP). The GBP are voluntary process guidelines that provide both an issuer guidance and aid by requiring an availability of information to determine the environmental impact of the bond (ICMA 2018). Origins of the GBP guidelines were established by a consortium of investment banks back in 2014. However, the monitoring and development of these guidelines has since moved to an independent third party called International Capital Market Association (ICMA) (CBI 2018). Nevertheless, these guidelines assist underwriters to move the market towards standard disclosures. Thus, the purpose of these guidelines is to recommend transparency, disclosure and reporting. (CBI 2018)

According to the latest ICMA (2018) report, the GBP have four core components:

- Use of proceeds

Set of appropriate legal documentation that describes the use of proceeds to green projects. If all or proportion of proceeds are refinanced it's recommended that issuer clarifies, which projects are refinanced.

- Process for project evaluation and selection

Green bond issuers should clearly communicate to investors: their environmental sustainability objectives, the assessment of projects in terms of project eligibility to green bond categories and the process applied to identify and manage both potential environmental and social risks associated with projects. One of the GBP cornerstones is transparency. Hence, issuers are encouraged to utilize an external review for project evaluation and selection.

- Management of proceeds

The proceeds of green bond should be traceable at all times. As long as the bond is outstanding, the balance of the tracked net proceeds should be allocated into green

investments. Thus, the green bond proceeds should be allocated into sub-account to facilitate the tracking of proceeds.

- Reporting

Issuer's should provide up to date information for investors through annual reporting in case of material developments.

2.2.3 Green bond categories and types

According to ICMA (2018), green bonds fall below Sustainable Bond category. There are two types of sustainable bonds green and social bonds. These bonds differ by their respective principles, Social Bond Principles (SBP) and GBP (ICMA 2018). Because of this classification, green bonds are occasionally referred as sustainable bonds in the literature. In total, ICMA (2018) recognizes 10 green project categories (Table 2).

Table 2: Green bond categorization

Green bond categories	
1. Renewable energy	6. Clean transportation
2. Energy efficiency	7. Sustainable water and waste water management
3. Pollution prevention and control	8. Climate change adaption
4. Environmentally sustainable management of living natural resources and land use	9. Eco-efficient adapted products, production technologies and processes
5. Terrestrial and aquatic biodiversity control	10. Green buildings

The types of green bonds are constantly evolving as the market matures but according to latest update of ICMA (2018) there are four types of bonds to be issued: standard green use of proceeds bond, green revenue bond, green project bond and green securitized bond (Table 3).

Table 3: Green bond types

Green bond types	
Standard green use of proceeds bond: Standard recourse-to-the-issuer debt obligation aligned with the GBP.	**Green project bond:** A project bond for a single or multiple green projects were investor has direct risks to projects with or without recourse that is aligned with the GBP.
Green revenue bond: A non-recourse-to-the-issuer debt obligation aligned with the GBP. The credit exposure proceeds go to green or non-green projects.	**Green securitized bond:** Collateralized bond by green project or projects that are aligned with the GBP.

2.2.4 Certification and third-party verification

Because of the voluntary nature of the GBP, the market includes green bonds that are only labeled by the issuer without any external verification. Hence, to provide standards, a non-profit organization called Climate Bonds Initiative (CBI) and Bloomberg keeps track on that green bonds follow the GBP guidelines. Of these two certifications, Bloomberg is less extensive in terms of greenness, even though it follows the GBP guidelines as well. Yet most of certified green bonds are labeled by both institutions. (Ehlers & Packer 2017)

CBI tracks the market but the inclusion on the CBI database does not constitute opinion by the CBI. Assets that are included to the CBI database are first approved by verified external second opinions or verified third-parties (Ehlers & Packer 2017). In terms of the GBP, the third-party verifications are recognized as more rigorous form of assessment than second opinions (Standard & Poor's 2016). The second opinions are executed by independent operators, such as CICERO (Center for Internationalized Climate Research) and Vigeo Eiris (CICERO 2018 & Vigeo Eiris 2018). However, as might be expected, all second opinion providers or third-parties are not verified by CBI. Hence, to increase the importance of second opinion or third-party verification the external party should be approved verifier by the CBI. For instance, whereas Vigeo Eiris, PwC, EY, Deloitte and KPMG, to name some, are verified by the CBI, CICERO is not verified by the CBI. All green bonds that are verified by the CBI are also certified bonds (CBI 2019a).

Beyond “yes or no” certifications some operators provide granular green bond ratings, based on the greenness of the bond (ICMA 2018). Especially, global credit rating agencies S&P and Moody’s provide specific green bond ratings alongside with normal credit ratings to green bonds (Standard & Poor’s 2019 and Moody’s 2018). In addition, Standard & Poor’s and Moody’s have developed indices for the market, which has subsequently led to introduction of green bond ETFs – exchange-traded fund. The third global rating agency Fitch does not provide any evaluation of the “greenness” of the bond (Fitch 2019). Outside of global credit ratings, CICERO also provides a granular assessment of bonds “greenness” (CICERO 2018). The assessment methodology of proceeds in terms of greenness, adaption for S&P, differs for all assessors (Table 4).

Table 4: Comparison of use of proceeds evaluation by green rating agencies (Standard & Poor's 2017, Moody's 2017 and CICERO 2018)

S & P		*Moody's*	*CICERO*	
Use of proceeds	*Examples*	*Use of proceeds*	*Use of proceeds*	*Examples*
Systematic decarbonization of economies	Wind, solar and hydro projects	Sustainable buildings	**Dark green:** Projects that represent low carbon and climate resilient future.	Wind energy projects
Significant decarbonization of key sectors through low-carbon solutions	Green buildings and green transport (not including hybrid)	Renewable energy	**Medium green:** Solutions that represent long-term visions but are not quite there yet.	Plug-in hybrid busses
Decarbonization by alleviating emissions in intensive industries	Industrial efficiencies, green transport (hybrid) and energy-efficient products	Energy efficiency	**Light green:** Solutions that are environmentally friendly but do not represent long-term visions.	Efficiency in fossil fuel industry that decreases emissions
Decarbonization technologies with significant environmental hazards	Nuclear and large hydro in tropical areas	Water and waste water management	**Brown:** Opposite of low carbon and climate resilient future.	New infrastructure for coal
Improvement of fossil fuel-based activities' environmental efficiency & impact	Coal to natural gas, clean fuel production and clean use of coal	Pollution prevention and control		
		Biodiversity and conversation		

The use of proceeds i.e. adaptation has only partial affect to the overall green bond grade. Depending on rating institution, different methods are applied to determine the appropriate green bond rating (Figure 2) (Ehlers & Packer 2017, Moody's 2018 and Standard & Poor's 2017). Both Moody's and S&P utilize a scale of 0 to 100 — 100 meaning the best grade.

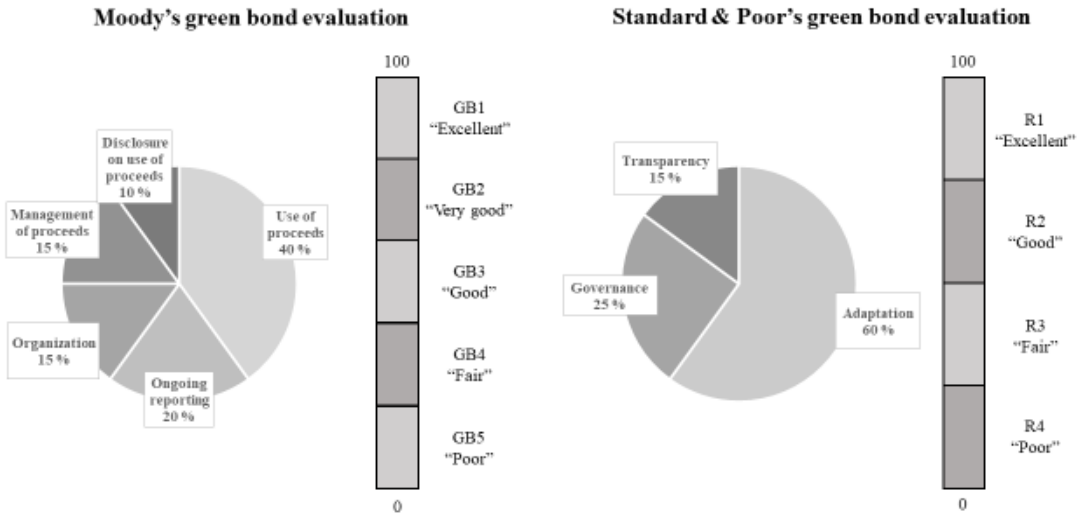

Figure 2: Weight of evaluation criterias and green bond rating of Moody's and Standard & Poor's

2.2.5 Different standards

Various different existing definitions and labels for green bonds pose a challenge. Consistent global procedures in issuing green bonds would allow both companies and investors gain more from green bonds. These gains are in relation with increasing transparency. Despite of imminent gains of transparency and great effort, international certification mechanisms differ, there are no unified green bond standards and there is limited enforcement of the law for supervising green integrity (Tang & Zhang 2018). For instance, the most prominent competitor for the ICMA GBP is a taxonomy used by China's Green Bond Finance Committee. Furthermore, the characteristics of different green bond identification and certification schemes differ significantly (Table 5) (Ehlers & Packer 2017).

Table 5: Green bond identification and certification schemes

Characteristics	*CBI*	*CICERO*	*Moody's*	*S & P*
Use of funds tied to green investments	Yes	Yes	Yes	Yes
Eligibility criteria differ by sector	Yes	No	No	Yes
Ex post monitoring/assessment	No	No	Yes	No
Granular assessments of greenness	No	Yes	Yes	Yes
Quantitative weights for factors	No	No	Yes	Yes

2.3 Green bond market

Since the first issued green bond in 2007 by the European Investment Bank (EIB), the market for green bonds has erupted. The market has more than quadrupled during last four years from 37 $ billions to 167 $ billions – over than 95 % of proceeds are allocated to green investments – see Figure 3 (CBI 2019b). Despite of the market eruption, green bonds account only 2 % of the total fixed income market but they are constantly gaining a share and they have already influenced wider capital markets through the increased corporate disclosure that they promote (Financial times 2018). In addition, there is a strong growth potential for green bonds in terms of non-labeled fully-aligned issuers and strongly-aligned outstanding bonds, 497 $ and 314 $ billion, respectively (CBI 2019b). According to CBI (2019b), there are 389 $ billion outstanding labeled green bonds.

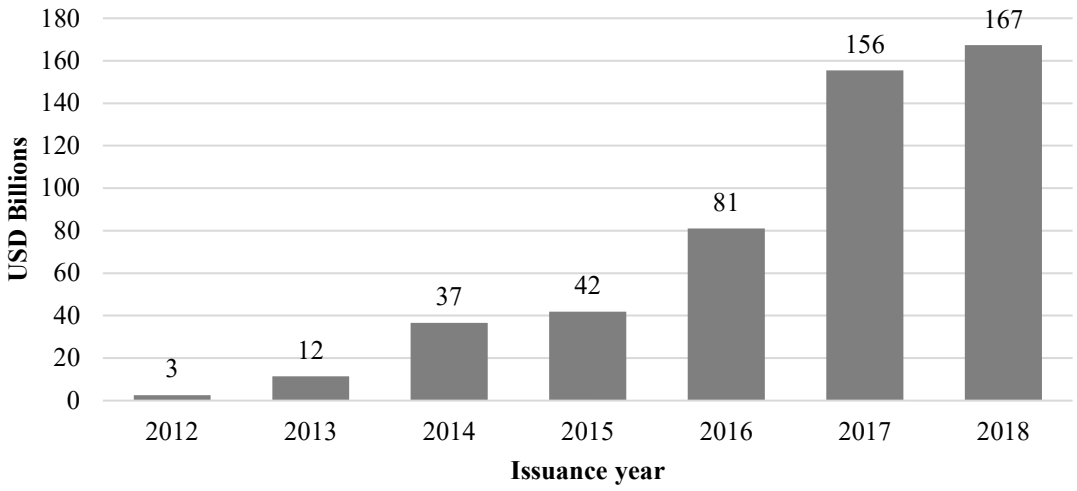

Figure 3: Nominal value of labeled green bonds per issuance year

In start of the inception, most green bonds were issued by development banks, such as EIB. As the market has matured the share of the development bank green bonds has declined from over 40 % to below 10 % (Figure 4). This thesis focus areas non-financial and financial issuers have kept a total market share of over 40 %. During the last years, new types of labeled green bonds have emerged such as asset-backed-securities, government backed entities and sovereign green bonds, which all have over a 10 % market share currently. (CBI 2015, CBI 2016, CBI 2017, CBI 2018 and CBI 2019b)

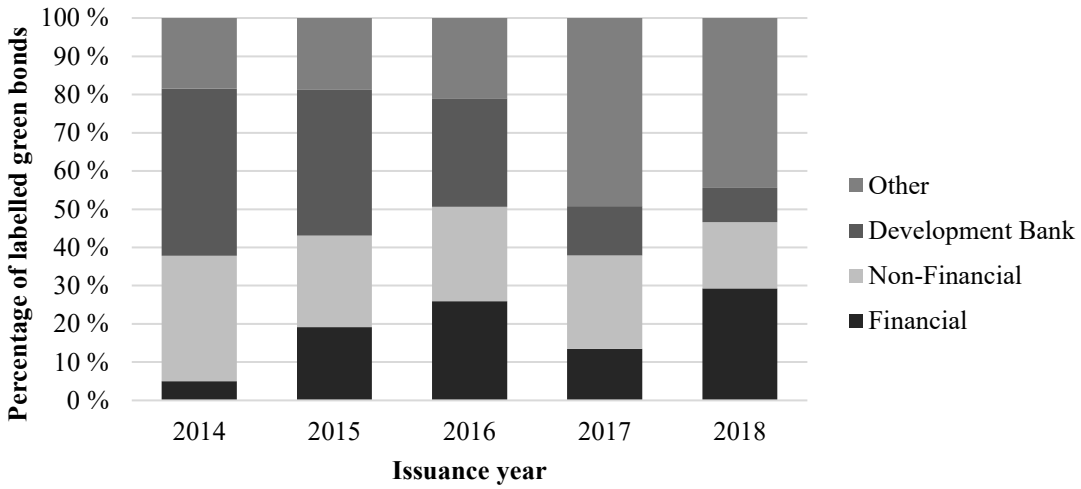

Figure 4: Labelled green bond volume by issuer type

The green bond market has faced a remarkable growth since its inception. However, there are some signs that the market seems to be cooling down particularly among the non-financial segment and in the developed countries. For instance, the non-financial segment issuances decreased to 29 $ billion in 2018, whereas in 2017, which was the historically the best year, the non-financial segment issuances were 38 $ billion (Figure 5). This slowdown is consistent with the issuances among the developed countries that grew only by 3 % from 2017. The growth in 2018, was fueled by the financial and ABS green bonds and issuance growth in the emerging markets (CBI 2015, CBI 2016, CBI 2017, CBI 2018 and CBI 2019b).

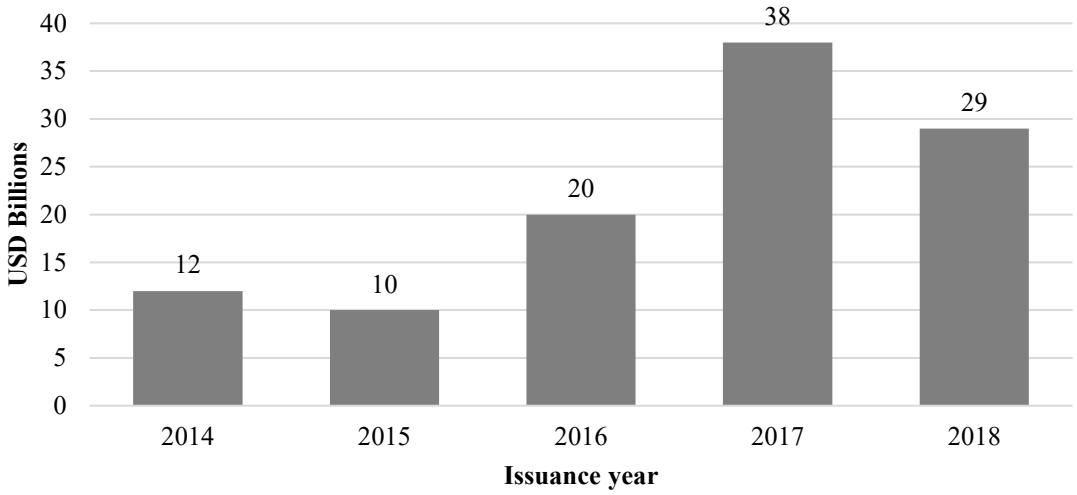

Figure 5: Issued green bonds by non-financial segment (corporations)

Majority of labelled green bond proceeds are allocated to energy production. According to CBI, roughly 60 % of green bond proceeds are allocated to renewable energy and energy efficiency investments (Figure 6). During last years, the energy efficient investments have topped the renewable energy investments as the most prominent green bond proceeds usage. The next 30 % have been historically allocated to low carbon transportation and sustainable investments (CBI 2016, CBI 2017, CBI 2018 and CBI 2019b).

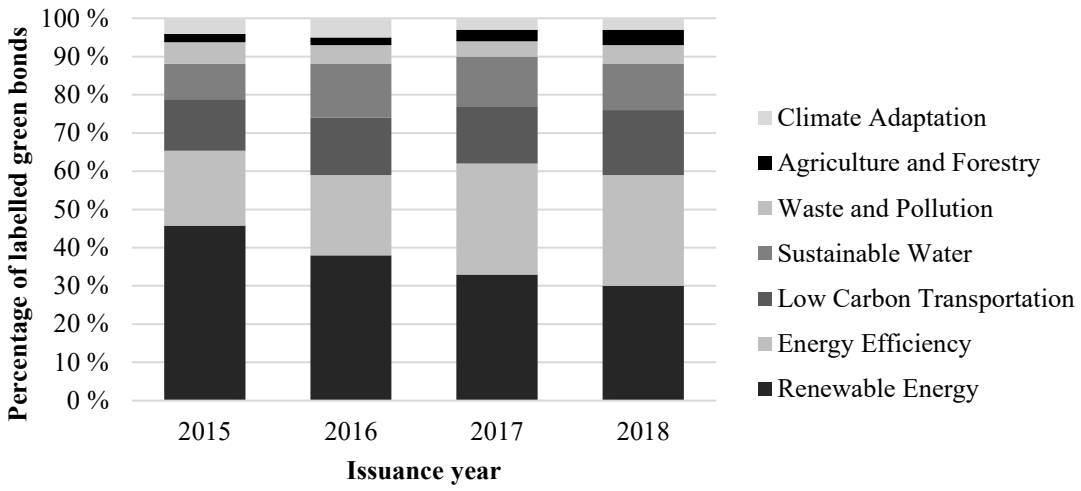

Figure 6: Use of labelled green bond proceeds

Historically Europe has been the strongest market for green bond issuances with slight gap to North America (Figure 7). However, since 2015 China has become a fierce competitor to these developed markets, which accounted 70 % of the green bond issuance market in 2018. In some estimates, China is the biggest market for green bonds, but these estimates calculate also green bonds that are only certified by China's Green Bond Finance Committee. These bonds particularly include excessive amount of bonds that are associated with industries of high CO_2 emissions. Hence, these bonds reduce emissions, but they also support industries that have high emissions. Subsequently, they do not fulfill the CBI standards. All green bonds that are included in Figure 7 are in line with the CBI standards (CBI 2016, CBI 2017, CBI 2018 and CBI 2019b).

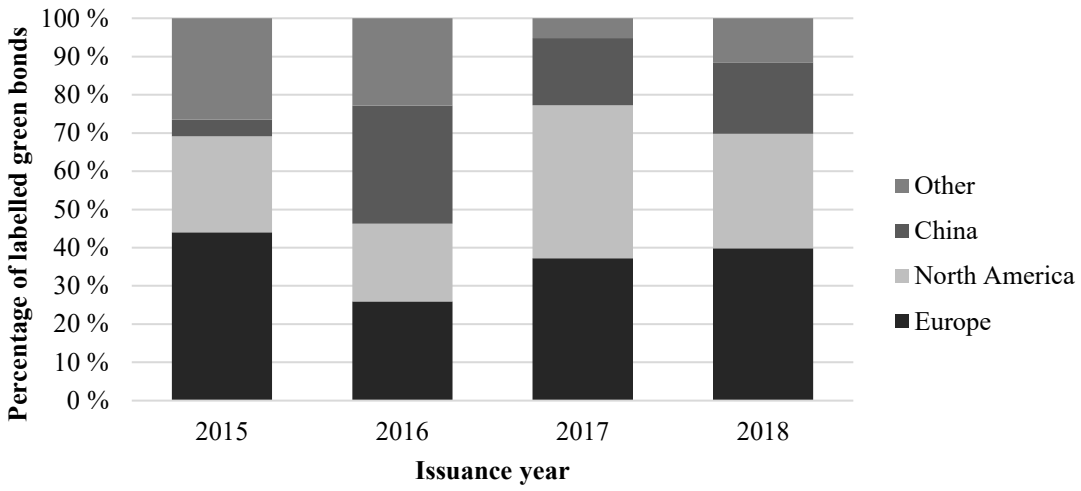

Figure 7: Green bond issuances by major markets

2.3.1 Sustainability as a driver

Companies and businesses are measured through Environmental, Social and Government (ESG) criterias that measure both sustainability and ethical impact of the investment. These criterias are particularly important for responsible investors, who pay attention to environmental and social impacts (Derwall 2007). The importance of ESG in investment decisions has become more prevalent during recent years due to climate change concerns and increased social awareness (Forbes 2018).

Increase of social awareness has triggered a growing demand for sustainable financial products that addresses social and environmental issues (Climate Bond Initiative 2017). Hence, investors seek Socially Responsible and Impact Investing (SRI) strategies, which drive companies to improve Corporate Social Responsibility (CSR) in terms of attracting new investors and environmental issues (Derwall 2007). Subsequently, this cycle generates companies with higher sustainability and ethical impact. According to ESG studies, higher company valuation correlates with improved ESG ratios (Figure 8) (Bassen & Kovacs 2008 and Dervall 2007).

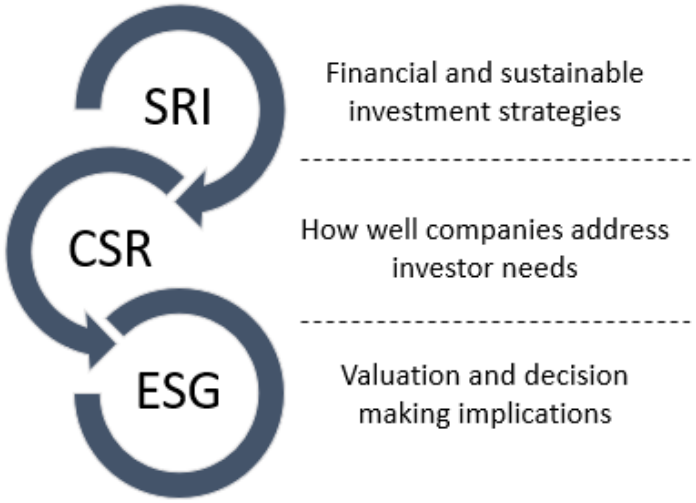

Figure 8: Sustainable investing terminology linkage

For a company top management CSR has important implications. First, CSR measures how the company has succeeded in responsibility goals. Second, it generates shareholder value (Derwall 2007). Financial Times (2017b) defines CSR by following manner:

"Corporate social responsibility (CSR) is a business approach that contributes to sustainable development by delivering economic, social and environmental benefits for all stakeholders"

In operational level, CSR creates impact throughout the company's value chain. The greatest environmental impact takes place in logistics, operations and technology improvement. First, efficient logistics reduce CO_2 emissions; second, operations concern emissions and waste, biodiversity and ecological impacts and energy usage; and third, technology improvements creates solutions that improves company's environmental impact. Improving these aspects of value chain creates self-evident environmental benefits and they are potentially linked with companies' competitive advantage but rarely do they enable major benefits for companies because they are executed in cost of more salient investment opportunities (Porter & Kramer 2006).

Sustainable financing is an emerging driver that might boost companies to sought CSR investments. Recent studies have pointed out that by improving corporate social performance – a ratio that measures company's CSR – companies can attain abnormal

shareholder returns (Heinkel et al. 2011 and Kempf & Osthoff 2007), reduced cost of equity (Chava 2010, ElGhoul et al. 2011 and Heinkel et al. 2011) and cost of debt and improving credit ratio (Oikonomou et al. 2014). These findings are partly consistent with Dervall (2007), who argues that CSR investments are not only executed in terms of responsibility goals but to act in the interest of shareholders even though Dervall (2007) does not found empirical evidence on reduced cost of equity.

While ESG measurements focus more on company valuation and CSR on company level performance, SRI pays attention to investor level strategies (Bassen & Kovacs 2008 and Dervall 2007). According to forum of sustainable and responsible investing SRI is:

"Investment discipline that considers environmental, social and corporate governance (ESG) criteria to generate long-term competitive financial returns and positive societal impact"

SRI is one plausible explanation why investors are eager to invest in companies that have either high CSP – Corporate Social Performance measurers CSR – or they pursue with investments that address environmental issues. For instance, Kempf & Osthoff 2007 show that by following a simple sell and short SRI investment strategy – buy stocks with high SRI ratings and sell stocks with low SRI ratings – investors can earn remarkably high returns. Furthermore, investors are facing an increasing pressure to address the ESG and SRI mandates. The pressure to address mandates will lead demand to surpass supply (Febi and Schäfer et al. 2018). In economic sense, this means a reduced financial cost for CSP investments.

2.3.2 Greenwashing

One plausible and maybe the most relevant risk for sustainable investing to take of is Greenwashing. In greenwashing, companies are marketing positive environmental policies to deceptively promote organizations environmental footprint (Delmas & Burbano 2011 and Flammer 2018). Greenwashing is not an act of crime, but it exaggerates corporations' green achievements or drags the attention from major green improvements to minor green improvements. Delmas & Burbano (2011) present that greenwashing is

caused by multiple drivers that can be either external or internal drivers. In financial perspective, the most important driver is to fulfill investors demand for green financial products. This external driver has been particularly increasing for green bonds (OECD 2016).

According to Delmas & Burbano (2011), the greenwashing has been skyrocketing during 21st century. They argue that recent trend might be rather harmful for environmentally friendly performance because of two very obvious reasons. First, greenwashing reduces consumers and investors' confidence both in green products and environmentally responsible companies. Thus, when there is no confidence in the market, investors and consumers are reluctant to reward companies for their high environmental performance. Second, partly incentivized by the first reason, it encourages companies to execute unfavorable environmental actions. In terms of green bonds, aforementioned aspects increase the importance of strict guidelines, standards and 3rd party verifications, which addresses the aforementioned transparency and creditability problem. For time being, it seems that these guidelines, standards and 3rd party verifications have been able to mitigate the greenwashing problem (see chapter 2.4 Implications of corporate green bonds) despite of their voluntary nature and unified market wide standards. Even though a few skeptical voices have questioned the value of green bonds, by arguing that they are just a form of greenwashing and they do not have any impact to aggregate decarbonization of economy (Financial Times 2015).

2.4 Implications of corporate green bonds

The academic literature on green corporate bond implications is relatively limited but an emerging topic in the academic context. Thus, to identify the pros and cons of green bonds the theoretical foothold in this section is also built on literature that focuses on the effects of CSP, SRI and environmental performance. In addition, studies provided by banks and independent third parties are included. During the past years, few notable academic articles have been published that solely focus on green bond implications. Flammer (2018) endorsed the positive relation of improved environmental benefits through green bond issuances to operational performance and value creation. Beyond environmental

measures, the recent green bond studies are focused to investigate green bond premiums (Baker and Bergstresser et al. 2018, Barclays 2015, CBI 2017, Ehlers & Packer 2017, Febi and Schäfer et al. 2018, I4CE 2016, Karpf & Mandel 2017, OECD 2016, Tang & Zhang 2018 and Zerbib 2017) and green bond liquidity (Zerbib 2017, Febi and Schäfer et al. 2018 and Tang & Zhang 2018) compared to conventional bonds. Moreover, these studies connect green bond issuances with positive CAR (Flammer 2018 and Tang & Zhang 2018), increasing institutional ownership (Tang & Zhang 2018) and improved credit ratings (Zerbib 2017).

2.4.1 Green bond fundamentals

Green bonds are a relatively new type of debt instrument. They are more prevalent in some industries than other because the GBP make issuances difficult in particular industries, such as mining and oil refinery. The basic features of green and conventional bonds are relatively similar. According to Febi and Schäfer et al. (2018), the average maturity of green and conventional bonds is 8.5 and 7.0 years, respectively. In addition, these both bonds are characterized by high issuance volumes and they are usually issued as investment-grade bonds.

Investors have different preferences when it comes to different markets in terms of sustainability. Subsequently, green bonds are geographically more prevalent in European market than in North America and China (Flammer 2018). The prevalence is caused by greater demand of green bonds in terms of both issuance and investor demand (Wall Street Journal 2017). The greener European market is also supported by green bond issuances in chapter 2.2.

2.4.2 Environmental performance versus financial performance

Solid environmental performances are correlated with higher CSP results and reduced equity cost of capital. Heinkel et al. (2011) argues that both good CSP results affects positively on stock prices and 10 % of funds are invested to SRI investments. These results are significant also in other aspects because both of these results have implications to the

economy wide cost of capital. In line with CSP results, academic literature encourages fund managers to follow up SRI procedures because statistically SRI investments lead to a better fund performance (Kempf & Osthoff 2007). Yet there is no consensus among the effects of CSR to CFP (Table 6).

Table 6: Correlation among corporate social performance and corporate financial performance

Source	*Methodology and data*	*Correlation*
Waddock & Graves 1997	Quantitative: S&P 500 firms	Positive
Orlitzky et. al 2003	Quantitative: 44 000 firms globally	Positive
Mahoney et. al 2008	Qualitative: 44 U.S firms	Positive
Aupperle et. al 1985	Qualitative: CEO questionnaire for 241 U.S firms	Inconclusive
Mahoney & Roberts 2007	Quantitative: 525 Canadian stock listed firms	Inconclusive
Friedman 1970	Shareholder theory	Negative
Bromiley & Marcus 1989	Qualitative: 4 large U.S car manufacturers	Negative

Kempf & Osthoff (2007) found that SRI investments lead to better fund performance. If this is true, investors should demand lower equity cost of capital from companies that address environmental issues appropriately, which is the case according to CSP literature. Literature that focuses on CSP and environmental issues notes that there is clear evidence from companies of high CSP to obtain a reduced cost of equity capital because of improved responsible employee ratios, environmental policies and sustainable product strategies (ElGhoul et al. 2011). To support this view from a different angle, Chava (2010) argues that investors expect significantly higher returns from companies that are excluded by environmental screens (such as hazardous chemical, substantial emissions, and climate change concerns). These environmental screens are utilized by socially responsible investors when they compare companies. Hence, companies that possess a favorable environmental impact tend to obtain a reduced cost of equity capital (Chava 2010 and ElGhoul et al. 2011).

To support environmental benefits and financial performance from green bond perspective, Flammer (2018) identified that green bonds have substantial positive impacts on ASSET4 environmental rating, a total increase of 8.8 %. Furthermore, and most importantly, the study shows that companies who have issued green bonds have had substantial positive impacts on company's valuation following the issuance in terms of Tobin's Q – total market value of a company divided by total asset value of a company – and ROA – return on assets. Thus, green bonds improve companies operating performance and valuation.

2.4.3 Ownership structure and bond concentration

We know that the investors demand lower return for their investment when companies have favorable environmental performance (Chava 2010 and ElGhoul et al. 2011). Thus, it is no surprise that both green funds (Baker and Bergstresser et al. 2018) and VC green funds (Barber et al. 2018) gain more attraction than their conventional peers. These all are clear evidence that some investors favor sustainable investments and there are truly environmentally responsible investors. This might indicate that there could be a higher bond concentration among green bonds compared to conventional bonds.

When it comes to characteristics of socially responsible investor, both Chava (2010) and Flammer (2018) recognize that institutions are more environmental responsible investors than private investors. Flammer (2018) argues that green bond issuances increase significantly institutional, long-term and green investors' equity stake. According to Flammer (2018), green bond increases institutional ownership by 1.2 %, long-term investor ownership by 2.3 % and green investors' ownership by 4.1 %, when looking the difference between issuance date and two years subsequent to issuance. Tang & Zhang (2018) found even stronger evidence and reported 7.9 % increase in the institutional ownership after green bond issuance compared to conventional bonds. By separating the institutional ownership to four categories, Tang & Zhang (2018) argued that domestic institutional ownership and independent domestic institutional ownership increases, 8.5 % and 7.6 %, respectively, whereas foreign institutional ownership and independent foreign institutional ownership decreases, -0.5 % and -1.9 %, respectively. This

phenomenon is caused by the domestic investors' home bias (Coval & Moskowitz 1999) and their more attention-driven perspective compared to the foreign investors (Tang & Zhang 2018). In a summary, these results are in line with the nature of institutional investors to be more socially responsible and long-term sighted. Thus, increasing institutional investor attraction goes hand in hand with Tang & Zhang (2018) second finding that green bond issuances reduce hedge fund holdings. One plausible reason for this empirical finding is the nature of green bonds being difficult to short (Baker and Bergstresser et al. 2018). Generally, reduced hedge fund positions are viewed positively by investors because they make stock less speculative and better predicted (Ben-David and Franzoni et al. 2013).

I4CE (2016) reflects that some investors have a stronger appetite for green bond issuances than others. Therefore, green bonds are a valid strategy for companies, who are eager to support green financing. According to Baker and Bergstresser et al. (2018), who study U.S. municipal and corporate green bonds, argued that there is an appetite for green bonds particularly among eMaxx institutions – a list of institutions that are reported by Thomson Reuters that includes international insurance companies, pension funds and mutual funds. Baker and Bergstresser et al. (2018) report eMaxx institutions to have 3.2 % higher stake in green bonds than in conventional bonds. Furthermore, Baker and Bergstresser et al. (2018) compare the Herfindahl-Hirschman Index (HHI) – 10,000 points means 100 % ownership for a single company and when index is close to zero not a single company has a stake that is drastically higher than zero – to measure the concentration differences between conventional bonds and green bonds. They found that HHI reports a higher ownership concentration in green bonds than in conventional bonds. Among AAA-rated green bonds the index is between 0.03 % and 0.08 % higher than with conventional bonds. The equivalent difference for below top size quantile bonds is between 0.07 % and 0.10 %.

2.4.4 Cost of capital

Literature offers two contradicting views how environmental investments affect to the cost of capital. Nobel Prize winner Friedman (1970), had an article in *The New York Times*

Magazine where he prompted companies to seek ultimate stockholder returns in cost of SRI investments. Friedman and his advocates of shareholder theory, regard environment expenditure as inefficient use of capital in terms of reduced company profits. Pursuing with less attractive investments leads to both higher interest expenses and cost of debt capital because of decreasing ability to pay debts. However, the stakeholder theory advocates to recognize that there are three positive effects of solid environmental results if the investments are also valid in economic sense in terms of reduced debt cost of capital. First, it reduces the amount of asymmetric information, which increases creditability and trustworthiness of borrowers (Kim et al. 2009 and Heinkel et al. 2011). Second, good environmental results increase bond's liquidity in terms of demand because the bond attracts also socially responsible investors (Heinkel et al. 2011). Thirdly, valid environmental investments increase sales that correlate both with decreasing litigation, sanctions and boycott risks and increasing customer activities and government support (Zerbib 2017). But all in all, Friedman (1970) states valid arguments against corporations' environmental investments because investments that are solely pursued to achieve environmental gains exclude the essence of companies, which is to increase shareholder value. However, the recent literature sheds light why environmental investments outperform mutually exclusive non-environmental investments with equivalent expected returns in terms of cost of capital.

First before digging into debt and equity market consequences, it is important to recognize that the consequences in the equity market are not directly applicable to debt market because of three reasons. First, the asymmetric payoffs of corporate bondholder differ from stockholder. Meaning that the corporate bond payoffs can be replicated by taking both a long position in company's assets and a short call option on the very same asset. Thus, the bondholder returns are limited but losses can equal invested amount (Merton 1973). Second, the debt market is enormous and usually debt accounts more in companies' balance sheet than equities (Zerbib 2017). Third, refinancing via debt occurs more frequently than trough equity market because of short-and medium-term corporate bonds. Therefore, companies are more sensitive to pressure of equity investors that focus on CSP development because they allow companies to mitigate possible reputation issues relating

company's activities impacting the environmental lead to overwhelming liquidity squeezes and possible viability issues. (Oikonomou et al. 2014)

2.4.5 Green bond premium and liquidity

Outside of academic literature green bonds and their effects are seen in a positive light, even though all studies do not proclaim green bond premium. For instance, study of OECD in 2016, states that as the social benefits are certain the financial benefits for green bonds are not yet evident. However, the study proclaims that if the market continues to grow it will increase the speed of "book building", i.e. the demand for green bonds will grow, which will reduce the costs associated with road shows (OECD 2016). According to Heinkel et al. (2011), this will also lead to reduced cost of debt. Institute for Climate Economics follows along OECD's footsteps and argues that there are potential cost benefits in green bonds through reduced cost of capital, but these gains are not yet evident (I4CD 2016). Continuing with these footsteps, Climate Bond Initiative (2017) studied 14 government and corporate related green bonds in 2016 and did not find any evidence of green premium. But in terms of liquidity they argued that due to oversubscription of issued green bonds there is unmet demand in the market. Barclays (2015) applied OLS regression to study the differences among conventional and green bond credit spread. The study inclined cost benefits of green bonds by showing that investor premiums on green bonds have been raising over time – the research period of study ends to August 2015 where the green bond premium is -17 bps. Green bond premium is supported by Financial Times (2017a), which argues that "Green bond issuers are poised to charge a premium" because the total return of environmentally labelled securities had outperformed the global bond average during 2017.

Academic literature provides statistical evidence of both reduced and increasing credit spread due to improvement of social performance. Because social performance indicators, such as CSP, include factors from community strengths to environmental strengths the inversive correlation of CSP with credit spreads can be interpreted as positive correlation of environmental strengths to credit spread. Oikonomou et al. (2014) reports results which are partly align with this notion. According to Oikonomou et al. (2014), controversially

bond that includes environmental strengths reduces credit spread by 30 % and bond that has environmental concerns reduces the spread by 12 %. Similarly, with the latter finding, Orlitzky et al. (2003), show that positive effects of CSP are not always aligned with the environmental improvements.

The recent academic literature that focuses either to green bond yields or credit spreads shows positive signs on the existence of green bond premium compared to conventional bonds. Zerbib (2017) reports decreasing yields for both EUR, an average of -2 bps and -4 bps for bond that are graded below AAA, and USD, an average of -5 bps and -9 bps for bond that are graded below AAA, nominated green bonds compared to conventional bonds. To support the existence of green bond premium, Ehlers & Packer (2017) report a significant green bond premium of -18 bps, which is consistent with the findings of Zerbib (2017). In line with these studies, Baker and Bergstresser et al. (2018) report that for municipal and corporate green bonds investors are willing to sacrifice several basis points of return to hold green bonds. By focusing solely on green corporate bonds in 28 countries Tang & Zhang (2018) found a significant green bond premium of -6.9 bps when only adding country fixed effects. However, the study provides inconclusive results when adding both issuers fixed effects and year by month fixed effects, -0.8 bps. In this scenario, Tang & Zhang (2018) report no statistically significant green bond premium and note that only 41 firms have issued both green bonds and conventional bonds during their study time frame. Consistent with significant premiums, Febi and Schäfer et al. (2018) measured that the yield spread for green bonds is -5 to -30 bps lower compared to conventional bonds. Nonetheless, they notice on that the yield spread premium has almost become negligible during the past years, which is a potential sign of maturing green bond market.

Contradicting with all the studies that show existence green bond premium, Karpf & Mandel (2017) analyze municipal bonds on the secondary market and argue that the "green nature" bonds are penalized by the market in terms of higher yields than their credit profile indicates by + 7.8 bps. However, the study is not fully comparable with previous studies because Karpf & Mandel (2017) utilize Oaxaca-Blinder decomposition by looking into coefficients, such as days to maturity and value, and their effect to green and conventional bond yields. This differs from prior green bond studies that try to control

the variables and explain what the yield differences among green bonds and conventional bonds for a company are if they would issue both types of bonds with same specifications and issuance dates. Moreover, Karpf & Mandel (2017) utilize less restrictive framework by accepting all bonds that possess Bloomberg green flag whereas Zerbib (2017) and Ehlers & Packer (2017) focus solely on bonds that fulfill both GBP and possess Bloomberg green flag.

One and maybe the most plausible reason for green bond premium is higher bond liquidity compared to conventional bonds. Febi and Schäfer et al. (2018) provide an empirical background for this explanation by investigating the determinant power of both bid-ask spread – by which the ask price exceeds the bid price – and LOT liquidity measure – difference between the percent of buying cost and the percent of selling costs – to yield spread among conventional bonds and green bonds. They conclude that conventional bonds are less liquid than green bonds because of bid-ask spread and LOT liquidity measure. Febi and Schäfer et al. (2018) and Zerbib (2017) found that bid-ask spread is insignificant determinant for green bond yields whereas it is a valid determinant for conventional bonds. Vice versa, Febi and Schäfer et al. (2018) show that LOT measure is a valid determinant for green bond yields whereas it is an insignificant determinant for conventional bonds. To support these findings, Zerbib (2017) also notes that there is a liquidity premium on green bonds in the secondary market and that the green bond premium is caused by increased liquidity.

Higher liquidity level of green bonds seems to be a robust phenomena in the market. Because at the moment and most likely in the future, investors are facing pressure to address the ESG and SRI mandates, which will lead to demand surpass over to supply (Febi and Schäfer et al. 2018). The supply is most likely to stay low because lack of fiscal incentives for investments (Zerbib 2017) and a lack of an official and global classification system (Cochu and Glenting et al. 2016) even though GBP is seeking to address this latter problem. Thus, better liquidity of green bonds might not stem up from environmental improvements but from shortage of supply that enables green bond premium (Zerbib 2017). Other factor that might prove illiquidity of green bonds compared to conventional bonds is the lack of credit risk profile in terms of inadequate reporting of green projects

and the ratings of green bonds are more focused to balance sheets instead of green project investments (Cochu and Glenting et al. 2016). Hence, green bonds could actually be allocated to riskier investments than conventional bonds, which should indicate a negative green bond premium. This higher risk level is supported by the relation of bond maturity and yield. Academic studies argue that investment grade bonds are expected to have a positive relationship among maturity and yield spreads (Campbell & Taksler 2003). Because significant number of green bonds are investment grade bonds, we should except equivalent results. However, Febi and Schäfer et al. (2018) found an inversive relationship among these two factors, which is expected for speculative-grade bonds (Helwege & Turner 1999). The same phenomena appeared also in the study of Karpf & Mandel (2017), who found inversive relationship among these factors for bonds where years to maturity are below 3 years.

2.4.6 Cumulative abnormal returns and stock liquidity

Academic literature shows a positive correlation among green bond announcements and CAR. Tang & Zhang (2018) report a positive 1.39 % CAR for green bond issuers, and even higher for first time issuers, during a 21-day window – 10-days prior and after the announcement. This finding is supported by Flammer (2018), who found statistically significance CAR increase after green bond announcement for large companies that have high environment materially score. In her study Flammer (2018), sought to examine CAR in various event windows. The return was highest near the announcement, two-day window [-1, 0]. The CAR for companies during this two-day window was 0.67 [-1, 0] % and during 41-day event window [-20, 20] the CAR was 1.14 %. Tang & Zhang (2018) argued that the presented positive stock market reaction is caused by increased liquidity and increased institutional ownership instead of reduced cost in debt financing.

Beyond of increased bond liquidity (Febi and Schäfer et al. 2018 and Zerbib 2017), green bonds also increase stock liquidity (Tang & Zhang 2018). By utilizing the Amihud illiquid measure (Amihud 2002), Tang & Zhang (2018) found a statistical evidence of increased liquidity after green bond issuance. One year after the green bond issuance they found improved stock liquidity of 4.87 %, whereas for conventional bond issuers the increase

was only 2.2 %. Furthermore, Tang & Zhang (2018) show that an average daily turnover of stock – daily volume divided by stock float – is twice as large during the green bond announcement month compared to 12-months prior and after the announcement. According to Tang & Zhang (2018), the reason for this phenomenon is triggered both by increased media exposure and the impact where investors must fulfill their investment mandates, such as ESG and SRI. To support the positive liquidity effect of green bonds, environmental impact has also a positive impact to demand of venture capital funds. Barber et al. (2018) reports that impact funds have 14.1 % higher probability of attracting investors than traditional venture capital funds. The reported impact is particularly high if the fund addresses environmental issues.

All in all, compared to debt market implications the equity market implications in green bonds are significantly less studied. Whereas the debt market implications are studied to the extent where cause-effect patterns behind green bond implications are defined, the equity market implications are just detected with little reasoning. This is somewhat strange due to the fact that equity holders are the ones who shape the future and strategy of the company.

2.4.7 Credit rating

Oikonomou et al. (2014) reports improved credit rating for bonds that include environmental strengths. According to Oikonomou et al. (2014), bond that incorporates environmental strengths is rated 3.5 bond rating scores higher than a conventional bond. This is a major increase because the study only is based on the S&P rating scores, which includes only 8 rating scores. Controversially, similarly as in the credit spreads, Oikonomou et al. (2014) reports 0.5 increase in the bond rating score when the bond incorporates environmental concerns. Nonetheless, the first argument of Oikonomou et al. (2014) is supported by Ehlers & Packer (2017), who report reduced environmental credit risk among green bond issuers, which correlates with lower credit rating. High corporate green bond credit rating score is supported by Barclays (2015) credit research, who observe that over 80 % of issued green bonds in 2015 had an investment-grade rating.

The association of green bond credit rating and green bond premium is studied (Febi and Schäfer et al. 2018 and Zerbib 2017). These studies show a significant relation, where green bond premium increases as the credit rating decreases. Thus, this could imply significant cap on equity market reactions between investment-grade and speculative-grade companies.

2.4.8 Verification

Companies can issue green bonds without verification. Thus, it is reasonable to expect positive "label effect" for green bond that is verified by a second opinion or by a third party. The "label effect" is caused by increased trustworthiness and transparency that should increase positive market reaction and green bond premium. Subsequently, the positive implications of green bond are caused by the green bond announcement effect and the "label effect" of third-party verifier, where the latter one is expected to be higher (Tang & Zhang 2018). Nonetheless, only a half of currently outstanding green bonds are verified by a third-party in terms of CBI standards (Baker and Bergstresser et al. 2018).

Certification through verified third-parties amplifies positive implications associated with green bonds. Baker and Bergstresser et al. (2018) report higher green bond premiums and ownership effects, such as concentration of bondholders, among bonds that are certified by external verifiers. To support significantly higher green bond premium, they found that for bonds with 10-year duration the premium for certified green bonds were -18 bps, which is three times higher than for non-certified green bonds. In terms of concentration, Baker and Bergstresser et al. (2018) report that the HHI index is 0.04 % higher for green bonds but 0.24 % higher for certified green bonds compared to conventional bonds. Verification also creates amplified stock market reaction, according to Flammer (2018), the stock market reaction is twice as large for certified green bonds relative to non-certified green bonds, 0.8 % and 0.4%, respectively. Flammer (2018), also report slightly enhanced Tobin's Q, ROA and institutional ownership and significantly improved environmental ratings and CO_2 emissions to certified green bonds compared to non-certified green bonds. In line with Flammer positive stock market reaction, Tang & Zhang

(2018) argue that the positive stock market reaction is also available for second time issuers as it would make sense to obtain positive reaction only once.

In order to be financially attractive, the verification must increase green bond premium because the issuance costs are higher for certified green bonds. Naturally, these costs are highest for companies that haven't been utilizing verification services prior to issuance (Tang & Zhang 2018). These costs stem up from additional transaction costs, such as contracting external reviews to receive a green bond certification (Febi and Schäfer et al. 2018). If the company is eager to hire a third-party verifier for green bond, these costs vary between 10,000$ and 50,000$ (Baker and Bergstresser et al. 2018). Hence, in existence of green bond premiums, let's say -5 bps, green bonds will outperform conventional bonds only if bond issuances are over 10 $ million. This cost level brings two important practical implications. First, the certification can be valuable deal for larger and longer maturity bonds. Second, it encourages to foster current green bond certification standards to increase validity and value of certifications.

2.5 Synthesis of literature review

The green bond market is evolving and growing in terms of standards and issuance volume. Despite of having unified worldwide green bond standards yet, the quest for defining the use of proceeds of bonds and provide transparency for investors is received positively by the market. Nonetheless, it is difficult to see scenario where green bonds would become a major source of financing because of the current strict guidelines on use of proceeds that restrict the utilization of these type of bonds in many industries. Thus, probably the most import implication what green bonds will provide for global bond market is transparency if investors start to demand disclosure on use of proceeds. In terms of greenness, this might pressure companies always to allocate some extend of financing into green investments.

In terms of green bond implications, the green bond premium is the most widely studied topic. Even though the studies are not fully consistent with each other, they show that green bonds have a minor premium compared to conventional bonds. To support this finding there is evidence that bond liquidity is larger for green bonds, which is caused by

increased demand. Demand is particularly higher for institutional, long-term and green investors.

Beyond green bond premiums, such as financial performance, stock price and credit rating effects, green bonds seem to have positive implications. However, the financial performance relation to environmental performance is somewhat inconclusive and both stock price and credit rating effects are little studies in the academic context. This means that the current studies on stock price effects have only sought to prove the positive implications, without going further into causalities. Furthermore, the credit rating relation to stock market reaction is not studied in the green bond context. In the empirical part of this thesis, I sought to go further into these topics and study that are the stock price effects dependent on time, market, industry and currency.

The summary of green bond implications is showed in Table 7. Even though green bonds should to be studied more, the results are conclusive to state that the green bonds are placed higher in the pecking order of debt than their conventional bond peers with equivalent credit rating. In addition, to support aforementioned statement, the studies show that higher rating of "greenness" in terms of green bond verification effects affects positively to the green bond implications.

Table 7: Synthesis of green bond articles

Source	*Baker and Bergstresser et al. 2018*	*Barclays 2015*	*Climate Bonds Initiative 2017*	*Ehlers & Packer 2017*	*Febi and Schäfer et al. (2018)*
Green bond principles alignment	No	Yes	Yes	Yes	Yes
Bond types	Municipal and corporate		Sovereign and corporate	Sovereign, municipal and corporate	Sovereign, municipal and corporate
Scope	U. S	Global	Euro and U. S	Euro and U. S	London and Luxemburg stock exchange
Number of bonds	2083 municipal and 19 corporations	N.A.	14	21	64
Method	OLS regressions	OLS regressions	Comparison	Comparison	OLS regressions
Time period	2010 - 2016	Mar. 2014 - Aug. 2015	Jan. 2016 - Mar. 2017	2014 - 2017	N.A.
Primary / Secondary market	Primary	Secondary	Primary	Primary	Secondary
Liquidity control	Issue amount	Date of issuance	No	No	LOT
Strict maturity control	Yes	No	No	Yes	Yes
Environmental performance					
Financial performance					
Ownership structure	Increase of eMaxx institutions and HHI				
Green bond premium	-2 bps	-17 bps	No	-18 bps	-5 bps to -30 bps
Bond liquidity					Increased
CAR					
Stock liquidity					
Credit risk				Reduced	
Verification effects	Amplifying and Increased issuance costs				Increased issuance costs

Source	*Flammer 2018*	*Karpf & Mandel (2017)*	*Tang & Zhang 2018*	*Zerbib 2017*
Green bond principles alignment	No	No	Yes	Yes
Bond types	Corporate	Municipal	Sovereign, municipal and corporate	Sovereign, municipal and corporate
Scope	Global	U. S	Global	Global
Number of bonds	368	1880	1510 (firms 132)	135
Method	Comparison	Oaxaca-Blinder decomposition	Quantitative and matching sample	Matching sample
Time period	2013-2017	2010-2016	Jun. 2007 - Jul. 2017	Jul. 2013 - Dec. 2016
Primary / Secondary market	Primary	Secondary	Primary / Secondary	Secondary
Liquidity control	No	Number of transactions	Yes	Yes
Strict maturity control	No	Yes	No	Yes
Environmental performance	ASSET4 + 8.8 %			
Financial performance	Increased Tobin's Q and ROA			
Ownership structure	Increase of institutional (1.2 %), long-term (2.3 %) and green (4.1 %) investors		7.9 % increase of institutional	
Green bond premium		+ 7.8 bps	-1 bps	-2 bps to -9 bps
Bond liquidity				Increased
CAR	+ 1.14 % (41-days)		+ 1.39 % (21-days)	
Stock liquidity			Increased	Increased
Credit risk				
Verification effects	Amplifies stock price		Positive	

2.6 Hypotheses

2.6.1 Cumulative abnormal returns around green bond announcements

Compared to the debt market implications the equity market implications in green bonds are significantly less studied. This is somewhat strange due to the fact that equity holders are the ones who shape the future and strategy of the company. Particularly, the academic literature concerning the relation between green bond announcements and shareholder returns is limited (Flammer 2018 and Tang & Zhang 2018). In line with increasing social awareness among investors (Climate Bond Initiative 2017), both prior results on CARs around green bond announcements are positive. Tang & Zhang (2018) report a CAR of 1.39 % during a 21-day window around the green bond announcements. Flammer (2018) found a significant abnormal stock price increase after the green bond announcements for large companies with high environment materially score. Both of these studies are important due to the fact that straight debt announcements cause negative stock market reactions (Espen 1986 and Mikkelson & Partch 1986).

Despite of positive findings, there is a fear that the positive CAR around green bond announcements is becoming neglected. First, if it is revealed that green bonds are just a product meant for greenwashing, the higher demand of green bonds compared conventional will erode due to social awareness. Second, the volume of green bonds will rise as the market matures, which may cause the market to move according to shareholder theory where companies would focus on profit generation rather than CSR (Friedman 1970). Given light of these theoretical aspects, new data and more focused market scope, it is important to test are the CAR's positive around green bond announcements.

H1: CAR's around green bond announcements are positive

The development of positive green bond effects is inconclusive and requires more academic research. The studies over time focus mostly on green bond premium, which has slightly reduced during recent years (Febi and Schäfer et al. 2018). This argument is supported by empirical literature, which seems to report smaller green bond premiums depending on the contemporary of the research. However, Febi and Schäfer et al. (2018)

report an increasing market demand for green bonds and Zerbib (2017) argues that there is a shortage of green bond supply in terms of ask yield comparisons between green and conventional bonds. In terms of CAR, this indicates that there is a limited amount of companies that fulfill responsible investor mandates. Thus, looking through economical perspective the increasing green bond premium due to shortage of green bond supply indicates an increasing CAR around the green bond announcements. In line with presented theory, the market is more aware of green bonds than ever (CBI 2019c), green bonds increase positive media exposure and investors possess increasing pressure to satisfy their investment mandates, such as ESG and SRI (Tang & Zhang 2018).

The topic of CAR returns after green bond announcement must be studied further because the current results do not investigate shareholder return differences over time. More empirical research is required because it might be so that the CAR's are only focused to a short time frame. I argue that the CAR's have been increasing over time because of both increasing recognition (CBI 2019c) and increasing shortage of green bond supply.

H2: CAR growth after companies' green bond announcement has been increasing over time

2.6.2 Cumulative abnormal returns around green bond announcements between Non-European and European market

It is significant to study different market differences in terms of CAR for two obvious reasons. First, it would encourage corporate managers to undertake green investments despite of home market. Second, there might be markets where conventional bonds outperform green bonds.

There are no previous studies that compare abnormal shareholder returns in European and Non-European market after the green bond announcement. According to Flammer (2018), the green bonds are more prevalent in Europe compared to North America and Asia, which indicates that the shortage of supply is smaller in European markets than in North America and Asia. However, Wall Street Journal (2017) reports that in Europe there is a greater investor demand for green bonds compared to North-America, which on the other

hand supports higher of green bond supply in Europe compared to Non-European market. I argue that the investors' demand prevails the issuance supply of green bonds in European market compared to Non-European (North America and developed Asian countries) market because in European market the importance of ESG in investment decisions has outperformed North-American market (Schroders 2017). Hence, the shortage of supply is higher in European market compared to Non-European market.

H3: CAR increase around company's green bond announcement is higher in European than Non-European market

3. Data and methods

3.1 Data

This thesis is a quantitative study where hypotheses are tested trough an event study method. Data for the empirical part is collected from two sources. First, the green bond data is retrieved from Bloomberg database, which is the most comprehensive up-to-date database for financial securities. The Bloomberg data incorporates announcement date, amount issued, bond type, company name, coupon, CUSIP code, credit rating and maturity. In the second phase, the Bloomberg green bond data is connected to stock price and index data to determine the CAR. Both historical stock prices and indices values are retrieved from Thomson Reuters Eikon.

In line with Flammer (2018), to map out all issued green bonds, the corporate green bond data is extracted from Bloomberg's fixed income database that are labeled as "green bonds" and where the "use of proceeds" is "Green Bond/Loan". Following with the Flammer (2018) method, I excluded all bonds whose issuer's BICS – Bloomberg Industry Classification System – is "Government. Then, I excluded companies that have financial BICS excluding real estate companies. Thus, this means that I excluded all Banks, which is relevant because green bonds issued by banks are different (Flammer 2018). Large amount of issued Green Bonds by banks are allocated to "green loans" instead of green projects. Because of different taxonomy used by China's Green Bond Finance Committee, China is excluded from this study (Ehlers & Packer 2017). Using the above criteria between 1.1.2013 and 31.12.2018, I extracted total of 814 corporate green bonds.

To enable the comparison between European and Non-European market, I incorporated only CAD, EUR, GBP, NOK, SEK and USD nominated bonds, 567 bonds in total. Other currencies are rejected from the study to enable comparison between developed markets. To compare issuances in different currencies, all issuance values have been converted to USD. After currency extraction, bonds issued by private companies are excluded, leaving 243 bonds. For subsidiaries, I required 100 % ownership by a public parent company. Then bonds with multiple trances are incorporated together leaving total of 170 bonds.

Finally, I removed the year 2013 because there is only one valid data point. Thus, the valid data sample between 1.1.2014 and 31.12.2018 is 169. Majority of these 169 bonds are issued by subsidiary companies. Hence, in CAR calculations I have connected these subsidiaries to their respective parent companies. The summary of data statistics is shown in Table 8 in terms of bond quantity, value and currency. In total the study includes 169 green bonds, with total value of 75.9 $ billions.

Table 8: Summary statistics

Year	*USD*	*EUR*	*SEK*	*NOK*	*GBP*	*CAD*	*Total*	*Volume (USD M)*
2014	3	6	3	0	1	0	13	8301
2015	35	5	1	1	0	0	42	10728
2016	7	8	5	1	0	0	21	13447
2017	10	19	8	2	0	0	39	24182
2018	15	18	20	0	0	1	54	19242
Total	69	57	37	4	1	1	169	75900
Volume (USD M)	29545	42476	2842	390	414	232	75900	

To calculate the CAR, I followed procedure where CAR is calculated between one day prior to announcement – -1 – and announcement day – 0. This is a commonly followed procedure because some information may have been revealed to public before the announcement (Flammer 2018). In line with previous studies in this topic by Flammer (2018) and Tang & Zhang (2018), I investigate CAR also in other time frames to increase the study validity. In the existence of significant CAR, the study validity increases if CAR returns are concentrated to close proximity of the green bond announcement i.e. [-1, 0] event window. The other time frames are: [-20, -11], [-10, -2], [1, 10] and [11, 20]. Thus, aggregate event window is [-20, 20], which is equivalent with Flammer (2018). Both company specific stock returns and market specific index returns for each bond are calculated for same event window [-20, 20]. In overall, I calculated the CAR by using three different models: market model, market return model and CAPM.

3.2 Event study methodology

Event study methodology examines the stock price reaction around the announcement of the event. Opposed to the issuance date, the announcement date is more relevant event date because it captures the date when market receives the information. In this study, I study CAR returns around the green bond announcement, within an event window of [-20, 20]. To test the hypotheses comprehensively and increase the research robustness, I apply three different models for CAR calculation: market model, market return model and CAPM, where market model is utilized by Flammer (2018) and CAPM by Tang & Chang (2018). Whereas market model is the main model of this study both market return model and CAPM are applied to test the robustness of market model results. To utilize these models, I have to define and calculate set of variables and parameters.

3.2.1 Variables and parameters

CAR

CAR is the difference among realized stock return and expected stock return. In most cases, the expected stock returns are calculated by utilizing index returns as a variable. Often CAR is calculated to measure the performance of single stock against the market, but it is as relevant for measuring portfolio performance against stock or market movements. Nonetheless, CAR can be utilized to determine abnormal shareholder returns around company announcements, such as the green bond announcements (Flammer 2018 and Tang & Zhang 2018).

Event window

CAR can be calculated for different event windows. Both Flammer (2018) and Tang & Zhang (2018), study abnormal shareholder returns in different event windows around the green bond announcement. Both these studies, particularly Flammer (2018), note that the CAR is most significant for two day [-1, 0] event window. Thus, to study significance reaction that are only caused by green bond announcement, I focus on two day [-1, 0]

event window to capture only green bond effects. Similarly, as Flammer (2018) I study CAR within the [-20, 20] event window to robust test findings on the [-1, 0] event window.

Market return

To measure stock performance against country specific index returns, I have chosen the most prevalent indices from each market. Subsequently, I have selected indices that are the best representors for the aggregate stock market, such as S&P 500 in the US and CAC 40 in France. This, methodology is line with both Flammer (2018) and Tang & Chang (2018). The index values are utilized in all CAR models to determine the expected stock market return.

Years

The data incorporates all green bonds between 2013 and 2018. The year 2013 was excluded from the final sample as well as the years prior to 2013 due to limited data.

Markets

The market variable is utilized to determine whether the European market is "greener" compared to Non-European market. This variable is required for the third hypothesis: CAR increase around company's green bond announcement is higher in European than Non-European market. The data includes four currencies in European market: EUR, SEK, NOK and GBP, two in Non-European market: USD and CAD. Some of the companies that have issued USD bonds are listed in Asia or either in South America, but they have been included to study because of similar market characteristics with North America in terms of green bond appetite (Flammer 2018). In addition, these companies possess a strong presence in global markets. Bonds nominated in Chinese renminbi are excluded due to possible green bond taxonomy differences (Ehlers & Packer 2017).

Risk-free rate

Risk-free rate needs to be defined for the CAPM. Usually, risk-free rates are derived from government bonds. In this study, the risk-free rate is market specific 10-year government bond yield on the announcement date of green bond.

Company beta and alpha

For the two latter models, market model and CAPM, there are two parameters defined: beta (β) and alpha (α). Both of these parameters have been calculated individually for each data point because these parameters vary depending on company and point of time. To calculate these parameters, I have constructed a linear regression model for each data point. In these regressions, the daily index returns are an explanatory variable for the daily company stock returns. I apply equivalent methodology than Flammer (2018) and calculate the parameters based on 200 trading days before the event window. Thus, the estimation window is [-21, -221] to allow comparability with Flammer's (2018) results.

$R_{i,t} = \alpha_{i,t} + \beta_i * R_{m,t} + \varepsilon_{i,t}$, where

$R_{i,t}$ = dependent variable that represents estimates daily stock returns

$\alpha_{i,t}$ = alpha

β_i = beta

$R_{m,t}$ = market return

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

In linear regression the best fitting line is calculated by estimating the β parameter by applying least-squared method, which is the most common method for fitting the regression line. The linear regression of single independent variable has three assumptions. First, the relation among dependent and independent variable should be linear. Second, there should be no autocorrelation in the data. Autocorrelation occurs when the residuals are not independent from each other. Third, assumption is homoskedasticity. Meaning that the residuals should be equally across the regression line.

Company beta measures the systematic risk of the company compared to the market returns, i.e. company volatility. If the beta is higher than 1, it tells that company tends to be more volatile than the market. Vice versa, if the company has a beta that is lower than 1, company tends to be less volatile than the market. And companies that have a negative beta tend to move opposite direction compared to the market. Beta quantifies the expected market return compared to market return. For instance, if company has beta of 1.2 and market return is 1 %, the expected stock return is 1.2 * 1 % = 1.2 % when alpha is zero.

Whereas beta measures the company volatility, alpha measures the stocks excess returns compared to market returns. Compared to beta, alpha has usually less significant effect in the stock expected return calculation. The summary of all variables and parameters applied in the event study are listed in the Table 9.

Table 9: Summary of variables

Variable/Parameter	*Metric*	*Supportive literature*
CAR	Market return model, market model and CAPM	Flammer (2018) and Tang & Zhang (2018)
Event window	Two days and starting one day prior to announcement [-1, 0]	Flammer (2018)
Market return	Major country specific stock indices	Flammer (2018) and Tang & Zhang (2018)
Year	2014-2018	
Markets	0 - 1, where 0 represents CAD and USD and 1 EUR, GBP, NOK and SEK	
Beta	Stocks equity beta in [-21, -200] event window	Flammer (2018)
Alpha	Stocks alpha in [-21, -200] event window	Flammer (2018)
Risk-free rate	Market specific 10-year government bond	

3.2.2 Models

Market model

Whereas market return model does not separate companies for each other, market model distinguishes each company based on their equity beta and alpha. Thus, the market model is based on assumption of a constant linear relationship with individual stock and market returns. First in the market model I calculated beta and alpha. After defining the parameters, I calculated the estimated return $E[R_{i,t}]$ on the stock of company i on day t:

$R_{i,t} = \alpha_{i,t} + \beta_i * R_{m,t} + \varepsilon_{i,t}$, where

$E[\varepsilon_{i,t}] = 0$

$$VAR[\varepsilon_{i,t}] = \sigma_{\varepsilon i}^2$$

$$E[R_{i,t}] = \alpha_{i,t} + \beta_i * R_{m,t} + \varepsilon_{i,t}$$

And then the abnormal return for each day:

$$AR_{i,t} = R_{i,t} - E[R_{i,t}]$$

The market model is one of the most common ways to measure CAR. It is simple, and it accounts company differences through equity beta and alpha. Hence, it is held to be more accountable than market return model. Compared to CAPM, market model is less comprehensive because it does not incorporate risk-free rate. However, given the light of recent almost zero risk-free rates the differences between market model and CAPM should be insignificant. Flammer (2018) also utilized the market model to examine CAR around green bond announcements.

Market return model

In market return model, the beta of all companies is estimated to be equivalent with the market. Meaning that beta is 1 and alpha is 0. Thus, the abnormal stock returns are calculated by subtracting daily index return from realized stock return:

$AR_{i,t} = R_{i,t} - R_{m,t}$, where

$AR_{i,t}$ = abnormal stock return for company i in day t

$R_{i,t}$ = realized stock return

$R_{m,t}$ = index return

CAPM (Capital assets pricing model)

CAPM is one of the most important theoretical notions among finance. Compared to market model CAPM is extension. The beta and alpha of CAPM are equivalent with market model, but the estimated return formula takes another form and incorporates the risk-free rate:

$$E[R_{i,t}] = \alpha_{i,t} + R_f + \beta_i * (R_{m,t} - R_f) + \varepsilon_{i,t}$$

Then the abnormal returns are calculated similarly as in other models:

$AR_{i,t} = R_{i,t} - E[R_{i,t}]$

CAPM is also simplistic model to calculate stock return compared to sophisticated Fama and French models. CAPM and market model are the most applied models for stock return calculations. Tang & Chang (2018) utilized the CAPM to examine CAR around green bond announcements.

3.3 Testing the hypotheses

For statistical hypotheses testing, I have calculated t-test results with their respective p-values to measure the significance of CAR in different event windows and markets. In t-tests, I have applied one sample t-test to measure, do these samples significantly differ from $CAR = 0$. The t-test calculates p-values that measure the significance of sample. The null hypothesis is $CAR = 0$ and alternative hypothesis is $CAR \neq 0$. Thus, for deterring significant results the p-value should be close to zero. If the p-value is smaller than 0.01, it means that within 99 % confidence interval the sample mean differs from zero. I do not utilize two sample t-tests to measure significance of market differences because of unequal sample means, variances and sizes. The one sample t-test for CAR is:

$t = \frac{CAR - \mu_0}{\frac{s}{\sqrt{n}}}$, where

$\mu_0 = 0$ (null hypothesis)

$s =$ sample standard deviation

$n =$ sample size

3.3.1 Robustness

Compared to issuance volume of some companies the sample of 169 bonds may include some biases. For instance, the sample includes 31 bonds that are issued by Tesla Inc. The large percentage of bonds issued by a single company can distort the conclusions in many

ways. Thus, to mitigate the risk of possible distorted conclusions the results are also calculated without the Tesla Inc.'s green bond issuances.

In this study, the European market preferences are dictated by four currencies. To test European findings as consistent among different currencies, I compare green bond effects in different issued currencies.

To test event study findings, sample skewness, kurtosis and median are calculated. Skewness measures the symmetry of sample. Closer to zero more symmetrical the data is. Kurtosis measures the tails of the sample. Median is a comparative result to CAR and it is also a measurement of normality assumption similarly as skewness and kurtosis. Measuring the normality assumption is important for this study because the significance of all samples in this study are measured through one sample t-tests, which assumes samples to follow normal distribution. Validity of the study results will increase if the data is symmetrical and the tails of the sample are close to each other.

4. Results

4.1 Market model

Market model reveals a positive CAR with a low p-value, during [-1, 0] event window (Table 10). In overall, the corporate green bond announcements cause a 0.073 % CAR during the aggregate event window [-20, 20]. However, this result is not significant and has a high standard error of 0.783 %. Moreover, the CAR differs significantly within different event windows. For instance, within [-20, -11] and [1, 10] event windows the CAR is negative, -0.056 % and -0.109 %, respectively. The highest positive CAR is reported during [-1, 0] event window. Most importantly this CAR of 0.234 % has a low and significant p-value of 0.0516.

Table 10: Stock market reaction to the corporate green bond announcement (Market model)

Event time	CAR %	St. Error	P-value
[-20, -11]	0.023	0.324	0.472
[-10, -2]	0.137	0.349	0.348
[-1, 0]	0.261*	0.159	0.0516
[1, 10]	-0.182	0.410	0.329
[11, 20]	-0.120	0.413	0.386
[-20, 20]	0.073	0.783	0.463

Marks *, ** and *** denotes the significance at the 10 %, 5 % and 1% level, respectively.

Out of the last 20 quarters the CAR [-1, 0] has been positive for 14 times, according to market model (Figure 9). However, the CAR [-1, 0] returns during different quarters seem to differentiate a lot between 2 % and -2 %. Because of increasing green bond announcement volume trend, the volatility of green bonds CAR [-1, 0] around green bond announcements between quarters seem to be decreasing. In line with this notion, the green bond announcements CAR [-1, 0] has stabilized between 0 % and 1 %, during the last two years. This stabilization and positive CAR [-1, 0] of 0.234 % indicates slight positive appraisal of investors towards the corporate green bond announcements. Nonetheless, the

data does not reveal any conclusive information whether the CAR has been decreasing or increasing over time. This is partly caused by limited data between years 2014 and 2016.

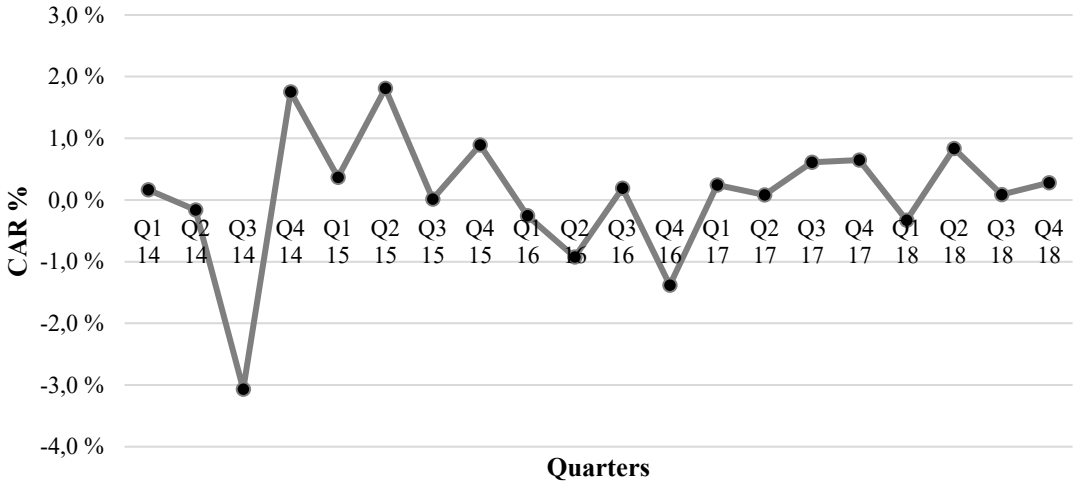

Figure 9: CAR of green bonds over time (market model)

Market model reports a 0.114 CAR [-1, 0] difference in favor of European market compared to Non-European market (Table 11). In the European market, consisting of 99 observations, the CAR [-1, 0] is 0.308 % and has a p-value of 0.054, according to the one sample t-test. The low p-value indicates that the European market CAR [-1, 0] is significant. The Non-Europe CAR [-1, 0], consisting of 70 observations, is not significant due to a high p-value of 0.242 but the CAR is positive by 0.194 %. Thus, these results suggest that both green bonds seem to cause positive stock market reactions overall in the markets and green bonds are more favored in the European than Non-European market. The evidence on markets and preferences within European and Non-European market is not conclusive but it is directional.

Table 11: Stock market reaction to the corporate green bond announcement in different markets (market model)

Market	CAR [-1, 0] %	St. Error	P-value	Observations
Europe	0.308*	0.190	0.054	99
Non-Europe	0.194	0.276	0.242	70

Marks *, ** and *** denotes the significance at the 10 %, 5 % and 1% level, respectively.

Figure 10 depicts that major part of the green bond announcements in CAR [-1, 0] event window are condensed close to zero. Furthermore, the Figure 10 shows that large positive outliers tend to outperform large negative outliers. Whereas only two data points have a CAR below of -4 %, there are 7 data points that report CAR over of 4 %. In terms of market differences based on announcement quantity, European green bond announcements outperform Non-European announcement in all years except 2015.

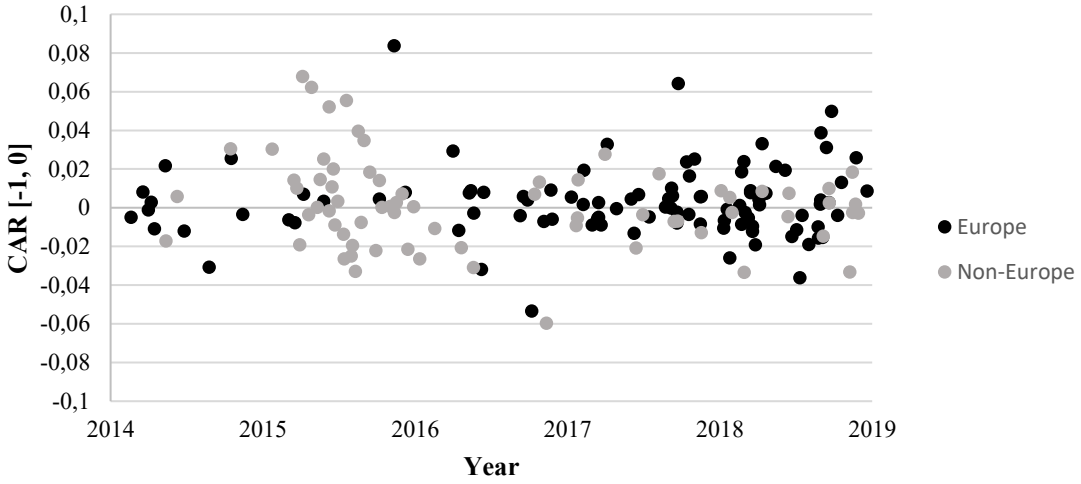

Figure 10: Scatter plot of CAR in different markets (market model)

4.1.1 Market model parameters

Average beta for all companies was 0.77, which indicates that majority of companies in this study are defensive i.e. tend to be less volatile than the market. The average beta for European companies was 0.64 whereas it was 0.96 for Non-European companies. Thus, the nature of issuance companies differs by some part within these two geographical markets, even though majority of the sample in both areas are either energy or real estate companies that tend to have low betas. Plausible explanation for the difference of average market betas is Tesla Inc., which has issued 31 green bonds during the study time frame with an average beta of 1.31. The potential causes of Tesla to the study results are empirically tested in the chapter 4.4 Robustness (Table 16).

4.2 Market return model

According to market return model, the CAR for the aggregate event window [-20, 20] is 0.183 % (Table 12), which is 0.110 higher than in the market model. Despite of lower CAR [-20, 20], the market model CAR [-1, 0] is 0.234 %, which is 0.027 lower than in the market model. Consistent with the market return model the CAR [-1, 0] is significant within the 10 % level in the market model. Both market model and market return model seem to report negative CAR's between days 1 and 20 after the corporate green bond announcement and positive between days -20 and -2 prior to the corporate green bond announcement.

Table 12: Stock market reaction to the corporate green bond announcement (Market return model)

Event time	CAR %	St. Error	P-value
[-20, -11]	-0.056	0.322	0.432
[-10, -2]	0.114	0.355	0.374
[-1, 0]	0.234*	0.168	0.082
[1, 10]	-0.109	0.404	0.393
[11, 20]	0.000	0.415	0.500
[-20, 20]	0.183	0.769	0.406

Marks *, ** and *** denotes the significance at the 10 %, 5 % and 1% level, respectively.

Quarterly results on market return model CAR [-1, 0] are in line with findings that were made in the market model. By 14 times out of 20 quarters the CAR [-1, 0] is positive and the results are more consistent in years 2017 and 2018, except quarter Q1 2018 which has a negative CAR [-1, 0] (Figure 11).

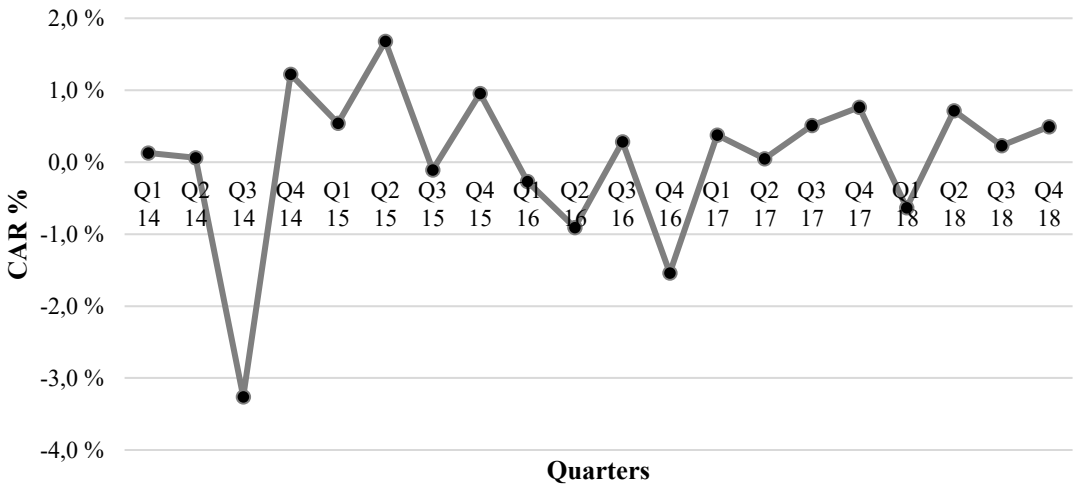

Figure 11: CAR of green bonds over time (market return model)

The market differences of market model are in line with market return model. However, the CAR [-1, 0] cap in market return model has increased to 0.213 whereas in market model the cap was only 0.114. In European and Non-European market, the market return model reports CARs [-1, 0] of 0.322 % and 0.109 %, respectively. According to p-values, the European CAR [-1, 0] is more significant with a p-value of 0.057 than Non-European CAR [-1, 0] with a p-value of 0.354. These results amplify the significance of market differences that were stated in the market model. Nonetheless, the difference between markets is detectable but taken account the standard error of Non-European CAR [-1, 0] 0.289 the differences are not statistically significant for conclusions. Thus, in the light of results presented in Table 13 the findings are more directional than conclusive.

Table 13: Stock market reaction to the corporate green bond announcement in different markets (market return model)

Market	CAR % [-1, 0]	St. Error	P-value	Observations
Europe	0.322*	0.202	0.057	99
Non-Europe	0.109	0.289	0.354	70

Marks *, ** and *** denotes the significance at the 10 %, 5 % and 1% level, respectively.

In overall, the market return model results validate the findings, which were made in the market model. In addition, the findings on market differences in market return model can be held to be more significant in terms of p-values and CAR differences. However, compared to market model the market return model results are held to be less valid because market return model does not incorporate any company differences.

4.3 CAPM

The CAPM provides almost equivalent CARs [-1, 0] with the market model. Importantly, both these sophisticated models report higher CAR [-1, 0] than the less sophisticated market return model. CAR of CAPM [-1, 0] is 0.259 % (Table 14), which is significant with a p-value of 0.053. To increase the significance of CAR [-1, 0] both CAPM and market model report over 0.025 higher CAR [-1, 0] results with 0.01 reduced standard error than the market return model.

Table 14: Stock market reaction to the corporate green bond announcements (CAPM)

Event time	CAR %	St. Error	P-value
[-20, -11]	-0.022	0.323	0.473
[-10, -2]	0.137	0.349	0.347
[-1, 0]	0.259*	0.159	0.053
[1, 10]	-0.182	0.410	0.329
[11, 20]	-0.120	0.413	0.386
[-20, 20]	0.073	0.783	0.463

Marks *, ** and *** denotes the significance at the 10 %, 5 % and 1% level, respectively.

The CAPM quarterly CARs [-1, 0] are consistent with two previous models (Figure 12). Based on these three models the quarterly CARs, [-1, 0] tend to be positive. Particularly, the last eight quarters that possess lower volatility, suggest that quarterly CARs [-1, 0] are consistently between 0 and 1 %. However, CAPM and prior models do not provide any evidence on growing or decreasing trend of CARs [-1, 0].

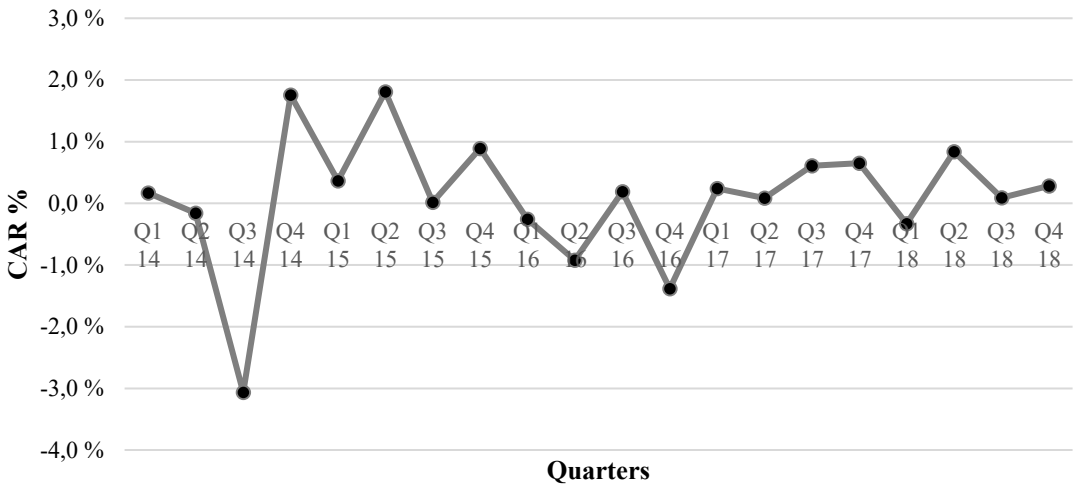

Figure 12: CAR of green bonds over time (CAPM)

CAPM model supports the evidence that there is over 0.1 CAR [-1, 0] difference between the means of European and Non-European companies around the green bond announcements. The CAR [-1, 0] in CAPM is 0.305 % (Table 15). Hence, all of the models show that the CAR [-1, 0] is over 0.3 % in the European sample, with p-value significance below a 10 % level. Nonetheless, the Non-European sample has also positive a CAR [-1, 0] in all models. Subsequently, these results do not show conclusive evidence on market differences.

Table 15: Stock market reaction to the corporate green bond announcements in different markets (CAPM)

Market	CAR % [-1, 0]	St. Error	P-value	Observations
Europe	0.305*	0.190	0.056	99
Non-Europe	0.193	0.277	0.244	70

Marks *, ** and *** denotes the significance at the 10 %, 5 % and 1% level, respectively.

The key reason why differences between CAPM and market model result are negligible is the low risk-free rate particularly in developed countries. Average annual risk-free rate in this study is 1.63 %. In order to calculate daily CARs the annual risk-free rate is converted to daily risk-free rate, which is only 0.013 % by average. The average annual

risk-free rate in Europe and Non-Europe was 1.08 % and 2.41 %, respectively. This 1.31 difference is insignificant in the daily level and has minor impact to the market comparisons. All in all, in the existence of low risk-free rates, the market model and CAPM provide results that are almost equivalent with each other.

4.4 Robustness

4.4.1 The effect of Tesla on CAR

The data of 169 corporate green bonds incorporates 76 companies. In terms of announcement quantity, Tesla Inc. is largest by 31 green bonds. Because Tesla has a large share of total bonds, particularly in Non-Europe, and a higher beta than an average company within this study, it is relevant to examine what the effects of Tesla to this study are. The significance of Tesla for different sub-samples is presented in Table 16.

Table 16: Significance of Tesla on sample results

	CAR [-1, 0] %			
Sample	Market return model	Market model	CAPM	Observations
Tesla	0.889**	0.946**	0.951**	31
Non-Europe sample excluding Tesla	-0.511*	-0.403*	-0.409*	39
Aggregate sample excluding Tesla	0.087	0.107	0.103	138

Marks *, ** and *** denotes the significance at the 10 %, 5 % and 1% level, respectively.

The green bond announcements of Tesla have resulted to significantly higher CARs [-1, 0] compared to the overall sample. Market model and CAPM model show 0.946 % and 0.951 % CAR [-1, 0], respectively. Despite of the small sample size, 31 observations, both of these results have a p-value, which is smaller than 0.05. When excluding Tesla from

the overall sample, the CAR [-1, 0] of the aggregate sample is only 0.107 % or 0.103 % depending on market model or CAPM, respectively. In addition, the exclusion of Tesla increases the CAR [-1, 0] p-values so that they are over 0.1.

Excluding Tesla from Non-Europe sample amplifies market preference differences between European and Non-European market. After the exclusion of Tesla, the Non-European CAR [-1, 0] is -0.403 % and -0.409 % in market model and CAPM, respectively. Both of these results statistically differ from zero within 10 % level even though sample size is only 39.

To refresh the memory on earlier results, the CAR [-1, 0] for European market was 0.308 % and 0.305 % in market model and CAPM, respectively. And these results were as well as significant within 10 % level. Thus, both markets have significant CARs [-1, 0] to opposite directions, which suggest that market differences are prevalent between European and Non-European market.

Figure 13 differentiates the Tesla data points from other data points. Majority of green bond announcements of Tesla were conducted during 2015. This explains why Non-European green bonds outperformed European green bond announcements during 2015. Moreover, the Figure 13 depicts that CAR [-1, 0] around Tesla's green bond announcements tend to fluctuate more than in another green bond announcements. This notion is in line with Tesla's higher average equity beta compared to other companies.

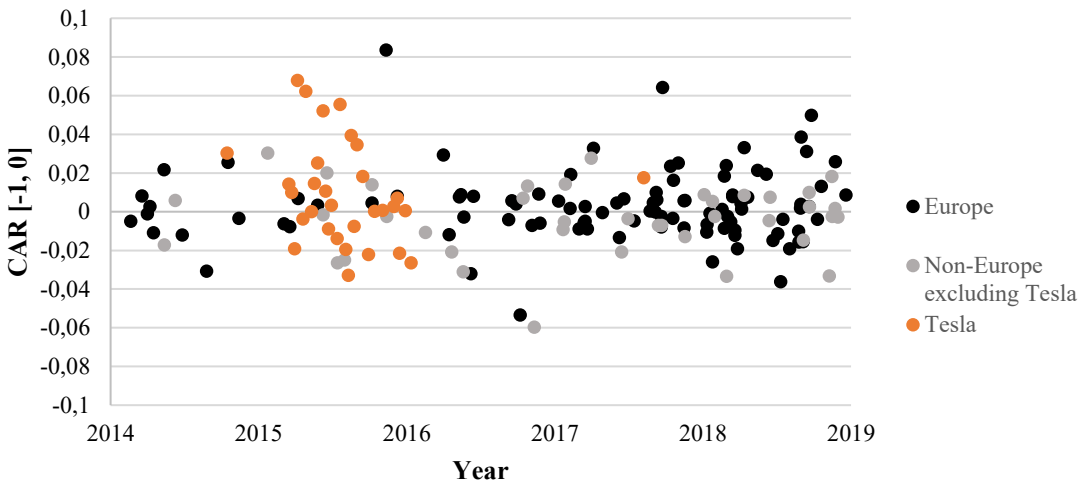

Figure 13: Scatter plot of CAR in different markets and Tesla (market model)

4.4.2 Robustness of sample and currency and segment differences

For the sake of parsimony robustness results for skewness, kurtosis, median and currency and segment differences are calculated only with market model. In addition, the robustness tests are only executed in [-1, 0] event window, which was the only event window that had p-values under of 0.1.

Skewness measures the symmetricity of the data, which is requirement for the normality assumption. General rule of thumb is that if skewness is either higher than 1 or less than -1 data is not symmetrical. The skewness for the aggregate data sample is 0.707 and skewness for European and Non-European sample are 0.991 and 0.509, respectively. Meaning that the data sample is little rightly-skewed but still symmetrical. Rightly-skewed data indicates the distribution to have a long tail towards high positive values. This is most likely caused by outliers with significantly higher positive values than the overall mean of the sample.

The overall kurtosis of the sample is 5.331. This indicates that the sample is peaked and more concentrated than a normal distribution i.e. the distribution is leptokurtic. Kurtosis that represents the perfect normal distribution is three. Hence, Non-European and European samples are also peaked. Particularly, Europe that has a kurtosis of 7.023. High

kurtosis of over three is not as harmful as low kurtosis values because it indicates that values are concentrated close to mean.

Based on the skewness and kurtosis all sample distributions are rightly-skewed and peaked. Meaning the sample outliers tend to be positive. Consistent with these findings the median is slightly lower than the respective sample means. Nonetheless, the median remains to be positive among the both markets of this study.

In a summary, skewness, kurtosis and median results for the different data samples do not possess major threat for the t-test results reported in the results chapter. The peakedness of data does not harm validity of t-test results and the sample is symmetrical. The sample is said to be symmetrical if skewness is under one. Hence, in terms of skewness, the European data is less valid for an interpretation of t-test results. Market model skewness, kurtosis and median are reported in the Table 17.

Table 17: Market model kurtosis, skewness and median

Sample	Skewness	Kurtosis	Median
All	0.707	5.331	0.120
Europe	0.991	7.023	0.169
Non-Europe	0.509	4.075	0.042

Remarkably all the issued currency means of CAR [-1, 0] are positive (Table 18). However, this noteworthy occurrence is not statistically valid in terms of p-values. Based on the green bond announcement CARs in different currencies, the higher European CAR compared to Non-Europe is driven by the Nordics. In terms of CAR, both the NOK and SEK nominated green bond announcements have outperformed the EUR nominated green bonds. Actually, to reduce the significance of market differences in CAR, USD nominated green bonds have outperformed EUR nominated green bonds, 0.183 and 0.164, respectively. Nonetheless, this result turns drastically opposite when Tesla is excluded from USD nominated bonds.

Table 18: CAR in different currencies

Currency	CAR [-1, 0] %	St. Error	P-value	Observations
CAD	1.001	-	-	1
EUR	0.164	0.227	0.236	57
GBP	0.819	-	-	1
NOK	2.935	1.879	0.108	4
SEK	0.232	0.295	0.218	27
USD	0.183	0.280	0.258	69

Marks *, ** and *** denotes the significance at the 10 %, 5 % and 1% level, respectively.

Table 19 presents CARs [-1, 0] in different industries according to Bloomberg's BICS classification. The highest CAR is in Materials industry, 1.03%. However, this result is inconclusive due to small sample size. Based on the sample size and p-value, the most significance CAR is in Energy industry, 0.841 %. This is partly caused by Tesla whose green bonds are allocated to energy investments. Most importantly, the industry analysis does not reveal any conclusive evidence on the association of equity beta and CAR around green bond announcements.

Table 19: CAR in different industries

Industry	CAR [-1, 0] %	St. Error	P-value	Beta	Observations
Consumer discretionary	0.733	0.931	0.231	0.408	7
Consumer staples	0.819	-	-	1.014	1
Energy	0.841**	0.459	0.037	1.150	40
Financials	0.305*	0.195	0.062	0.602	52
Industrials	0.193	0.330	0.289	0.799	11
Materials	1.038	1.738	0.329	0.527	2
Technology	-2.154**	0.650	0.040	1.025	3
Utilities	-0.171	0.263	0.259	0.693	53

Marks *, ** and *** denotes the significance at the 10 %, 5 % and 1% level, respectively.

5. Discussion

5.1 Theoretical and empirical findings

Literature review of this thesis had three goals: differentiate green bonds from conventional bonds, assess the pecking order of green and conventional bonds and test hypothesis to study CAR around green bond announcements. To address the first goal, literature review clarified and explained the theoretical framework for issuing green bonds. For the second and third goal, the literature review encompassed a theoretical background for pecking order of debt and green bond implications. Based on the theoretical review, the green bonds are positioned higher up in the pecking order of debt in terms of stock market reaction and cost of debt.

The purpose of the empirical part was to assess CAR around green bond announcements. These assessments were conducted in different markets over time. Data for assessments was retrieved both from Bloomberg green bond database and Thomson Reuters Eikon. Bloomberg was utilized to retrieve bond data and Thomson Reuters Eikon was utilized to connect the bond announcement dates with stock returns and market returns. The quantitative research assessments for CAR were executed with three different models: market model, market return model and CAPM. Both market return model and CAPM were utilized as a robustness tests for the market model. The research results of these models were tested in different event windows ranging from -20 days prior to the green bond announcement to 20 days after the green bond announcement to test the findings that were made in [-1, 0] event window. These results in the [-1, 0] event window were further assessed in terms of additional robustness test. These additional robustness tests assessed the robustness of market model results among different currencies and industries. Furthermore, the sample skewness and kurtosis were checked to test the one sample t-test significance measurements.

Quantitative research results found a significant CAR between years 2014 and 2018 in terms of t-test p-values. Nonetheless, the CAR had been fluctuating a lot within the study time frame. Thus, the results on CAR consistency were inconclusive. The results pointed

out market differences between European and Non-European market. Particularly, when Tesla Inc. was excluded from the sample the results differentiated significantly.

5.1.1 Positive CAR

The first hypothesis of positive CAR around the green bond announcements was supported with p-values between 0.05 and 0.06 within event window [-1, 0] trough three different models market return model, market model and CAPM, 0.234 %, 0.261 % and 0.259 %, respectively. Other time frames between 20-days prior and after the green bond announcement were not significant according to p-values. However, this finding supported the first hypothesis argument that CAR's are concentrated to close proximity of green bond announcement.

CAR results were somewhat in line with prior studies. In terms of significance in [-1, 0] event window, the results were consistent with Flammer (2018), who reported CAR of 0.67 % through market model with smaller p-value than 0.05. Tang & Chang (2018) reported insignificant results with CAPM, during [-1, 0] event window but they reported strong positive results within aggregate 21-day [-10, 10] event window, 1.39 %. Equivalently with Tang & Chang (2018), Flammer (2018) reported positive CAR of 1.14 % during 41-day [-20, 20] event window. Compared to these studies, the market model CAR within [-20, 20] event window was only 0.073 %. This is somewhat interesting and peculiar because I applied similar methods than in the study of Flammer (2018) in terms of model, event window and parameter calculations. Different results indicate three possible findings. First, CAR fluctuations between data years. Second, decreasing CAR in 2018. Year 2018 was not included in the samples of Flammer (2018) and Tang & Chang (2018). Third, the study of Flammer 2018 includes green bonds from other currencies than were represented in this study, and these green bonds have a higher CAR compared to presented currencies.

5.1.2 Fluctuating CAR over time

There was no evidence of increasing CAR during the sample time frame between years 2014 and 2018. Thus, the second hypothesis of increasing CAR around green bond announcement over time was rejected, based on [-1, 0] event window results. Due to data concentration on years 2017 and 2018, the CAR was more consistent among the latter part of data. Furthermore, the results particularly from years 2014 and 2016 are inconclusive due to small sample sizes. In line with CAR presented in previous studies, the CAR was remarkably higher during 2015, reporting nearly a CAR of 1 % on an annual level.

Results on CAR over time indicate that CAR's around green bond announcements are mostly positive on the annual levels. However, the CAR returns are fluctuating strongly; and therefore, it should not be self-evident for corporate managers that green bonds announcements are beneficial actions for shareholders in terms of stock market reactions.

5.1.3 Inconclusive market differences

Third hypothesis of significant market difference between European and Non-European market in terms of CAR was mildly supported. Based on [-1, 0] event window results, all the models of this thesis reported over 0.1 % CAR differences between the markets in favor of European market. Market model showed 0.308 % and 0.194 % CAR for European and Non-European market, respectively. The results of the European market where significant within the 10 % level as the Non-European results were not significant. Nonetheless, the significance of test results is decreased due to small and different sample sizes between the markets. Thus, only one sample t-test were conducted.

The results indicate mildly different investor preferences among markets. In addition, the results show that depending on the market the corporate green bond announcements are value enhancing actions for corporate managers. This argument is supported in robustness tests, which report positive CAR around green bond announcements for all currencies within [-1, 0] event window.

5.1.4 Tesla Inc. amplifies market differences

The sample data of corporate green bonds is concentrated, which may cause results to be biased. For this reason, it is noteworthy to point out that the sample of this study incorporates 31 green bonds issued by Tesla Inc. In terms of company characteristics, Tesla differs greatly from energy, utility and real estate companies that represent the wide mass of sample data. Compared to these companies, Tesla is a company that has a strong growth and it operates in a new field of industry. Thus, the beta of Tesla, 1.31, is significantly higher than the average of overall sample, 0.77.

Tesla has significant implications to all three hypotheses of this thesis. It reduces the overall CAR, explains especially high CAR during 2015 and amplifies the market differences between European and Non-European markets. When excluding Tesla from market model results, the CAR [-1, 0] for the aggregate sample is only 0.087 % and the CAR [-1, 0] for Non-European market excluding Tesla is -0.511 %, which is consistent with the results of conventional bond CAR's around bond announcements (Mikkelson & Partch 1986).

Substantial amount of Tesla's bonds where announced during 2015. This is probably one of the main reasons for the test results differences between this and prior studies. Prior studies on CAR around green bond announcements do not incorporate 2018 data. In a summary the results of Tesla indicate three new aspects that the prior studies have not been addressed. First, in the global level the CAR's around green bond announcements are insignificant. Second, there are significant market differences in CAR's around green bond announcements. Third, CAR's around green bond announcements tend to correlate with company beta. The conclusions of hypotheses are presented in Table 20.

Table 20: Conclusion of hypotheses

Hypotheses	All sample result	Results when excluding tesla	Conclusion
H1: CAR around green bond announcements are positive	Weak support	Rejected	Depends on market
H2: CAR growth after companies' green bond announcement has been increasing over time	Rejected	Rejected	Rejected
H3: CAR increase around company's green bond announcement is higher in European than Non-European market	Weak support	Supported	Supported

5.2 Implications

Compared to previous studies on the corporate green bond announcement effects to CAR (Flammer 2018 and Tang & Chang 2018), this study scrutinizes the underlying data and points out market differences. Through the critical assessment of data, this is the first study on this topic to recognize significant market differences and insignificant CAR globally around green bond announcements. Furthermore, given light the results of previous studies, this study indicates that CAR of green bonds compared conventional bonds (Mikkelson & Partch 1986) and convertible bonds (Dutordoir et al. 2016) is significantly higher in the European market but equivalent in the Non-European market

Despite of showing in significant global CAR around green bond announcements, the results of thesis encourage corporate managers to issue green bonds. Together with Flammer (2018) and Tang & Chang (2018) the thesis results do not show any evidence that green bonds should be positioned lower in the pecking order of debt than conventional bonds. In addition, according to increasing political pressure of economy decarbonization and development of green bond taxonomy, it is unlikely that conventional bonds would outperform green bonds in future in terms of pecking order of debt.

By solely interpreting CAR around green bond announcements, the gains of green bond might seem to be small for corporate managers. A diminutive positive CAR near to zero,

will have little effect for their decision making. Attitude of corporate managers might change after a comparison of green bond CAR results with conventional bond CAR results. Then the CAR gain could be over 1 % for green bonds. However, for some corporate managers this could be still a diminutive gain compared to external review cost that are associated with green bond issuances. Thus, in terms of corporate financial benefits the green bonds become financially beneficial for corporate managers only when the aggregate benefits of green bonds are summed up. In light of positive CAR around green bond announcements, negative green bond premium, increased stock and bond liquidity, improved credit rating and improved financial performance, green bonds are valid value enhancing activities for corporate managers.

5.3 Limitations

The main limitations for the results of this thesis can be divided into four categories: sample size, sample scope, market preferences of global companies and history of green bonds.

Size of the sample possesses limitations for the market preference comparisons. For instance, excluding Tesla from Non-European companies decreases the sub-sample to only 39 bonds. Thus, comparing differences between 99 European bonds and 39 Non-European bonds gives rise to some validity issues. However, to support the findings, the average company characteristics of these two sub-samples are close to each other. Related with sample size, the scope and methodology of the research has excluded green bonds that have been incorporated in previous studies in terms of announcement year, currency and 100 % ownership of public parent company. Thus, the straight comparison with Flammer (2018) and Tang & Chang results (2018) might hinder some comparability issues. Moreover, both Flammer (2018) and Tang & Chang (2018) incorporate all issued green bonds by public companies whereas this study focuses on limited amount of currencies to study developed markets.

When measuring market differences between European and Non-European market, the home country of the company might not be the right expectation for the home market. Majority of companies that are included in this study operate globally. Thus, the

companies might be both listed in European and Non-European stock exchange. In addition, both European and Non-European companies have significant number of shareholders outside of their respective home markets. Thus, especially in the case of large global conglomerates it is valid to ask whether the result is caused by market or global preferences.

The fourth limitation of this study is associated with the short history of green bonds. Naturally, the data size of green bonds announcements substantially differs from the data of conventional bond announcements. Thus, the validity of results in terms of sample size is not comparable.

5.4 Suggestions for further research

The topic of CAR around green bond announcements is little studied. Furthermore, the market of the corporate green bonds evolves and matures constantly. Due to these aspects, the results that have already published might become negligible in future as new data emerges. Hence, new research is required to replicate earlier findings and to take insight into factors that cause and amplify CAR around green bond announcements.

This thesis suggested that company beta amplifies CAR around green bond announcements. However, the only statistical evidence for this occurrence is based on Tesla. In addition, there are no previous studies on the relation of public credit rating and CAR around green bond announcements. According to Oikonomou et al. (2014), corporations that issue bonds with environmental strengths have an improved credit rating. These and other potential factors that may cause and amplify CAR around green bond announcements, such as bond type and yield, should be studied further. Results on these fields would encourage corporate managers to execute green investments and facilitate them in executing optimal financial decisions.

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