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**Green Bonds as a Financial Instrument for
Businesses: Financial Performance, Effects on
Climate and Greenwashing**

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ABSTRACT:

Climate concerns are affecting financial decisions made by businesses in every industry. Green bonds are a modern financial tool to help businesses raise money for investments supporting sustainability, while signalling to investors and competitors in the industry of their commitment towards the environment. Green bond issuance can be hard on occasion, because a business issuing a green bond is making a commitment to the environment. This causes stricter oversee processes and reporting standards. Therefore, many businesses still rely on conventional bonds. To encourage green bond issuance, it is essential to explore the qualities of green bonds, both financial and environmental. Reviewing the performance through Signalling Theory and Efficient Market Hypothesis gives an overview on how green bonds perform financially and how the issuance affects investors and market. Still, investors might feel that the issuer is not committed to said goals or might be greenwashing their public image. Raising awareness of the mechanisms to mitigate greenwashing through green bonds helps investors trust the product more. Gaining investors trust improves the performance of green bonds and makes it a more attractive debt instrument for businesses.

Keywords:

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Figure 1, Growth of green bond issuance and number from 2007 to 2021, Data source: Bloomberg's Fixed Income Database (Liang, C.; Ma, X. & Liao, X.; 2024). Green bond market is considered to have begun in 2007. Growth before 2013 was slow and almost non-existent, but after the first corporate green bond in 2013 issued by Toyota growth shot up. Since then, the market size has improved significantly creating clearly more attraction for issuance with the market size reaching over 500 billion USD in 2021..... 14

Figure 2: Comparison table of findings about green premium in the source material. (Note: Liang, Ma & Liao (2025) presented twice to separate their findings about the effect of refinancing in green premium) 16

1 Introduction

The financial sector is continuously growing, and new increasingly complicated products flood the markets. During this growth in the late 2000's a new debt instrument called green bonds was conceived. Green bonds are bonds that allocate the collected funds for environmentally sustainable projects (Flammer, C.; 2021). Climate change has been a topic of conversation in the public for decades now, and the financial sector must acknowledge the concerns. Therefore, green bonds is an important topic to discover.

Measurements for green bonds performance are still very narrow. The novelty of these instruments causes measurement issues and access to data from allocation and effects in emissions is restricted. Another issue that appears regularly in the sources is refinancing, distorting the data in some sections. Since it appears in most sections, it is covered throughout the study. This study aims to bring together three main topics concerning green bonds, amidst the data restrictions and refinancing issues. The goal is to educate both businesses and investors about green bonds.

The central approach is to indicate why businesses would benefit from green bond issuance. Does it affect their performance in the markets and how investors view the issuers. Raising awareness for both businesses and investors on the performance of green bonds is important to improve the green bond market. To bring a more conclusive review, the post issuance effects cannot only be narrowed to financial benefits. This is why the study briefly looks at other measurement methods carried out after the issuance. A concerning issue in the green bond market is greenwashing. This is mostly covered by theoretical background in regulatory elements in the market.

This study looks at the financial performance of green bonds in the market, and how investors view green bonds. Growth in the green bond market is covered. Cost of capital is explored, and the study looks at green bond issuances effect on investors through the stock market. Green bonds performance during market stress is covered. Two hypotheses concerning the financial performance of green bonds are:

H1: Green bonds are an effective financial instrument for businesses.

H2: Green bond issuers attract investors in the market.

Green bonds can signal the investors of commitment the business has for their environmental footprint. This is best measured through emission intensity after green bond issuance. The data for this is narrow, but some measurements can be found from the source material. Therefore Hypothesis 3 is the following.

H3: Emission intensity improves for green bond issuers.

The thesis covers greenwashing. Greenwashing means that a company makes unsubstantiated and misleading claims about their environmental commitment according to Flammer (2021). Restrictions and guidelines for green bond issuances are covered in the greenwashing section, to find out if the legislative control for the market is sufficient.

Every one of the hypotheses tries to provide evidence for the question whether a business should issue a green bond or not. When examining the financial aspects there is evidence that green bond issuance creates positive reactions in the market. Looking at emission development post issuance there is evidence of lower intensity over a one-to-two-year time period. Exploring the guidelines for green bond issuance and reporting post issuance raises awareness about the process for both businesses and investors.

1.1 Structure of the study

In order to find evidence for the hypothesis' this study approaches the topic from three perspectives: financial performance, climate effects and greenwashing/regulation. Understanding and exploring each area provides a basis to answer whether or not businesses benefit from green bond issuance.

Measuring the performance of green bonds as a financial instrument was structured by exploring the market size and history, the yield differences to explore if the market is willing to give up yields for environmental benefits, and finally the investor perspective to explore the behavioural finance aspect in the market. The latter was approached by using the stock market as a measure of investor preference.

As a debt instrument for environmentally sustainable projects, expectations for sustainable growth grows towards the issuer. To explore the climate effects from the issuer, this study looks at emission reductions after green bond issuance.

Greenwashing is explored by looking at the regulation and reporting mechanisms and looking at the possible channels and possibilities for greenwashing. Rather than looking at past evidence of greenwashing the study focuses on how it can be prevented and what issues greenwashing creates. Lack of evidence and studies in the matter narrowed the section down. The latter two areas are supporting or opposing the financial performance area, and the study is not as involved around those areas.

1.2 Purpose of the study

The purpose of this study is to find evidence on behalf or against the issuance of green bonds and their reliability as a financial instrument. The approach is concerned on the effects of green bonds and aims to provide evidence of the benefits for businesses.

Demski, Dong, McGuire, & Mojon, (2025) state that the Paris Agreement in 2015 caused the financial sector to focus on environmental issues. After the Paris agreement industries started to focus more on their emission goals. For businesses to reach their emission goals, additional funding is required and this study explores the financing of environmentally sustainable projects and development through green bonds.

Research was conducted from studies that focus on the financial aspects of green bonds. The novelty of the subject caused slight restrictions on research. Therefore, it is highly likely that arguments made in the study can either receive supporting or contradicting evidence in the future. The findings on this review focused on the evidence found from several sources and comparing the findings from the sources. Inclusion criteria included current studies, which are all written in the 2010's, sources for the theoretical background excluded. The supporting chapters about climate effects and greenwashing are conducted on the basis of the existing evidence. This study aims to conclude evidence to support green bond issuance for businesses. It also enlightens the process of issuance and possible post-issuance effects.

2 Theoretical background

This chapter covers the key theories applied or evaluated in the study. This study is a literature review so there is no empirical section. The theoretical ground covered is applied to or taken from the source material.

2.1 Signalling theory

Signalling theory is based on information asymmetry in the markets (Flammer, C.; 2021). She states that businesses know more about their own capabilities than their investors, causing asymmetry between the business and investors. This asymmetry causes difficulties for the investors to find companies with the right attributes they want to invest in (Flammer, C.; 2021). This issue can be mitigated through signals to investors, in this case via green bonds. Green bonds signal investors of the business's commitment towards sustainability and is viable in this study as presented later.

2.2 Efficient market hypothesis

Efficient market hypothesis (EMH) is a prominent theorem in modern finance. First introduced by Fama (1970) it has since been interpreted in modern finance constantly. Fama (1970) claims that the market works efficiently when all available information is available to investors. This leads to three categorisations of the EMH. Fama (1970) presents that weak form is when only historical prices and returns are reflected in the price of the stock. In the semi-strong form, all available public information is affecting the stock. In the strong form even private and insider information reflects in the prices of stocks. Market efficiency post green bond issuance is evaluated in the study.

2.3 Behavioural finance

Investor's reactions to green bond issuance and the appeal of a green bond issuer to investors is evaluated through behavioural finance. Behavioural finance focuses on

investor behaviour and why investors make certain decisions in the market. Climate concerns affect investor preferences in the stock market. In this review the stock market reactions after green bond issuance are evaluated. In addition the preferences institutional investors have in the stock market concerning climate issues is covered.

2.3.1 Socially Responsible Investing theory

Socially Responsible Investing (SRI) theory is based on responsible investment choices. Berry & Junkus (2012) explain that when investors (institutional or private) are constructing a portfolio, they exclude businesses that are from industries that are considered harmful for society, for example military technology, tobacco or pornography manufacturers. By constructing a portfolio excluding certain manufacturers investors can still participate in the market without supporting harmful business models or industries.

Applying this theory to green bonds is relevant because by including green investment products to portfolios it strengthens the SRI targets of said portfolio. Also, as discovered further in the study green bonds can be used as a hedging or diversification instrument so investors can benefit from investing to green bonds in multiple ways.

The theoretical background presented is most applicable to the following chapter which focuses on the financial performance of green bonds. Different approaches in examining the financial performance opens different views on the theoretical background. All findings from the next chapter are later mirrored on the theoretical background.

3 Financial Performance of Green Bonds

To find basis why businesses should issue green bonds, there are several things to take in consideration. The background on what green bonds are and how the green bond market has grown helps understand the perspectives on the investor side. Seeing how investors react to green bond issuances and issuers opens the performance aspect.

It is also important to see how the stock market reacts to green bond issuances. The stock market speaks a lot about how both institutional and private investors perceive a business. This section hopes to find a conclusion to Hypothesis 2. Looking at how green bonds react to altercations in the market gives understanding of the volatility of green bonds. To begin reviewing the financial performance, background, rationale for issuance and market history are the logical place to start.

3.1 Background on green bonds

“A green bond is any bond instrument where the proceeds will be exclusively applied to finance or refinance, in part or in full new and/or existing eligible green projects”, (Bhutta, S.B.; Tariq, A.; Farrukh, M.; Raza, A. & Iqbal, M.K.; 2022). According to Flammer (2021), such projects can include renewable energy, sustainable construction and resource conservation. With a green bond, the issuer is agreeing to pay a premium for the buyer with a fixed rate (Flammer, C.; 2021). Flammer (2021), tells that when issuing a green bond, the issuer needs a third-party verification for the allocation of the collected funds to go into environmental targets. The green bond market is larger in industries where the natural environment is financially material to the companies (Flammer, C.; 2021). After defining green bonds, the rationales for issuance need to be understood.

3.1.1 Rationales for issuance

Flammer (2021) lists three rationales for issuing green bonds. First is that green bonds serve as an indicator for investors and the market, about the business’s commitment

towards the environment. According to the signalling theory investors can lack sufficient information about a business's commitment towards environment and therefore green bond issuance raises investor awareness and can improve the financials of the business (Flammer, C.; 2021).

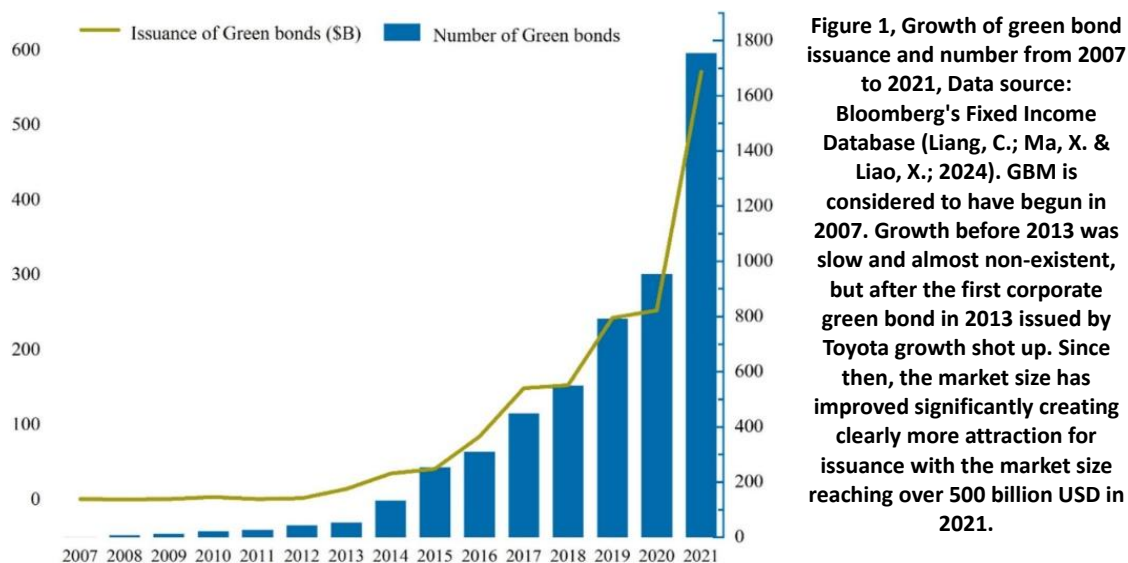
The second rationale is greenwashing, which means that a company makes unsubstantiated and misleading claims about their environmental commitment in order to win the trust of customers or investors (Flammer, C.; 2021). Greenwashing is covered more broadly in Chapter 5.

Third rationale is that if investors are willing to trade off profits for environmental effects, it should offer the business a cheaper cost of capital (Flammer, C.; 2021). This can be evaluated through the green premium which will be covered later in this chapter. These arguments come up in different sections of this study. Before moving to the actual performance review, green bond market history and size need explaining. This furthers the understanding of the novelty of these instruments.

3.2 Market size and history

It is considered that the first green bond was issued in 2007 by the European Investment Bank (EIB), and it was issued for environmental reconstruction and development (Liang, C.; Ma, X. & Liao, X.; 2025). The first notable corporate green bond was issued in 2013 by Toyota to finance leases and loans for fuel efficient cars, after which the corporate green bond issuance started to popularise (Bagnoli, M. & Watts, S.B.; 2019).

“The global market share of green bonds presently stands at less than 1 % of the overall market for traditional bonds indicating considerable potential for growth”, (Meo, M.S.; Afshan, S.; Zaied, Y.B. & Staniewski, M.; 2025). The green bond market (GBM) had a surge in 2021 when the size of the market increased by nearly 60 % from 297 billion USD in 2020 to 517.4 billion USD in 2021 (Pyka, M.; 2023).



All events mentioned above can be seen in Figure 1. 2007 is considered the starting point for green bond issuance and since the 2013 Toyota green bond issuance it is visible how much the market has grown. Pyka (2023) states that the GBM is predicted to grow to 1.5 trillion USD in 2025. In a Q1 report from Bank of International Settlements (2025), writers Demski, Dong, McGuire & Mojon report that in March of 2025 the GBM capitalisation was estimated to be worth 2.9 trillion USD. This is nearly six times the market value in 2018, and 1.4 trillion USD larger than Pyka (2023) predicted in his article. This signals significant growth in the green bond market.

Another key takeaway from Figure 1 is the year 2015 which was a major turning point for the GBM. Demski, Dong, McGuire, & Mojon (2025) state that the major reason for this was the Paris Agreement in 2015, which prompted ambitious emission targets around various sectors. This was complemented by much stricter requirements for reporting and transparency for corporate emissions.

As the GBM keeps growing, understanding the possible financial benefits of green bonds for issuers is important. First concrete approach to evaluate the financial performance of green bonds is finding out whether or not there is an existing yield difference between green bonds and conventional bonds.

3.3 The green premium

As Flammer (2021) states, there is an argument that businesses can use green bonds as a tool to gain cheaper capital. This is explored through the green premium effect, which means a lower yield percentage for bonds that allocate collected funds to environmentally sustainable targets (Flammer, C.; 2021). The basic argument is that investors are willing to give up yields for environmental benefits. The green premium can be defined by comparing a green bond and a conventional bond with similar properties in the market (Zerbib, O.D.; 2019).

Study (Year)	Sample Size & Scope	Time Period	Methodology	Definition of Green Premium	Main Findings	Statistical Significance	Key Notes / Interpretation
Zerbib (2019)	110 green bonds (~17% of issued worldwide)	2013–2017	Matched green bonds with synthetically built conventional bonds with similar characteristics	Yield difference between green and matched conventional bonds	-2 bps (-0.02%)	Low	Evidence of green premium, but statistically insignificant
Tang & Zhang (2020)	Corporate green bonds vs corporate bonds	Not specified	Comparison across firms and within same firm and year	Yield spread between green and non-green bonds	+6.94 bps (0,069%) (higher yield for green bonds)	Not significant when same issuer/year	Suggests firm-level reputation effect, not green premium
Flammer (2021)	All green bonds issued	2013–2020	Comparing green bonds with conventional bonds from same issuer	Yield difference for issuer and bond characteristics	No significant difference	Not significant	Questions the existence of green premium for issuer

Liang, Ma & Liu (2025)	1,692,213 bonds from 53,912 entities	2007-2022	Large-scale empirical analysis	Yield difference between green and conventional bonds	-18 bps (-0.18%)	Significant	Large take implicates a realistic green premium
Liang, Ma & Liao (2025)	Subsample of green bonds	2007-2022	Refinancing vs new project financing	Yield difference by use of proceeds	-22.9 bps (-0.22%) (new projects); small for refinancing	Significant	Refinancing reduces average due to greenwashing concerns

Figure 2: Comparison table of findings about green premium in the source material. (Note: Liang, Ma & Liao (2025) presented twice to separate their findings about the effect of refinancing in green premium)

The first look at Figure 2 shows contradictory findings. Even though the methods in every single study are slightly different, because of the sample size or the methodology, the findings can be interpreted as follows.

A solid definition of green premium is impossible to make from the findings. However, when approaching the two studies that presented evidence for the green bond, the largest take in the sources found a significant yield difference. Liang, Ma & Liao (2025) present a -18-bps yield difference from their findings. A take that sized and a finding that is statistically significant speaks on behalf of the green premium. Although the other supporting article by Zerbib (2019) found no statistically significant green premium, the evidence can be interpreted for the green premium.

Flammer (2021) on the other hand, had different findings and her take is the nearest comparative to Liang, Ma & Liao (2025) take. Flammer (2021) found no significant yield difference between green bonds and conventional bonds issued by the same company. The take in Flammer's (2021) study was all issued green bonds between 2013-2020. The study was completed by comparing green bonds to conventional bonds with similar attributes. When reviewing the results it is clear that different methods and takes in defining the green premium gives different results. Two out of four findings support the

green premium. Whilst Tang & Zhang (2020) found a positive premium, they found no significant yield difference comparing the results to the same companies' conventional bonds. Flammer (2021) found no significant yield difference.

The differing results can be interpreted in a few different ways. Since there is evidence from two different sources that the green premium is existent, it can be defined but under conditions. Whether or not the green premium is dependent on the company has not been defined, and this has to be taken into consideration. Findings from Tang & Zhang (2020) claim that the yield difference is not related to whether the bond is green or not. This can mean that bonds issued by a company that has issued green bonds, has a more positive image amongst investors. Therefore, investors have an environmental motive behind their investment decision.

Furthermore, Fatica & Panzica (2021) bring up in their article refinancing as an issue. This means that some green bonds are issued to refinance already existing projects. If a green bond is issued to refinance a project already financed by conventional bonds, it likely does not offer the same environmental incentive for investors. A green bond issued for a completely new project is more appealing. Liang, Ma & Liao (2025) explore the refinancing issue in their article and find that investors look at green bonds issued for refinancing more sceptically in fear of greenwashing. Furthermore, they found that green bonds used to finance completely new projects has a negative -22.9 bps benefit. When green bonds were used for refinancing they found a much smaller or a non-existent premium. This explains the before mentioned negative -18 bps Liang, Ma & Liao (2025) found, meaning the green bonds used for refinancing lower the average premium of the take.

The clear reduction in the premium after refinancing bonds were taken into consideration, speaks about investor vigilance. Investors want to make sure that the instrument they are investing in, allocates the funds where the business claims to allocate them. This supports the theory behind green premium. Investors want to make

sure that their investments are allocated correctly and therefore are willing to agree to a lower yield from the bond. This leads to a cheaper cost of capital for the business issuing the green bond.

As mentioned above the green premium can be defined. However there are variables like the refinancing issue and a business specific effect that can alter the understanding and definition of a green premium. Investors seem to be mostly aware of the basic issues related to green bond issuance. For example, green bonds used for refinancing are far less popular among investors than green bonds issued for new projects. Although investors are aware of different factors in the green bond market, issuing a green bond does not necessarily mean a lower cost of capital. As the findings are contradictory, H1 is not proven by this section alone.

Since the arguments for lower cost of capital are not bulletproof, reviewing how investors behave after and during green bond issuance becomes important. The most concrete place to evaluate this is the stock market.

3.4 Investor perspective

Investors and their perspective are a useful tool to evaluate how a business or a financial instrument performs. To understand the use of green bonds as a financial instrument it is important to look at green bonds from investor perspective and the effects green bond issuance has on investors. The green premium discussed in previous chapter is a direct effect caused by investors, but there are other effects that investors cause and experience because of green bond issuance. When using a debt instrument a business must evaluate whether or not the instrument is appealing to investors and how the business is perceived after issuance. The logical place to look at for investor reactions is the stock market.

3.4.1 Stock market reaction

As mentioned in the review before, in order to issue green bonds a business needs a third party to verify that the proceeds from the bonds will go to environmentally sustainable projects. This requires transparency from the issuer and stricter reporting, therefore more information about the business is available to investors.

The issuance of a green bond causes news coverage and expanded google searches, which broadens the conscious investor base, which moreover increases liquidity (Bhutta, S.B.; Tariq, A.; Farrukh, M.; Raza, A. & Iqbal, M.K.; 2022). Bhutta, Tariq, Farrukh, Raza & Iqbal (2022) tell that this channel is often referred to as the investor attention channel. In addition to the liquidity of the issuer stock, Tang & Zhang (2020) found in their study that stock turnover increases during green bond issuance. The bid-ask spread of the issuer of a green bond was more favourable (lower) than for a compared business issuing conventional bonds.

Green bond issuance reveals detailed information about the future projects of the issuer and works as an information channel to investors (Tang, D., Y. & Zhang, Y.; 2020). Tang & Zhang (2020) claim that this reduces information asymmetry which helps investors do more rationalised decisions about their position on the stock. As Flammer (2021) stated green bonds can be used to signal investors of the issuer's environmental commitment, agreeing with the signalling theory. More available information in the market makes the market more efficient giving basis to the efficient market hypothesis.

Furthermore, the expanded reporting increases stock price informativeness (SPI), (Wang, H. & Jiang, S.; 2023). Their study implies that the larger the asset size, the smaller the impact on the SPI. The larger the business the bigger their share is in the index, and therefore large businesses tend to be more synchronized with the market, (Wang, H. & Jiang, S.; 2023). In the other hand smaller businesses benefit from more specific information about their stock to attract a larger investor base.

The more information is available to investors, the more efficiently the markets work. Efficient market hypothesis tells that semi-strong markets have all public information effecting the price of the stock, hence effecting investors. Information disclosed during green bond issuance effect the stock price contributing to semi-strong market.

To explore the effect green bond issuance has for investors it is important to see how the stock market reacts. Tang & Zhang (2020) explore the post green bond issuance effect on the markets to the issuers stock and find a 1.4 % cumulative abnormal return (CAR) during a 21-day event window during and after green bond issuance. This abnormal return is often larger to a first-time issuer according to Tang & Zhang (2020).

Flammer (2021) found also a cumulative abnormal return of 0.49 %. Similar to the findings of Tang & Zhang (2020), Flammer (2021) also found that CARs are larger for first time issuers. Flammer (2021), also states that the CAR is larger for green bonds that have verification from an independent third party.

Similar with the green premium effect, findings from different sources vary. However, there is evidence that the stock market has a positive reaction for the issuance of a green bond. Again, similar to the green premium this is conditional and there are variables to what the reaction is. In this instance a large factor is whether the issuer is issuing a green bond for the first time or not. First-timers benefit more after issuance. Abnormal returns in the stock market proves a positive reaction to green bond issuance and strengthens H2. Positive reactions in the stock market also strengthen H1. If the issuers stock is positively affected amidst issuance, the instrument can be considered effective.

Looking at the green premium and the stock market reaction, the stock market reaction is more concrete and larger than the green premium effect. The issuers stock is affected more than their cost of capital. The stock market's reaction is more dynamic when it comes to green bond issuance, and it seems to effect investors more. The cost of capital does not remain as the only financial argument for businesses to issue green bonds.

Positive development in the issuers stock increases attraction and market capitalisation, improving the issuers public image. An improved public image can improve terms for loan, cooperation possibilities and customer relations, all which the issuer will benefit from.

Positive reaction in investors post issuance is a strong motive for green bond issuance. Even though this seems to be the case generally in the market, larger financial institutions may present a different view. Large financial institutions often bring a more informed or justified opinion in the markets, and their reactions might differ to the previous findings.

3.4.2 Institutional investors

Chapter 3.4.1 focused on the investor reaction in the markets to the issuance of green bonds. There are different operators in the market and whilst private individuals take part in investing it is vital to look at how institutional investors view green bonds.

Kreuger, Sautner & Starks (2020) conducted a study through interviews with large institutional investors and found out that the vast majority of institutional investors are taking climate risks in consideration when creating portfolios. According to the study, climate risks pose both nonfinancial and financial risks for portfolios, and managing this risk should happen through engagement, not divesting. Kreuger, Sautner & Starks (2020) also tell that to address climate issues, institutional investors with a longer investment horizon might first aim for a private intervention with the management of the business. Only if these private interventions fail, they take their reaction to the market. The institutions are trying not to upset the businesses stock by dumping them but rather play a part in the environmental development of the business.

Kreuger, Sautner & Starks (2020) found that institutional investors take climate risks seriously, and in terms of ownership this does hold true. Tang & Zhang (2020) found that institutional ownership increased 7.9 % after green bonds issuance compared to firms

issuing conventional bonds. However, majority of institutions growing their investments in the green bond issuers are domestic institutions, whereas hedge funds reduce their ownership in a business after green bond issuance (Tang, D., Y. & Zhang, Y.; 2020). Hedge funds reducing their stake in a green bond issuer could be reasoned by the possible default of the green label in the issued bond. By extension to signalling theory, if the business makes a claim for fund allocation from green bonds to have environmental effects, and this proves to be a false statement, or the business is found to make invalid claims about the allocation, it can have a negative impact on the business and its stock. Furthermore, this creates an unwanted risk for the hedge fund and that would explain why hedge funds steer away from green bond issuers.

Flammer (2021) discusses the green premium and its effects on institutional investors. According to interviews by Flammer (2021), some leading analysts and financial operators in high level institutions claim that they would not invest in a green bond if they had to give up yields. Flammers (2021) findings as stated in Chapter 3.3 present that there is no statistically significant yield difference between a conventional and green bond issued by the same company. The findings for green premium and the interview answers are aligned, so Flammers (2021) evidence is strong.

The effects of green bond issuance for institutional investors are contradictory to one another. Kreuger, Sautner & Starks (2020) found that institutional investors care for the climate effects of their investments especially in the long run. Tang & Zhang (2020) found that domestic institutions find green bond issuers an attractive investment excluding hedge funds who typically steer away from green bond issuers. Flammer (2021) contradicts most of this by claiming that institutions are not willing to give up yields for climate effects, although her interviews conducted with traders in large financial institutions only represent a small portion of all institutional investors. Institutions with a long investment horizon tend to care more about the climate risks that the businesses they invest in pose. Specifically, if this is happening domestically. In the big picture, some institutional investors don't seem to care whether the bond is green or not, as long as

the yields are competitive. H2 is true when the institution investing has a clear agenda in SRI, but for some investors this makes no difference. However, green bond issuance creates attraction in some investors, so H2 is true in this case.

It can be argued that because of the contradicting findings, the investment preferences in institutional investors can largely be contributed by the institutions investment policy and willingness to commit to the environment. If the issuer is committed to made allocation plans, H1 is true. Getting institutional investors involved, is important for the issuer. As mentioned before, institutional investors bring an informed and justified decision in the market. This strengthens the issuer's decision and creates trust in the market.

This all applies in a stable market, without increased market stress or volatility. Competitive yields in a healthy market are easy to measure, since bonds usually yield very stable. However, markets are not always stable. Looking at green bond performance during market stress gives a broader understanding of the instruments performance.

3.4.3 Market stress

To explore the stability of green bonds in the market, it is useful to look at how green bonds have behaved during the major stress spikes in the markets since the first green bond issuance in 2007, (Liang, C.; Ma, X. & Liao, X.; 2025). Given that the financial crisis of 2008-2009 happened right after the first green bond issuance, there isn't much to discover from that time period. To see how green bonds hold up against market crisis, their role as a safe haven – a stable investment during market turmoil (Meo, M.S., Afshan, S., Zaied, Y.B. & Staniewski, M.; 2025) – should be explored.

Meo, Afshan, Zaied, & Staniewski (2025) state in their study that because green bonds comprise for roughly 1 % of the conventional bond market, the effects of green bonds as safe havens or hedging instruments have not been studied enough. Meo, Afshan, Zaied, & Staniewski (2025) conducted their study by studying the co-movements of GBM and

various other financial markets before and during the COVID-19 crisis. These other financial markets consisted of conventional stock markets, Islamic stock markets, commodity markets, digital currency markets, conventional bond markets, Sukuk markets and foreign exchange markets.

Before COVID-19, Meo, Afshan, Zaied & Staniewski (2025) found that GBM behaved asymmetrically towards other financial markets, depending on the attitude of the markets (bearish, neutral or bullish). Meo, Afshan, Zaied & Staniewski (2025) state that according to the findings green bonds can be used as a hedging instrument or a tool to diversify a portfolio.

During COVID-19 the GBM had a negative correlation with other financial markets listed previously, (Meo, M.S., Afshan, S., Zaied, Y.B. & Staniewski, M., 2025). By having negative correlation compared to other financial markets, green bonds prove that the performance during market crises is stable and green bonds can be considered a safe haven. Reasons for this reaction in GBM can be that green bonds require an extra level of reporting and accountability which increases the credibility of the bonds. By being able to withstand the market stress, green bonds can be seen as an attractive investment that yields well during long-term ownership.

Because the instrument is stable during market stress, it can be considered an effective instrument as claimed in H1. The stability and effectiveness of green bonds during market stress also creates attraction for investors. H2 proves to be true, if investors consider the instrument stable and reliable.

The findings of Chapter 3 speak on behalf of green bond issuance. The evidence alone is not enough, but the findings should be mirrored to the theoretical background. This opens understanding of the benefits of green bonds further.

3.5 Findings mirrored on theoretical background

After exploring the financial performance of green bonds, the findings need to be mirrored to before mentioned theories. As covered in Chapter 2 there are three financial theories that this study reflects on green bonds. According to signalling theory the issuer of a green bond can signal to the market of their commitment towards sustainability and the environment. Findings about the green premium and stock market reactions present that investors have a positive perception of a business issuing green bonds. This leads to more positive market outcomes for the issuer. Even though findings on the cost of capital were contradictory, the stock market reacted positively to issuance. This means businesses benefit from green bond issuance generally more than issuing conventional bonds.

Signalling Theory can be linked to SRI theory. According to SRI, investors aim to construct their portfolios with more weight on responsible investments. The issuer of a green bond is signalling to the market that they are committed to sustainability which creates attraction in investors who are making investment decisions on SRI basis. This was proven by the stock market analysis. Tang & Zhang (2020) and Flammer (2021) found cumulative abnormal returns after green bond issuance, strongly suggesting that investors found the issuer stock to become more attractive after their commitment to sustainable financing practices and development. In addition, green bonds seem to perform well during market stress. Because of this, investors can use green bonds as a diversification or hedging tool to control volatility, all the while improving the responsibility of their portfolio.

Efficient Market Hypothesis explores what information is available to investors and how it affects the market. Since strong market (all information including insider information is available to investors) is practically impossible to reach, the findings support a semi-strong market hypothesis. Investors have public information and historical prices at hand to support their investment decisions. Increased reporting and oversee after green bond issuance improve firm-based information, which was proven to improve stock price

informativeness (SPI). This supports a semi-strong market hypothesis, because investors have more business-based information at hand to support or object their investment choices. Accelerated turnover in the issuers stock implicates that the information released ahead, during and after issuance creates more informed investment choices in investors. Also, a narrower bid-ask spread indicates that the market prices the stock more accurately due to the information released amidst green bond issuances.

Financial performance and effects caused by it, are not the only measuring factors for green bonds. Since the bond is issued for environmentally sustainable projects, looking at financial performance alone will not give the whole picture of these instruments. To see whether these bonds actually deliver what the issuer claims, post-issuance emission development is essential to look at. This gives clarity in whether green bonds are issued only to improve the public image of the issuer or are there actual effects on the climate.

4 Climate effect

As the previous chapter portrayed, green bond issuance offers positive outcomes in the markets. However, a lot of this is based on investors perception about green bonds and the benefits of these bonds. To see whether the positive reactions are justifiable, post issuance outcomes on the climate effects needs to be studied. Therefore, effects on the business's finances cannot be the only way to measure effects post issuance. To determine any effect on the climate, emission intensity is a central measure. Another reliable measure is Key Performance Indicators, that are used to measure outcomes from the bond issuance.

When measuring the effects post issuance, refinancing has to be taken into consideration again. This makes measuring difficult because the allocation is not directed to a profoundly new project. The amount of green bonds issued for refinancing is roughly 16 % from a pool of 1105 green bonds issued in the corporate sector during years 2007-2019 (Fatica, S. & Panzica, R.; 2021).

Fatica & Panzica (2021) state that most important data concerning the actual climate effects in projects funded by green bonds are hidden due to data limitations. They claim that ideal measurement conditions would involve detailed information from the projects and actual data on the effects and progress made. Fatica & Panzica also tell that the lack of legislative regulation is the reason why there is hardly any data reported from such projects. Because of limited data access and lack of research material, the conclusions in this section could be overcome in the future. The long-term effects post green bond issuance are yet to be explored simply because all of it is not yet measurable. This section is meant to increase the little understanding there is for now, about the post issuance effects of green bonds, beginning with emission development.

4.1 Emissions

Accurately measuring the effects of green bond issuance in the businesses environmental footprint can be difficult due to the above-mentioned reasons. The most efficient method is to look at emission development post green bond issuance.

Fatica & Panzica (2021) conduct their study by comparing two different bonds, one green and one conventional bond, and explore how the emissions change based on the issuer of each bond. They find that the green bond issuers have a reduction in emissions compared to the conventional bond issuer. Findings from Fatica & Panzica (2021) conclude that the reduction on emissions including bonds issued for refinancing purposes have a total of 4 % reduction in direct emission intensity. Furthermore, when excluding from the scope the bonds issued for refinancing, Fatica & Panzica (2021) find that, the reduction in emission intensity reaches a statistically significant 9 %. This difference in outcome is a distortion created by the refinancing bonds.

Flammer (2021) uses a matching method when determining effects of green bonds compared to conventional bonds. Her findings regarding emission intensity align with Fatica & Panzica (2021). Flammer (2021) finds a reduction of emissions per/1 million USD in assets, of 12.9 %. These findings are based on a longer period of time. The differing findings by Fatica & Panzica (2021) and Flammer (2021) could be explained by differing methods. Regardless, both findings support the improvement in emission intensity for the green bond issuer. Flammers (2021) take was from a longer period of time, and as the following findings prove this makes a difference when measuring emission intensity.

Benlemlih, Jaballah & Kermiche (2022) conducted research from issued green bonds between years 2013 and 2019. They narrowed selection down to 49 firms based on criteria and found that the post-issuance effect on firms issuing green bonds was significant in terms of emission grade, but not in CO₂ emissions. Thesis for this was that in order to record significant reduction in CO₂ emissions requires time. After deepening their research Benlemlih, Jaballah & Kermiche (2021) found this to be true. One year

after issuance CO2 emissions were significantly down, and a two-year measuring period carried even better results.

Findings presented above are coherent, meaning that post issuance effects of businesses issuing green bonds includes recordings of lower emission intensity. A central factor is that it takes time for the effects to take place so that they can be referenced as significant. However, the effects are measurable and are in favour of green bonds. These findings provide evidence for H3, green bonds do have an effect on the climate, albeit it happens over a longer period of time. The time factor leaves the emission measurements open for future research which might further prove it or deny it. The evidence points towards further reduction, but only time will tell. Meanwhile, there are other measuring methods for the post issuance effects.

4.2 Key Performance Indicators

After proving that emissions reduce post green bond issuance, other measurement methods need to be looked at. To further understand the measuring of a bond issued to improve sustainability, this chapter looks at an alternative way to measure effects of green bonds. When discussing green bonds, it is important to take notice of sustainability linked bonds, dubbed as SLB's (Feldhütter, P.; Halskov, K. & Krebbers, A.; 2024). SLB's are bonds that are used to finance projects that have one or more Environmental, Social and Governance (ESG) goals (Feldhütter, P.; Halskov, K. & Krebbers, A.; 2024). Key Performance Indicators (KPI) are a way to measure bond sustainability by ESG standards, rather than placing restrictions for fund allocation from the bonds (Feldhütter, P.; Halskov, K. & Krebbers, A.; 2024). KPI's suggest that the business issuing a green bond has reason to commit to the environment and society.

KPI's are often business specific (Feldhütter, P.; Halskov, K. & Krebbers, A.; 2024). Business specific KPI's are targets set for the business in specific, to maximise benefit from compliance. For example, a construction company can have a KPI measuring how affordable the housing they build really is, or a KPI aimed for a food company can

measure the food and water waste they produce (Feldhütter, P.; Halskov, K. & Krebbers, A.; 2024). To control the performance of the bond Feldhütter, Halskov & Krebbers (2024), explain that the KPI targets set for the issuer are measured, after which the coupon of the bond is adjust according to their performance. Compliance and good performance keep the coupon at level or slightly improve it and negligence or failure to meet targets raises the coupon.

Regarding SLB's or green bonds, the KPI's can be seen as an effective tool. Since the argument for cost of capital has not been proven, KPI's could serve as an incentive for both financial and ecological compliance for the issuer. Good performance in KPI scores can improve cost of capital as a levelled coupon. The issuer can improve their image by complying to the KPI's set to measure the sustainability of the issuer's actions. Since the investor perspective has been taken into consideration in previous chapters, it is therefore appropriate to do it again.

4.3 Investor attraction

The mentioned measurements of post issuance effects are very important considering the future of the GBM. The novelty of green bonds can cause uncertainty among investors, and as found previously in the study there is still a portion of the market who cannot justify investing in green bonds because of less competitive yields. Proving actual effects of environmental benefits from green bond issuance is a way to signal to investors that green bonds are a good investment option. For investors in doubt, both proof of emission intensity reduction and the controlling element of KPI's can work as a strong incentive to take part in the GBM.

Socially responsible investors are further attracted to issuers who can prove that their green bond has caused a reduction in emission intensity proving H2. Furthermore, reporting on emissions or using KPI's as a way to inform investors about the effects of fund allocation, improves an efficient market by releasing more information to investors. Reporting is not only a way to hold the issuer accountable but also attract investors and

improve market efficiency. Reporting standards are covered more broadly in Chapter 5.1.2.

If there is no proof of the emission reduction post-issuance the green bond becomes questionable. Fear of greenwashing makes environmentally sustainable products less attractive for investors. The next chapter covers the steps taken to mitigate greenwashing in the GBM, aiming to help investors trust the product more.

5 Greenwashing and regulation

The previous chapter proved that there is a reduction in emission intensity after green bond issuance. Though there are real and measurable effects after green bond issuance, some issuers only claim this without actual proof, in hopes of improving their public image. This chapter explores the issue of greenwashing. Greenwashing means that a company makes unsubstantiated and misleading claims about their environmental commitment, according to Flammer (2021). Controlling greenwashing can be difficult, but through tightened reporting standards presented in the European Green Bond Standard (Pyka, M.; 2023), it has become slightly easier.

Greenwashing is an important issue to look at, but more important is to explore the mechanisms and regulation created to tackle it. In the expanding GBM, both private and public bodies have taken steps to reduce greenwashing. Whether the means meet the targets is still unclear and therefore this chapter focuses heavily on the regulatory process for green bonds. After that it becomes easier to find out how and why greenwashing happens.

5.1 Certification, regulation and reporting

Flammer (2021), tells that when issuing a green bond, the issuer needs a third-party verification for the allocation of the collected funds to go into environmental projects or development. The third parties verifying that the issued green bond is used to raise funds for environmental projects, are often private. These third-party verifiers are not under any significant control of the broader government in the area they operate. This chapter focuses on the regulation and certification processes as well as reporting.

5.1.1 Certification and regulation

The GBM in EU is self-made and self-regulated (Pyka, M.; 2023). This has led to a response by the market itself to establish control over the certification process of green

bonds. Such bodies include International Capital Market Association (ICMA) and Climate Bonds Initiative (CBI) who have begun providing frameworks for green bond certification to legitimize the GBM based on their standards (Pyka, M.; 2023). The frameworks include the Green Bond Principles (GBP) and Climate Bonds Standards (CBS). These frameworks are supported by large banks globally and the frameworks are largely complied in the certification of green bonds (Flammer, C.; 2021).

The reason for certification is to help investors know that they are actually investing in bonds issued for sustainable projects (Flammer, C.; 2021). The process for getting certification for the green bond is guided by ICMA and CBI. They suggest the issuer gets a second party to review and consult on the issuance and finally a third-party verification for the bond (Flammer, C.; 2021). This ensures that the funds raised through green bonds are allocated responsibly, and in compliance of the frameworks provided by these institutions.

The privatization of the GBM raises issues. Since the GBM is self-governing, it has only limited enforcement mechanisms over the issuers (Flammer, C.; 2021). This raise concerns on the greenwashing issue. The fear is that without involvement of a governing body with legislative power, or even an enforcing mechanism, greenwashing becomes more prominent in the market (Flammer, C.; 2021). Although the regulation seems insufficient, Flammer (2021) found that reports after green bond issuance do record lower carbon emissions for the issuer, hence not proving that greenwashing happens on regular basis. Findings from Chapter 4.1 agree with Flammer. Although heavily privatised, the GBM is raising awareness in legislative entities as well.

5.1.1.1 European Green Bond Standard

The findings from Flammer (2021) are sufficient enough to implicate that the greenwashing argument can be denied. However, since the GBM is in rapid growth as stated in Chapter 3.2, it is likely that the regulation of such a large market becomes

increasingly difficult. The European Union has taken steps to tackle this issue, by drafting the European Green Bond Standard (EuGB) (Pyka, M.; 2023).

Pyka (2023) explains that the EuGB practically means letting go of private enforcement. The EuGB is based on four key requirements, and they are driven by public enforcement mechanisms. According to Pyka (2023), the first requirement is the EU Taxonomy alignment, which requires that the funds collected from green bonds are allocated to projects that align with the EU Taxonomy. Second requirement is full transparency, meaning detailed reporting on the allocation of the funds (Pyka, M.; 2023). Third is external review, which makes sure that requirements one and two are complied with, and fourth requirement is supervision over the external reviewers (Pyka, M.; 2023). Due to the complexity of the process the issuer can expect increased costs during issuance. Meanwhile this complexity opens the process up for falsely claimed statements, or even corruption. The sources neither prove nor deny this. The next logical step to prevent greenwashing would be post issuance reporting.

5.1.2 Reporting

The IMCA informs in their guidelines that annual reporting on the management of collected funds is mandatory, and there has to be a third party to review these reports (Fatica, S. & Panzica, R.; 2021). A common additional step that green bond issuers take, is disclosing the management of proceeds during issuance state. This means that they disclose the project the funds are collected for and the financial features of the bonds (Fatica, S. & Panzica, R.; 2021). Fatica & Panzica (2021) explain that this is done to increase transparency and therefore offer more detailed information orienting investors choices. This is relative to the SPI of the issuers stock that was brought up in Chapter 3.4.1, and was studied by (Wang, H. & Jiang, S.; 2023).

Reporting on the outcomes of green bond issuance is a complex topic. Fatica & Panzica (2021) address this by saying that impact reporting on green bonds is not mandatory under any given guidelines. Yet still Fatica & Panzica (2021) claim that impact reporting

is considered to be the best practice for monitoring effects after green bond issuance. Therefore, it remains unclear why reporting impacts is not made mandatory for issuers, and the effects must be monitored indirectly.

Essentially reporting after green bond issuance can be divided to two standards. Reporting of allocation, meaning the management of profits made from green bond issuance, and reporting of impact, that has been achieved with the fund allocation. Both standards become ambiguous if the bond is issued for refinancing. Refinancing was mentioned to repel investors because of greenwashing concerns. Refinancing is only one way, to greenwash a business's finance.

5.2 How greenwashing happens

Once the regulatory mechanisms of green bonds have been covered, it becomes easier to understand how greenwashing happens. Since the market is very loosely regulated, individual greenwashing incidents can be hard to point out. This chapter focuses on the main reasons why and how greenwashing happens.

Refinancing occurs as an issue again. As mentioned before, Fatica & Panzica (2021) found that 16 % of issued green bonds are for refinancing purposes. Liang, Ma & Liao (2025) found that investors hardly notice the differing green attributes of bonds. This causes a delusion in the investment process since investors might not be fully informed about the allocation process of the green bond or simply ignore it. Although Chapter 3.4 proves that investors do care about the environmental aspect in investing, the background work required when investing in green bonds can be insufficient for many investors. Furthermore, this leaves the door open for businesses to attract investors with false claims of their environmental commitment.

Because of weak legislative control in the green bond market, Pyka (2023) explains that when a green bond defaults, (meaning the green bond fails to meet the standards for

the allocation before maturity) there is no real financial repercussions to the issuer, or any reimbursement for the bondholder. According to Pyka (2023) this is because any financial repercussions are contract specific and therefore not universalised. In case of a default in a green bond's environmental standards, only the verification for the bond is withdrawn. This lack of repercussions hardly incentivizes green bond issuers to comply to the standards set by ICMA and CBI. Furthermore, the insufficient background work investors might have during investment process can tempt the issuer to neglect the standards set for fund allocation completely.

However, the findings of the study neither prove nor deny that the GBM would generally be used as a greenwashing platform. Since there is evidence that green bonds have an impact on emission intensity, and the financial reactions after issuance are generally positive it seems that greenwashing is not as regular as feared. Still, the lack of proper legislative control opens the market up for dishonest behaviour.

6 Conclusion

The goal of this review was to explore the financial aspects of green bonds, and post issuance effects. This was done to find out whether or not green bonds are a useful financial instrument for businesses or not. Findings vary from one another, as seen.

H1 claims that green bonds are an effective financial instrument for businesses. A growing market size gives grounds for a business to get involved in the GBM. The growth itself speaks for growing awareness in the green bond sector. The green premium evaluation doesn't unanimously give grounds for issuance. However, the green premium was significant in a study from Liang, Ma & Liao (2025). The take size was considerable and therefore it proves that the green premium is measurable, but conditioned. Investor reactions and preferences in the market provide evidence for the issuance. Investors seem to value efforts towards climate considerably. Stock turnover increases around issuance, which causes positive reactions in the market. Although this doesn't directly affect the cost of capital, it is concrete evidence of a positive market reaction. The findings from Chapter 3 can be interpreted to support H1, excluding the argument for cheaper cost of capital. Depending on what a business wants to accomplish through green bond issuance, the results can be read differently. One thing is clear though, investor reactions are positive, which leads to H2.

H2 was concluded in Chapter 3 and was found to be partially true. Whilst private and institutional investors are concerned for climate effects of the businesses they invest in, competitive yields are still a major factor. This can be reaffirmed by Chapter 3.3 which covers the green premium. Investors seem to care for the "greenness" of a business but are not willing to give up their own financial benefit. However, the stock market reactions to green bond issuance were found to be positive. Performance during market stress was good. The expanding GBM proves that investors pay more attention to climate effects. SRI theory also speaks for investor attraction. When it comes to evidence of reducing emissions post issuance, it comes clear that there are measurable effects from green

bond issuance. Most issuers seem to comply with their own allocation plans. This evidence together proves that H2 is true.

H3 claims that green bonds have actual effects on the climate. Findings from the source material prove this. The period after which emissions could be measured to be lower than the comparison point (businesses issuing conventional bonds) is roughly one to two years post issuance. This does not only confirm H3 but speaks of a positive effect in the long run for the issuers. Covered thoroughly this can bring more attention from investors and create growth in green bond markets. Proper covering also enhances investor trust.

As Chapter 5 discusses, the legislative control in the green bond market is fairly weak and most of the controls are based on guidelines. This reduces the amount of reporting mandated by the institutions setting the guidelines, like IMCA and GBI. Because the insufficient control mechanisms and inadequate repercussions from neglect, greenwashing is too easy in the green bond market. Majority of alleged greenwashing happens through refinancing, which makes the measuring of green bond markets so difficult. Despite insufficient control over green bond markets, majority of green bonds in the market improve the emission intensity of the issuer as presented in Chapter 4.

A general conclusion supports green bonds as a financial instrument for businesses. They behave well in the market and improve investors' perceptions of the company. Improved cost of capital is debatable, but there is evidence for it so counting it out completely is not necessary. Evidence from past issuers prove that emissions reduce post issuance, so committing to sustainable projects is worthwhile. However, when issuing a green bond, the issuer should make sure that it is for a new project and not a refinancing bond. Refinancing bonds raise concerns in investors and without measurable post issuance effects it can be determined to have been issued as a greenwashing tool. Even though sanctions for greenwashing are still very mellow, damage for the businesses image is unavoidable.

Green bonds are a reliable instrument for businesses. The market size is growing and according to the findings, investors are attracted to green bond issuers. Proof that emission intensity reduces post-issuance strengthens attraction for investors committed to SRI. Issuing a green bond therefore draws investors towards the issuer. This improves the public image of the issuer, if they are to comply with the regulatory elements and allocation plans. Taken all this into consideration, a business should consider issuing a green bond to finance sustainable projects. This benefits not only the environment, but the business as well.

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