# Green Bonds as a Tool of Green Financing

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# GREEN BONDS AS A TOOL OF GREEN FINANCING

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## Introduction

Underlying all great stories of innovation in human history is a story of innovative financing. For example, to bring the lightbulb to every household, Thomas Alva Edison needed the (then) innovative concept of a limited liability corporation. The next great challenge for humanity is to mitigate the causes of long-term anthropogenic climate change and adapt to the climate risks soon. Dealing with a multi-dimensional problem like climate change will require large-scale financing. The European Commission estimates that an annual investment of US $376 billion is necessary to address the most urgent climate concerns, such as net-zero greenhouse gas emissions, by 2050. Raising financing of this size will require new financial innovations, both from the private and the public sector. Towards that goal, corporates and business organizations are incorporating sustainability concerns in their business strategies. Some companies have sought to raise capital to (re)finance their green initiatives by taking on a new kind of debt called green bonds.

Green bonds are fixed-income securities committed to using the proceeds for green projects (Climate Bonds Initiative, 2019; ICMA, 2022). The proceeds from these bonds can be deployed to environmental projects consistent with the Paris Agreement's goals to limit global warming to well below two degrees Celsius (and preferably even to one and a half degrees Celsius)[1] To achieve these climate targets in the European Union, the European Commission President Ursula von der Leyen has set a target to raise climate action funds by issuing green bonds. These green bonds will comprise 30 per cent of the €750 billion issued under the Next Generation EU program. In addition, global leaders expressed taking further actions to counter climate change at the recent UN Climate Change Conference 2021 "COP26" (UNFCCC, 2022). This means that more funding focusing on green projects will be necessary in the coming years.

This chapter aims to provide an overview of the *corporate* green bonds market and generate questions for future research related to green bonds. Although also public sector and supranational institutions have issued, and are still issuing, green bonds, we focus on corporate green bonds for three main reasons. First, there has been an intense focus in recent years on the climate impacts of large corporations. Therefore, these organizations are under pressure to generate a new stream of financing for their decarbonization projects. Second, in many cases, public sector green bonds are issued to provide loans to local businesses for their decarbonization projects.


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Third, corporate green bonds can be seen as an important instrument to involve the private sector in greening the economy.

In particular, we aim to discuss and synthesize two key questions about corporate green bonds as a tool for financing a greener future. First, we discuss what factors may influence companies to issue green bonds. In that, we focus on factors related to financing needs and company, industry, and country characteristics. Second, we discuss the realized outcomes of green bonds on the company and the environment. In this part, we also focus on the concerns related to greenwashing motives of green bond issuance.

The remainder of this chapter is organized as follows. The second section discusses the nature of green bonds and how they differ from other types of bonds and green finance products. This section also provides a short overview of the trends in issuing green bonds from 2017 to 2020. The third section provides an overview of the research that has investigated the reasons why companies issue green bonds, while the fourth section goes into discussing the outcomes of issuing green bonds both for the issuing company, as well as for the environment. The fifth section provides conclusions as well as some suggestions for future research.

## Green Bonds: Concepts and Trends

The growing focus on green bonds as a financing instrument merits a broader understanding of the nature and effectiveness of these bonds. These debt instruments are voluntary capital-raising activities by companies to decarbonize the value creation process. Most green bonds are green "use of proceeds" or asset-linked bonds. Proceeds from these bonds are either earmarked for green projects or used to replace high-emitting assets with greener alternatives. Raising money through green bonds requires that an issuing organization invests or reinvests the proceeds exclusively in projects related to green technology, emission abatement, or adaptation to climate risks, that is, these projects should be geared towards contributing to investments in renewable energy and the energy efficiency sector to combat climate change (European Investment Bank, 2020).

Green bonds usually have the same credit profile as other vanilla bonds from the same issuer, but with an added covenant on environmental outcomes. To obtain the green bond label for the bond issue, an issuer must undergo specific processes as defined for instance by green bond standards by the Climate Bonds Initiative (CBI) and the International Capital Market Association (ICMA). Furthermore, ongoing monitoring of the use of proceeds through independent external parties and appropriate reporting is required for an issuer to maintain the green bond label for the outstanding financing.

The first green bond was issued by the European Investment Bank (EIB) in 2007 (European Investment Bank, 2022a), at this point labeled as the Climate Awareness Bond (CAB). Since this first green bond was issued, several other supranational institutions, such as the World Bank, the European Investment Bank (EIB) and the International Finance Corporation (IFC), but also municipalities, and state-owned banks, and companies have issued similar types of bonds. In some cases, institutions have used different labels, such as Forest Bonds (IFC, 2016), Catastrophe/disaster Bonds (World Bank, 2014), and Green Transition Bonds (European Bank for Reconstruction and Development, 2019) (Schumacher, 2020). In addition, institutions increasingly also issued bonds focusing on other sustainable development goals (SDGs) than climate change, examples being the Sustainability Awareness Bonds (European Investment Bank, 2022b) and the Sustainable Development Bonds (World Bank, 2017), the proceeds of which should be used to fund social projects. (Schumacher, 2020). The most recent development is the issuance of so-called green convertible bonds, which encompass green, social, and sustainable goals. The

development of these different types of labels has made the market for green bonds less transparent and has contributed to calls for creating uniform frameworks and standards regarding the definition of green bonds (Schumacher, 2020).

Since the first issue of green bonds in 2007, total annual green bond issuance has increased from less than US $1 billion to over US $250 billion in 2019 (see Figure 28.1), while the number of issues of these bonds has grown from less than 50 in 2010 to around 1,800 in 2019 (Figure 28.2). There is quite some diversity between countries in terms of the values and numbers of green bonds issued. The United States has been clearly leading in terms of total issuance amount (mainly due to bonds issued by municipalities), but China has become an important issuer as well. Within Europe, France is leading the market. In addition, emerging economies such as Mexico, India, and Indonesia have become active issuers of bonds (Weber & Saravade, 2019).

While public sector and supranational issuers have certainly been important drivers of the growth of the green bonds market, companies (including commercial banks) have become important issuers of green bonds as well, showing significant growth rates. In 2019, the total value of corporate green bonds issued was 114.3 billion dollars, a 44 per cent increase over the

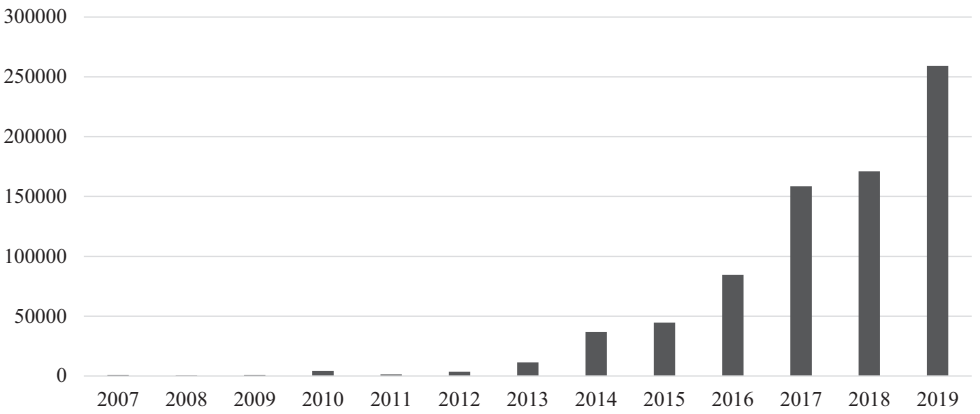


*Figure 28.1* Value of green bond issuance in US dollars (in $m). Source: authors' calculation from Climate Bonds Initiative data (2022)

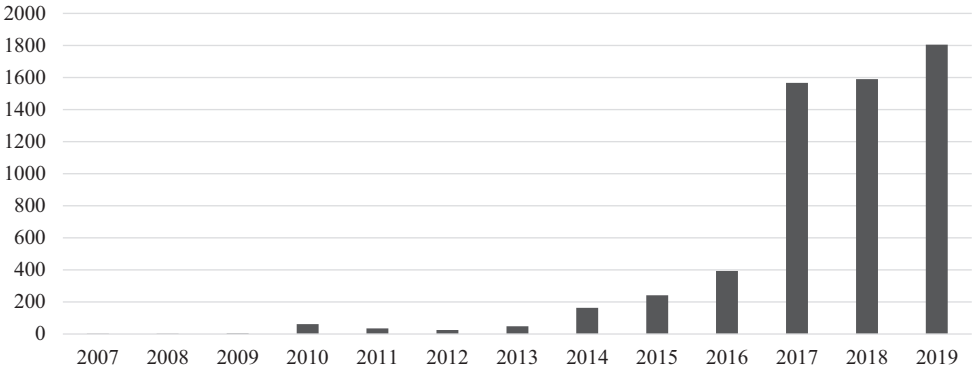


*Figure 28.2* Number of green bonds issued. Source: authors' calculation from Climate Bonds Initiative data (2022)

previous year (see Figure 28.2). The supply of green bonds by companies has steadily increased, and the demand for green financial instruments has also grown. These factors yield a price premium compared to conventional bonds (ING, 2021). Again, companies in The United States and, especially China, are most prevalent in issuing green bonds, measured in terms of the value of the issued bonds. In Europe, companies in France, Sweden, and, to a lesser extent, Germany and the Netherlands seem to lead the market in terms of the number of bonds; in terms of value, the Netherlands, France, and Germany are leading. In some emerging markets, such as Mexico, Brazil, India, Taiwan, South Korea, and Singapore, the corporate green bond market seems to have emerged recently as well, although both the number and value of green bond issues remain relatively low (Flammer, 2021).

Despite the growing popularity, there is no universally accepted definition of a green bond nor a global standard for how bonds can be classified as green. The most commonly used classification system is the Climate Bonds Standard of the Climate Bonds Initiative (Climate Bonds Initiative, 2019), hereafter, CBI. CBI is an international non-profit organization working on gathering and collating market intelligence, developing market standards, and guiding policy and regulation in the market for sustainable financing. CBI manually collects data on "green" securities issued by companies, governments, public institutions, and other organizations. CBI has its own criteria to classify a bond as green. Thus, even if a company describes its bonds as green, if the bond characteristics do not satisfy the predetermined criteria and undergo voluntary certification, CBI does not classify it as a green bond in its database.[2]

The lack of a globally accepted verification standard leads to widespread concern about greenwashing motives of issuing green bonds, i.e., the issuance of these debts is merely symbolic without any material impact on the environment. Such concerns plague the green bond market, as issuers are concerned with securitizing verifiable green assets, and investors are concerned about both the returns and the use of proceeds of these bonds. The European Commission aims to solve the current issues arising from the absence of a generally accepted standard by introducing its own standard for green bonds, the European Green Bond Standard (European Union, 2022a). This standard is supposed to embrace the current EU Taxonomy (for sustainable activities) that can be seen as a classification framework for sustainable investments and activities (European Union, 2022b). Further European initiatives, such as the Sustainable Finance Disclosure Regulation (SFDR), which requires certain types of institutional investors to report on their approach towards ESG risks in their portfolios (S&P Global, 2021), will certainly play a role in introducing these standards into common business practice and support the growth of the green bond market.

The introduction of the targets by the European Union and the wider international commitments highlight the importance of green bonds as a financial and public policy tool to address climatic priorities. This increased support is reflected in the sharp increase of the value issued in green bonds recently to US $259 billion in 2019 (Figure 28.1). The growth continued throughout the global pandemic's starting year, leading to a cumulative exposure of US $1,000 trillion since the first green bond issuance in 2007 by early December 2020 (Climate Bonds Initiative, 2022). At present, an ending of the current trend is not foreseeable.

## Determinants of Issuing Corporate Green Bonds

In this section, we review the literature that evaluates what factors may influence companies to issue green bonds. We synthesize the academic literature on green bonds with respect to this theme by surveying articles in business, management, economics, finance, sociology, and public policy. Our two main sources for searching for articles are Scopus (for articles published in

international peer-reviewed journals) and SSRN (for working papers). In the first phase of the search, we used the following Boolean logic, applied to the abstract, title, and author keywords:

> ("issuance" OR "issuing" OR "driver" OR "issue" OR "decision" OR "drivers" OR "determinants") AND ("green bond" OR "green bonds")

This resulted in a dataset of 308 articles from Scopus and 184 papers from SSRN. In the second phase of the search, we read the abstracts of these articles and working papers to see to what extent they would fit into a review of the literature on the determinants of green corporate bond issuance. The final dataset consists of 25 articles and papers.

Most of the literature on the determinants of issuing green bonds is of recent date, that is, most publications we use in this review have been published after 2019. Slightly less than half of them (12) have been published as a working paper. The other 13 papers have been published in peer-reviewed journals such as the *Journal of Financial Economics*, *Journal of Business Ethics*, *Business, Society & the Environment*, *Finance Research Letters*, and *Sustainability*.

The literature discusses various reasons explaining why companies decide to issue green bonds. Several papers argue, and show empirical evidence, that issuing green bonds increases access to and reduces the cost of capital (Hadaś-Dyduch et al., 2022; Lin & Su, 2022). Glavas (2022) shows that companies that issue green bonds have significantly higher financial constraints, suggesting that access to finance may be an incentive for companies to engage in the green bond market. Dutordoir et al. (2022) also find some evidence that financial constraints drive green bond issuance.

Investors may find green bonds attractive because they add to improving the "greenness" of their portfolio. Their interest to include green financial instruments in their portfolios can be explained as follows. First, their stakeholders, and in particular their beneficiaries, put pressure on them to include green investments in their portfolios to contribute to reducing climate change. Second, investors are increasingly urged to disclose their strategy with respect to climate change risks and the integration of environmental and social criteria into their investment decisions by their stakeholders. Third, by investing in green financial instruments such as green bonds, investors can reduce the risk of non-green investments because of climate change and other environmental impacts (Weber & Saravade, 2019). The resulting increase in demand for green bonds provides an additional source of finance for companies issuing them and reduces the premium companies must pay when issuing these bonds vis-à-vis the premium for regular (non-green) bonds.

In line with the above arguments, several papers argue that by issuing green bonds companies can signal their commitment to climate-friendly policies, making them attractive for investors who aim at contributing to reducing climate change risks (Kuchin et al., 2019; Daubanes et al., 2021; Flammer, 2021; Sisodia et al., 2022). These papers analyze the signaling effect by looking at how the stock market responds to the issuance of green bonds. Some papers show that the yield for green bonds is lower than that of conventional bonds, suggesting that investors are willing to forego profits for environmentally-friendly projects (Glavas, 2020; Löffler et al., 2021; Zhang et al., 2021; Zhou et al., 2022; Benincasa et al., 2022). The difference in yields between conventional and green bonds is sometimes termed a "greenium". Glavas (2020) shows that the positive market response to the issuance of green bonds increases after the Paris Agreement. He explains this outcome by pointing out that investors apparently expected climate-related regulations following this agreement. For this reason, they find green bonds more attractive as investment targets. Some papers argue that the lower cost of capital only materializes after the repeat issuance of green bonds (Petreski et al., 2022). Zhou et al. (2022) show that the greenium

is more pronounced for corporate green bonds with third-party certification. Such a certification informs the market about the green status of a company.

Other papers, however, do not find evidence for the existence of such a greenium. Wang and Li (2020) and Wang et al. (2022) show that investors do not seem to be willing to trade profits in non-green projects for investments in environmentally sustainable projects. Zheng (2021) shows that green bonds differ from regular bonds only when issued by companies in countries that have adopted climate policy by enforcing companies to internalize the cost of emissions through a carbon tax or through introducing an Emissions Trading System (ETS). This latter result is corroborated by Wang et al. (2022), who find that companies that are subject to the ETS are more likely to issue ESG bonds.

These contrasting results may be explained by the fact that different studies focus on different types of green bond issuers and bond issuances in different country contexts. For example, Wang et al. (2022) use a sample of Korean companies; Flammer (2021) has data on corporate green bonds from over 25 countries; and Zheng (2021) uses a sample of corporate green bonds issued in 55 markets around the world. Different types of bond issuers in different country contexts may have different reasons to use green bonds and investors may accordingly respond differently to their use of these bonds. In any case, these mixed findings do question to what extent companies can effectively signal their commitment to climate-friendly policies by issuing green bonds.

A few papers investigate why companies issue green bonds by focusing on the role of specific company characteristics (Bancel & Glavas, 2020). In particular, these papers suggest that the size of companies matters (Bedendo et al., 2022; Wang et al., 2022). They show that larger companies tend to have a higher probability of issuing green bonds. A related finding by Löffler et al. (2021) reveals that green bonds have larger issue sizes as compared to conventional bonds. The argument for these findings may be that issuing green bonds is demanding, as the process of obtaining certification requires funding and expertise. This makes it less likely that smaller companies opt for this type of financing. This corroborates research showing that larger companies tend to be more willing to invest in environmental and social projects as their ESG performance is usually better as compared to smaller companies (Drempetic et al., 2020).

Dutordoir et al. (2022) focus on a few other company-specific characteristics. In their study, they show that companies with lower costs of disclosure, higher reputational gains when investing in green projects, and a stronger focus on innovation have a higher probability of issuing green bonds. These results suggest that companies trade off the costs and benefits of their efforts to commit to environmental efforts when deciding on issuing green bonds. The importance of reputational benefits is also mentioned by Hadaś-Dyduch et al. (2022).

Some papers emphasize the importance of different corporate governance mechanisms, such as ownership structure and board structure composition. Bancel and Glavas (2017) show that state ownership is a primary determinant of green bond issuance and that the role of state ownership in determining the use of green bonds in contexts where institutional frameworks are weak. Their results indicate that the state may be an important stakeholder emphasizing the role companies should play in making contributions to improving the environment, that is, it shows the state as taking up its role as guardian of societal interests. Others emphasize the presence of foreign shareholders (Wang et al., 2022). These foreign shareholders, such as large institutional investors, may have a stronger preference for holding green stocks, leading to a stronger pressure to finance green projects, which among other things, may be achieved by issuing green bonds. Wang and Li (2020) show a related, but different finding. In their study, they find that after a company has issued green bonds, the share of institutional investors increases. Wang and Li (2020) show evidence for reverse causality, that is, their outcomes may indicate that issuing green bonds may make companies more attractive to investors who aim at improving their ESG score.

Wang et al. (2022) find that companies that have established a board committee that focuses on ESG have a higher probability of issuing ESG bonds, including green bonds. Establishing such a committee signals the commitment of a company to sustainability, increasing the willingness to issue green bonds. Cicchiello et al. (2022) show that the independence of boards and board gender diversity are positively related to green bond issuance.

Some papers focus on the environmental and social performance of companies by zooming in on ESG ratings (Dan & Tiron-Tudor, 2021). Higher ESG ratings may signal the company's commitment to contributing to sustainability and reducing climate change. This commitment may show itself by a higher probability of issuing green bonds from companies with higher ESG ratings. This is indeed confirmed in studies by Zheng (2021). Cheng et al. (2022) focus on ESG disclosures, rather than ESG performance, and find similar results. In a related finding, Bedendo et al. (2022) show that commercial banks that have publicly expressed their aim to focus more on contributing to a green transition have a higher probability to issue green bonds.

## Corporate Green Bonds and Outcomes

The risk characteristics of a green bond are essentially identical to those of a conventional bond issued by the same company. It is important to note that while the proceeds from the issuance of a green bond are earmarked for environment-linked assets, green bonds are serviced from the cash flows of the entire operations of the issuer – not just the green project. These characteristics are important to evaluate the financial attractiveness of green bonds to issuers and investors. This section focuses on the financial and environmental outcomes for companies that issue green bonds.

### *Company Outcomes*

The primary question on financial outcomes is whether investors are willing to pay a higher price for green-label bonds. If a significant fraction of investors is willing to pay a premium for green bonds, it would be reflected in the issuance price of these bonds. Such demand-and-supply issues can affect bond yield spreads (Collin-Dufrense & Goldstein, 2001; Greenwood & Vayanos, 2014). Investor preference for socially-responsible practices can reduce the cost of debt and lower bond yields (Hasan et al., 2017; Ghouma et al., 2018). Relatively less evidence exists in the specific context of green bonds. As most issuers of green bonds also regularly issue conventional bonds, it is possible to measure the bond yields after accounting for issuer-specific idiosyncratic factors like credit risk.

As was already discussed in the third section, there seems to be no consensus on whether investor preference for green bonds reflects a green premium for these bonds. For example, Ehlers and Packers (2017) and Hachenberg and Schiereck (2018) find a negative premium for green bonds in the primary and secondary markets. Zerbib (2019) finds a negative premium of 2 basis points for green bonds nominated in both euro and USD. In contrast, Karpf and Mandel (2018) control for the bond's liquidity and find a positive premium of 7.8 basis points for green bonds.

Despite the ambiguity about the premium for green bonds, many of the largest institutional investors, asset managers, or owners aim to transform their portfolios towards net-zero emissions by 2050 (UNEPFI, 2022). This raises the demand for securities bound to green purposes. From this perspective, we should expect investors to react positively to the issuance of corporate green bonds. Wang et al. (2020) document positive announcement returns following new issuances of green bonds in China, which they attribute to investors' perception that the environmental engagement of a company will increase its long-term value. Their study thus provides evidence

that financial markets seem to associate green bond issuance with the long-term value of an issuer. They suggest issuing companies benefit from higher stock liquidity and higher stock prices around the issuance announcement.

How markets conceive green bond issuances and their underlying projects to be financed mostly depends on the question if the future actions of the issuing company will create or destroy value. If value-enhancing measures are taken, it is reasonable to assume that the financial markets reward the green bond issuance, and stock prices may rise. Likewise, suppose the new business actions reduce risk. In that case, it is reasonable to assume that next to increasing prices, liquidity in these stocks could improve, for instance, by the increased investor base or because of an increase in public attention, as suggested by Tang and Zhang (2020).

In contrast, Lebelle et al. (2020) find evidence for a negative market perception. They show that announcement returns of corporate green bond issuances are negative. They suggest that this may be due to the underlying risks that could arise following changes in the business model. These considerations seem to indicate that value in relation to risks deteriorates.

It is important to answer whether green activities will create long-term value in the discussion about the feasibility of issuing green bonds and the market's reaction. One way to evaluate the financial impact of green bonds is to focus on performance over time because investors may not always hold the bonds until maturity. Therefore, it is important to focus on both the primary and secondary market premia. The green bond indices are a good starting point to examine secondary market premia. Green bond indices contain a diversified portfolio of bonds and provide a good comparison with the performance of other bond indices. Ehlers and Packers (2017) show that the performance of hedged green bond indices is similar to that of global bond indices of comparable credit rating composition.

## *Environmental Outcomes*

Whether corporate green bonds affect the overall environmental impact of their operations depends on the use of proceeds, i.e., what does the company do with the money raised? Currently, no regulations or disclosure norms allow investors to ex-post track the use of proceeds from green bonds. This has led to concern about green bonds being (yet) another avenue of corporate greenwashing.

Greenwashing occurs when entities issue green bonds to improve their reputation or benefit from green bonds by pretending to investors that they are working on projects that help improve the environment, while these bonds are, in fact, not green. Clear standards, certification, and close monitoring are key to the success of green bonds, enabling these bonds to have a true impact on the environment and become an important tool to counter climate change. The green bonds standards, defined by the CBI (Climate Bonds Initiative, 2019) or the ICMA Green Bond Principles (ICMA, 2022), combined with voluntary certification and monitoring, have been established to provide transparency about the funds being adequately used for their green purpose, as defined in the relevant green bond standards. Third parties have started to issue certifications to organizations when their use of proceeds from green bonds qualifies certain requirements. For example, the green bond principle (GBP), the Climate Bond Initiative (CBI), Green Bond Indices, CICERO, and Moody's Green Bond Assessments (Ehlers and Packer, 2017) have all been providing assurance statements for green bonds. However, there is not one general, mandatory certification yet. Certification could help to increase the linkage between green bond proceeds and a company's climate targets and thus close the gap that may arise when issuers face little pressure from stakeholders (Tuhkanen & Vulturius, 2020). Fatica et al. (2021) highlight the importance of external reviews in this regard.

Fatica et al. (2021) compare green bond issuers with conventional bond issuers with similar financial characteristics and environmental ratings. They find that the carbon intensity of a company's assets decreases after issuing green bonds. This decrease is stronger and has a longer-term effect on green bonds that lead to new projects rather than green bonds used for refinancing. Flammer (2021), in her study, finds comparable results. She concludes that, although green bonds as a financing source are still relatively small compared to conventional bonds, her empirical results indicate that green bonds may truly impact the strategies of a company related to environmental issues.

Given the lack of uniform reporting and uniform certification standards, direct causal analysis of the impact of green bonds on environmental outcomes is complicated. The most likely way to evaluate the environmental performance of green bond issuers is to observe whether a company's environmental performance is changing, for instance, in third-party ratings. In many jurisdictions, it is possible to track companies' carbon emissions, waste disposal, and renewable resource management practices. These factors provide circumstantial evidence of whether green bond issuers have materially different environmental impacts. In practice, however, as the underlying projects are often running over the years or even decades in operation, evaluating the impact of green bonds on the environment might face limitations since environmental assessment is a new topic and time-series data is rare. The main concern here is that companies already engaged in sustainable projects may find it easier to issue green bonds since it is not difficult for them to implement these bonds in their strategy. It complicates a causal analysis, but the reinforcing relationship between green bonds and environmental sustainability practices mitigates concerns about greenwashing.

To summarize, it is important to attribute the true marginal contribution of financing projects with green bonds to the environment. The mere assessment of post-issuance improvements on environmental measures of a company might be insufficient and could lead to wrong judgments regarding causality. For example, it can be questioned to what extent the environmental projects for which green bonds are issued would have been financed anyway, using other financing instruments such as conventional bonds, debt, or equity. Concerning this, it is important to assess what implication the potential alternative ways of financing have on the feasibility of the (green) projects when potential benefits of green bonds related to, e.g., financing costs, policy implications, and the availability of financing are absent. Besides that, the costs for companies to issue green bonds also need to be incorporated. Green bond certification, issuance, and monitoring processes may require the company to invest in developing knowledge about these processes.

An underexplored area in the academic literature on green bonds is how these debt instruments affect corporate sustainability initiatives. It is crucial to understand the mechanisms because it sheds light on whether these debt instruments are effective in financing the transition to a low-carbon economy. For example, Flammer (2021) notes that:

> the green bonds themselves are likely too small to bring about significant improvements at the firm level (among public firms, the average green bond issue is $0.26B compared to the average issuer's asset size of $33.5B). Instead, and consistent with the signalling argument, a natural interpretation is that green bonds signal a credible commitment towards the environment. As this commitment materializes in eco-friendly behaviour, companies improve their environmental performance. Some of these improvements – but not necessarily all of them – maybe due to the projects that are financed by the green bond proceeds.

One plausible conjecture about the mechanism through which green bond issuance results in better environmental outcomes may include adopting emission targets. This is because, as

green bond issuers attract further scrutiny due to their green label, these companies may be incentivized to engage in activities that will result in tangible and measurable environmental outcomes, such as lower emissions. The signaling motive can also motivate green bond issuers to incur the cost of third-party verification of their carbon emissions. Further, it is plausible that the financial and environmental effects of green bond issuance reflect broader organizational processes and environmental strategies (Walls et al., 2012). For example, companies that consider environmental issues salient will likely have corporate governance systems that facilitate environmental strategies. Board oversight and managerial incentives are two broad channels through which the corporate governance system can impact strategic choices. Green bond issuers may also be more likely to integrate climate change issues into their business strategies (Eccles et al., 2014).

Whilst it is central to understanding the real impacts of green bonds, empirical evidence on the pathways through which proceeds from green bond issuance affect corporate environmental performance is scant. This lack of evidence is primarily due to a lack of transparent and comparable reporting standards for green bond issuers to report the use of proceeds information. The post-issuance disclosure information is often not publicly available in many jurisdictions. Some data vendors, such as the CBI, are increasingly focusing on this aspect (see the Climate Bonds Standard v3.0; Climate Bonds Initiative, 2019), and the data quality is likely to improve in the future.

## Discussion and Suggestions for Further Research

Addressing climate change by transitioning to a low-carbon value creation process will take an investment of unprecedented scale. Raising the amount of money available for this transition will, among other things, also take innovations in financing, particularly for companies that must simultaneously optimize profits and their environmental impacts. In this chapter, we provided a review of the antecedents and consequences of one such modern financing tool used by companies to raise money for green technology, that is, green bonds. We focused on discussing the determinants that may explain why companies may want to issue green bonds. Moreover, we discussed whether and how green bond issuance can affect corporate financial and environmental performance. Research on these topics is still in its infancy as green bonds are relatively new financial innovations and, as a consequence, data availability is still fairly limited. As more data become available, future research could provide larger-scale evidence of the reasons why companies may use them as an instrument to finance their environmental efforts, as well as of the long-term implications of corporate green bonds.

In terms of the determinants of green bond issuance by companies, there are various directions future research could explore. In general terms, it would be important to zoom in more systematically on company and country-level differences. In particular, research could focus on the importance of governance mechanisms, such as the role of boards and their individual members in stimulating the issuance of green bonds.

For example, Homroy and Slechten (2019) have looked at the presence of non-executive directors with previous experience in environmental issues and the impact on a firm's ethical and environmental behavior. Chen et al. (2022) find evidence that companies that have appointed directors with executive experience in NGO-type of organizations perform better with respect to ESG. Future research may focus on analyzing whether companies that have appointed directors with a background in environmental issues and/or executive experience in environmental NGOs are also more likely to issue green bonds and whether and to what extent their presence has an impact on the so-called greenium.

Research may also look into the role of executive remuneration and the use of environmental criteria to determine the level of executive pay. Over the last few years, the use of such criteria in executive pay contracts has increased (Cohen et al., 2022). It would therefore be interesting to evaluate to what extent the use of such environmental criteria is also conducive to stimulating the issue of green bonds.

Another area of future research would be to focus on the different ESG profiles of companies and investigate what types of profiles are associated with a higher probability of green bond issuance. For example, do green bonds complement or substitute environmental performance? Is there a difference for the type of environmental performance? Does it substitute or complement social performance? Does governance performance play a role?

Future research could also go deeper into the question of what country-specific features may affect the likelihood of companies issuing green bonds. More specifically, research may focus on differences in environmental policies, macroeconomic conditions, legal institutions, innovation, and cultural traditions and their role in determining the issuance of corporate green bonds. For example, regarding the role of culture, one could focus on how specific cultural settings may have an impact on the extent to which society is committed to taking up environmental challenges. This may also influence the extent to which green bonds may be seen as a potential funding source for companies.

Finally, an important first-order question pertains to the growth and governance of the green bond market. Although this market has been growing rapidly over the past few years, its size is still small in terms of the challenges of climate change it may want to address, as well as compared to the size of traditional bond markets. According to Deschryver and de Mariz (2020), important barriers to its growth are lacking harmonization of global standards, the risk of greenwashing, the (perceived) high costs of issuing green bonds, the low supply of green corporate bonds, and the lack of a well-functioning green bond market infrastructure. These outcomes are at least partly corroborated in a study by Sangiorgi and Schopohl (2021).

To a large extent, the difficulty in drawing conclusive evidence on the role of green bonds in climate financing can be traced back to the current absence of credible systems that govern the issuance and use of the proceeds of green bonds. Companies seek to add credibility to their green bond issuances through third-party certifications. Yet, in the absence of a uniform definition of what constitutes green assets, such certifications are hard to interpret and compare for financial market participants. Future developments in the green bond, such as those proposed by the European Commission's Green Taxonomy, could alleviate some of the issues related to homogeneous disclosure on the use of proceeds from corporate green bonds. We would like to highlight these aspects as exciting avenues for future research.

As a final note, we would like to add that a successful transition to a low-carbon emitting economy also requires actions from governments, next to efforts from businesses. Obviously, the business sector alone will not be able to perform this transition successfully. Companies will need to be incentivized to trigger change. Governments should make way by providing the right policy frameworks, supporting standardization, and providing opportunities for private and public environmental projects to be realized (Magale, 2021). Appropriate measures, such as incentives in the form of governmental support, tax reliefs, or subsidies for environmental activities may help to support the development of green projects and thus allow financing through the green bond market. Restrictive policies, such as those already partly introduced by institutional investors in the form of exclusion lists for non-green business operations, could be another possibility to stimulate change in the economy. Moreover, appropriate international support to countries that are currently lagging behind the green transition can help to reach a balanced worldwide development. In the end, a successful transition to a

low-carbon emitting world economy will be based on joint efforts of governments and the business sectors.

## Notes

1 More information on the Paris Agreement can be found at: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement.
2 A full description of the CBI methodology is available on their website: www.climatebonds.net/cbi/pub/data/bonds.

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