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# What Future for the Green Bond Market? How Can Policymakers, Companies, and Investors Unlock the Potential of the Green Bond Market?

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**Abstract:** The green bond market is attracting new issuers and a more diversified base of investors. However, the size of the green bond market remains small compared to the challenges it is meant to address and to the overall traditional bond market. This paper is based on a unique methodology combining an extensive literature review, market data analysis, and interviews with a large spectrum of green bond market participants. We identify the current barriers explaining the lack of scalability of the green bond market: a deficit of harmonized global standards; risks of greenwashing; the perception of higher costs for issuers; the lack of supply of green bonds for investors; and the overall infancy of the market. This paper makes several recommendations to overcome these obstacles and unlock the full potential of green bonds to finance sustainability goals.

**Keywords:** green bonds; sustainable investing; ESG; impact measurement; socially responsible banking

## 1. Introduction

Green bonds and climate bonds have received increasing attention over the past few years as key instruments to finance the transition towards a low-carbon economy. From being a niche at its creation in 2007, the market has grown significantly, with new types of investors and issuers participating in its expansion.

Green bonds offer several benefits for issuers, investors, and policymakers. For issuers, green bonds align with long-term project maturities, reduce debt financial expenses (Curley 2014), and improve firm-level environmental footprints and financial performance (Flammer 2018). Investors can better support their investment strategies with additional information on issuers' sustainability plans (Ng 2018) and increase their exposure to less volatile instruments (Veys 2010), which is appealing to both traditional profit-seeking investors and socially responsible investors (Chatzitheodorou et al. 2019). Thus, issuance has risen from USD 1.5 billion in 2007 to USD 389 billion of outstanding bond volume in 2018 (CBI 2018a). This shift has mobilized substantial capital to finance clean energy and efficiency energy projects mostly. However, the tangible contribution of green bonds for channeling investment into climate change mitigation and adaptation projects has so far been marginal (Noor 2019).

There is a critical need to reinforce confidence in the green bond market and gain a better understanding of the financial characteristics and challenges associated with this asset class. The academic literature has focused on the macroeconomic conditions affecting the green bond market (Cochu et al. 2016; Jun et al. 2016) and its growth determinants, highlighting in particular the link between national development contributions and green bond issuance volumes (Tolliver et al. 2020). Moreover, several empirical works examined green bond pricing (Flammer 2018; Karpf and Mandel 2017; Packer and Ehlers 2017; Reboredo 2018; Zerbib 2018), with a primary focus on the "green bond premium". Previous research has also considered the risks that issuers are attempting to remedy

(Tripathy 2017) and the environmental integrity of green bonds (Shishlov and Morel 2016). There remains a need to examine in detail the critical barriers to the scalability of the green bond market.

This paper explores the specific challenges faced by different types of stakeholders and is based on a unique holistic methodology. Our approach combines an analysis of market prices for green bonds, a thorough revision of the latest literature, combined with primary data coming from interviews with eleven experts, including investors, issuers, and intermediaries, such as banks and consulting firms. This research on green bonds contributes to at least two growing currents of research, namely corporate social responsibility and sustainable investing. The present paper aims at bridging the gap of reliable information on the lack of scalability of the green bond market and offers, to the best of our knowledge, the most comprehensive analysis of those barriers. We answer questions such as: what are the major barriers that each category of market participant faces with a green bond issuance? Is there a standardized process to issue a green bond? What are the perceived versus real obstacles to the green bond market expansion? Which risks are associated with green bond issuance for each category of stakeholders? Are green bonds an accessible instrument—both financially and technically—to fund sustainable investment? How can policy makers attract bond holders to green investments?

Section 2 summarizes relevant literature on the state of the market. Section 3 presents the drivers of growth by category of market participants. Section 4 identifies the explanatory barriers to scalability. Section 5 suggests policy recommendations to expand the green bond market. Section 6 presents concluding remarks.

## 2. State of the Green Bond Market

### 2.1. A Simple Definition That Offers Some Degree of Flexibility

Green bonds are fixed-income instruments aimed at financing environmental and sustainable development projects. Their proceeds are used exclusively to finance or refinance, partially or in full, new and ongoing green projects, in particular, infrastructure investments. Green bonds differ from a traditional obligation (a “vanilla bond”) by the detailed reporting of its use of proceeds and the “green” nature of the projects.

Four types of green bonds exist: conventional bonds invested in green projects; green bonds guaranteed by income; project-specific obligations; and securitized green bonds, as shown in Table 1. Net proceeds from a green bond issuance must be credited to a sub-account, placed in a secondary portfolio, or be the subject of a suitable form of allocation. The essential characteristic of green bonds is to associate the use of proceeds to specific environment-friendly projects. Green bonds address climate change mitigation and adaptation goals, answering the growing awareness of systemic climate damage by investors, insurers, banks, and governments.

**Table 1.** Four categories of green bonds (ICMA, 2018).

Category	Definition
Green Use of Proceeds Bonds	Similar to traditional bonds by offering full recourse to the issuer and sharing the same credit rating as the issuer.
Green Use of Proceeds Revenue Bonds	Non-recourse to the issuer and repays investors based on a revenue stream such as tolls, fees, and taxes.
Green Project Bonds	Recourse or non-recourse to the issuer.
Green Securitized Bonds	Bond collateralized by one or more specific Green Project(s). The first source of repayment is generally the cash flows of the assets.

Several non-binding frameworks define green bonds. The Green Bond Principles (GBP) are voluntary guidelines for the issuance of green bonds developed by the International Capital Markets Association (ICMA). Four main principles are at the core of GBP: use of funds; selection and evaluation of projects; fund management; and reporting. The GBP specify that all green projects must have a clear

environmental benefit, which will be estimated and, when possible, measured by the issuer. Most issued green bonds comply with the categories of eligible projects set out in the GBP. Such categories include clean energy, energy efficiency, low carbon transport, smart grid, and agriculture and forestry. However, there is also a large proportion of green debt instruments that are not labeled as green bonds under the GBP—even though they may have fulfilled the criteria. This category falls under the label of climate or climate-aligned bonds, which is estimated to be twice as large as the labelled green bond market (CBI 2018a; Migliorelli and Dessertine 2019).

The Climate Bonds Initiative (CBI) is an international charity trust focused on investors. It has developed a standard of climate bond certification, which helps investors and governments to classify and prioritize investments that effectively address climate change. CBI's database only includes green bonds that their issuers label as such, have at least 95% of proceeds dedicated to green assets aligned with the Climate Bonds Taxonomy, and offer sufficient information on the financed projects. Labeled green bonds are primarily issued by diversified companies, whereas the unlabeled portion of the climate-aligned universe mostly comes from pure-play issuers (CBI 2018c).

Additionally, many national and regional jurisdictions have developed their national green instrument taxonomies. Several countries (e.g., UK, China, Mexico, Morocco) and regional organizations (e.g., EU, ASEAN countries) have adopted green bonds guidelines and they have formed taskforces (e.g., The Expert Panel on Green Finance, the Central Bank-led Network for Greening the Financial System). Some programs are also helping to both sustain and go beyond green bonds. Such initiatives are the Taskforce for Climate-related Financial Disclosures (TCFD); the United Nations-World Bank Group Roadmap for a Sustainable Financial System; and the High-Level Expert Group for Sustainable Finance.

The EU Technical Expert Group (TEG) on Sustainable Finance published the Green Bond Standard (TEG 2019), which defines more restrictively green bonds as “any type of listed or unlisted bond or any other capital market debt instrument issued by a European or international issuer, as long as three requirements are met: the issuer's ‘Green Bond Framework’ needs to explicitly affirm the alignment with the EU-Green Bond Standards (GBS); the proceeds will finance or re-finance ‘Green Projects’; and the alignment of the EU-Green Bond Standard is verified by ‘an accredited External Verifier’”. The current dialogue between China and the European Union to come up with a harmonized language represents an important step towards a global standardized green certification scheme, which goes beyond a domestic investor base (Packer and Ehlers 2017).

Moreover, many variations exist, and green bonds have had a spillover effect with the creation of climate, blue, social, sustainable, and transition bonds. This paper will focus on green bonds without excluding a broader look by encompassing social and sustainable bonds.

## 2.2. A Growing and Innovative Market

The green bond market grew from USD 1.5 billion in 2007 to USD 389 billion outstanding in 2018 (CBI 2018c). The European Investment Bank (EIB) pioneered the idea of assigning bond proceeds for environmentally friendly initiatives with a EUR 600 million Climate Awareness Bond focusing on renewable energy and energy efficiency in July 2007. The World Bank issued in 2008 the first green bond labeled as such. The corporate world came on-board in November 2013 with the issuance of a SEK 1.3 billion bond by the Swedish largest property company Vasakronan in partnership with Skandinaviska Enskilda Banken (Scandinavian Individual Bank, SEB). By 2014, the market had tripled in size with USD 36.6 billion. Thus far, the Korean firm LG Chem, the French utility Engie, and the Industrial and Commercial Bank of China have issued the largest corporate green bonds for, respectively, USD 1.6 billion, EUR 1.5 billion, and USD 1.5 billion. In terms of country issuance, France and the United States are the biggest issuers of green bonds as of Q2 2019 (Refinitiv 2019).

Appetite for green bonds continued to grow into 2018, with a total issuance of USD 167.3 billion—marking a 3% year-on-year increase (CBI 2020). As of June 2018, 498 green bonds had been issued with an outstanding bond volume accounting for 32% of the total issuance to date; 52 issuers of labeled green bonds are also fully or strongly aligned. The remaining 446 green bond issuers

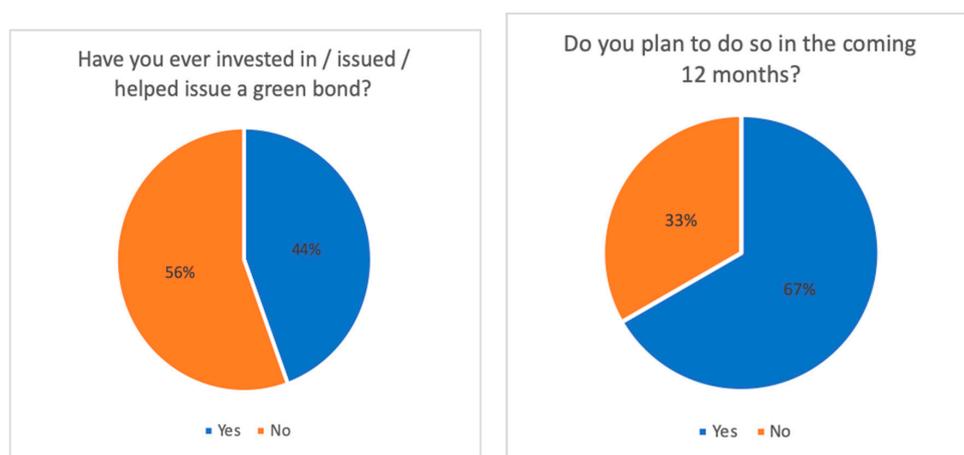
have less than 75% of revenue derived from “green” business lines and are therefore not considered as fully or strongly aligned issuers.

In 2019, green bond issuance surpassed USD 100 billion for the first time. Refinitiv registered USD 173 billion of total proceeds raised from green bonds globally, with a 31.0% increase from a year ago; Dealogic and Bloomberg registered USD 228.2 billion for 2019, as shown in Figure A1 in Appendix A. The market is growing with a higher number of issuances, larger sizes, a broader group of issuers, and a wider investor base. However, the size of the green bond market pales when it comes to financing USD 1 trillion in annual green investment early in the 2020s to implement a robust and critical energy transition, according to the Green Bond Pledge launched by the Former United Nations climate chief Christiana Figueres. It also pales in comparison with the global traditional bond market, representing between 1% and 2.2% of total global issuances (Hupart 2019; Noor 2019; Refinitiv 2019).

### 3. Several Drivers behind the Momentum

#### 3.1. For Issuers, a Formidable Marketing Tool

Investors show a substantial commitment to green bonds. In our survey, 56% have participated in issuing a green bond and 67% are planning to do so in the coming twelve months, as shown in Figure 1, demonstrating the dynamism of this market.



**Figure 1.** Overview of issuance in our survey. Source: based on interviews with 11 experts across issuers, investors, and intermediaries, conducted in December 2019.

Investment opportunities include individual green bonds as well as green bond mutual funds or ETFs. Key players include the Calvert Green Bond Fund (USD 418.4M of total net assets as of 12/21/19—Calvert 2020), Mirova Global Green Bond Fund (USD 36.8M as of 12/31/19—Mirova 2019), and VanEck Vectors Green Bond ETF (USD 26.6M as of 10/17/19—Van Eck 2020), besides more recent funds launched in 2018 by Allianz Global Investors, BlackRock, and Teachers Advisors.

According to Fitch, six European green bond funds held EUR 5.6 billion of assets in green bond funds at the end of 2018. This number appears small compared to the size of total European domiciled bond fund assets with about EUR 2.5 trillion as of December 2018 (Sewell 2019). The rising environmental awareness among investors contributes to an increased demand for green bonds and to oversubscriptions, thus enabling the funding of eco-friendly projects in a cheaper way (Agliardi and Agliardi 2019).

European pension funds have participated in changing mindsets in the industry by supporting financial investments for positive impact. Other investors have followed, due to both compelling and mounting research on the impact of climate risks on returns, and growing requests from shareholders, consumers, and stakeholders for sustainable outcomes. The types of investors have broadened since the beginning of the green bond market, to include impact investors, pension funds,

insurance companies and asset managers, corporate and bank treasuries, as well as retail investors (Reichelt and Keenan 2017).

The causes of the growth vary by type of investors. Our survey suggests that institutional investors are present in the green bond market primarily due to their retail investors' request, the positive communication and branding benefits associated with this instrument, and the perception of lower risks. For corporates, the issuance of green bonds may signal a strong focus on environmental issues. For example, the RWE credit rating has been downgraded from A1 to Baa3 by Moody's since 2009, mostly driven by its weaker position in the roll-out of subsidized renewables in Europe. On the contrary, issuing a green bond helps improve a company's environmental performance (Flammer 2020).

### 3.2. Financial Institutions Encourage This Upward Trend

Banks, as financial intermediaries, support these transactions. Most large banks active in international capital markets have now dedicated teams to accompany their clients in issuing green and sustainable bonds. For example, Morgan Stanley created its Global Sustainable Finance platform in 2009 (Choi 2018) and Goldman Sachs launched its Sustainable Finance Group in July 2019.

Along with the development of new teams, financial institutions develop tailored and innovative tools to support the green and sustainable bond market. In September 2019, the Italian energy group Enel issued a USD 1.5 billion sustainability-linked loan; Fibra UNO, one of the largest real estate companies in Latin America<sup>1</sup>, launched a USD 1.11 billion sustainable revolving credit facility; and more recently in September 2019, the European Bank of Reconstruction and Development issued the first dedicated climate resilience bond for USD 700 million. These few selected examples illustrate sophistication efforts supported by banks and an eagerness from issuers to singularize their issuance.

### 3.3. Pressure from Stakeholders to Join the Green Bond Market

Issuing a green bond can be a signal of corporate social responsibility policy (CSR) (Li et al. 2019) and many companies present their green issuance as such. Green bonds belong to the broad universe of socially responsible investing (SRI)—defined as an investment strategy that seeks to consider both financial returns and social good (Robeco n.d.).

Green bonds offer a communication tool towards investors, employees, and customers. In some cases, the green issuance is the culmination of a well-thought impact strategy. In other cases, it intends to boost the company's image and raise new funds to accelerate sustainable initiatives. The USD 1 billion PepsiCo green bond issued in October 2019 illustrates this point, as shown in Table A1 in Appendix A—from the perspective of cost of funding, there is little difference between this green issuance and a hypothetical non-green senior unsecured note—the 30-year green bond is likely to yield about 92 basis points over a Treasury bond (Bloomberg). However, the bond is critical for the sustainability strategy of the company. Pepsi had been called out previously by sustainability advocates for its failure to increase U.S. bottle and can recycling rates (MacKerron 2019); it is also the first time a company allocates proceeds to sustainable plastics and packaging. Likewise, Mexico's Nacional Financiera (Nafin) received three major awards by notorious institutions in the green bond market<sup>2</sup>. When the State of Massachusetts and the Government of South Africa issued their green bonds in June 2013, they both received positive coverage (Byrne et al. 2016), demonstrating investor confidence and commitment to environmental stewardship at the international level. In 2013, the State of Massachusetts issued both a conventional bond and a green bond. Despite the same pricing and a similar credit rating, the regular bond was undersubscribed, while the green bond benefitted from a

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<sup>1</sup> With 560 companies in its portfolio and 8750 gross leasable area.

<sup>2</sup> Nafin received the first Green Bond-Mexico by Climate Bonds Initiative, Bond of the Year SSA by Environmental Finance and Latin American Green/SRI Bond Deal of the Year by Global Capital.

30% oversubscription (Reuters 2019). The success of the 2013 issuance led to renewing a green bond issuance at a larger scale in 2014, as shown in Table A2 in Appendix A.

The second reason behind an issuance is to respond to peer pressure. In the beverage industry, PepsiCo’s green bond followed that of Starbucks in 2016 with its USD 500 million sustainability bond, the first-ever U.S. corporate bond of this kind (SEC 2016), and in 2019 Coca Cola amended a loan issued in June 2015 to include a sustainability element.

Third, issuing a green bond is a powerful instrument to reinforce pride and commitment among employees. Indeed, a large majority of millennials and young professionals are attracted by sustainable investments (Lo Giudice 2017), and this group prioritizes resource scarcity, environmental protection, and climate change as second only to unemployment (Deloitte 2014).

Finally, issuers are eager to strengthen their relationship with investors, which a green issuance can offer. There are various considerations backing this argument—the green issuance tackles themes that are not traditionally covered by corporates and investors, and it can deepen investors’ understanding of business processes and operations, making the corporate–investor relationship stickier. According to a study by Harvard Business Review, green issuers attract long-term investors with an increase of 21% (the share of long-term investors increases from 7.1% to 8.6%), coupled with an increase of 75% of green investors (the share of green investors increases from 3% to 7%) (Flammer 2018, 2020). This suggests that a green bond issuance favors a diversification of the investors’ base.

#### 4. The Green Bond Market Remains a Dwarf Due to a Combination of Challenges

##### 4.1. Overall, a Marginal Market

Despite positive reasons to be optimistic about the green bond market perspectives, several challenges remain. Clear standards are needed, especially in taxonomy, certification, and regulation.

Most of these challenges are both general across sectors and geographies and specific to some markets. The United States, China, and France accounted for 47% of global issuance in 2018, with USD 34.1 billion, USD 30.9 billion, and USD 14.2 billion, respectively (CBI 2018a). In the global traditional bond market of USD 102.8 trillion at the end of 2018 (Sifma 2019), the global outstanding green bond market represents only 0.39%, and the climate-aligned bond market 1.17% (CBI 2018b). Select emerging markets (Africa, Asia, Middle East, and Latin America) reached 20% of the green bond market in 2019, as shown in Figure 2. The green bond market of USD 136 billion represents about 0.5% of total outstanding bonds in these economies over the same period (IFC and Amundi 2018). Hence, green bonds’ issuances remain a drop in the ocean across geographies.

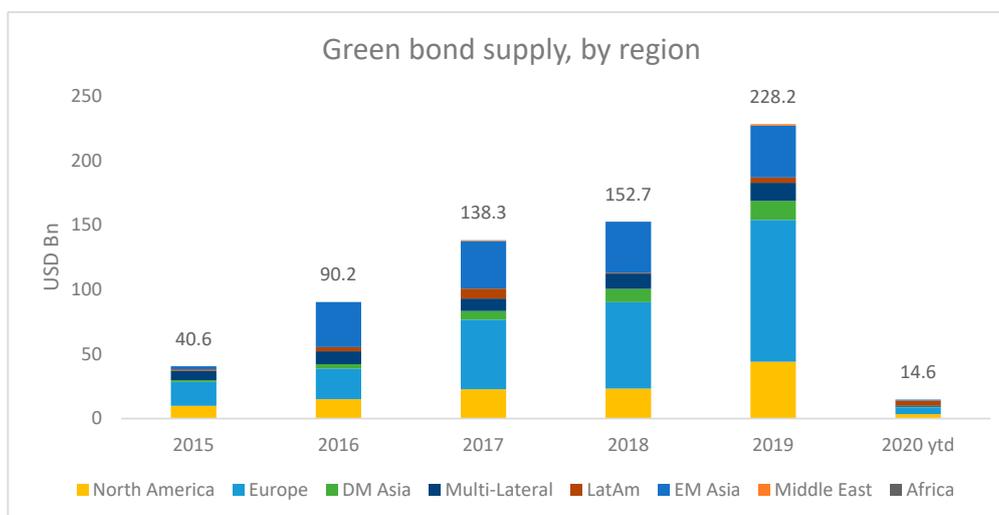


Figure 2. A market with a more diversified pool of issuers. Source—Dealogic, Bloomberg as of 20 January 2020.

Based on our methodology on primary and secondary data, we propose five explanations to justify the still incipient share of the green bond market.

- There is a perception of uncertain benefits in a green bond issuance;
- Green bond issuance is associated with higher costs and complex processes;
- The lack of standardization, despite substantial improvements, remains a key obstacle for all market participants;
- The green bond market is still relatively young, and it offers neither the level of credentials nor the amount of supply that investors are expecting;
- Greenwashing remains a serious risk for all stakeholders.

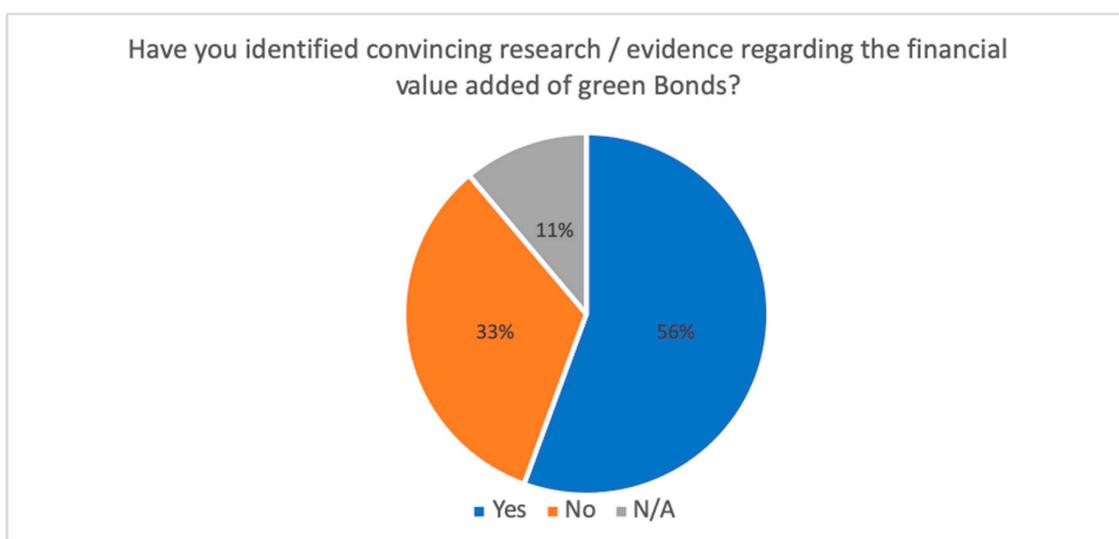
These challenges are common for all market participants, with various degrees of significance for each of them:

- For issuers, three main reasons help explain a certain reluctance to issue green bonds: a complex process without a clear financial incentive, a lack of identifiable projects to finance, and high risks of greenwashing.
- For investors, the key issues regard the lack of standardized frameworks, the demanding level of requirements, and a problem of liquidity.
- Financial institutions also have to deal with operational and management concerns when they engage with their clients on green bond issuance.

This section details these challenges in detail.

#### 4.2. An Unclear Benefit

The price benefit of green bonds remains relatively unclear for interviewees, as shown in Figure 3. While a majority of respondents considers there is convincing research on the financial value of green bonds (56%), 33% think the contrary, and 11% do not know. Some studies argue for significant price differences between green and similar ordinary bonds (Hachenberg and Schiereck 2018) or a moderate green bond premium (Zerbib 2018); others support a negative yield gap for ordinary bonds (Fatica and Panzica 2019). On the secondary market, research also offers a broad range of results from no premium to up to -17 bps of premium (Preclaw and Bakshi 2015).



**Figure 3.** Clarity on the benefits of green bonds among stakeholders. Source: interviews with 11 experts across issuers, investors, and intermediaries, conducted in December 2019.

According to Climate Bond Initiative, 72% of green bonds in 2018 achieved a higher oversubscription and spread compression than their vanilla equivalents after one day, and 62% were tighter after 28 days (CBI 2018a). Green bonds tend to be less volatile thanks to their orientation towards long-term institutional investors with a buy-and-hold strategy and a more diversified investor base. According to S&P, there is a difference between the American and the European green bond market pricings with a tighter spread for the European green bonds in the secondary market compared to their green U.S. dollar-denominated equivalents (Prabhu et al. 2019), likely driven by a greater European regulatory pressure. Sovereign and state agencies show tighter pricing on the secondary market (Karpf and Mandel 2017).

Moreover, this question is less relevant for investment-grade companies, contrary to high-yield companies. The overall investment-grade profile of the green issuers—80% being A or above (ICMA 2017), partly explains the insignificance of the greenium in this market. The situation is the opposite in the high-yield segment—their differences contribute to increasing spread gaps, and consequently to a potential greenium (Prabhu et al. 2019). The PepsiCo example shows that an investment-grade issuer benefits from similar pricing for both its green and non-green bonds. In November 2019, its green notes priced close to outstanding bonds. In emerging markets, the situation is different. The scope of issuers is heterogeneous, while the market benefits from higher yields than in the global green bond market with a yield-to-worst of 4.11% compared to 2.68% in the green US-hedged Index<sup>3</sup>.

The uncertainty around the benefit of issuing a green bond emphasizes the importance of intermediaries to issuing companies. Major financial institutions have put in place qualified teams in origination. These teams have an advisory role and need to dedicate a higher amount of resources to originate a green bond issuance (e.g., identification of strategic proceeds, development and review of a green bond framework, liaison with second-party opinions). Banks may find it difficult to charge an extra fee to issuers, as it could weaken the perception of a greenium and make green issuance less competitive than traditional bonds. The growth of dedicated coverage teams will only make sense as the market matures and gains a critical size.

Lastly, as highlighted by their summary report on Green Finance published in 2016, G20 members explicitly mentioned the lack of clarity of green activities and products as an obstacle to investment (G20). This barrier, associated with financial hurdles (e.g., still high levels of subsidies for the production and consumption of fossil fuels, green bond market still maturing, and the absence of a single carbon price which discourages companies to offer low-carbon solutions to the market), structural barriers (e.g., transaction costs) and the lack of standardized frameworks, would lead to mispriced green bonds. Consequently, green bonds would remain less attractive than the so-called brown projects.

#### 4.3. *The Infancy of the Market and the Lack of Supply*

The juvenile green bond market suffers from a lack of credibility, credentials, and supply. There is a “chicken and egg” problem (Bowman 2019)—the infancy of the market does not offer enough data to investors to make an educated investment decision. In this impasse, investors are reluctant to move forward. They may look for the perfect transaction, i.e., large deals, with direct allocation of the use of proceeds in relatively simple green assets, in order to measure an unequivocal impact. Therefore, the critical demand for quality, size, and recurrence of projects appears to be unmet, aggravating a scalability issue. On the other side, and even more critically, the specific characteristics and procedures of green bonds prevent many issuers from entering this market, reinforcing a lack of supply.

As mentioned by an investor, quoted in an article by Bowman (2019), “The early growth was from renewable energy assets but that is done now. . . . Many companies have a limited amount of renewable and energy efficient assets on their balance sheets”. Indeed, the GBP require an issuer

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<sup>3</sup> As of 28 April 2017, and 10 May 2017, respectively (JP Morgan EM Corporate bond index and Bloomberg).

to use at least 90% of the bond's proceeds to fund a specific green project (e.g., renewable energy, biodiversity conservation, climate change adaptation projects or technologies). However, for a green bond to make financial sense for issuers and investors, and ensure liquidity and index inclusion, it must have a critical size, which can hardly be below the USD 300–500 million mark. Many companies do not possess a pipeline of qualifying capital expenditures up to this size on their balance sheets. The same issue applies for governments at the national, regional, and local levels as they do not have a pipeline of large enough eco-friendly projects (Cochu et al. 2016).

When considering the shift of the European Central Bank's bond purchase policy towards non-polluting and green companies' bonds, President Christine Lagarde emphasized the current deficit of green assets—"Green assets, while rapidly developing, are still a relatively limited asset class and a taxonomy of what constitutes a green asset is still in its infancy". The growth of the green bond market led investors to look for higher levels of assurance and for reinforcing the comparability of green bond projects issued by a diverse pool of issuers. However, comparability remains a challenge. Many investors argue in our interview that they face a deficit of sufficient research and data to inform their investment decisions. Pension funds particularly deplore the lack of issuer variety and liquidity, and that of scalable investment vehicles (Reichelt and Keenan 2017). The lack of breadth of the corporate green bond market penalizes its growth and its potential to become more mainstream. Investors are looking for green bonds in sectors other than utilities, e.g., green transport and green buildings.

Part of this problem is also to adopt a restrictive approach regarding the green aspect. The current focus on green bonds earmarked for adaptation and mitigation related-projects can limit companies that are more familiar with socially responsible investments. Green bonds are not the most adequate instrument for companies willing to develop socially-oriented projects (e.g., in affordable housing, education, sustainable sourcing). Thus, sustainable bonds offer a broader approach by combining green and social projects and allow for more flexibility. Nevertheless, green, social, and sustainable bonds require a segregation of proceeds to specific projects, which remains a limit to expand green investments. Furthermore, a downside is a risk of cannibalization; entities could issue sustainability bonds instead of green, thus further restricting the supply of green projects.

#### 4.4. How Costly Is the Process?

Awareness and bias factor contribute to the tardy issuance. There is either a lack of awareness regarding the benefits of green bonds or the perception of an extra cost associated with a green issuance for, respectively, 74% and 41% of the participants of a survey led by the G20 Green Finance Study Group (Jun et al. 2016). The perception of a costly process is also the first challenge identified by issuers in our survey, as shown in Figure 4. While the cost is relatively small in the context of an issuance—around USD 30,000 (Kaminker et al. 2018)—it can still represent a deterrent in the long run as issuing a green bond requires additional efforts in terms of monitoring, disclosure, and impact reporting to align with the GBP. Prior to issuing a green bond, issuers have to get prepared: training and hiring knowledgeable staff on environmental, social, and governance (ESG) issues; development of environmental accounting; environmental, social, and governance communication (e.g., sustainability reports for investors, shareholders, and customers). Additionally, the pre-issuance process requires developing of a framework that aligns with the GBP; getting a second-party opinion to examine the issuer's ESG risks and mitigation strategies; reviewing the project selection, fund allocation, and reporting process; and obtaining opinions on the social and environmental impacts of projects.

	Challenge #1	Challenge #2	Challenge #3
Issuer	Costly process	Lack of internal capacity to manage the green bond process	Complex regulation and rules to follow
Investor	Lack of supply in terms of projects	Fear of greenwashing / reputation	Costly process
Intermediary	Fear of greenwashing / reputation	Lack of supply in terms of projects	Lack of standardization

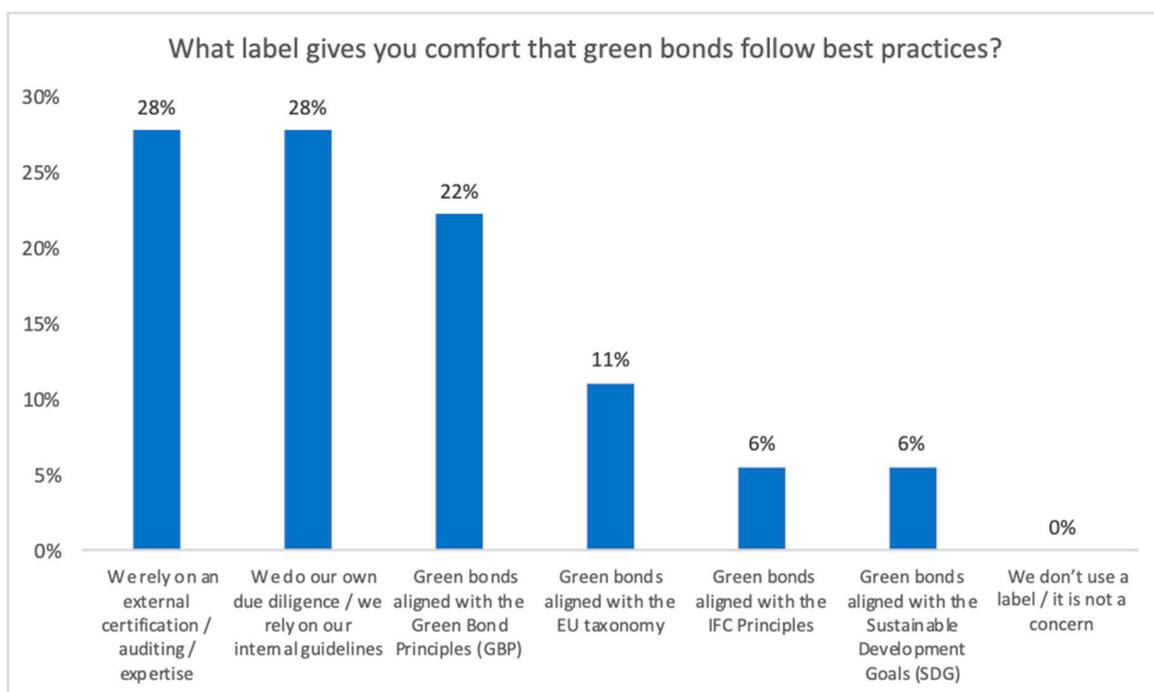
**Figure 4.** Top three challenges faced by category of green bond market participants. Source: based on interviews with 11 experts across issuers, investors, and intermediaries, conducted in December 2019.

Investors expect issuers to meet specific requirements. While green bonds are tied to specific projects in the GBP, the results of our interviews suggest that investors consider issuers’ ESG profile holistically. Even though a project aligns with the GBP, the issuance could be unsuccessful if the issuer does not possess a solid sustainability profile or strategy across its organization. Therefore, adopting a comprehensive view is coupled with more demanding standards.

#### 4.5. A Lack of Standardization for All Stakeholders

The absence of a commonly agreed definition and of a unique reference framework are major barriers to the development of the green bond market. Several bodies have defined different guidelines and best practices around green bonds (see supra). In addition, several issuers of green bonds have developed and published their own green bond frameworks. Development Banks—e.g., the Asian Development Bank and the International Finance Corporation—and also other actors, such as the Nordic Investment Bank, have done so.

Across categories of green bond players, developing its own methodology remains the most common approach for the respondents of this survey, as shown in Figure 5. In these frameworks, there is a close alignment between the definitions of green projects and issuers’ priorities, portfolios, and needs. Nevertheless, the compliance of green bonds with the GBP is relatively less significant given the broad categories of eligible projects under the latter (Gardes 2018).



**Figure 5.** An equal split between external certification and internal guidelines. Source: interviews with 11 experts across issuers, investors, and intermediaries, conducted in December 2019.

In this context, a prospective green bond issuer faces complex questions. Does the company have an explicit green strategy in place? Which framework of principles should they comply with? To what extent should they disclose the alignment with the Green Bond Principles? Moreover, if issuers are willing to disclose non-financial information, do they have the necessary operational resources? These questions are even more difficult to answer for small and medium enterprises (SMEs), which typically have fewer resources.

In our interviews, investors note the lack of a consistent certification system, in comparison with standardized credit ratings in the vanilla bond market. The lack of a common standard with “no unique definition among investors of what green investing entails” (Croce et al. 2011) is a significant obstacle. Moreover, these labels tend to neglect environmentally related financial risks of green bonds, while these instruments are more likely to be exposed to such risks (Packer and Ehlers 2017). Various frameworks currently coexist, all of them being non-binding and diverging on the expected criteria, as shown in Table 2.

Furthermore, the various definitions of green investments put investors at risk. For example, the People’s Bank of China’s Green Bond Endorsed Project Catalogue (backed on the Guidelines for Establishing the Green Financial System) includes “clean utilization of coal” as an eligible project category (The Green Finance Committee of China Society of Finance and Banking 2015); and China has with 7.4 billion yuan (USD 1.1 billion) in green corporate and financial bonds issued by 13 coal projects in the first half of the year (Stanway 2019). This inclusion may be unacceptable for some investors or issuers in other countries; for example, the EU taxonomy excludes coal and nuclear as eligible sectors. A study shows that the company ratings by the leading ESG data providers, MSCI and Sustainalytics, are only consistent for slightly more than half of the coverage universe<sup>4</sup> (Kumar and Weiner 2019). Since most ESG data providers’ methodologies are proprietary information, investors are not able to reconcile those differences. The current development of ESG scoring by traditional credit agencies could bring an additional source of heterogeneity.

<sup>4</sup> With a correlation of only 0.53 points between their respective ESG scores.

**Table 2.** Selected existing standards, principles, indices, and frameworks.

Category	Name
International standards	Green Bond Principles (by ICMA)
	Climate Bond Standards (by Climate Bond Initiative)
International indices	Barclays/MSCI Indices
	S&P Dow Jones Green Bond Index and Green Bond Project Index
Regional frameworks	ASEAN—ASEAN Green Bond Standard (GBS)
	European Union—Action Plan for Financing Sustainable Growth
SPO Frameworks and methodologies	VigeoEiris (CBI’s Verifier), Second Party Opinion Methodology for green bonds
	Oekom, Green Bond Analysis Framework
Stakeholders’ frameworks (issuers /Investors)	(Issuer) Citi Green bond Framework
	(Issuer) Asian Development Bank Green bond framework
	(Investors) Axa Transition Bond Guidelines
National frameworks	China—Green Bond Endorsed Project Catalogue (or the Catalogue); Green Bond Assessment and Verification Guidelines
	France—Energy Transition Bill and National Low-Carbon Strategy
	Netherlands—Green Funds Scheme

Source: authors’ desk research.

Investors with a stricter view of green investing, also referred to as “dark green investors”, believe that instead of making the market expand, a flexible approach would harm its credibility with a serious risk of greenwashing. On the other hand, investors with a softer screening process, and leaning towards the lighter green of the spectrum, appear to be eager to seize the green bond market opportunity while addressing climate change challenges. Meanwhile, underwriting banks also face this complexity.

4.6. Risky Green Bonds?

Issuing a green bond brings several benefits and offers a window of transparency on the overall profile of the issuer and its sustainable strategy, as shown in Figure 6.

	Benefit #1	Benefit #2	Benefit #3
<b>Issuer</b>	A favorable sustainability reputation with our clients / public	Alignment with our mission	Access to a larger and/or a more diverse investor base
<b>Investor</b>	A favorable sustainability reputation with our clients / public	Development/reinforcement of disclosure compliance	A more sustainable financial return in the long term
<b>Intermediary</b>	A favorable sustainability reputation with our clients / public	Access to a larger and/or a more diverse investor base	A more sustainable financial return in the long term

**Figure 6.** Top three benefits of the green bonds for each category of market participants. Source: interviews with 11 experts across issuers, investors, and intermediaries, conducted in December 2019.

It also brings constraints and potential drawbacks to issuers. Some issuers may prefer avoiding attracting a closer look at their operations and sustainability performance. At the board level, the risk of greenwashing can be strong enough to reject a green bond issuance. Environmentalist Jay Westerveld

coined the term “greenwashing” in 1986 in a critical essay about the irony of the “save the towel” movement in hotels. Greenwashing is not only in relation to an unsubstantiated or misleading claim about the environmental benefits of a product, service, technology, or company practice, it also exists when an organization spends more time and money branding itself or its projects to be green than actually implementing sustainable business practices. Greenwashing can be costly for a company—in February of 2017, Walmart paid USD 1 million to settle greenwashing claims that misleadingly claimed to sell “biodegradable” or “compostable” plastics (Lyons Hardcastle n.d.). In 2017–2018, the Russian aluminum company Rusal was expected to issue a green bond raising USD 500 million. Rusal had previously launched a green aluminum brand and actively communicated around this development. Eventually, no green bond was issued. This non-event emphasizes the risk associated with a green bond coming from an industry known for its energy-intensive and polluting industrial processes (Hale 2018).

Some companies may not be eligible for green bonds, while some of their projects could be. Then, are some sectors banned from green issuance de facto? Sectors such as oil, mining, or meat production are large, topical, and sensitive. In this regard, the TEG’s taxonomy proposal had evolved since its initiation. The TEG’s proposed taxonomy includes economic activities that are already low carbon as well as “transition activities”, such as steel or cement manufacturing. Nevertheless, this point remains contentious. Marfrig’s transition bond illustrates this controversy, as shown in Table A3 in Appendix A—Marfrig is one of the leading beef producers in South America; it issued in July 2019 a USD 500 million sustainable bond to fund the exclusive purchase from Brazilian cattle producers who would respect strict environmental rules. The issuance provoked strong reactions in the green bond community given the core activity of the issuer and of the project itself (Petheram 2019).

Similarly, the EUR 500 million green bond by Repsol in May 2018 is a case in point, as shown in Table A4 in Appendix A. Its use of proceeds aimed at reducing greenhouse emissions of the company through energy efficiency upgrades. However, the bond would also enable the extension of the life of the Spanish oil and gas company’s assets. Influential indices such as Bloomberg Barclays, MSCI, S&P DJI, and Solactive did not list the bond, and Climate Bonds Initiative argued that it did not represent a fundamental change in the oil company’s business model. Nevertheless, the second-party opinion provider VigeoEiris validated the bond as green and considered it aligned with the GBP (Vigeo Eiris 2017).

The lack of visibility on the use of the proceeds is another risk, given that no existing framework requires a direct and restricted allocation. Green bond proceeds are fungible. Thus, the risk of misallocation exists. Research highlights the example of China, which accounted for 39% of total issuance in 2016, and where issuers were allowed to use up to half of the proceeds to repay bank loans and invest in working capital (Morgan Stanley Research 2017). Under green bond frameworks, issuers commit to having an audit of their management of proceeds—which a second-party opinion verifies. Up to 12 months after the issuance of the bond, the issuer must provide its verifier with information supporting that the bond proceeds have been allocated according to pre-issuance plans or of any change. This is meant to respond to a common criticism that green bonds, when used to refinance projects, are a mere way of “repackaging” traditional bonds without any additional and substantial net benefits (Shishlov and Morel 2016). The 2017 revision of the U.S. tax code participates in explaining the slowdown in new green-labeled issuance from municipalities and may worsen the dynamism on the U.S. green bond market. The revision reduced issuers’ ability to refinance their existing debt by eliminating advance-refunding transactions. In 2017, 15 refinancing transactions amounted to USD 3.8 billion labeled as green—equaling 23% of the transactions and 36% of the par issued in 2016 (De La Gorce 2019).

Some differences are noteworthy between American and European investors. European investors tend to be more stringent compared to their American counterparts when it comes to green investing. Indeed, 21% of the market value of bonds contained in the 2019 Bloomberg Barclays MSCI Green Bond Index meets the proposed EU Taxonomy criteria as of June 2019, which can be considered relatively

low for a green bond index (MSCI 2019). Per sector, the segmentation is the following: less than 2% by number of bonds on the Index would meet EU requirements for transport-related bonds; less than 1% for energy efficiency-related bonds; and about 5% for real estate-related bonds.

Finally, supporting a green bond issuance also brings a reputational risk to the underwriter. As reported by Reuters, accompanying Marfrig's transition bond was a source of internal tensions at BNP Paribas with a high reputational risk feared by some officials (Gore and Miluska 2019).

Select corporates may prefer not to take those above-mentioned risks. Despite the initiatives to engage with the largest greenhouse gas emitters to curb emissions such as Climate 100+ and a growing number of investors divesting from the oil and gas industry—from 180 investors in 2014 with a total USD 52 billion to more than 1100 now (Nauman 2019), fossil-fuel companies are still benefiting from a robust demand for their traditional bonds. Saudi Aramco issued its first bond in April 2019 and raised USD 12 billion, in a U.S. dollar-denominated debt issue, after receiving more than USD 100 billion in orders, one of the most oversubscribed debt offerings in history (Smith et al. 2019). Admittedly, Saudi Aramco outlined some risks posed by climate change and the energy transition in its debt prospectus.

## 5. Policy Recommendations for Growth

### 5.1. Standardize the Green Bond Market

There is a need for common global definitions and norms upon which issuers and investors could agree. The development of various standards and principles at different levels displays the dynamism of the market with several bodies actively trying to address the lack of green standardization. By setting out what is green and what is not, a standardized language on green bonds would have to meet a series of key characteristics for its success, in particular: a wide field of application (including activities not directly green); a high degree of granularity; flexibility to respond to future technological, scientific, and regulatory changes; the integration of the entire value chain of an activity; and a potential to be a universal standard. In this process, both private and public actors should aim at striking the right balance between stringency and leniency—in terms of scope and procedures.

The European taxonomy has significant potential for globalizing the green bond market. The discussions of the European Commission's International Platform on Sustainable Finance, which began in the Fall of 2019, will be key, especially with Canada and China, which are developing their own classifications. To enhance and expand the green bond market and effectively achieve sustainable green growth, the cooperation for a common language among different stakeholders needs to be promoted (Nguyen et al. 2019).

Additionally, the need to harmonize standards goes beyond developed markets. Many Asian and Latin American clients issue green bonds in hard currency (USD or EUR). Therefore, in the medium-long term, green bond investors can mobilize capital to fund emission reduction projects in emerging and developing economies. In these markets, information related to environmental concerns is scarcer and less reliable. Hence, it is even more important to strengthen and standardize frameworks and the verification processes that accompany green bonds.

### 5.2. Adopt High Standards of Disclosure and Reporting

Policymakers must facilitate how companies disclose and report information on which part of their revenue comes from green activities and green assets, and on the use of proceeds of all green bonds issued.

#### 5.2.1. Disclosure

Policymakers should accompany institutional investors, and asset managers who market investment products as environmentally sustainable, to explain whether, and how, they align with sustainable investment classifications and guidelines, and subsequently disclose the proportion of the underlying fund that is consistent with it. The EU Taxonomy represents a meaningful tool to achieve

this objective at a large scale. By clarifying the metrics of what is green and what is not green, the TEG's document takes away some reputational risk borne by issuers and investors. Hence, disclosure on the "use of proceeds" of all bonds issued would provide clear assurance to investors that their investments are aligned with long-term environmental objectives, decrease the distortion in transaction costs between green bonds and 'vanilla' bonds, and facilitate the distinction between brown and green assets and assess alignment with a low-carbon and climate resilient (LCCR) trajectory. Other financiers, companies, and local authorities both within and outside the EU can also use the Taxonomy voluntarily (UNEP FI 2018). As the market increases, issuers are becoming more familiar and are deploying more sophisticated tools to integrate green issues. Hence, arguing a lack of standardization to justify the slow growth of the green market is going to be increasingly irrelevant.

### 5.2.2. Reporting

Issuers may also reinforce the measurement of the environmental impact of green bonds. Reporting should be standardized, thereby strengthening the greening objective and capacity of green bonds. However, while it makes sense to define indicators straight away for fairly standardized projects, other projects cannot be subject to the prior definition of a control information system. It illustrates the choice of information system (Aghion et al. 1994)—if the degree of uncertainty of the project is high, the project owner or issuer should manage the reporting, otherwise, it should be set by the investor.

The introduction of a stringent and mandatory reporting obligation on green assets to all firms or all bonds issued would encourage companies to further integrate climate change into their business model and to adapt their strategy accordingly. This measure would also entail additional implementation costs. Those costs could be reduced if the same level of transparency were to be required for all bonds and from all firms. The regulator has a role to play in this regard, by requiring all issuers to disclose information on the alignment along the LCCR pathway.

### 5.3. Develop Synergies with Other Sectors and Instruments

Alternative instruments represent a potential answer to address the limits of the green bond pipeline. Given the divergences regarding the modalities and pace related to the LCCR transition, but considering the critical need to adopt an inclusive approach, establishing common principles with a "lower common denominator" in terms of sustainable sectors would facilitate the mobilization of capital towards a greener economy. With a sustained pipeline of projects, the green bond market would benefit from a reduced cost of capital, thereby creating a virtuous circle to its expansion.

#### 5.3.1. Transition Bonds

Transition bonds are a new category of bonds, designed to enable companies, which currently could not offer traditional green bonds, to issue bonds aiming at supporting them to gradually transition towards a greener business model. AXA offered a pioneering framework which requires issuers to allocate proceeds to "climate transition-related activities" (Takatsuki and Foll 2019). A non-exhaustive list of project categories in its Transition Bond Guidelines includes cogeneration plants, carbon capture, and storage for example. Brown issuers are also compelled to tell an articulated story about their LCCR transition, supported by short-term targets and a clear commitment.

Nevertheless, transition bonds come with a lot of pending questions. The EU taxonomy, in this regard, sets out which areas of the industry are sustainable and which are not, including an analysis of "transitional" activities ("greening of"). The final taxonomy published on 9 March 2020 does not preclude the possibility of extending the taxonomy to cover 'brown' activities (Technical Expert Group on Sustainable Finance 2020). The TEG's ambition is that the taxonomy would ultimately comprise three performance levels: "substantial contribution" [green]; "significant harm" [brown]; and a category for those activities that do neither. The second category of investments would eventually be coupled with incentives to reduce environmental harm.

To scale up the green bond market, and address the deficit of green CAPEX, the transition bond option can meet investors' pressure on the world's largest emitters while reaching a much larger pool of issuers and investors. The focus on big emitters' CAPEX plans aligned with the Paris Agreement and a zero-carbon economy could address the critical need of supply and eventually unlock the green market.

A distinct framework, based on consistent and differentiated language and labels, would also protect the green bond market from being diluted. Such a framework should follow a 2 °C trajectory, given that each activity sees its carbon intensity gradually decreasing, at a level and a rate depending on the specificities and technological breakthroughs experienced by the sector. "Coherence checks" would be necessary (Shishlov and Morel 2016) to certify that so-called green and transition bonds are truly aligned with an LCCR pathway.

### 5.3.2. Generic Financing Instruments

Given the over-representation of a small number of stakeholders and of some sectors (i.e., energy and transportation) in the green bond market, many other challenges of climate change remain unaddressed. Public and private sector players are encouraged to be innovative and embrace sectors beyond energy, including water-efficient technology, extreme weather-resilient building materials, new financial and insurance products, early warning systems, environmentally friendly agribusiness, drought-resistant seeds, new health products, or waste management. To address the supply issue (see supra), it is relevant to align the green financial instruments and incentives with the way most companies operate.

Sustainability-linked financing—either with loan facilities or bonds—represents a suitable option to mainstream the green and sustainable market. The funding is not earmarked to a specific project, but its pricing is linked to definite sustainability targets. Hence, they offer companies, which do not possess substantial green projects to finance, the possibility to issue debt for general corporate purposes. They also present a way to capture the sustainable improvement and impact of the issuers. By linking the ESG performance of the firms to the pricing, this type of instrument offers an incentive for the issuers to become greener.

It could be an efficient way to help oil and gas companies to make a progressive shift away from fossil fuels. Enel's USD 1.5 billion Sustainable Development Goal (SDG)-linked loan, which offers euro notes with coupons tied to environmental goals represents an interesting example. Enel would use the financing for ordinary needs, including for more than half of its non-green power generating business. Enel's bond focuses on four SDGs related to energy, industry, sustainable cities, and climate action, coupled with specific targets. For example, regarding SDG 7 on "Affordable and clean energy", Enel has committed to have over 11.6 GW of additional renewable generation capacity by December 2021; this represents going from 46% to 55% of its total capacity. The interest spread applied to drawings on the line, and the commitment fee for any unused portion of the credit facility would vary based on a step-up and step-down mechanism depending on how Enel meets its set targets. There was USD 4 billion in demand for the bonds, and Enel said the deal had saved it 20 basis points compared to a conventional bond (ENEL 2019).

### 5.4. Facilitate Investment in Emerging Economies

In most emerging markets, where green bonds are less established, a constructive use of guarantees and de-risking measures are much sought-after tools to expand the green bond market. The key barriers in these economies are a lack of appropriate institutional arrangements for green bond management, the small size of issuances, and high transaction costs (Banga 2019).

In this regard, the Amundi Planet Emerging Green One (EGO) fund, co-sponsored with the International Finance Corporation (IFC), offers an example of solution to this challenge by capturing emerging market debt premium while reducing the risk with a first-loss buffer and high portfolio diversification. The launch of a green bond fund targeting non-financial or 'real economy' issuers in emerging markets (REGIO) shows the market adequacy of this supporting instrument and its potential for replication (Le Houérou 2019).

## 6. Conclusions

In July 2019, the Chief Investment Officer of Japan's Government Pension Investment Fund called green bonds a "lose-lose" proposition, adding that "there is still a risk that the green bond will remain a passing fad" (Asgari 2019). Meanwhile, challenges related to climate change emphasize the need for various stakeholders to take actions and prevent what Mark Carney, Governor of the Bank of England, described as "a tragedy of the horizons" (Carney 2015). To analyze the scalability of the green market, this paper presents key findings drawn from a revision of the latest literature, market data analysis, and interviews conducted with industry experts.

Investors, issuers, and enabling financial institutions, are facing several challenges across their investment, underwriting, and group-wide risk management practices regarding green bonds. These obstacles prevent green bonds from being leveraged as a key instrument to address climate-related challenges. Barriers to a greater expansion of the green bond market include unclear perceptions around financial benefits from issuers, limited benchmarks, lack of supply diversity and liquidity, a deficit of standard approaches for managing the proceeds, and impact reporting difficulties that reinforce risks of greenwashing.

This paper suggests four pillars of recommendations to expand the green bond market. First, we recommend pursuing efforts of standardization of issuance through the development of a common green bond framework, which will attract a larger number of issuers and investors. Second, we recommend improving transparency and disclosure, by supporting knowledge sharing and requesting impact measurement and reporting procedures, with the promotion of the Taskforce for Climate-related Financial Disclosures Framework. Third, we suggest distinguishing the green bond market from other instruments, such as transition bonds and sustainability-linked instruments, reducing the risk of greenwashing. Fourth, we advocate for mechanisms that facilitate investments in emerging economies, which can become a relevant source of issuance.

Ultimately, the scalability of the green bond market depends on a paradigm shift. Stakeholders today perceive the green bond market mostly as a communication tool, with a relatively limited or unclear economic benefit. Thanks to a coordinated effort, the green bond market can acquire a data-driven legitimacy both in terms of sustainability and financial returns. That shift will reduce transaction costs and crowd in more issuers, especially smaller ones, and give comfort to a wider investor base, expanding the scope of green bonds to more corporate sectors and geographies. Select investors with a buy-and-hold strategy are demonstrating a rising interest in green bonds, especially central banks, paving the way for an acceleration in issuances.

## 7. Definition of Terms

Corporate social responsibility (CSR)

A company's efforts to assess the effect of its operations and processes on communities and to set policies that maximize the positive impact of its activities.

### **Environmental, social, and governance (ESG)**

- Factors to consider when measuring the sustainability and ethical impact of an investment.
- **Environmental:** A responsible investing factor dealing with climate impact, energy consumption, biodiversity, waste management, and natural resource use. Example: Waste management—innovative packaging to reduce waste while cutting down material and transport costs.
- **Social:** A responsible investing factor dealing with employee engagement and development, labor relations, human rights practice, product safety, and consumer protection. Example: Health and safety—effective health and safety programs can mitigate unexpected costs caused by workplace injuries, e.g., medical expenses, workplace disruption, productivity loss.
- **Governance:** A responsible investing factor dealing with management structure, board accountability and independence, executive compensation, audits and internal controls, and shareholder rights. Example: Board diversity—a wide range of competencies, knowledge, and perspectives can lead to better decision-making and more effective corporate governance.

### **Green bond**

A bond in which proceeds are used to fund new and existing projects with environmental benefits, such as renewable energy and energy efficiency projects.

### **Green Bond Principles (GBP)**

The Green Bond Principles are voluntary process guidelines that recommend transparency and disclosure and promote integrity in the development of the green bond market by clarifying the approach for issuance of a green bond.

### **Green Bond Standard (GBS)**

A labelling scheme for green bonds by the EU.

### **Greenwashing**

Falsely communicating the environmental benefits of a product, service, or organization. The goal is to claim a deceptive environmentally friendly policy and positioning.

### **Global Reporting Initiatives (GRI)**

The Global Reporting Initiative is an international independent standards organization that helps public and private organizations understand and communicate their impacts on climate change, human rights, and corruption.

The GRI launched the GRI Standards in October 2016; they are the first global standards for sustainability reporting.

### **ICMA**

The International Capital Market Association or ICMA is a self-regulatory organization and trade association for participants in the capital markets. ICMA formulates the Green Bond Principles.

### **Integrated reporting**

Company reporting that articulates the relationship between a company's strategy, governance, and performance, and how it creates value for a range of stakeholders.

### **Impact measurement**

The measurement of how companies' activities affect the world both positively and negatively.

### **Low-carbon economy**

An economy based on low-carbon power sources with a minimal output of greenhouse gas (GHG) emissions into the biosphere. The Paris Agreement commits to the transition to a global low-carbon economy over the next 30 years.

### **Low-carbon and climate resilient pathway (LCCR)**

Shift in the allocation of private finance flows from carbon-intensive activities to investments compatible with a 2 °C pathway.

**Paris Agreement**

An accord within the United Nations Framework Convention on Climate Change addressing greenhouse-gas-emission reduction, adaptation, and finance adopted by 195 countries in December 2015 at the Paris conference. The Paris Agreement’s objective is to limit the rise of global mean temperature to +2 °C compared to the preindustrial period.

**Physical risks of climate change**

The risk posed by climate events on physical assets and infrastructure.

**Screening**

An investment approach used to filter companies based on pre-defined criteria before investment.

**Second-Party Opinion**

Provision of an assessment of the issuer’s green bond framework, analyzing the “greenness” of eligible projects/assets. Some second party opinions also provide a sustainability rating, giving a qualitative indication.

**Socially responsible investing (SRI)**

Originally, a term used interchangeably with environmental, social, and governance (ESG) investing. Typically, legacy SRI approaches have emphasized exclusionary screening.

**Stewardship**

An ongoing and purposeful dialogue between shareholders and boards that aims to ensure a company’s long-term strategy and day-to-day management is effective and aligned with shareholders’ interests.

**Sustainable investing**

An investment approach in which a company’s sustainability practices are paramount to the investment decision and in which ESG analysis forms a cornerstone of the investment process.

**Taxonomy on Sustainable Finance**

A classification tool to help investors and companies make informed investment decisions on environmentally friendly economic activities.

**Taskforce for Climate-related Financial Disclosures (TCFD)**

The Task Force on Climate-related Financial Disclosures was set up in 2015 by the Financial Stability Board (FSB) to develop voluntary, consistent climate-related financial risk disclosures for use by companies, banks, and investors in providing information to stakeholders. TCFD’s Phase 1 report outlined some of the key areas towards identifying the current challenges in the reporting environment, setting the objective of climate-related financial information, the type of information reporters will have to provide, and where they should report it.

**Technical Expert Group**

The European Commission’s EU Technical Expert Group on Sustainable Finance that published the EU Taxonomy.

**Third party assurance**

Third party assurance reports state whether the green issuance is aligned with the Green Bond Principles and the Climate Bonds Standard.

**Transition risk**

The financial risks that could result from significant policy, legal, technology, and market changes in the transition to a lower-carbon global economy and climate resilient future.

**UN Principles for Responsible Investing (PRI)**

A voluntary set of principles, backed by the United Nations, under which signatories commit to integrating ESG factors into their investment decisions.

**UN Sustainable Development Goals (SDG)**

A collection of 17 goals reflecting the biggest challenges facing global societies, environments, and economies today. The SDGs were set in 2015 by the United Nations General Assembly and intended to be achieved by the year 2030, as part of the 2030 Agenda.

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**Appendix A**

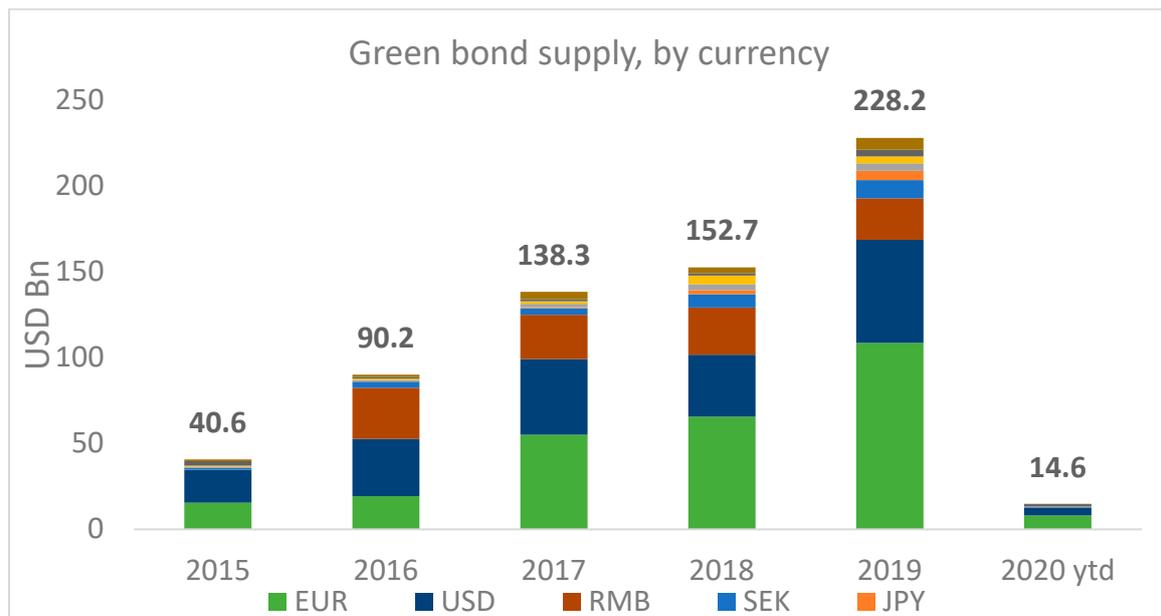
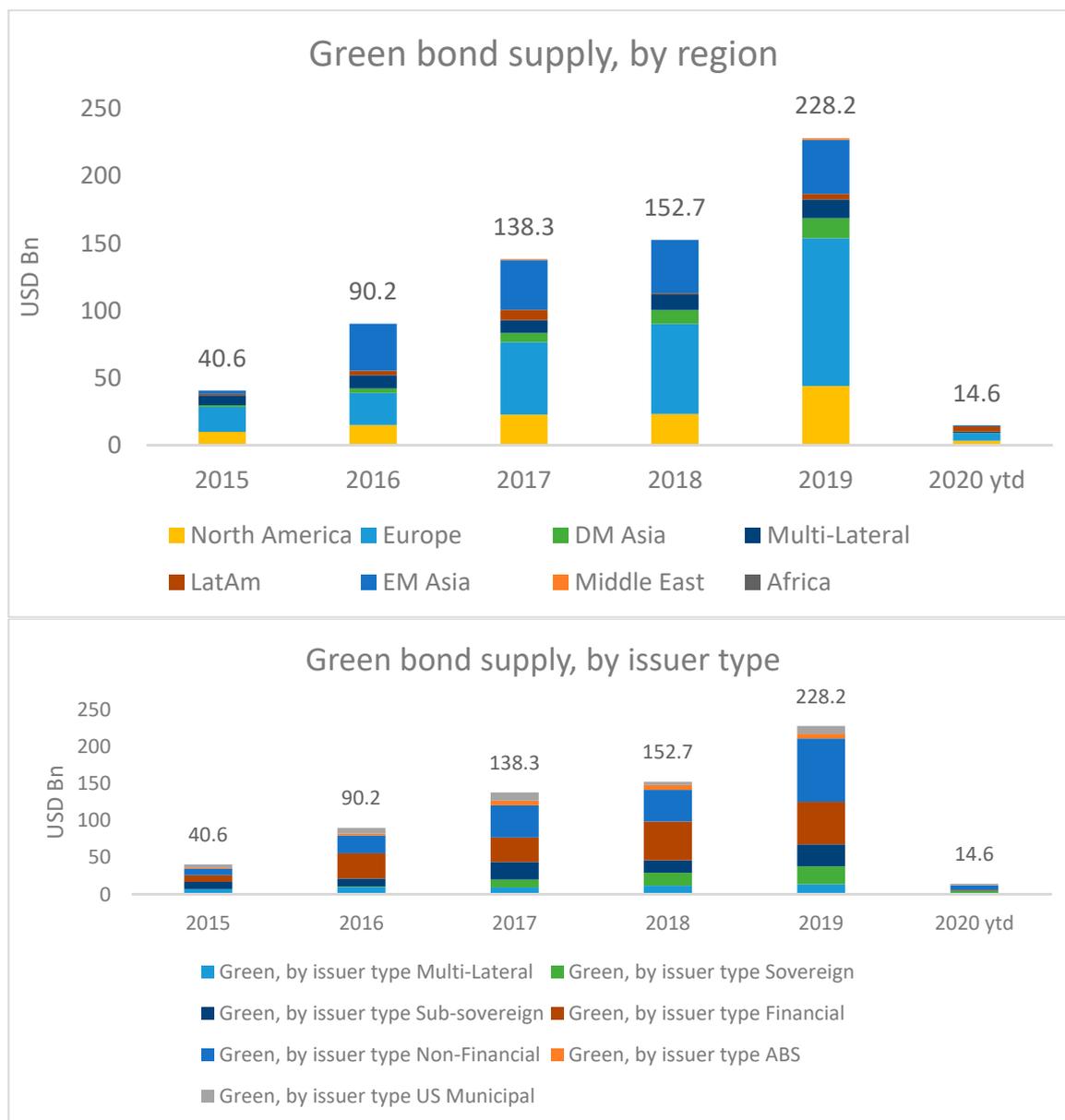


Figure A1. Cont.



**Figure A1.** Overview of the green bond supply since 2015. Source: Dealogic, Bloomberg (for munis) as of 20 January 2020. Financials include covered bonds.

**Table A1.** PepsiCo’s green bond.

Issuer	PepsiCo
Issuance date	October 2019
Nominal value	\$1 billion
Nominal currency	USD
Rating (issuer, bond)	A+ (S&P), A (Moody’s)
Framework	Green bond
Tenure	30 years
Coupon	2.875%
Use of proceeds	Eco-friendly plastics, water use efficiency, packaging, and cleaner transportation
Bookrunners	Morgan Stanley, Goldman Sachs, Mizuho Financial group

**Table A2.** The 2014 U.S. State of Massachusetts's green bond.

<b>Issuer</b>	<b>U.S. State of Massachusetts</b>
Issuance date	September 2014
Nominal value	\$350 million
Nominal currency	USD
Rating (issuer, bond)	AA+ (Fitch), Aa1 (Moody's), AA+ (S&P)
Framework	Green bond
Tenure	3 to 17 years
Coupon	2.45%
Subscription level	3 times
Investor base	Residents and local retail investors
Use of proceeds	Water projects, offshore wind port facilities, energy-efficient buildings, and restoration and preservation projects
Bookrunners	Morgan Stanley

**Table A3.** Marfrig's transition bond.

<b>Issuer<sup>5</sup></b>	<b>MARFRIG</b>
Issuance date	July 2019
Nominal value	\$500 million
Nominal currency	USD
Rating (issuer, bond)	BB-(S&P and Fitch)
Framework	Transition bond
Tenure	6 August 2029
Coupon	Fixed 6.625%
Optionality	Callable at 103.31 the 06 August 2029
Rank	Senior Unsecured
Issuance price	Initial price talk in the high 6% range up to 7%, and then priced the 10-year notes to yield 6.625%
Subscription level	3 times
Investor base	Europe, the United States, and Asia
External review	VigeoEiris <sup>6</sup>
	Exclusive allocation to the purchase of cattle <sup>7</sup> :
Use of proceeds	(1) From farmers located in the Amazon Biome; (2) In the States of Mato Grosso, Rondonia, and Pará; (3) From suppliers respecting Marfrig's eligibility environmental and social criteria
Bookrunners	BNP Paribas, ING, and Santander

<sup>7</sup> Marfrig, "Marfrig Sustainable Transition Bond."

<sup>6</sup> VigeoEiris, "Second Party Opinion on the Sustainability Credentials and Management of the Sustainable Transition Bond Issued by Marfrig."

<sup>5</sup> Source: Bloomberg.

**Table A4.** Repsol's green bond.

Issuer <sup>89</sup>	Repsol International Finance
Issuance date	23 May 2018
Nominal value	€500 million
Nominal currency	EUR
Rating (issuer, bond)	Baa (Moody's), BBB (S&P)
Framework	Green bond
Tenure	4 years
Coupon	0.50%
Rank	Senior Unsecured
Issuance price	99.568% of the Aggregate Nominal Amount
Spread emission	+35 bps vs. m/s
External review	VigeoEiris
Use of proceeds	Energy efficiency upgrades in Repsol's oil and chemical refineries
Bookrunners	Multiple (Morgan Stanley, Santander, HSBC)

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<sup>9</sup> REPSOL, "Repsol Final Terms."

<sup>8</sup> Bloomberg.

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