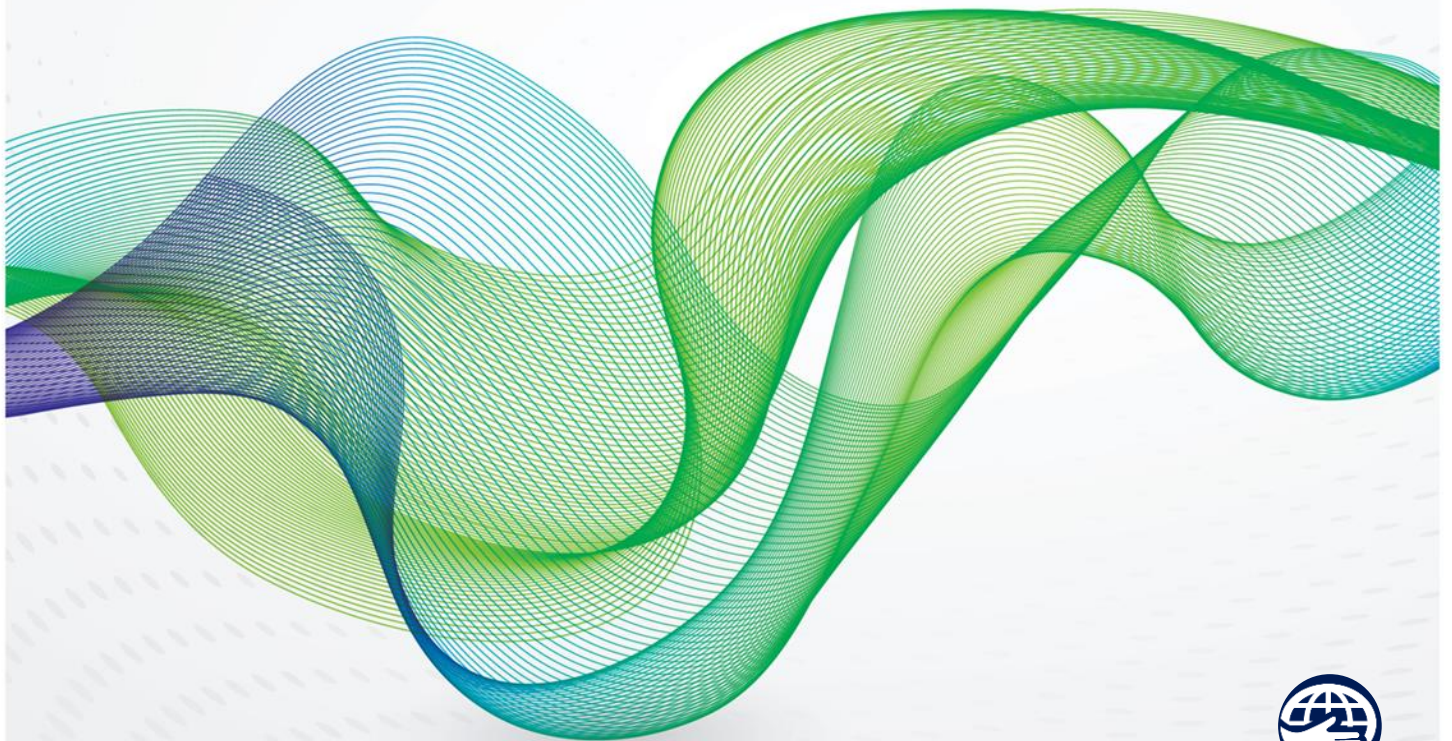


February 2022

Financing the Energy Transition: The Role, Opportunities and Challenges of Green Bonds



ENERGY TRANSITION



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Abstract

This paper discusses the current developments and adoption of financial instruments designed to support the efforts of governments and corporations in decarbonizing their activities. Particular focus is given to the role of Green Bonds, a debt-like financial instrument whose proceeds are used to finance 'Green' projects/assets. Green bonds have experienced strong growth at the global level and represent, as of 2021, a USD1.5 trillion market, with issuers including governments, supranational institutions, and corporates. Among corporate issuers within the energy sector, utility firms stand out as early adopters, motivated by their investments in renewable infrastructure as part of their strategy to reduce greenhouse gas (GHG) emissions. From the issuers' perspective, several incentives motivate the issuance of green bonds including i) diversifying their investor base, ii) accessing a larger and more stable investor base, and iii) signalling strong commitment to credible decarbonization strategies. These incentives are considered to compensate for the additional costs incurred by third-party verification and enhanced post-issuance reporting. This paper reviews evidences on the 'greenium' – namely the premium paid by investors on green bonds and also discusses the important role played by institutional investors and financial institutions in the green bond market. Central banks are also expected to play a major role in shaping the pricing and adoption of green finance – and green bonds in particular – by providing guidance and adapting their supervisory and monetary interventions. The paper concludes by reviewing more recent 'green' financing instruments, such as Sustainability Bonds and, in particular, Sustainability-Linked Bonds, as they are of particular relevance for the energy industry and hard-to-abate sectors.



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1. Introduction

The 2018 Intergovernmental Panel on Climate Change (IPCC) report¹ emphasized the urgency of combatting climate change and was unequivocal in stating that immediate action was needed to reduce greenhouse gas emissions (GHG) in order to achieve the objectives of the Paris Agreement.² The urgency and the scale of the challenge underpinning climate change requires a unique level of effort and coordination at global level, with the involvement of both public and private players. To put this into scale, the 2018 report by the IPCC estimates that limiting global warming to 1.5°C above pre-industrial levels requires energy systems investments of USD2.4 trillion annually (equivalent to 2.5 per cent of world GDP³) between 2016 and 2025.

Private capital is considered as a primary instrument in achieving reduction in GHG emissions. In this respect, green financing instruments – such as green bonds, sustainable bonds, and sustainability-linked bonds – have been specifically designed to align firms' incentives towards 'greener' business models and have been identified as a primary tool for corporates to use in implementing transition strategies towards low-carbon emissions.

Among this new asset class, green bonds have grown since 2007 to reach a total of USD1.5 trillion in issuance as of H2-2021,⁴ thus representing an important component in financing green projects/assets. Combined with appropriate transparency frameworks and reporting standards, such as the *Green Bond Principles*, the *Climate Bond Initiative (CBI) Green Bond Standard*, and the *EU Green Bond Standard*, green bonds and green financing can, in principle, serve both the needs of investors and issuers in redeploying capital into green assets and infrastructures.

The recent initiatives led by regulators and policy makers around the world are expected to further provide a fertile ground for green bonds. In the EU, the European Commission has proposed for consultation at parliament level a major scheme to introduce an *EU Green Bond Standard* which builds on the recently established *EU Taxonomy*.⁵ The EU initiatives around green finance and climate-risk-related reporting show the importance attributed by EU policymakers to decarbonization in line with the ambitious targets set by EU states (with the aim of becoming the first net-zero continent by 2050⁶). These initiatives are expected to become a benchmark also for other jurisdictions worldwide.

Issuers consider green bonds as an attractive financing tool for several reasons. Among the driving factors for incentivizing issuance, and among the benefits recognized by issuers, green bonds provide a more stable and a larger investor base, attract higher demand from investors, and signal a firm commitment to decarbonization, thus providing reputational benefits to the issuing firm.⁷ The benefits associated with green bond issuances are considered to compensate for the higher issuing and reporting costs associated with green bonds, according to a recent survey conducted by Climate Bond

¹ 'IPCC Sixth Assessment Report', <https://www.ipcc.ch/report/ar6/wg1/>.

² Limiting global warming at close to 1.5 degrees Celsius or well below 2.0 degrees Celsius to pre-industrial levels. See: The Paris Agreement (<https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>). In order to achieve the target of the Paris Agreement, net carbon emissions need to be reduced to zero by 2050. Targets vary according to the so-called Nationally Determined Contributions (NDCs) which define voluntarily defined net-zero pathways by countries. In particular, the EU committed to GHG emissions reduction of 55% by 2030 with respect to 1990 levels.

³ See the 2018 IPCC report: <https://www.ipcc.ch/sr15/>.

⁴ Climate Bonds Initiative, <https://www.climatebonds.net/market/data/>.

⁵ The *EU Taxonomy* is a classification system, establishing a list of environmentally sustainable economic activities at EU level. See https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en.

⁶ See the action plans on the European Green Deal: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en.

⁷ See for example the recent 'Theme Chapter of the Asian Development Outlook 2021' at: <https://www.adb.org/sites/default/files/publication/692111/ado2021-theme-chapter.pdf>.



Initiative (CBI⁸). From the perspective of investors, green bonds and green finance represent instruments that can redeploy capital towards greener sectors of the economy, diversify investment portfolios, and respond to changing preferences and mandates from their investor base.

Fuelled by increased transparency and standardization, the increase in demand by institutional investors in recent years has been one of the main drivers for the fast growth in the green bond markets. We review the evidence on the pricing benefits (lower cost of debt financing) provided by green bonds to issuers. The ‘greenium’ – namely the premium paid by investors in green bonds vis-à-vis comparable conventional bonds – is mostly driven by increased demand from institutional investors and limited supply from green bond issuers. Yet, systematic evidence on the ‘greenium’ in primary and secondary market transactions remains limited and the evidence on the ‘greenium’ remains mixed. Following Ehlers and Packer (2017), we argue that the ‘greenium’ does not arise from green bonds providing an insurance (or hedge in financial terms) against climate transition risk, but it rather emerges from the strong demand from a new clientele of investors chasing sustainable investments (see Baker et al. (2018) for a study of ownership in the US Municipal green bond market). First, the majority of corporate green bonds are structured as unsecured bonds and are, as such, claims to the overall issuers’ operations. Second, as will be explained in more detail in the paper, the green bond label does not represent an opinion with respect to the environmental credit risk exposure of the issuer, but rather a signal of the green benefit of the assets and activities it finances. Finally, the majority of corporate bond issuers, with the exception of financial institutions, are in the energy and industrial sectors, which are notable for being among those most exposed to climate transition risk and environmental credit risk due to potential stranded assets.

A major challenge related to green bonds remains the scope of what defines a ‘green’ asset and the scope of eligibility in different economic sectors. While green bonds represent an opportunity for sectors of the economy with a clear path to net-zero, the criteria remain largely absent for hard-to-abate sectors and in those economic sectors for which a clear path to net-zero is not yet available.⁹

In the case of the energy industry, and in contrast to the utility sector, the total issuance of green bonds remains largely limited. Motivated by the challenge that the energy industry, and the more hard-to-abate sectors in general, face in finding viable and eligible assets for green bonds issuances, other alternative labels have emerged under the umbrella of ‘transition finance’ or ‘green finance’. These promote the objective of providing broader financing alternatives for economic sectors which are largely excluded by green bonds sector criteria, but which nevertheless could contribute to GHG emissions reduction. Among these alternatives, *Sustainability-Linked Bonds/Loans* stand out as a promising new avenue for issuers. Sustainability-Linked Bonds/Loans (SLB/SLL) differ from Green Bonds in that they are not ‘Use of Proceeds’ bonds but are financing instruments which raise funds for general purpose finance at the entity level, while being structured to embed financial incentives linked to credible decarbonization targets. SLB and SLL have experienced rapid growth in the last few years and are set to become a major asset class supporting firms in the energy and hard-to-abate sectors in their transition to low-carbon emission business models.

Against this background, this paper provides insights on the current state of the green bond market and more generally on the market for green financing instruments. Particular attention is given to the role, opportunities, and challenges provided by green bonds with respect to the energy sector.

The rest of the paper is structured as follows. Section 2 focuses on green bonds and provides a global overview of the green bond market. Section 3 discusses the costs and benefits associated with the issuance of green bonds. Section 4 considers pricing of green bonds and the ‘greenium’. Section 5

⁸ ‘Green Bond Treasurer Survey 2020’, <https://www.climatebonds.net/resources/reports/green-bond-treasurer-survey-2020>.

⁹ See for example the Climate Bond Initiative Sector Criteria in Table (3) below which, to date, mostly include activities for climate mitigation and adaptation. Similar case for the EU Taxonomy.



focuses on the specific design of green bonds, the most-adopted green bond frameworks, and their rationale. In Section 6 we review the current regulatory landscape with particular attention to the EU Taxonomy. Section 7 provides reference to the role of institutional investors and central banks in the development of green bonds. Section 8 discusses emerging trends in transition finance and dives into the opportunities and challenges faced by the energy sector and the recent adoption of Sustainability-Linked Bonds by the energy industry. Section 9 concludes.

2. Green bonds: a global perspective

Green Bonds are debt financial instruments specifically issued by firms in order to raise capital to finance 'green' projects/assets.¹⁰ What differentiates 'Green Bonds' from standard or conventional (vanilla) corporate bonds are both the bond structure and the unique type of 'Use of Proceeds':

- First, the 'Use-of-Proceeds' type of structure differs from the 'general purpose finance' structure of conventional bonds in that funds are clearly earmarked to the project/asset they are directed as per the bond prospectus.
- Second, in a typical green bond, proceeds are used exclusively to finance/refinance 'green' projects/assets, in line with established green bond frameworks and standards to which the green bond prospectus refers.

A green bond is not intended as a standalone solution. It is an instrument within a wider set of tools necessary to achieve an overall firm-level decarbonization pathway. In order to achieve third-party verification, as recommended by the *Green Bond Principles* (see below for more details), firms need to show credible, ambitious and, most importantly, 'science-based' decarbonization strategies.¹¹ Science-based targets for firm-level decarbonization are an essential requirement for establishing a common benchmark for firms to set and track their progress over time. The objectives of the Paris Agreement (in which governments have agreed to limit temperature rise by 2050 below 2.0 degrees Celsius above pre-industrial levels, and committed to pursue efforts to limit global warming to 1.5 degrees Celsius) represent the common benchmark towards targeting firms' and countries' efforts. The Intergovernmental Panel on Climate Change (IPCC) has estimated that GHG emissions need to be halved by the next decade in order to achieve these objectives.

Contrary to common belief, the 'Green' label is a voluntary disclosure in the bond documentation that issuers attribute to their bond. As of today, the state of regulation on green bonds is still in its infancy.¹² However, the financial industry has developed specific guidance to increase the standardization and transparency of the market, by providing *Green Bond Frameworks* and *Taxonomies* for issuers and investors on what defines 'green' bonds and 'green' assets/projects. At their discretion, issuers can reference in their bond documentation that the bond is a 'green bond' and whether the 'green' label is referenced to a particular Green Bond Framework or Taxonomy, and provide investors with third-party assurance and verification. These practices of pre and post-issuance verification have now become the market standard.¹³

The green bond market has experienced steep growth over the last decade in both corporate and government/supranational issuers. The very first green bond was issued in 2007 by the European

¹⁰ The World Bank defines Green Bonds as 'A Green Bond is a debt security that is issued to raise capital specifically to support climate related or environmental projects'. See: <https://openknowledge.worldbank.org/handle/10986/22791>.

¹¹ See <https://sciencebasedtargets.org/>.

¹² Exception made by the EU Green Bond Framework which is set to be approved by the EU parliament in 2022.

¹³ See 'Post Issuance Reporting in the Green Bond Market 2021', <https://www.climatebonds.net/resources/reports/post-issuance-reporting-green-bond-market-2021>.



Investment Bank (EIB), in a landmark issuance that would set the stage for future developments of the asset class. Since then, green bonds have been issued by financial and non-financial firms, supranational institutions, and sovereign countries. The first corporate issuance is dated as early as 2013.

The initial development of the green bond market received support primarily from multilateral development banks. In 2007 the EIB issued EUR600 million through its *Climate Awareness Bond* with the focus on renewable energy and energy efficiency. As part of the World Bank programme on climate finance, the International Bank for Reconstruction and Development (IBRD) issued its first green bond in 2008 for USD440 million,¹⁴ while the International Finance Corporation (IFC) issued an initial green bond in 2010 and a USD1.0 billion bond in 2013.^{15,16}

Figure 1: The main milestones achieved by the green bond market since its inception in early 2008 to its establishment as a USD1.5 trillion market in 2021



Source: Climate Bond Initiative and author elaboration.

Figure (1) shows the main milestones achieved by the green bond market since its inception in 2007, with the EIB issuance, to the USD1.5 trillion green bond landmark as of H2 of 2021. Important to note is the establishment of green bond market frameworks such as the 'Green Bond Principles' set by the International Capital Market Association (ICMA) in 2014, and the recent 'EU Green Bond Standard' in 2021. Green Bond frameworks and market-led initiatives have grown significantly in the last few years, with green bond frameworks now being available in most developed and developing jurisdictions.¹⁷

¹⁴ Originally issued in SEK, the Green Bond was meant to provide a financial instrument for Scandinavian Pension Funds seeking to invest in climate-oriented projects.

¹⁵ To put numbers into perspective, as of 2015 the IFC has issued 37 Green Bonds totalling USD3.8 billion.

¹⁶ Other Multilateral Development Banks involved in the issuance of Green Bonds include: the Asian Development Bank (ADD), the European Bank for Reconstruction and Development (EBRD), and the Nordic Investment Bank (NIB).

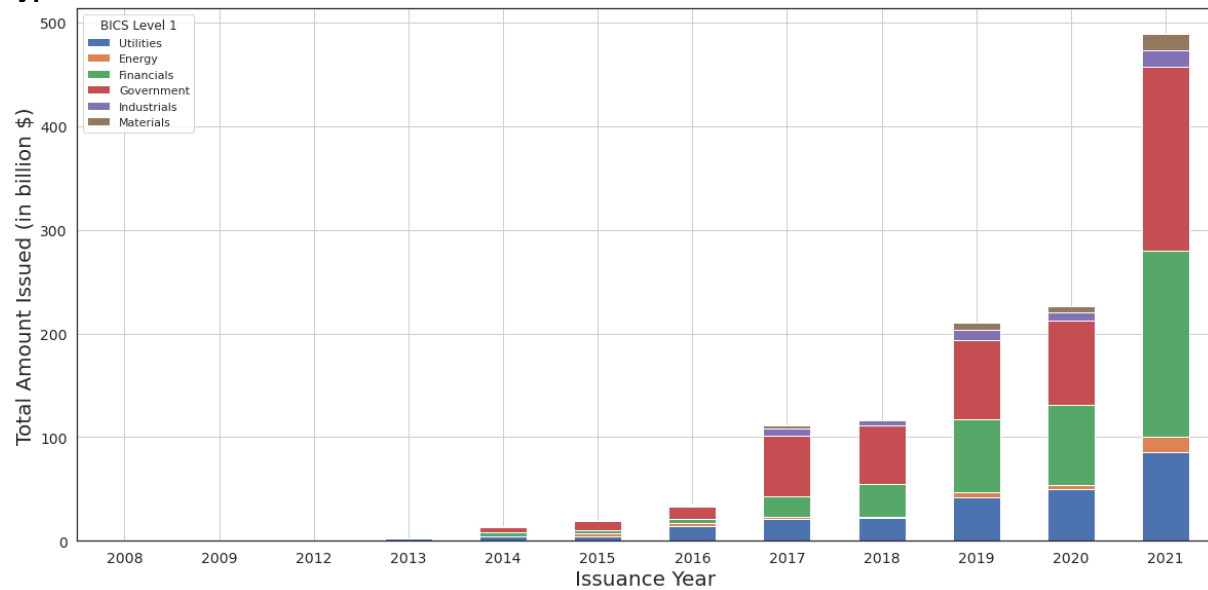
¹⁷ See for example the Climate Bond Initiative Policy dataset: <https://www.climatebonds.net/policy/data>



Finally, 2021 has been characterized by central banks starting to signal their interest in supporting the adoption of green bonds. The People Banks of China (PBoC) was one of the first central banks to advocate in 2015 for a major role for monetary and financial authorities in promoting green finance (see Dikau and Volz (2021)¹⁸).

Figure (2) shows the exceptional growth of green bonds issuance since 2007. To date, top-rated sovereign/supranational issuers dominate in terms of outstanding amount of green bonds, followed by financial institutions and non-financial corporates. Government-related issuances are of particularly great importance to provide credibility and guidance for private issuers, given that they provide funding to Nationally Determined Contributions (NDCs) commitments under the Paris Agreement.¹⁹ The latest snapshot, as of 2021, of total green bond issuers²⁰ confirms the historical figures, with sovereign, government-backed institutions and financial corporates representing the large majority of total issuance, followed by non-financial corporates such as utility and energy sector firms. Data from the Climate Bond Initiative²¹ (CBI) provides information on the issuance of other financial structures beyond unsecured corporate debt, such as Asset-Backed-Securities (ABS) collateralized with green receivables, which accounted at global issuance level for USD32.6 billion and USD20.8 billion as of 2019 and 2020 respectively.

Figure 2: The annual issuance of Green Bonds in USD billions between 2011 and 2020 at issuer type level



Source: Bloomberg Fixed Income Database and author's calculations.

Figure (3) shows the time series evolution of 'Use of Proceeds' for the global issuance of green bonds. Capital raised has been mostly invested in improvements in energy efficiency, green buildings, and green transportation. Figure (4) shows the aggregate EUR-denominated issuance of green bonds at

¹⁸ This policy article focuses on 'window guidance' – in other words, policies to encourage the expansion of credit provided by financial institutions to sustainable assets and activities and to reduce lending to high carbon-emitting sectors. The article can be accessed at the link: <https://www.lse.ac.uk/granthaminstitute/publication/out-of-the-window-green-monetary-policy-in-china-window-guidance-and-the-promotion-of-sustainable-lending-and-investment/>.

¹⁹ Climate Action Tracker: <https://climateactiontracker.org/countries/>.

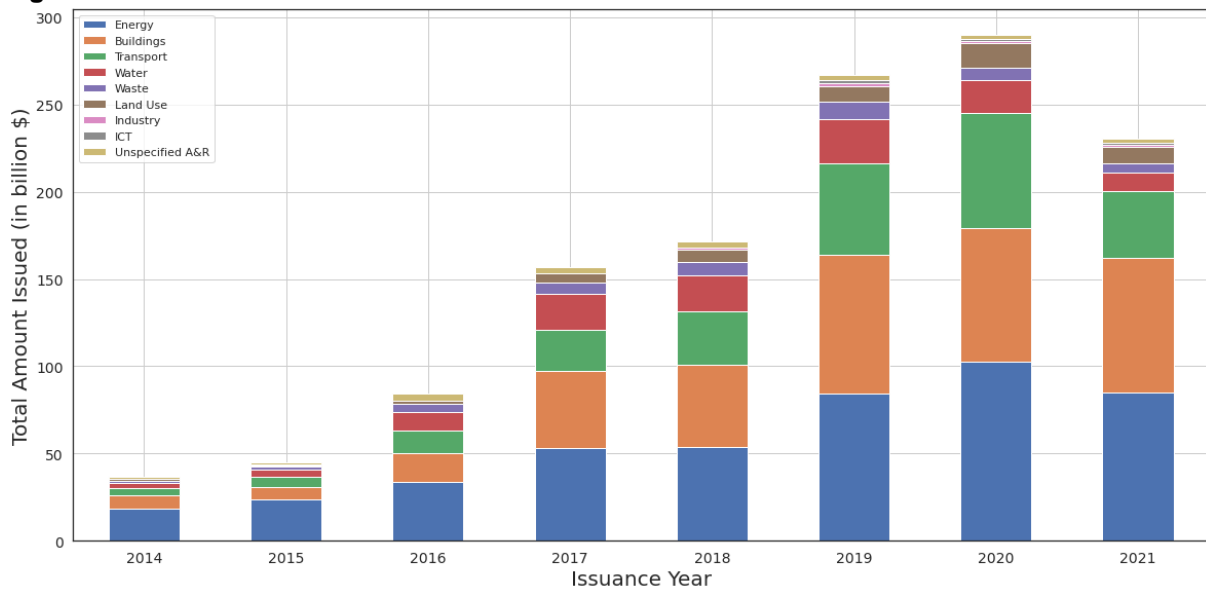
²⁰ Climate Bonds Initiative: <https://www.climatebonds.net/market/data/>

²¹ <https://www.climatebonds.net/market/data/>.



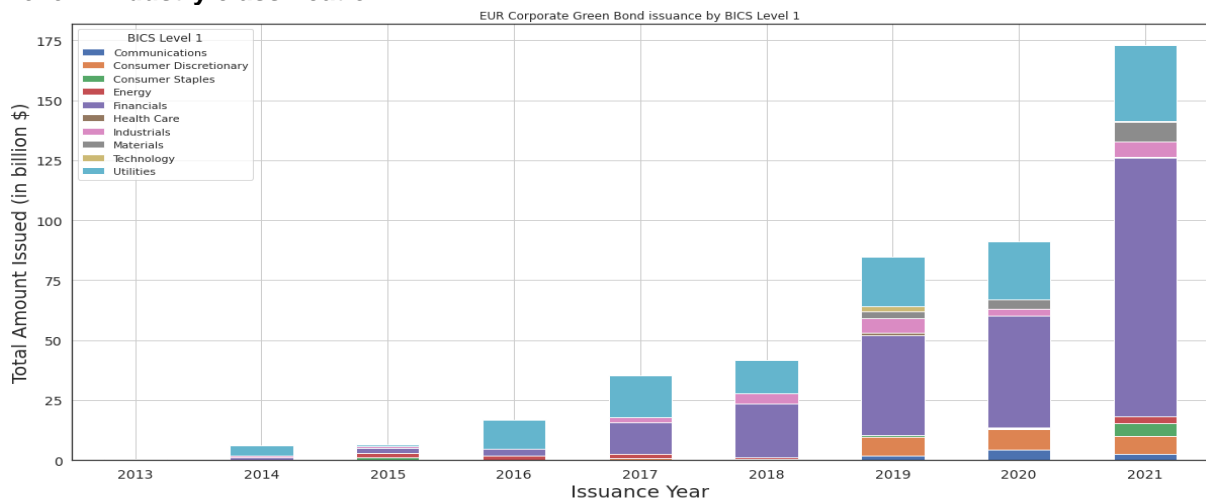
sector level (total issued amounts are reported in USD billion). Given that green bonds represent ‘Use of Proceeds’ instruments, whereby raised funds are directed towards the financing of specific projects or assets as detailed in the bond prospectus, understanding the issuers’ sectors provides interesting guidance on which type of projects have been financed between 2013 and 2021. As will be explained in more details in later sections, the target assets or projects need to comply with eligibility criteria set forth by green bonds standards for the security to be labelled as a green bond compliant with a specific green bond framework.

Figure 3: Green Bond issuance at ‘Use of Proceeds’ level between 2014 and 2021



Source: Climate Bond Initiative Database.
 Note: Legend shows the type of underlying assets and projects financed for each issuance year.

Figure 4: The annual EUR-denominated issuance of corporate green bonds 2013–2021 at BICS Level 1 industry classification

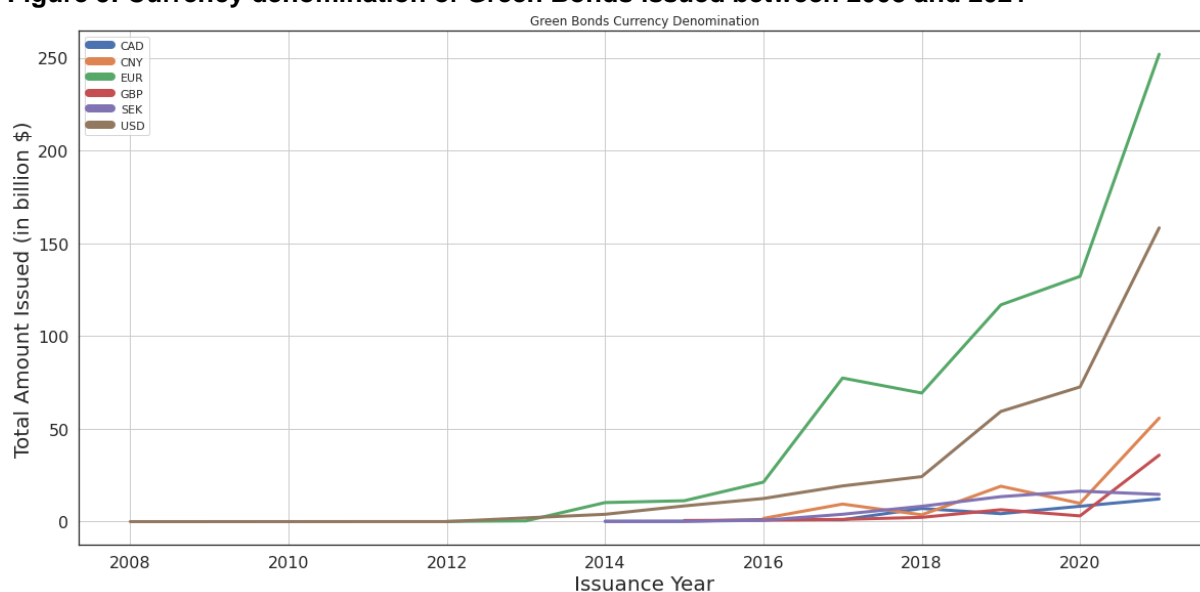


Source: Bloomberg Fixed Income Database and author calculations.



Figure (5) shows the time evolution of currency denomination for green bond issuance and its total aggregate levels up to 2021. Interestingly, since 2013 the euro (EUR) has been the leading issuance currency worldwide for green bonds.²² This is in line with the increased effort by the EU to provide finance to the ambitious targets set forth in its NDCs.²³ Green bond tickets have been increasing since 2015 (see Figure (A-5)), with issues of size between USD500 million up to USD1 billion or more accounting for 67 per cent as of 2021.²⁴ In cumulative terms, large tickets account for up to 60 per cent of total issuance as of 2021.²⁵

Figure 5: Currency denomination of Green Bonds issued between 2008 and 2021



Source: Bloomberg Fixed Income Dataset.

The above figures show the exceptional growth and adoption in different sectors of the economy of green bonds and the breath of funded assets. However, additional effort is needed to include a larger segment of the economy, and in particular those highly-emitting sectors which are, to date, excluded by the eligible sector criteria of green bond standards and taxonomies. Figure (6) and Figure (7) show issuance of EUR-denominated green bonds by industry classification (Bloomberg Industry Classification Systems (BICS) Level 1 and BICS Level 2²⁶). The industry distribution for EUR-denominated issuances as of 2021 shows that green bonds issuances have mostly focused on sub-sectors of the economy where investments in energy transitions are more straightforward, such as for utility firms. In contrast, investments in other sectors, such as heavy industries and the energy sector, remain limited.

²² Figure (5) is based on data from Bloomberg Fixed Income Database. When looking at the evolution of currency denomination for green bonds from CBI data, it shows that total issuance of EUR-denominated green bonds surpassed that of USD-denominated green bonds as of 2018. The mismatch between the two data sources is not surprising and is discussed by Ehlers and Packer (2017) which shows that as of 2018, only 60% of total green bond issuance is recorded in both databases. Figure (A-3) shows currency-denomination trends using CBI data. Finally, Figure (A-4) shows total green bond issuance since 2008 by currency denomination.

²³ In October 2021 the European Commission issued the first *NextGenerationEU* green bond, thus raising €12 billion to be used exclusively for green and sustainable investments across the EU. See: https://ec.europa.eu/commission/presscorner/detail/en/ip_21_5207.

²⁴ <https://www.climatebonds.net/market/data/>.

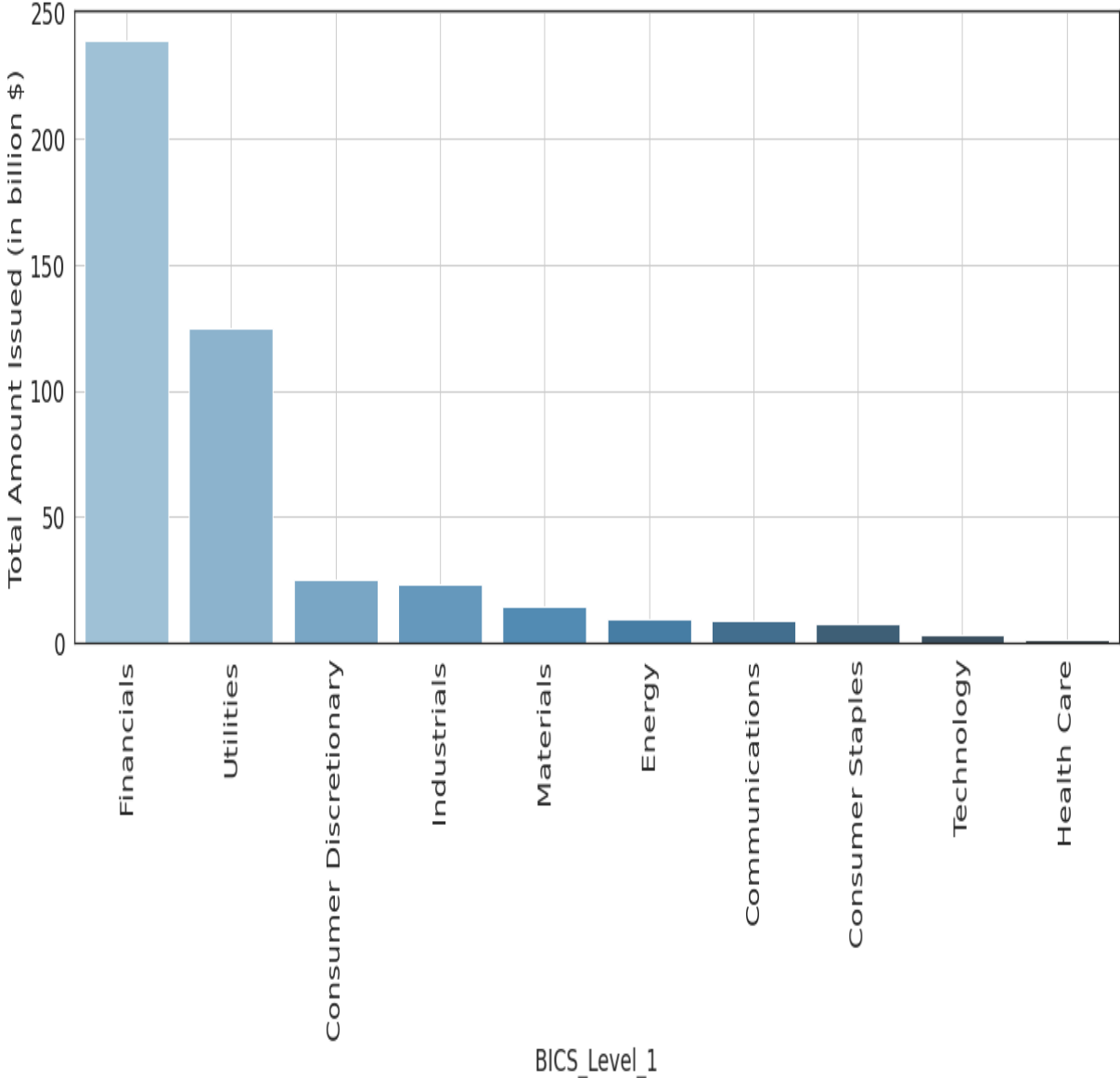
²⁵ <https://www.climatebonds.net/market/data/>.

²⁶ 'Index Methodology', Bloomberg, http://www.bbhub.io/indices/sites/2/2016/01/633470877_INDX_GFI_WP_151022.pdf.



The financial sector represents the largest issuer of corporate green bonds since 2018 – as in Figure (4). Figure (6) shows that the financial sector totalled approximately USD240 billion as of December 2021 (denominated in EUR), outpacing by far the second-largest industry issuer, utility firms, which had a total amount issuance in EUR-denominated green bonds of approximately USD125 billion. Common use of proceeds from financial institutions represents the origination of green loans and mortgages.²⁷

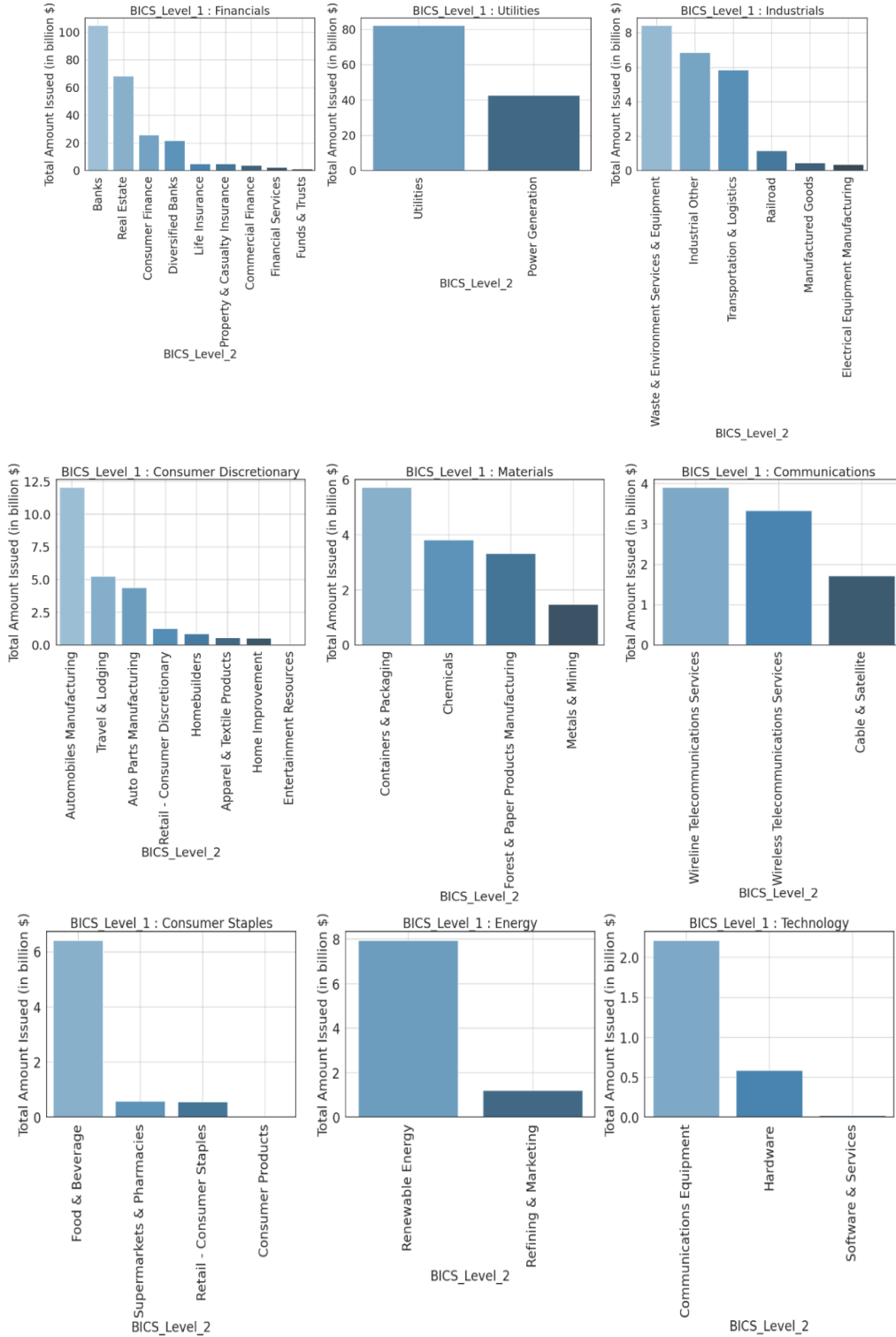
Figure 6: EUR-denominated issuance (in USD billions on y-axis) as of 2021 of Green Bonds at Industry Level (BICS Level 1 classification)



Source: Bloomberg Fixed Income Database Data and author calculations.

²⁷ See for example a recent article by the FT referring to Barclays lending programmes in the UK: ‘Barclays intends to use the funding to refinance mortgages on residential properties in England and Wales “based on the carbon intensity of the underlying residential property”, using publicly available data’. Article accessible at: <https://www.ft.com/content/3b525ae3-0139-3514-8598-88bcf0db530a>.

Figure 7: EUR-denominated issuance (in USD billions on y-axis) as of 2021 of Green Bonds at Industry Level (BICS Level 2 classification)

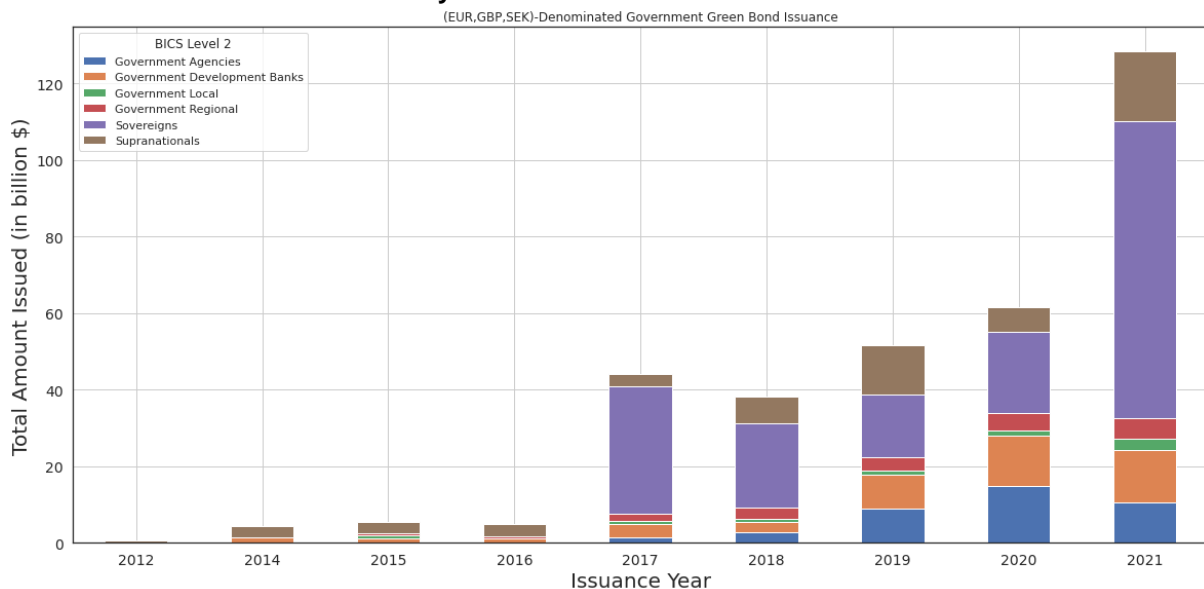


Source: Bloomberg Fixed Income Dataset and Author calculations.



In order to promote initiatives under the NDCs, governments and supranational institutions have been financing countries' transition plans with green bond issuances. Figure (8) shows the evolution of government-related total issuance of green bonds and the largest issuers in EUR, Pound Sterling (GBP), and Swedish Krona (SEK) as of Q4 2021. Total issuances in 2021 totalled approximately USD130 billion and has been characterized by important first-time issuers such as the UK Green Gilts²⁸ and European Commission EUR12 billion issuance in Q3 2021, which is part of an expected EUR250 billion plan making up roughly a third of the EUR800 billion COVID-19 recovery fund.²⁹ Other jurisdictions include the treasuries of France (which sold its first sovereign green bond in 2017), Germany, Poland, Ireland, and Italy (which sold more than EUR8 billion in Q1 2021, representing the strongest government green bond debut to date³⁰). Figure (A.1) in the appendix shows the total issuance in USD as of 2021 at BICS Level 2 for Government issuers and Figure (A.2) shows the top 20 government issuers as of 2021.

Figure 8: The annual issuance of (EUR, GBP, SEK)-denominated government green bonds since 2012 at BICS Level 2 industry classification



Source: Bloomberg Fixed Income Database and author calculations.

Finally, the majority of growth and issuance of green bonds has been concentrated in developed countries, while developing countries have experienced limited growth in their local green bond markets. In the case of BRICS³¹ countries, green bonds issuance and policy initiatives are still limited or at a very early stage, with the exception of China. Driven by strong support from public institutions and by the Chinese Central Bank (People Bank of China, PBoC), the Chinese green bond market has experienced

²⁸See 'UK's debut 'green gilt' sale draws blockbuster demand' <https://www.ft.com/content/94d604a9-50b9-49f1-b377-a7b6e4083d01> and 'UK to launch first green savings bond to boost climate credentials' <https://www.ft.com/content/09587e4f-16c3-41bb-8df8-bcb8100fda94>.

²⁹ The green label of the bond is expected to provide member states with capital for energy efficiency, transport, and nature protection projects and assets. The EU issuance attracted a price premium ('greenium'). 'The yield of 0.45% represented a borrowing cost of about 0.025 of a percentage point under what would be expected for an equivalent conventional bond' according to Johannes Hahn, EU budget commissioner, reported the FT: <https://www.ft.com/content/18039150-3048-4f67-9ece-9243fac969d1>.

³⁰ 'Italy raises €8.5bn in Europe's biggest-ever green bond debut' <https://www.ft.com/content/2b1d7d2f-2755-474b-8696-2607de4366d4>.

³¹ BRICS countries are (in order): Brazil, Russia, India, China, and South Africa.



strong early growth. Figure (A-6) shows the time series of yearly issuance of green bonds in the BRICS countries. It clearly emerges that CNY-denominated green bonds (left hand side of the graph) have experienced green bond issuance at a stronger pace compared to other BRICS currency-denominated green bonds (right hand side of the graph). Figure (A-7) highlights the same observation but in aggregate terms of green bond issuance in USD billion between 2013 and 2021. When accounting for the state of green bond markets in BRICS countries, and more generally in developing economies, it is important to perceive the state of the financial infrastructure needed to channel private capital towards green assets and projects.³²

3. Costs and benefits associated with green bonds

The latest Climate Bond Initiative (CBI) survey of corporate Treasurers³³ has highlighted the increased interest from issuers in using green bonds as a tool to diversify and attract a new clientele of investors focused on financing green projects/assets. Research has been dedicated to the question of whether green bonds attract a more favourable pricing compared to conventional bonds – this is often referred to a ‘greenium’.³⁴ To date, evidence on the more favourable pricing of green bonds is mixed.

Apart from lower direct financing cost, green bond issuance benefits lie on the wider objective of providing a signal to investors about a firm commitment to a credible decarbonization strategy. In line with Bolton and Kacperczyk (2021a), which studies the cross section of US stock returns conditional on firms’ carbon emissions, US investors require a ‘carbon premium’ based on direct (Scope 1 and Scope 2) emission levels and they link the effect to the shift in demand by institutional investors away from high-emitting firms to lower-emitting ones. Flammer (2021) studies in detail the US corporate green bond market – specifically what drives US corporate issuers’ decisions to issue a green bond and how they react post issuance. She finds that stock investors in firms issuing green bonds react positively to the announcement of a new issuance and that the stock reaction is stronger for first-time issuers and for certified bonds (‘certified’, namely green bonds which have received a secondary-party opinion in compliance with a green bond framework). Finally, post issuance, green bond issuers improve their environmental rating and reduce their direct carbon emissions. Furthermore, their post issuance ownership base shows an increase in long-term and green investor ownership.

Respondents to the Climate Bond Initiative survey highlight the following benefits as being drivers for internal treasury decisions when issuing green bonds under a Green Bond Framework:

- *Higher Transparency:* compliance and reference to a Green Bond Framework heightens the required transparency for investors and reduces concerns about ‘greenwashing’.
- *Increased Reputation:* green bonds raise awareness about an issuer’s environmental strategy. Flammer (2021) finds that in a small window around green bond issuance announcements, stock returns of issuers increase on average by 7 basis points.
- *New Clientele of Investors:* issuers are able to reach a new investor base focusing on Principle for Responsible Investments³⁵ (PRI). This investor base has been shown to be less volatile across market states, thus providing firms with a solid and reliable source of funding.

³² A more in-depth analysis of the state of the green bond markets in developing countries will be discussed in future research.

³³ ‘Green Bond Treasurer Survey 2020’, <https://www.climatebonds.net/resources/reports/green-bond-treasurer-survey-2020>.

³⁴ The academic literature often refers to ‘greenium’ as the difference in yield-to-maturities between a green and conventional bond which differ on the type of use of proceeds: green assets or projects vs general corporate purpose. In general, the analysis of the ‘greenium’ is complicated by the difficulty of finding ‘twin bonds’, namely bonds which differ only along the use of proceeds characteristics.

³⁵ ‘What are the Principles for Responsible Investment?’, Principles for Responsible Investment, <https://www.unpri.org/pri/what-are-the-principles-for-responsible-investment>.



- *Carbon Reduction offsetting carbon premium:* Flammer (2021) shows that direct investments in green projects/assets allow firms to reduce their carbon footprint and consequently attract institutional investors' demand for green firms. Similarly, Bolton and Kacperczyk (2021a) (see also Bolton and Kacperczyk (2021b) and Bolton and Kacperczyk (2021c)) show that 'carbon premium' in the cross section of stock returns is economically significant and is mainly derived by institutional investors' capital flows.³⁶

The survey also highlights some of the costs that are immediately perceived as relevant in relation to the additional reporting and certification burden that green bond issuers need to undertake in order to reduce the risk of greenwashing and to increase transparency for investors. These include *higher fixed issuance* and *post issuance costs* related to activities such as certification, verification, regular reporting, and monitoring.

Another important point in relation to green bonds is whether these instruments provide a hedge against environmental risks for investors. These environment-related risks are categorized by the Task Force on Climate-related Financial Disclosures³⁷ (TCFD) as Transition Risks, namely risks stemming from policy/regulatory or technology shocks, and physical risks (such as risks originating from natural disasters and change in climate patterns such as global warming). To the extent that green bond issuers are less exposed to environment-related risks, investing in green bonds could provide a hedge against these shocks. However, green bonds per se provide a rather limited risk management device in that respect. On the one hand, the majority of green bonds are claims to the overall issuers' operations, and the green label per se does not provide an opinion to an issuer's level of exposure to those risks. Furthermore, by the fact that the majority of green bond corporate issuers are in sectors such as energy and industrials, which are notably more exposed to environmental credit risk, investment in green bonds by issuers in these sectors potentially provides considerable environmental risk exposure (Ehlers and Packer, 2017). On the other hand, issuance of green bonds signals an issuer's commitment to reducing its climate risks exposure, which is in line with the findings of Flammer (2021) relating to investors' positive reaction to a firm's announcement of green bond issuance.

4. Green bonds pricing and the 'greenium'

Pricing, as highlighted by the CBI report, remains an important driver for issuers and investors when deciding to label or invest in a green bond. Anecdotal evidence from surveys and investor interviews³⁸ highlights the fact that green bonds and (comparable) vanilla bonds³⁹ are priced very closely. In this section we attempt to bring additional context to this debate by showing evidence of pricing in the primary and secondary EU debt capital market of green and vanilla bonds.

³⁶ Bolton and Kacperczyk (2021a) shows that: 'The effect is also economically significant: a one-standard-deviation increase in SCOPE 1 leads to a 13 basis points increase in stock returns, or 1.5% annualized, and a one-standard-deviation increase in SCOPE 2 leads to a 23 basis points increase in stock returns, or 2.8% annualized. Finally, a one-standard-deviation increase in SCOPE 3 increases stock returns by 30 basis points per month, or 3.6% annualized.'

³⁷ 'Recommendations of the Task Force on Climate-related Financial Disclosures', <https://assets.bbhub.io/company/sites/60/2021/10/FINAL-2017-TCFD-Report.pdf>.

³⁸ Flammer (2021) interviews several practitioners in leading industry institutions on the question of whether Green Bonds attract a better pricing vis-a-vis comparable vanilla bonds. She finds that investors consider Green Bonds pricing very close to otherwise vanilla bonds, and that no systematic mispricing may result from temporary high demand rather than being a permanent effect.

³⁹ Vanilla bonds (also known as conventional bonds) are any financing instruments used by firms, governments, or any other issuing entity which are used for generic entity purposes and are not subject to restrictions. In that respect they are different to green bonds, which are not general-purpose financing instruments because the raised funds must be deployed to specific assets or projects are specified in the green bond prospectus.



In principle, green and vanilla bonds from the same issuer with similar characteristics, such as maturity, structure, and coupon, should price at equal yield-to-maturity. However, growing demand and limited supply for green bonds could make them more expensive for investors. Indeed, several papers on the asset pricing of bond securities have shown that factors beyond credit risk can be significantly priced in bond yields. Collin-Dufresne et al. (2001) and Greenwood et al. (2014) provide evidence of the role of demand and supply factors. Longstaff (2004) and Amihud et al. (2006) provide evidence of liquidity premia.

Finding a definitive answer to the question of whether a premium exists on green bonds is challenging at least for two reasons. First, an ideal setting would be given by a large enough set of green and vanilla bonds issued by the same issuers and having the exact same characteristics (or at least those which are known to affect pricing). Second, temporary prevailing market conditions may affect pricing due to, for example, high and increasing demand for green investments (for example due to a shift in investors' preferences for environmental, social, and governance (ESG) assets) and/or a limited supply of green investments.

An interesting case study is given by the recent issuance of the *German Twin Bonds*. Since early 2020, the German Sovereign Treasury has been issuing a series of bonds ('bunds' in German) with identical characteristics, apart from some being labelled as 'green bonds'. Computing the difference in yield-to-maturities provides a good proxy of the so-called 'greenium' (a proxy for the pricing premium that investors are willing to pay to hold green assets⁴⁰). Following Pastor et al. (2021), we collect data on mid yield-to-maturities for the first twin bonds⁴¹ issued in September 2020 till August 2021. The interesting feature of these bonds is that they are issued almost simultaneously and have maturity of 10 years, which represents the most liquid traded tenure, besides the conventional bonds being issued at larger volumes than the green twins, which could otherwise impair comparisons due to liquidity concerns.

Figure (9) provides evidence in support of the higher pricing received by green bonds in the case of the German Twin Bonds (Left panel). Between Q4 2020 and Q4 2021, the 'greenium' – in other words, the difference in yield-to-maturities between the equivalent conventional and green bond – ranged between 2 basis points and 8 basis points (Right panel). However, the evidence comes with caveats, given that this green bond issuance represents one of the first from the German Treasury, which is known to attract a number of investors for their safe assets feature.

In a similar analysis, Ehlers and Packer (2017) study the primary market pricing of 21 green bonds issued between 2014 and 2017, comparing the credit spreads at issuance with the credit spread of conventional bonds with the closest issuance date and from the same issuers – a methodology which allows the minimization of differences in market conditions and credit risks.⁴² They find an average difference in spreads of 18 basis points, in line with findings from Zerbib (2019). Interestingly, the 18 basis points 'greenium' on primary issuances represents a sizable premium paid by investors compared to the issuance costs incurred by issuers when labelling and certifying green bonds.⁴³ Finally, the 'greenium' exhibits a large (27 basis points) variation around the average spread of 18 basis points, with five issuers pricing green bonds at a yield spread premium compared to conventional bonds. This variability highlights the fact that a systematic answer on primary market 'greenium' is subject to considerable uncertainty.

⁴⁰ This example is borrowed by the recent working paper by Pastor et al. (2021) which studies the determinants on the 'Green Factor'.

⁴¹ The two bonds have ISIN DE0001102507 for the vanilla bond and DE0001030708 for the Green Bond. Data is from Bloomberg and Datastream.

⁴² To further restrict the impact of idiosyncratic pricing components, the authors also restrict the matching sample to bonds which are EUR and USD denominated, have similar time to maturity, and are *pari passu* fixed rate bonds – in other words, they have the same seniority and are not floating rates.

⁴³ For instance, the CBI certification is given by a flat 0.1 basis points while credit rating might charge fees in line with traditional credit ratings which are in the range of 3–5 basis points (White (2002)).



A second piece of analysis on the ‘greenium’ in the secondary market considers a large sample of EUR-denominated corporate vanilla and green bonds. They consist of bonds with duration ranging between 1 and 15 years. In order to allow for comparison at credit rating level, we consider only bonds with a Moody’s Credit Rating above Ba2 and compare average mid-yield-to-maturities across different duration and credit ratings. Figure (10) shows the average ‘greenium’ between conventional and green bonds for different rating (Moody’s credit rating) buckets (from Ba2 in the left top panel to Aaa in the right bottom panel) and for different duration (x-axis of each subplot). Shaded areas around the average ‘greenium’ represent two standard deviations around the mean and highlight the high level of heterogeneity in secondary-market pricing, which complicates the comparability of green and conventional bonds solely in terms of duration and credit rating. Figure (10) suggests that evidence on the ‘greenium’ is indeed mixed and varies across different duration and credit rating buckets.

Finally, Climate Bond Initiative carries periodic primary and secondary market reports with particular emphasis on trends in ‘greenium’ across corporate and sovereign issuers.⁴⁴ In the first half of 2021, they provide several examples of primary market transactions which attracted substantial over-demand although priced at a premium compared to comparable vanilla bonds. Ehlers and Packer (2017) find similar results on primary market ‘greenium’, in line with Zerbib (2019), whereas they do not find a significant difference in secondary market yield spreads; this suggests that investors’ demand for new-issued green bonds drives overperformance compared to conventional bonds. However, post-issuance, green bonds and comparable conventional bonds exhibit similar performance. Studying green bonds in the US municipal market, Backer et al. (2018) find after-tax ‘greenium’ at issue for green bonds to be approximately 6 basis points. Interestingly, they show that the ‘greenium’ is between two and three times higher for third-party certified green bonds rather than for self-labelled ones. By considering a 12 basis point increase in yield-to-maturities in conventional bonds for each rating notch, they estimate that an average of 6 basis points for the ‘greenium’ is akin to a half-notch higher credit rating. The effect is even more pronounced for bonds which are CBI certified – here the average ‘greenium’ of 26 basis points corresponds to a two notch higher credit rating.

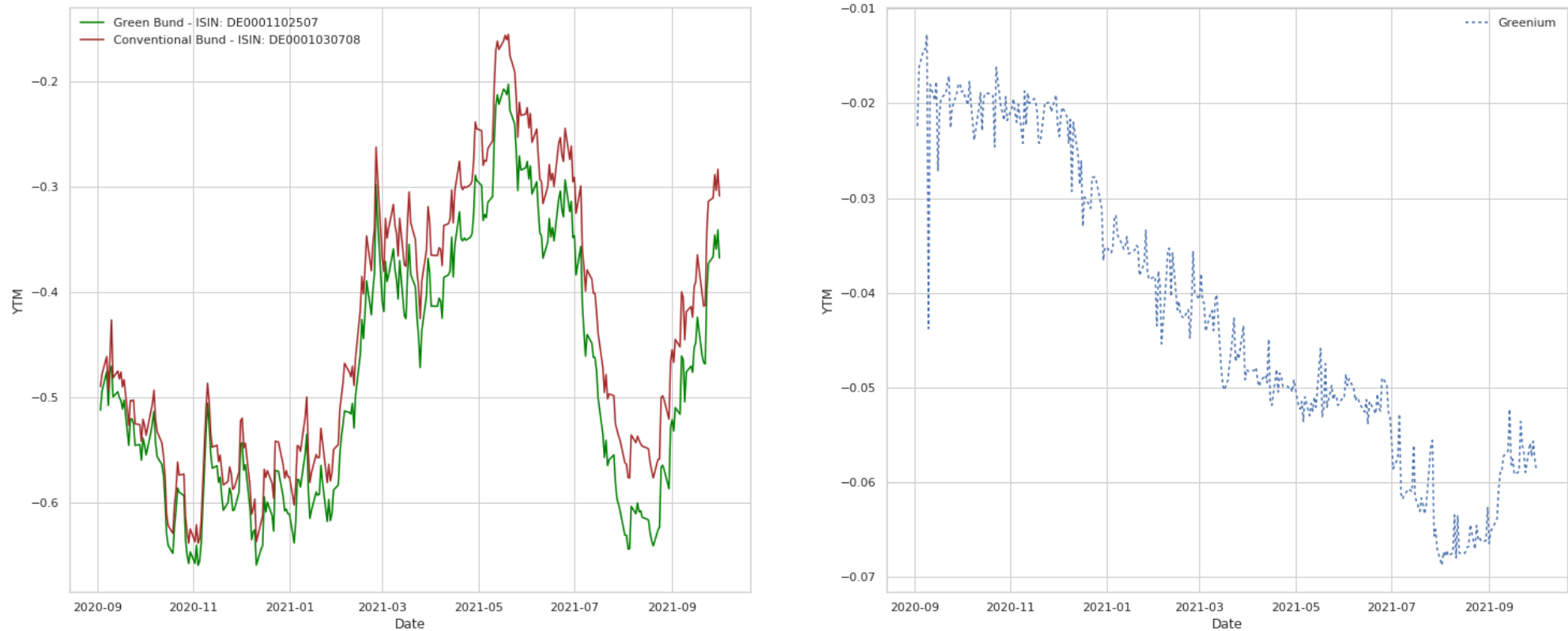
This section makes the case that evidence on the ‘greenium’ – the relative difference between pricing of green and vanilla bonds in primary and secondary markets – is currently mixed. However, future changes in demand for green bonds from investors (such as heightened demand from institutional investors which may lead to oversubscribed issuances and lower interest paid by green bond issuers) and changes in climate transition risks for issuers (which may instead increase green bond supply given the present value benefits of reducing firms’ carbon emissions) could shift the evidence on the ‘greenium’ in either direction.

Finally, it is worth highlighting the fact that differences in pricing between green bonds and conventional bonds do not stem from fundamental differences between the two types of securities. As highlighted in previous sections, a green bond label does not represent an opinion with respect to the environmental risk exposure of an issuer, but rather the compliance with a specific type of asset/project financed by the bond. Furthermore, in terms of credit risk, the majority of green bonds (with the exception of project bonds and ABS-type green bonds) represent generic claims to an issuer operation, thus sharing a similar credit risk profile to conventional bonds.

⁴⁴ ‘Green Bond Pricing in the Primary Market H1-2021’, Climate Bonds Initiative, <https://www.climatebonds.net/resources/reports/green-bond-pricing-primary-market-h1-2021>.



Figure 9: 'Greenium' for the Twin German Bonds measured as the difference in YTM (%) between the twin German bonds issued in September 2020.
 German Twin Bonds YTM and Greenium

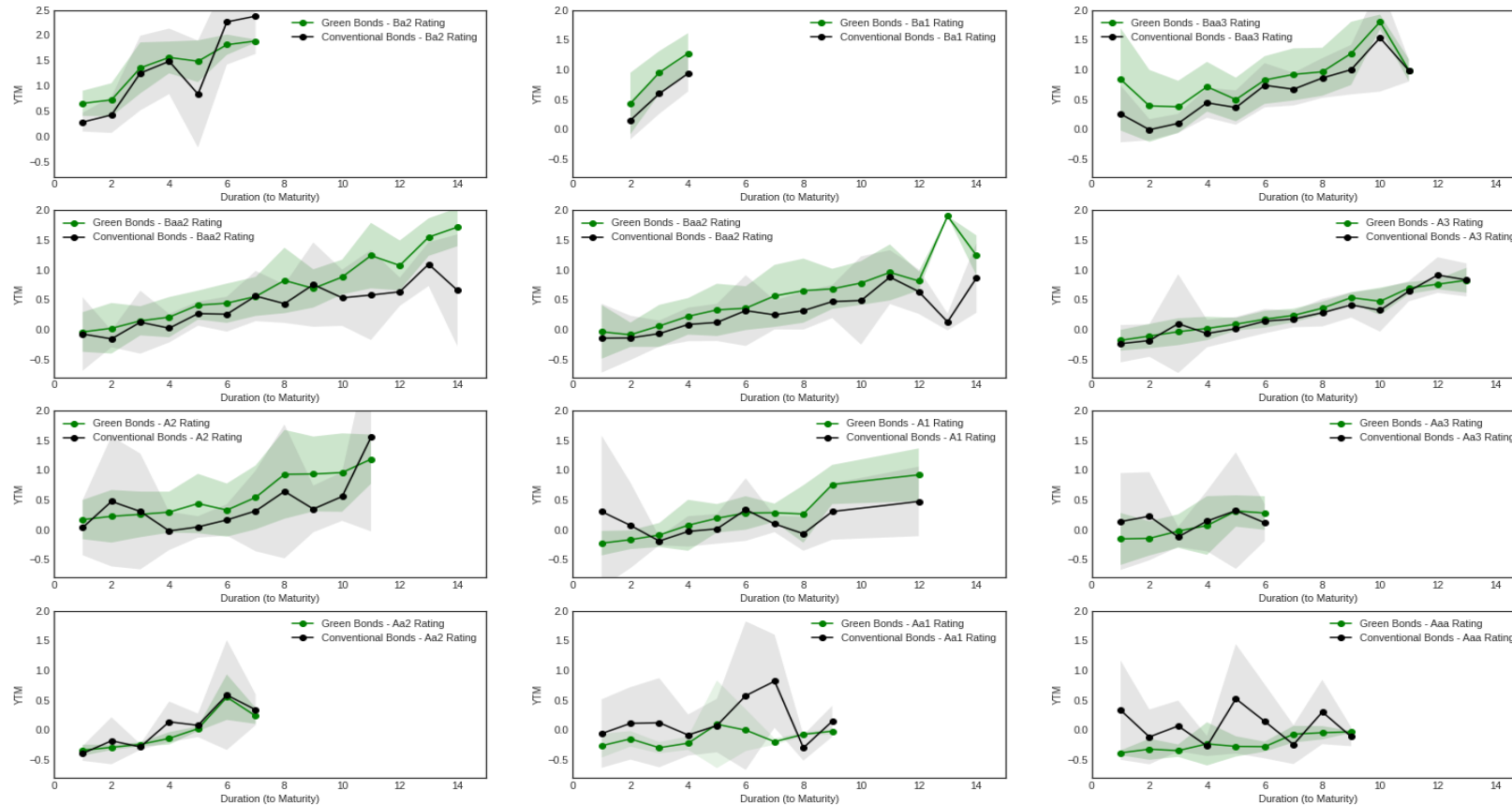


Source: Datastream data and author calculations.

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Figure 10: The average mid yield-to-maturity for Green Bonds across credit rating buckets and for different values of duration between 1 and 15 years.



Data is collected for EUR-denominated green bonds with credit rating between Ba2 and Aaa from Bloomberg Fixed Income database. Mid yield-to-maturities are from Refinitiv Datastream.

Note: Shaded area represents standard deviations

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5. Green bonds: instrument design

Multiple market standards have been proposed and are available for issuers in different jurisdictions.⁴⁵ Among these existing frameworks, the ICMA *Green Bonds Principles* (GBPs) stands out as the most widely referenced and adopted by green bonds issuers. The GBPs define a set of criteria or principles to guide issuers in labelling green bonds. Green bonds which comply with the GBP need to satisfy *four core principles*. Ultimately, the goal is to promote transparency, standardization, and disclosure, thus safeguarding the integrity and functioning of the green bond market.

In practice, the 'green' bond label can be applied to any debt security such as private placements, secularization, covered bonds, as well as loans, as in Table (1). In particular, specifically for loans, the Loan Market Association (LMA) has recently released a dedicated framework, the Green Loan Principle⁴⁶ (GLP).

Another important framework which stands out for breadth and guidance for Green Bonds issuers is the Climate Bond Initiative (CBI) *Climate Bond Taxonomy*.⁴⁷ The Climate Bond Taxonomy, which features eight sectors (Energy, Buildings, Transport, Water, Waste, Nature-based Assets, Industry, and ICT), allows for a clear mapping between economic activities, green assets or investments, and the 'Green' label.

Whether firms will adopt a combination of green bonds and green loans remains an open question that further research needs to clarify. The equilibrium mix of debt and bank loans in firms' capital structure will depend on the way in which banks and debt markets price the climate externality. Early evidence from Beyene et al. (2021) shows that firms with a higher carbon footprint have already anticipated the higher climate pricing from the bond market and have reduced their reliance on bond financing by substituting with bank syndicated loans.⁴⁸ A recent Principle for Responsible Investment (PRI) Blog Post⁴⁹ has highlighted this trend. Their report highlights early evidence that fossil fuel companies increasingly substitute bonds for syndicated bank loans, and do so when 'banks price the risk of stranded assets less than the bond market'.

The biggest challenge for the development and adoption of the green bond market is the threat of 'greenwashing'. 'Greenwashing' is the practice of companies giving a false impression of their environmental impact or benefits. Greenwashing misleads market actors and does not give due advantage to those companies that are making the effort to green their products and activities. It ultimately leads to a less green economy.^{50,51}

⁴⁵ See: 'Green Finance and Investment, Developing Sustainable Finance Definitions and Taxonomies', OECD, https://read.oecd-ilibrary.org/finance-and-investment/developing-sustainable-finance-definitions-and-taxonomies_134a2dbe-en#page1.

⁴⁶ The Green Loan Principles can be accessed at the link: <https://www.lsta.org/content/green-loan-principles/>.

⁴⁷ 'Climate Bond Taxonomy' which is based on the Climate Bond Standard is a sector criteria framework which maps each intra-sector use of proceed assessment to criteria allowing them to be aligned with the goal of limiting global warming at 2 degrees Celsius. The CBI Taxonomy can be accessed at the following link: <https://www.climatebonds.net/standard/taxonomy>.

⁴⁸ The authors find that bond markets and syndicated loan markets price the risk of fossil fuel stranded assets differently, from banks in the syndicated loan market, putting a lower price on the climate transition risk. As a consequence, firms investing in fossil fuel assets increasingly rely less on bonds and more on loans.

⁴⁹ See 'Fuelling fossil fuel: Bond to bank substitution in the transition to a low-carbon economy', 24 April 2020, <https://www.unpri.org/pri-blog/fuelling-fossil-fuel-bond-to-bank-substitution-in-the-transition-to-a-low-carbon-economy/5712.article>. Similarly, a VOX EU column discusses the main findings of Beyene et al (2021) and can be accessed at this link: <https://voxeu.org/article/bond-versus-bank-financing-transition-low-carbon-economy>.

⁵⁰ See EU Commission documentation at the following links:

'Initiative on substantiating green claims', https://ec.europa.eu/environment/eussd/smcp/initiative_on_green_claims.htm, 'Screening of websites for 'greenwashing': half of green claims lack evidence',

https://ec.europa.eu/commission/presscorner/detail/en/IP_21_269, and from FINMA definition 'Investor protection: preventing greenwashing', <https://www.finma.ch/en/documentation/dossier/dossier-sustainable-finance/investor-protection.-c.-preventing-greenwashing/>.

⁵¹ Recent cases have surfaced to the public's attention, with DWS being investigated following claims of misleading clients about its sustainable investing efforts. See FT article on the DWS recent greenwashing claim: 'DWS shares slide after greenwashing claims prompt BaFin investigation', FT, 26 August 2021, <https://www.ft.com/content/0eb64160-9e41-44b6-8550-742a6a4b1022>.



Table 1: The types of structures typical of green bonds and recent examples for each category

TYPES OF GREEN BONDS AND OTHER DEBT INSTRUMENTS			
Type	Proceeds raised by bond sale are	Debt recourse	Example
'Use of Proceeds' Bond	Earmarked for underlying eligible green projects/assets	Recourse to the issuer: credit rating related to issuer credit profile given the 'unsecured' structure of the bond	EIB 'Climate Awareness Bond' (supranational issuer); Majority of Corporate Green Bonds in line with recommendations of the GBPs.
'Use of Proceeds' Revenue Bond or ABS	Earmarked for green projects/assets	The bond provides a security to investors with direct recourse to the underlying pool of assets which also provides cash flows to bondholders	Hawaii State Govt Green Bond; ¹ Corporate Utilities Green Bonds.
Project Bond	Ring-fenced for the specific underlying green project(s)	Recourse is only to the project's assets and balance sheet	Invenergy ¹ issued a green bond to refinance a wind farm asset in Uruguay (backed by Invenergy Campo Palomas wind farm)
Asset-backed security (ABS)	Refinance portfolios of green projects or proceeds. Usually an external Special Purpose Vehicle (SPV) provides earmark for green projects/assets	Recourse is on the collateral pool (e.g. solar leases or green mortgages)	Tesla Motors issued a green bond backed by residential solar leases; ¹ Obvion issued in 2016 first RMBS and it is CBI certified ¹
Covered Bond	Earmarked for eligible projects included in the covered pool	Recourse to the issuer and, if the issuer is unable to repay the bond, to the covered pool	Berlin Hyp green Pfandbrief; ¹ Sparebank 1 Bolligkredit ¹ green covered bond
Loan	Earmarked for eligible projects or secured on eligible assets	Full recourse to the borrower(s) in the case of unsecured loans. Recourse to the collateral in the case of secured loans	MEP Werke, Ivanhoe Cambridge and Natixis Assurances (DUO), OVG, Ghana (sovereign)

Source: Climate Bond Initiative and author.

The threat of greenwashing represents a risk for investors who are seeking to invest in debt and loans aiming to finance green projects/assets. This risk represents the difficulty and costs needed to distinguish between i) firms who claim alignment with green bond standards but who neither implement a credible decarbonization strategy nor allocate proceeds accordingly and ii) firms which claim alignment with green bond standards and do implement a credible transition strategy and comply with the allocation of proceeds. In that respect, with the objective of increasing market transparency and reducing asymmetry of information within green bond markets, several external verification mechanisms have emerged.



5.1. Third-party verification

Several options exist for issuers willing to provide transparency on the compliance of their green bond issuance. They are generally considered forms of ‘Third-Party Opinions,’ alongside the fact that breadth and depth of verification can largely vary. Common practices have evolved around the forms of (i) Assurance, (ii) Second Party Opinions (SPOs), (iii) Certification, and (iv) Green Bond Rating. While no definitive and unique definition exists for such practices, industry consensus can be summarized as in Table (2) with the main elements being:

- *Assurance*: represents the practice of assessing the sustainability of the issuer and the alignment of the bond framework attached to the bond prospectus with the *Green Bonds Principles*.
- *Second-Party Opinion*: represents the verification of compliance on a pre-issuance basis without further post-issuance verification. It varies on the methodologies adopted by service providers such as *CICERO*, *Sustainalytics*, and *Vigeo-Eiris*. Recent changes, however, show a tendency for SPO to extend requirements to post-issuance compliance.
- *Certification*: represents compliance with the Climate Bond Initiative’s Green Bond Standard.⁵² The certification process represents the most demanding third-party opinion, as it requires pre and post issuance compliance and reporting, on top of alignment with the Climate Bond Taxonomy and with specific sector criteria.⁵³
- *Green Bond Rating*: represents the validation with respect to a rating agency methodology providing an opinion regarding the environmental aspects of the green bond.

Table 2: The details on Pre-Issuance and Post-Issuance Review available to green bond issuers

Pre-Issuance Review		
	Scope	Providers
Assurance	Positive or Negative Assurance on compliance with the Green Bond Principles (GBP) or the Green Loan Principles (GLP)	Audit Firms
Second-Party Opinion	Confirm compliance with GBP/GLP and provide an assessment of the issuer’s green bond framework	Specialized Green Opinions firms: CICERO, Sustainalytics, Vigeo-Eiris, etc.
Green Bond Rating	Assess the bond’s alignment with the Green Bond Principles and give opinion on climate transition risk based on firms’ decarbonization commitments and stated trajectories	Moody’s, S&P, etc.
Pre-Issuance Verification	Third-party verification confirms that the use of proceeds adheres to the CBI Standards and Sector Specific Criteria	Approved verifiers under the CBI Standard scheme
EUGBS Compliance verification	Compliance with the EUGBS provided by approved verifiers	Verifiers need to be approved and supervised by ESMA
Post-Issuance Review		
	Scope	Providers
Assurance or SPO	Assurance of allocation of proceeds to eligible green projects	Audit Firms, ESG service Providers
Impact Report	Quantify the climate or environmental impact of a project/asset	Audit Firms, ESG service Providers
Post-Issuance verification	Assurance against the CBI Standard, allocation of proceeds	Approved verifiers under the CBI Standard scheme

Source: Climate Bond Initiative and author.

⁵² ‘Climate Bonds Standard V3.0’, <https://www.climatebonds.net/climate-bonds-standard-v3>.

⁵³ ‘Sector Criteria’, <https://www.climatebonds.net/standard/sector-criteria>.



5.2. ICMA green bond principles

*The Green Bond Principles*⁵⁴ (GBPs) provide a clear process and disclosure for green bond issuers. They are structured around four core principles and key recommendations. Bonds which comply with the principles are labelled 'green bonds' in the GBP sense, as in the definition below:

'Green Bonds are any type of bond instrument where the proceeds or an equivalent amount will be exclusively applied to finance or refinance, in part or in full, new and/or existing eligible Green Projects and which are aligned with the four core components of the Green Bond Principles'

The core components for alignment with the GBP are given by: 1) Use of Proceeds (UoP), 2) Process for Project Evaluation and Selection, 3) Management of Proceeds, 4) Reporting.

1. In *Use of Proceeds*: GBP-eligible green projects/assets need to provide environmental benefits. When proceeds are used for refinancing existing projects, they need to clearly state the extent of refinancing and new financing. The GBP considers only broad eligible environmental categories to which projects need to adhere: climate change mitigation, climate change adaptation, natural resource conservation, biodiversity conservation, and pollution prevention and control.

2. *Process for Project Evaluation and Selection*: relates to clear communication to investors regarding: (i) the environmental objective of the green project, (ii) the evaluation process of environmental sustainability by the issuer for the financed project, (iii) complementary information regarding the use of proceeds, including social and environmental risks when relevant. Issuers are also encouraged to provide information on how the green project fits within the overall environmental strategy of the firm and whether any standard of taxonomy is referenced.

3. *Management of Proceeds*: relates to the operational aspects of management of proceeds. In particular whether a special purpose vehicle (SPV) is established with the sole purpose of managing the funds for the green projects/assets or whether funds are included in a separate account at the holding company.

4. *Reporting*: issuers should keep reporting on the use of proceeds available and update them at least annually. In order to promote standardization in impact reporting, issuers are encouraged to follow the guidelines of the *Harmonised Framework for Impact Reporting*.⁵⁵

In addition, ICMA has key recommendations which represent heightened transparency in reporting and disclosures and are given by i) *Green Bond Frameworks* (a separate document or part of the bond's legal documentation detailing the alignment to the Green Bond Principles or other frameworks) and ii) *External Review* (which includes pre and post issuance review of compliance). While all core principles are necessary to be considered for compliance with the GBP, the criteria around the Use-of-Proceeds represents the most important, and at times the most challenging, set of criteria for issuers. To maintain compliance with GBP and GLP (as well as CBI Certification; see below), green bond issuers are required to report at least annually their status on the use of proceeds and stage of green projects/assets, along with their environmental impact. This procedure allows transparency and accountability in the Green Bond and Loan market to be ensured. A recent report that focused on post-issuance reporting⁵⁶ in the Green Bond market, conducted by the CBI, found that the proportion of reporting is 77 per cent by bond count and 87 per cent by amount outstanding of post issuance reporting for labelled green bonds.

5.3. Green bond frameworks and external reviews

An integral part of the well-functioning of the green bond market is attributed to the role played by external reviews on green labels, provided by specialized third parties. The scope of reviews is often different and, to date, there is no unique guideline or regulation around which external reviewers operate. However,

⁵⁴ 'Green Bond Principles, Voluntary Process Guidelines for Issuing Green Bonds', June 2021,

<https://www.icmagroup.org/assets/documents/Sustainable-finance/2021-updates/Green-Bond-Principles-June-2021-140621.pdf>.

⁵⁵ 'Impact Reporting Metrics and Databases', International Capital Market Association, <https://www.icmagroup.org/sustainable-finance/impact-reporting/>.

⁵⁶ 'Post Issuance Reporting in the Green Bond Market 2021', Climate Bonds Initiative, <https://www.climatebonds.net/resources/reports/post-issuance-reporting-green-bond-market-2021>.



market-driven initiatives have allowed, to some extent, the formation of a clear perimeter, around which external reviewers perform verification of green bonds.

Generally, external reviews provide an independent opinion on compliance with the Green Bond Framework, or other documentation with the GBP/GLP, or alignment with the CBI Standard. The GBP recommends that issuers provide a Green Bond Framework as an integral document, along with the bond prospectus or as an additional publication accompanying the bond documentation. Finally, the GBP recommends that issuers appoint external reviewers for verification and that reviewers' reports are readily available.

5.4. CBI certification

Another relevant certification scheme in the green bond market is represented by the Climate Bond Initiative⁵⁷ Certification scheme. The certification is based on the *Climate Bond Standard*,⁵⁸ a high-level framework for green bond eligibility under the CBI certificate. The CBI standard refers to the CBI Taxonomy,⁵⁹ a unified definition of sector-level criteria and 'green' project/asset definition. These sector criteria are 'science-based' and provide alignment of eligible assets with the targets set forth by the Paris Agreement.

Green bond certification is granted only when pre and post issuance eligibility criteria are fully satisfied as detailed in the CBI standard. Furthermore, to maintain certification, issuers need to report⁶⁰ at least annually and maintain readily available information regarding bond and asset information.

Table 3: Sector eligibility for the EU Taxonomy and Climate Bond Initiatives.

EU Taxonomy					
Energy	Transport	Water	Buildings	Forestry	ICT
Climate Mitigation: See Table 5.1 of TEG Final Report ⁶¹					
Climate Adaptation: See Table 5.2 of TEG Final Report ⁶²					
Climate Bond Initiative Taxonomy					
Energy	Transport	Water	Buildings	Forestry	ICT
Solar	Private Transport	Water Monitoring/ storage	Residential	x	x
Wind	Public Transport	Water Treatment/ distribution	Commercial		
Geothermal	Freight Rail	Flood Defence			
Marine Renewables		Nature-based solutions			

Source: EU Taxonomy and CBI Sector Criteria, author elaboration

⁵⁷ Climate Bond Initiative is an international organization with the objective of mobilizing debt capital markets towards climate change solutions. See <https://www.climatebonds.net/about>.

⁵⁸ 'Climate Bonds Standard, Version 3.0', <https://www.climatebonds.net/files/files/climate-bonds-standard-v3-20191210.pdf>.

⁵⁹ 'Climate Bonds Taxonomy', <https://www.climatebonds.net/standard/taxonomy>.

⁶⁰ Three types of reporting are foreseen by CBI: Allocation reporting, Eligibility reporting and Impact reporting.

⁶¹ https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy_en.pdf.

⁶² https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy_en.pdf.



Sector-specific criteria represent an essential part of the CBI standard. Sector Criteria, as in Table (3), establish benchmarks for sector-specific projects/assets, in order to be able to identify projects/assets that meet minimum eligibility as mitigation, adaptation, and/or resilience to climate change. The proposed criteria are the results of discussion between multi-stakeholders on what represents 'science-based' sector specific benchmarks for sector-based projects/assets.

5.5. EU green bond standard

The EU Green Bond Standard⁶³ (EUGBS) is part of the legislative momentum initiated by the EU as part of the *European Green Deal*,⁶⁴ a far-reaching plan to build the legislative ground for the EU agenda on the climate transition. The EU Green Deal includes several financing instruments such as the *NextGenerationEU*⁶⁵ Recovery plan, along with the EU budget. As part of the 'Sustainable Europe Investment Plan – European Green Deal Investment Plan',⁶⁶ the EU Commission announcement the plan to establish an *EU Taxonomy* and an *EU Green Bond Standard*, with the objective of providing a uniform definition of what constitutes a 'green' project/asset and a Green Bond Standard within the EU. Similar to previously discussed standards, the EUGBS is a voluntary standard, but is expected to become the main reference within the Single Block, and it is likely that similar initiatives will be adopted by other jurisdictions.⁶⁷

The proposed framework,⁶⁸ which is now under discussion at the EU Parliament, has four key requirements:

1. *Taxonomy Alignment*: green projects/assets need to be compliant with the definition set forth in the EU Taxonomy.⁶⁹
2. *Transparency*: Green Bond documentation needs to give adequate detail regarding the use of proceeds and the deal structure.
3. *External Review*: essential for the EU Green Bond Standard is that compliance with the framework is verified by an external reviewer.
4. *Supervisions of Reviewers*: External Reviewers must be registered and supervised by ESMA with the objective of ensuring uniform standards of external reviewers.

6. Changing regulatory landscape

The regulatory landscape around green finance and sustainability-related disclosures has also been evolving rapidly, especially since the Paris Agreement in 2015. With the growth of the green bond market and its adoption worldwide, a growing number of regulatory initiatives are emerging, with the objective of

⁶³ 'European green bond standard', European Commission, https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/european-green-bond-standard_en.

⁶⁴ 'A European Green Deal', European Commission, https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en.

⁶⁵ 'NextGenerationEU: European Commission successfully issues first green bond to finance the sustainable recovery', European Commission, 12 October 2021, https://ec.europa.eu/commission/presscorner/detail/en/ip_21_5207.

⁶⁶ 'Commission Communication on the Sustainable Europe Investment Plan', European Commission, 14 January 2020, https://ec.europa.eu/commission/presscorner/detail/en/fs_20_48.

⁶⁷ For example, PBoC and the EU have recently announced a cooperation with respect to taxonomy of green investments with the objective of converging towards a uniform classification system between the two countries. See: 'China reveals co-operation with EU on green investment standards', *FT*, 7 April 2021, <https://www.ft.com/content/cddd464f-9a37-41a0-8f35-62d98fa0cca0>. This initiative shows the growing momentum in a global far reaching effort of harmonization of green investments, which sees the involvement of two of the largest issuing denominations in Green Bonds and sustainable finance at large. See also CBI for a comparison between the two frameworks <https://www.climatebonds.net/china>.

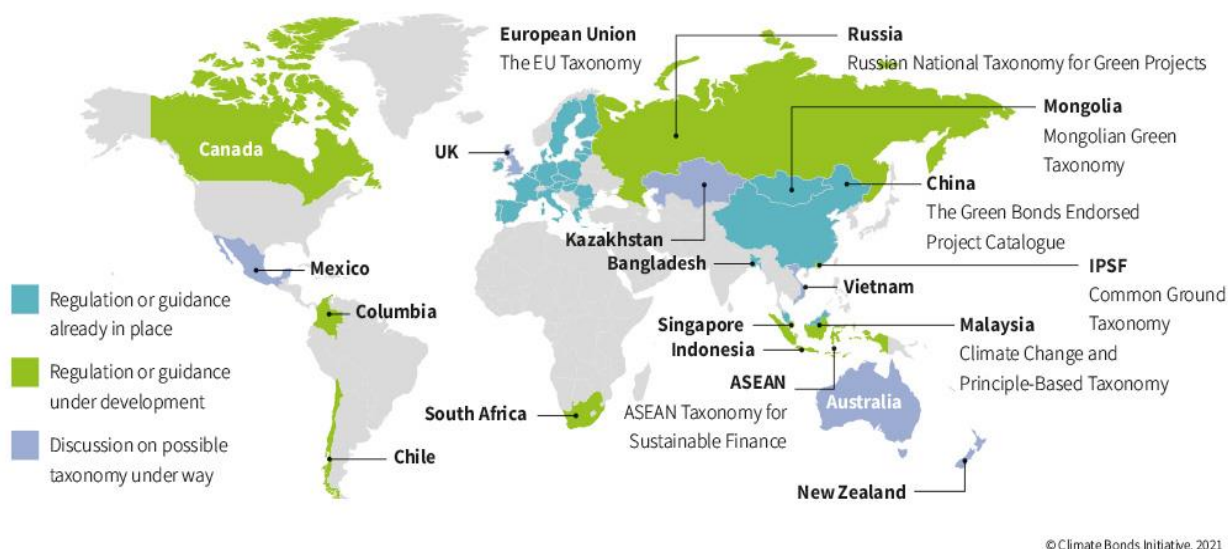
⁶⁸ 'USABILITY GUIDE – TEG Proposal for an EU Green Bond Standard', March 2020, https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-green-bond-standard-usability-guide_en.pdf.

⁶⁹ 'EU taxonomy for sustainable activities', European Commission, https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en.

emulating recent success in jurisdictions at the forefront of the market such as the EU. These initiatives often share a common structure and provide frameworks in terms of i) a *taxonomy*, unifying the definition of eligible ‘green’ assets and activities, and ii) a *framework* for green bond labelling in compliance with the jurisdiction taxonomy. Figure (11) provides a snapshot, as of 2021, of the multiple initiatives emerging at global level. The emergence of jurisdiction-level initiatives and frameworks is a necessary condition for further development and expansion of the green bond market. However, the heterogeneity in definitions and labels represents a challenge for investors, who would benefit from harmonization and cross-boundary standardization. In that sense, initiatives such as the *International Platform on Sustainable Finance (IPSF)*⁷⁰ aim at fostering dialogue and harmonization between regulators and policymakers on sustainable finance. In November 2021, as part of the IPSF initiative, the IPSF Taxonomy working group published the ‘EU–China Common Ground Taxonomy – Climate Change Mitigation (CGT)’, a report with in-depth comparisons between the EU Taxonomy and China’s Taxonomies, with the objective of improving comparability and interpretability and setting instrumental guidance for the harmonization of taxonomies.⁷¹

Figure 11: The growing number of regulatory initiatives worldwide

Taxomania: an international overview



Source: Climate Bond Initiative Policy Database.

6.1. EU regulatory landscape

The EU regulatory landscape in the area of sustainable finance and reporting has been particularly active and represents an important support for the market adoption of green finance instruments. Notable are the initiatives related to (i) enhanced reporting for climate-related risks and impacts such as the *Corporate Sustainability Reporting Directive (CSRD) proposal* and the *Sustainable Finance Disclosure Regulation (SFDR)*; and (ii) *EU Taxonomy* on what defines a sustainable asset and process. These initiatives are important enablers for further schemes which build directly on those regulatory pillars – such as the *EU Green Bond Standard*, which directly leverages on the tools provided by the EU Taxonomy. Table (4) summarizes some of the main initiatives undertaken at EU level.

⁷⁰ The founding members of the IPSF (founded in October 2019 by the European Union) are the relevant authorities of Argentina, Canada, Chile, China, India, Kenya and Morocco. To date, several other countries have joined the initiatives, including China and the United Kingdom. Together, the 18 members of the IPSF represent 55% of greenhouse gas emissions, 50% of the world population, and 55% of global GDP. See: ‘International Platform on Sustainable Finance’, European Commission, https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/international-platform-sustainable-finance_en.

⁷¹ See CBI note on the IPSF initiative: https://www.climatebonds.net/files/reports/comparing_chinas_green_definitions_with_the_eu_sustainable_finance_taxonomy_part_1_en_final.pdf.



The *EU Taxonomy* represents an important tool for green finance to thrive, as it ultimately defines what is a sustainable asset or process within the EU market. The benefits of the EU taxonomy can be summarized as follows:

1. 'Inventory Tool': allows the definition of what is a sustainable asset and process. Provides a reliable certification for investors on the environmental impact;
2. 'Reporting Tool': allows the unequivocal assessment of the degree of sustainability of an investment or product;
3. 'Transition Tool': combining its inventory and reporting utility, the EU taxonomy allows firms and investors to navigate and benchmark their economic transition to net-zero.

To date, the *Technical Screening Criteria* in the *draft Delegated Act* (December 2020) includes criteria for (i) Climate Mitigation and (ii) Climate Adaptation. Other technical screening criteria are under development, such as in the case of (i) Transition to a circular economy, (ii) Pollution prevention and control, (iii) Sustainable use and protection of water and marine resources, and (iv) Protection and restoration of biodiversity and ecosystems.

Table 4: Summary of the current status and scope of the three main regulatory initiatives in the EU

EU sustainability disclosure regime for financial and non-financial companies			
	Corporate Sustainability Reporting Directive (CSRD) proposal	Sustainable Finance Disclosure Regulation (SFDR)	Taxonomy Regulation
Scope	All EU large companies and all listed companies (except listed micro enterprises)	Financial market participants offering investment products, and financial advisers	Financial market participants entities all companies subject to NFRD/ CSRD
Disclosure	Report on the basis of formal reporting standards and subject to external audit	Entity and product level disclosure on sustainability risks and principal adverse impacts	Art.8: Turnover, capital, and operating expenditures in the reporting year from products or activities associated with Taxonomy
Status	Under negotiation; expected to apply from 2023	Applies from 10 March 2021	Applies from January 2022

Source: EU commission.

6.2.EU taxonomy

The EU taxonomy is a classification system which defines what constitutes environmentally sustainable economic activities. The Taxonomy Regulation was published in June 2020 and enters into force in January 2022, see Table (4).The Taxonomy Regulation established six environmental objectives:

1. Climate Change Mitigation.
2. Climate Change Adaptation.
3. The sustainable use and protection of water and marine resources.
4. The transition to a circular economy.
5. Pollution prevention and control.
6. The protection and restoration of biodiversity and ecosystems.



Under the Taxonomy Regulation, the EU Commission has initiated the development of technical screening criteria for each of the environmental objectives via Delegated Acts. In March 2020, the Technical Expert Group (TEG⁷²) published the first final report on the EU Taxonomy.⁷³ It includes 70 climate mitigation and 68 climate adaptation activities. Against this milestone, as of 2022 firms will need to report against the EU Taxonomy to meet the disclosure requirements as per the Taxonomy Regulation and SFDR.

In December 2021, the First Delegated Act (the EU Taxonomy Climate Delegated Act) was approved by the European Council, thus confirming into law the Technical Screening Criteria for activities that contribute to climate adaptation and mitigation.⁷⁴

The first delegated act represents an important milestone in the EU's pathways towards the achievement of its emission targets by 2030 and 2050. However, its scope includes, at this stage, only activities related to climate mitigation and adaptation. The inclusion of other activities is subject to negotiation between EU member states and is expected to be subject to controversial debates.

The case for the assessment of nuclear energy, gas, and biomass are some examples of controversy relating to inclusion in the EU Taxonomy.⁷⁵ In order to assess the feasibility of inclusion of nuclear energy within the EU Taxonomy, in 2020 the EU Commission launched an assessment of nuclear energy via the Joint Research Centre, the scientific arm of the EU Commission, which concluded its report in March 2021.⁷⁶ The EU Commission was expected to design a final proposal for the inclusion within the EU Taxonomy of nuclear and gas power plants by January 2022. An early draft of the proposal revealed the plan to regard certain gas and nuclear plants (those that meet certain emission bounds and energy efficiency) as 'transitional' or 'green' investments.⁷⁷ The proposal shows the results of different energy strategies for member states. For instance, France has invested considerably in nuclear energy whereas Germany and Austria are more reliant on gas-fired plant and are in the process of dismantling their nuclear plants.

After evaluating comments from the member parties, the EC presented on February 2022 a *Complementary Climate Delegated Act* which includes in the EU Taxonomy certain Gas and Nuclear activities.⁷⁸ The text, which has been the results of political negotiation between member parties in the EU, recognises the role of mobilizing investments on certain gas and nuclear activities in the transition which are however subject to clear limits and phase out periods. These selected gas and nuclear activities will be

⁷² The TEG provides the backbone of technical study behind the EU Taxonomy. It was established in 2018 by the EU Commission with the objective of advancing the workstream in sustainable finance. The TEG provided technical assistance in the development of the EU Taxonomy, the EU Green Bond Standard, the Methodologies for Climate Benchmarks, and the Guidelines for Climate-related disclosures by companies.

⁷³ 'Taxonomy' Final report of the Technical Expert Group on Sustainable Finance, March 2020, https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy_en.pdf.

⁷⁴ Among other contributions, the First Delegated Act sets the technology-neutral performance bound for power generation at 100 gCO₂e/kWh for substantial contribution to climate mitigation (following the recommendations of the TEG), and 270 gCO₂e/kWh for significant harm.

⁷⁵ With respect to nuclear energy, France, together with a block of 12 nations, is advocating for the inclusion of nuclear energy within the EU taxonomy ('Ten EU nations call for nuclear's inclusion in taxonomy', *World Nuclear News*, 11 October 2021, <https://www.world-nuclear-news.org/Articles/Ten-EU-nations-call-for-nuclear-s-inclusion-in-tax>), whereas Germany and another 5 nations are opposing that solutions ('Five EU countries form anti-nuclear alliance at COP26', EURACTIV, 12 November 2021, <https://www.euractiv.com/section/energy-environment/news/five-eu-countries-form-anti-nuclear-alliance-at-cop26/>). As in the cases of gas ('Gas and nuclear: Fate of EU green taxonomy "now in the hands of von der Leyen"', EURACTIV, 10 December 2021, <https://www.euractiv.com/section/energy/news/gas-and-nuclear-fate-of-eu-green-taxonomy-now-in-the-hands-of-von-der-leyen/>) and biomass ('Finland set to reject EU taxonomy rules over biomass', EURACTIV, 22 November 2021, <https://www.euractiv.com/section/energy-environment/news/finland-set-to-reject-eu-taxonomy-rules-over-biomass/>), similar controversies are expected to arise.

⁷⁶ 'Technical assessment of nuclear energy with respect to the "do no significant harm" criteria of Regulation (EU) 2020/852 ("Taxonomy Regulation")', https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/210329-jrc-report-nuclear-energy-assessment_en.pdf.

⁷⁷ 'LEAK: EU drafts plan to label gas and nuclear investments as green', EURACTIV, 1 January 2022, <https://www.euractiv.com/section/energy-environment/news/leak-eu-drafts-plan-to-label-gas-and-nuclear-investments-as-green/>.

⁷⁸ On 2nd February 2022, the ECB announced the "EU Taxonomy: Commission presents Complementary Climate Delegated Act to accelerate decarbonisation. See: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_711



particularly needed to reduce power generation from more polluting sources such as coal. According to the complementary delegated act, in order to be eligible:

- Both gas and nuclear activities, need to contribute to the transition to climate neutrality;
- Nuclear activities need to fulfil nuclear and environmental safety requirements. In particular, new plants must obtain construction permit before 2045 and show detailed plans to have a disposal facility in place by 2050 for high-level radioactive waste.
- Gas activities need to contribute to the transition from coal to renewables. New gas plants must replace an existing coal-fired power plants and be built by 31 December 2030 in order to be eligible for the green EU label. New gas facilities must also be designed to be able to run 100% on renewable or low-carbon fuels by 31 December 2035 and contribute to “a reduction in emissions of at least 55%” over their lifetime. Direct emissions must be lower than 270g CO₂e/kWh or must not exceed an average of 550kgCO₂e/kWh over 20 years.

The new rules add gas and nuclear power as “transitional” sources under the EU taxonomy. Furthermore, companies need to abide to new disclosure rules, according to which they need to report on a yearly basis about compliance with the green criteria.

The complementary climate delegated act on nuclear and gas is set to be scrutinized by the European Parliament which cannot make changes to the proposal but can only decide to reject it.

7. The role of institutional investors, financial institutions, and central banks

Institutional investors have recently increased their level of interest and commitment towards ESG and climate change. In 2020, the *United States Forum for Sustainable and Responsible Investment* (USSIF) reported a total of USD17.1 trillion (compared to USD569 billion in 2010) invested or reconcilable to sustainable investments mandates.⁷⁹ Larry Fink, CEO of Blackrock, among the largest institutional investment management firms, has highlighted in his annual letter to CEOs, the ‘*Fundamental Reshaping of Finance*’.⁸⁰ By recognizing Climate Risk as Investment Risk, and screening investments based on sustainability-related risks, together with actively engaging in firms via stewardship programmes to improve transparency and sustainability, institutional investors can become major players in this ‘*Tectonic Shift*’ of finance. In the case of green bond markets, private investor-led initiatives, such as the ICMA Green Bond Principles, have allowed the strong development of the market by fostering transparency and standardization. These initiatives have been, in most cases, ahead of time with respect to regulators and public policy initiatives for green taxonomies and green bond market standards.

Institutional investors play an important role in mobilizing capital to the objective of reducing the economy’s carbon footprint. First, by redirecting capital towards greener segments of the economy, either when subject to specific mandates or when being signatories of market-led initiatives on responsible and green investments.⁸¹ Second, by actively engaging portfolio firms with stewardship programmes. A recent example is the initiative led by Blackrock⁸² in engaging with portfolio companies and using proxy voting as a ‘voice’ instrument for promoting climate risk awareness and transition to a low-carbon economy. Another example of such initiatives is the formation of investor-led groups championing the adoption of sustainable investing practices, and engaging with firms as a unique block of representative investors. Possibly the largest example of such initiatives is *Climate Action 100+* an investor-led initiative, launched in December 2017 at the *One Planet Summit*, since then this has grown significantly into the largest investor engagement initiative on climate change.

⁷⁹ The executive summary report can be accessed here:

<https://www.ussif.org/files/US%20SIF%20Trends%20Report%202020%20Executive%20Summary.pdf>

⁸⁰ <https://www.blackrock.com/corporate/investor-relations/2020-larry-fink-ceo-letter>

⁸¹ See for example the PRI initiative (<https://www.unpri.org/>) and the climate action initiative (<https://www.climateaction100.org/about/>).

⁸² <https://www.blackrock.com/corporate/about-us/investment-stewardship>.



Beyond investor-led coalitions, activist investors and activist groups are increasingly becoming vocal and are advocating for advancing the agenda of the energy transition. These initiatives are mostly relevant for the energy and hard-to-abate sectors and might result in an increase in investments in green projects and possibly the increased issuance of green financing instruments to finance these investments.

Examples of activist-led actions are increasing rapidly, especially in the energy sector. One of the largest US energy companies, ExxonMobil, was subject to a proxy battle in Q4-2020, whereby the activist hedge fund, Engine-1, was advocating for a drastic overhaul of the company's strategy and proposed four board members for election at the company's shareholder meeting in late May 2021.⁸³ Other examples are the Third Point corporate activism on Royal Dutch Shell,⁸⁴ the recent Dutch court order to Royal Dutch Shell to step up its decarbonization strategy,⁸⁵ and activists' calls on Glencore to spin off thermal coal assets.⁸⁶ An emerging trend in the energy sector is the increasing pressure by activist investors for the spin-off of carbon-intensive assets and activities of energy sector firms, which might have the unintended consequence of removing carbon-intensive assets from the scrutiny and more stringent environmental regulation with which public companies are expected to abide.

A growing literature has studied the role of institutional investors in influencing greener policies for their portfolio firms. The literature has mostly focused on two main channels used by institutional investors to express their views in relation to green policies: the 'Voice' and the 'Exit' channel. According to the 'Voice' channel, investors engage, via stewardship programmes, with their portfolio companies either by voting at company meetings or directly engaging with senior management and boards. In the 'Exit' channel, investors express their dissent with a firm's policies by selling their shareholdings, or by implementing investment restrictions policies as part of their own mandates. Whether and which of these channels are preferred by investors is likely to depend on several factors, including the institutional investors' perception of the climate risk as an investment risk. Against this background, Krueger et al. (2020⁸⁷) run a survey on institutional investor perception on climate risk, and finds that investors believe these risks have financial implications for their portfolio firms and that the risks have already begun to materialize (climate transition risks in particular but see also Krueger et al. (2021) for a study of the effects of mandatory ESG disclosures). Interestingly, the majority of investors and, in particular, larger ESG-oriented, and long-term oriented investors, consider risk management and engagement, rather than divestment, to be the preferred channel for addressing climate risks. In the case of exclusion and exit criteria, Hong and Kacperczyk (2009) show that social norms in the form of exclusionary criteria in the context of 'sin stocks' affects stock coverage and increases costs of financing⁸⁸ for the excluded firms.

While these studies have been mostly focusing on the public stock markets, similar effects are expected to apply in the context of corporate debt markets. To the extent that ESG-oriented investors' demand for green assets and green financing instruments increases,⁸⁹ their adoption and performance is expected to outpace

⁸³ See new article on the matter at <https://www.ft.com/content/5ab010de-43c8-4b60-80f2-020f01610eee> ('Exxon faces "existential" risk over fossil fuel focus, activist investor warns') and <https://www.ft.com/content/52bd680a-696f-4d06-a019-954e2fd0b628> ('Exxon plans no "huge shifts in strategy" after losing board fight').

⁸⁴ See 'Royal Dutch Shell/Third Point: opportunistic attack may not yield desired result', <https://www.ft.com/content/e303d7bf-9c14-491d-9c1f-e76f424c58cb>.

⁸⁵ 'Dutch court orders Shell to accelerate emissions cuts', <https://www.ft.com/content/340501e2-e0cd-4ea5-b388-9af0d9a74ce2>

⁸⁶ See activist calls on Glencore: <https://www.ft.com/content/6f5a8c43-76d4-4843-a15e-47bc767ec6d8> ('Activist calls on Glencore to spin off coal assets') and follow up after activist call on Glencore: <https://www.ft.com/content/58ed952b-165e-4eaf-88f7-d5a98c277472> ('Cheering Shell's Cambo exit may be premature').

⁸⁷ An electronic version of the paper can be found at the link: https://ecgi.global/sites/default/files/working_papers/documents/finalkruegersautnerstarks_0.pdf ('The Importance of Climate Risks for Institutional Investors').

⁸⁸ As the author note, '[sin stocks] are less held by norm-constrained institutions such as pension plans as compared to mutual or hedge funds that are natural arbitrageurs, and they receive less coverage from analysts than do stocks of otherwise comparable characteristics. Sin stocks also have higher expected returns than otherwise comparable stocks, consistent with them being neglected by norm-constrained investors and facing greater litigation risk heightened by social norms.' The article can be accessed at the link: <https://www.sciencedirect.com/science/article/pii/S0304405X09000634> ('The price of sin: The effects of social norms on markets', *Journal of Financial Economics*, 93 1 July 2009, 15–36).

⁸⁹ 'Net inflows into UBS ETFs this year have been only to ESG funds', *FT*, 17 November 2021, <https://www.ft.com/content/c9f8e362-edb7-4693-92da-a57e77652850>.



that of conventional assets and financing instruments. The extent to which institutional investors reallocate capital to greener sectors of the economy – either by investing in green debt instruments or by directly deploying private capital in low-carbon assets – represents one important driver in the growth of the green bond market and low-carbon assets.

Beyond the availability and intentionality of capital reallocation towards greener sectors of the economy, which remains a necessary component for the transition of the economy, the availability of financial instruments and ‘financial infrastructure’ to channel investors’ capital represents another pivotal element.

In that context, the formation of benchmarks and the process of financialization of the asset class in general (in other words, the inflow of institutional investors’ capital, the development of benchmarks, indices, and exchange-traded funds (ETFs), allowing investors to take and track their exposure to the asset class) will allow a better and more efficient deployment of capital, see Basak et al. (2013).⁹⁰ The recent emergence of green bond indexes and of ETFs linked to them, as illustrated in Table (5), goes exactly in the direction of financialization of this segment of the market. The recent EU regulatory initiative with the EU benchmark Regulation⁹¹ also shows a regulator setting the appropriate landscape to promote a transparent development of the asset class.

Table 5: Recently developed Green Bond funds by leading institutional investors and ETF managers

ETF Name	Currency	Index Name	TICKER ETF
Lyxor Green Bond UCITS ETF	EUR	Solactive Green Bond Index	CLIM
Van Eck Vectors Green Bond ETF	USD	S&P Green Bond Select Index	GRNB
iShares Global Green Bond ETF	USD	Bloomberg Barclays MSCI Global Green Bond Select Index	BGRN
UC MSCI European Green Bond ETF	EUR	Bloomberg Barclays MSCI European Issuer Capped EUR Index	GB ECBI
Franklin Liberty euro Green Bond ETF	EUR	Bloomberg Barclays MSCI euro	FLRG
Lyxor Green Bond Screened	EUR	Solactive Green ESG Bond EUR USD	SGRESGIG
L&G ESG Green Bond UCITS ETF	EUR	JP Morgan ESG Green Bond Focus Index	GBND
Horizons S&P Green Bond Index ETF	CAD	S&P Green Bond U.S. Dollar Select Index	HGGB

Green bond indexes also provide an important reference for investors willing to assess the performance and diversification benefits from an asset class. Ehlers and Packer (2017) analyse hedged returns, namely

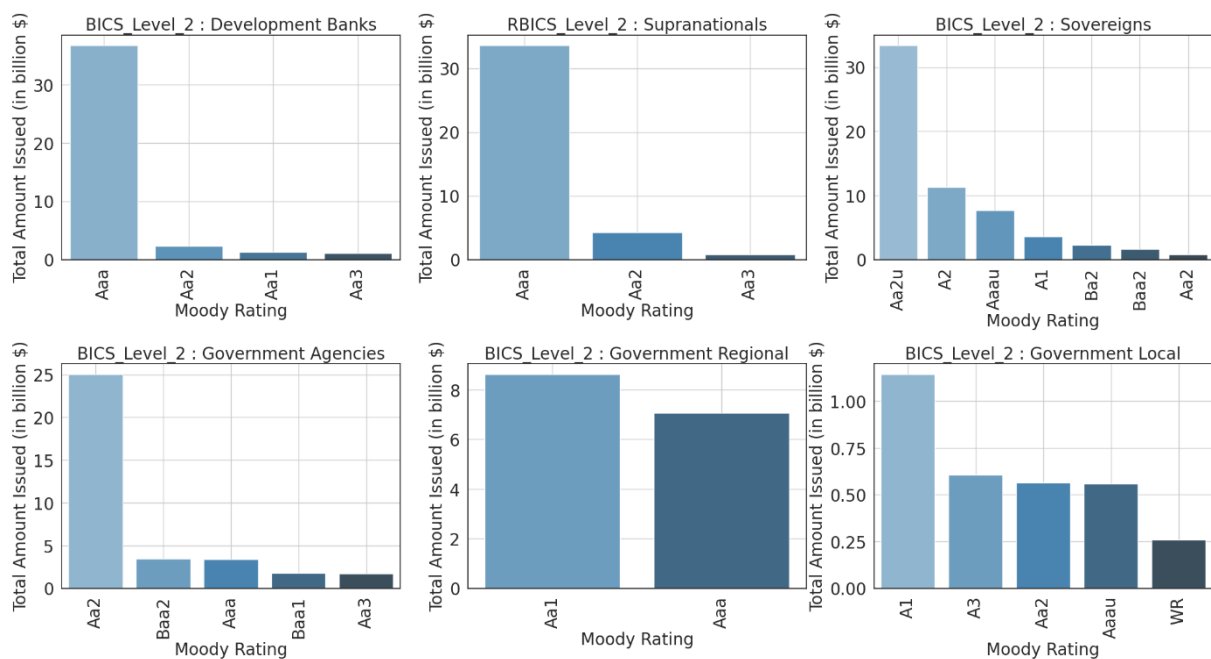
⁹⁰ Basak and Pavlova study an economy populated by institutional investors alongside standard retail investors. When institutional investors care about their performance relative to a certain benchmark (because tied to specific investing mandates), they overweight their holdings in stocks in their benchmark index. The resulting price pressure boosts index stocks, amplifies the index stock volatilities, and induces excess correlations among stocks that belong to their benchmark, generating a so called ‘asset-class effect’. An important example of financialization is the one that occurred around 2014 in commodity markets which experienced a strong influx of institutional investors’ capital, driven by the creation of ad hoc indexes and financial instruments. See, in relation to financialization and commodity markets, Basak and Pavlova (2016). The paper is accessible at the link: https://www.ijstor.org/stable/43868362?seq=1#metadata_info_tab_contents.

⁹¹ See ESMA dedicated page on the EU Benchmark Regulation implementation: <https://www.esma.europa.eu/policy-rules/benchmarks>

USD returns for hedged FX risks, for green bond indexes. They find similar hedged performance for green bond indexes compared to conventional global bond indexes of comparable credit rating.

In the context of the green bond market, another important element is the supply of high-rated securities. These seemingly credit risk-free assets are important for institutional investors looking for secure and large ticket investments that provide them with beneficial portfolio diversification. In the context of green bonds, these high-rated issuances are originated by highly-rated government and supranational institutions. Figure (12) shows the cumulative supply by high-rated government-related institutions in EUR-denominated green bonds as of Q4 2021, which accounts for approximately USD80 billion.

Figure 12: The total amount issuance in EUR-denominated green bonds by Government institutions and Supranationals by Moody's Credit Rating.



Source: Bloomberg Fixed Income database and author calculations.

Financial institutions are also positioned to play a critical role in the energy transition and in providing lending to green assets and investments. Given that capital investment decisions are essential in the nature and pace of the energy transition, the role of financial institutions is critical to this process. The pricing of green bonds and the cost of capital for carbon-intensive sectors of the economy is likely to depend on the way in which, and the extent to which, the banking sector prices transition risks.⁹²

Furthermore, given the project-based nature of green bonds, the increase in issuance in these instruments is tightly linked to the availability of green projects and assets, together with the extent to which bank credit is reallocated to greener sectors of the economy. Indeed, the substitutability of corporate bonds and syndicated bank loans has been the subject of several research papers in the banking literature (Badoer et al., 2019; Delis et al., 2019).

Recent research in the syndicated loan markets by Beyene et al. (2021) and Delis et al. (2019) shows that bonds to fossil fuel industry are priced at higher yields compared to syndicated bank loans, suggesting that

⁹² The energy transition represents a potential source of credit risk for financial institutions lending to carbon-intensive industries because of the risk of stranded assets. For example, in the case of the fossil fuel sector, a limit on resource extraction might curb future cash flow prospects because a large portion of existing fossil fuel reserves might remain unexploited to achieve the Paris Agreement targets. Banking sector response to increased transition risks is expected to materialize in higher interest rates (as a compensation for the increased default risk) and risk control measures in the form of reduced credit exposure to risky fossil fuel sectors.



the corporate bond markets are more extensively pricing climate transition risks⁹³ (see also Krueger et al. (2020)). These authors find that fossil fuel firms substitute from corporate bonds to syndicated loans, thus representing a contraction in the corporate bond supply in these sectors.

Central Banks (CBs) and Supervisory Authorities, have recently started exploring actions to address climate change. In Europe, the Bank of England (BoE) and the European Central Bank (ECB) are among the first institutions taking initial steps in this direction. The establishment and subsequent growth of the *Network for Greening the Financial System*⁹⁴ (NGFS) represents an important step forward in increasing the involvement and awareness of CBs in the assessment of climate risks to the financial system. The ECB has been particularly active, and has elaborated a roadmap to incorporate climate change considerations into its monetary policy and supervisory frameworks, while remaining within the perimeters of its mandate.⁹⁵ The BoE's championing of early integration of climate risks within its supervisory function during the leadership of Governor Mark Carney⁹⁶ is another example of central bank action.

Understanding central banks' actions and guidance in tackling climate change is relevant for bond markets, and for green bonds in particular. The major central banks – such as the ECB, the BoE, and the US Fed – have become large anchor investors in debt capital markets in the aftermath of the extensive asset purchase programmes that formed part of their unconventional monetary policy measures following the financial crisis and COVID-19 pandemic.

In the case of the ECB, Todorov (2020) shows that in the aftermath of the announcement and implementation of the Corporate Sector Purchase Program (CSPP) in 2016, the EU Corporate Bond market has undertaken a significant reassessment, followed by a shift towards CSPP-eligible corporate debt. By the same token, the recent announcement by the ECB (as part of the conclusion of its Monetary Policy Review) of their potential inclusion of preferential treatment of green bonds and green financing instruments within their CSPP programme, is expected to have a large effect on the issuance and pricing of green bonds in the EU debt capital market.⁹⁷

8. The next generation of green finance

The emergence of green bonds represents a landmark moment in financial innovation which is fundamental to supporting the energy transition, by redirecting public and private capital towards green projects/assets. However, while strict eligibility criteria as part of Green Bond Frameworks have enhanced the integrity of the market, by reducing the threat of greenwashing and fostering standardization and transparency, they have also prompted issuance mostly from those economic sectors with clearer net-zero pathways. One of these sectors has been the utility industry, which has seen most of the EUR-denominated green bonds issued being directed towards investments in renewable energy and infrastructure projects in relation to electrification.

⁹³ An alternative explanation is that banks are better placed for fossil fuel industries or in those hard to abate sectors which might be highly impacted by climate change policies, because banks have a comparative advantage, represented by repeated interaction and lower asymmetric information with respect to fossil fuel firms, compared to the corporate bond market.

⁹⁴ The NGFS group states its official missions as the following: '*The Network's purpose is to help strengthening the global response required to meet the goals of the Paris agreement and to enhance the role of the financial system to manage risks and to mobilize capital for green and low-carbon investments in the broader context of environmentally sustainable development. To this end, the Network defines and promotes best practices to be implemented within and outside of the Membership of the NGFS and conducts or commissions analytical work on green finance.*' Link to the initiative website: <https://www.ngfs.net/en>

⁹⁵ 'Climate change and the ECB', European Central Bank, <https://www.ecb.europa.eu/ecb/climate/html/index.en.html>.

⁹⁶ In its pioneering stands with respect of incorporation of climate risks assessment within the scope of the BoE supervisory function, Governor Mark Carney highlighted the challenges arising from the new form of non-financial risk, referring to the 'tragedy of the horizon' which refers to the long-term risks represented by climate change but with the necessarily high present cost of mitigation and adaptation. See: 'Breaking the tragedy of the horizon - climate change and financial stability - speech by Mark Carney', Bank of England, 29 September 2015, <https://www.bankofengland.co.uk/speech/2015/breaking-the-tragedy-of-the-horizon-climate-change-and-financial-stability>.

⁹⁷ The ECB Governing Council has recently announced a detailed action plan to incorporate climate related considerations within their monetary policy frameworks. See: 'The contribution of finance to combating climate change', Speech by Christine Lagarde, President of the ECB, 12 October 2021, <https://www.ecb.europa.eu/press/key/date/2021/html/ecb.sp211012-bfe7738d35.en.html> and 'ECB presents action plan to include climate change considerations in its monetary policy strategy', 8 July 2021, https://www.ecb.europa.eu/press/pr/date/2021/html/ecb.pr210708_1-f104919225.en.html.



In contrast, energy sub-sectors with less clear net-zero pathways – such as the oil and gas industry – have experienced limited green bond issuance, due to the exclusion of most of the hard-to-abate industries from green assets eligibility. In order to align financing with decarbonization pathways and to incentivize firms in the energy sector to reduce their carbon emissions, Sustainability-Linked Bonds/loans have found strong early adoption.

Furthermore, in the aftermath of the COVID-19 pandemic, governments issued recovery bonds with the dual objective of investing in green assets/projects, but also of being linked to social projects. This gave rise to sustainability bonds which combine both social and environmental benefits.

Against this background, recognizing both the urgency and the necessity of enlarging the scope of green financing to sectors of the economy with less immediate transition pathways (but which nevertheless are able to contribute to the achievement of curbing carbon emissions and ensuring a just economic recovery and transition) has spurred the development of the following additional labels.

8.1. Transition finance frameworks

Given the heterogeneity in net-zero pathways and a starting point at firm and industry levels, a number of comprehensive climate transition financing frameworks have been developed in order to provide guidance, particularly for ‘hard-to-abate’ sectors. Furthermore, in relation to more general transition strategies which go beyond the single climate label, other instruments have been proposed.

Unlike any green bond framework or the ‘use-of-proceeds’ approach, climate transition finance primarily focuses on (i) the credible net-zero pathway at issuer level, and provides general purpose corporate finance as in the case of sustainability-linked bonds, and (ii) including more than financing to environmental projects/assets by including social projects, as with sustainability bonds (which are also ‘use of proceeds’ bonds but take into account a larger scope of a project’s eligibility which also includes its social aspect). Two main frameworks have been developed by ICMA in that direction:

- Sustainability Bonds Frameworks.⁹⁸
- Sustainability-Linked Bonds Frameworks.⁹⁹

Beyond specific instrument design, both share high-level recommendation in terms of issuers’ disclosure in their bond documentation under the *Climate Transition Finance Handbook*¹⁰⁰ which encompasses:

1. Issuer’s climate transition strategy and governance.
2. Business model environmental materiality.
3. Climate transition strategy to be ‘science-based’, including targets and pathways.
4. Implementation transparency.

An issuer label has also been recently proposed by CBI under the so called ‘climate-aligned’ issuers’ label. Those are eligible for entities which generate at least 75 per cent of their revenues from green assets, whereas ‘fully aligned’ issuers account for at least 95 per cent of revenues generated from green assets.¹⁰¹

8.2. Sustainability bonds

According to ICMA Sustainable Bonds framework, Sustainability Bonds are defined as: ‘Sustainability Bonds are any type of bond instrument where the proceeds or an equivalent amount will be exclusively applied to finance or refinance a combination of both Green and Social Projects.’

⁹⁸ ‘Sustainability Bond Guidelines’, International Capital Market Association, <https://www.icmagroup.org/sustainable-finance/the-principles-guidelines-and-handbooks/sustainability-bond-guidelines-sbg/>.

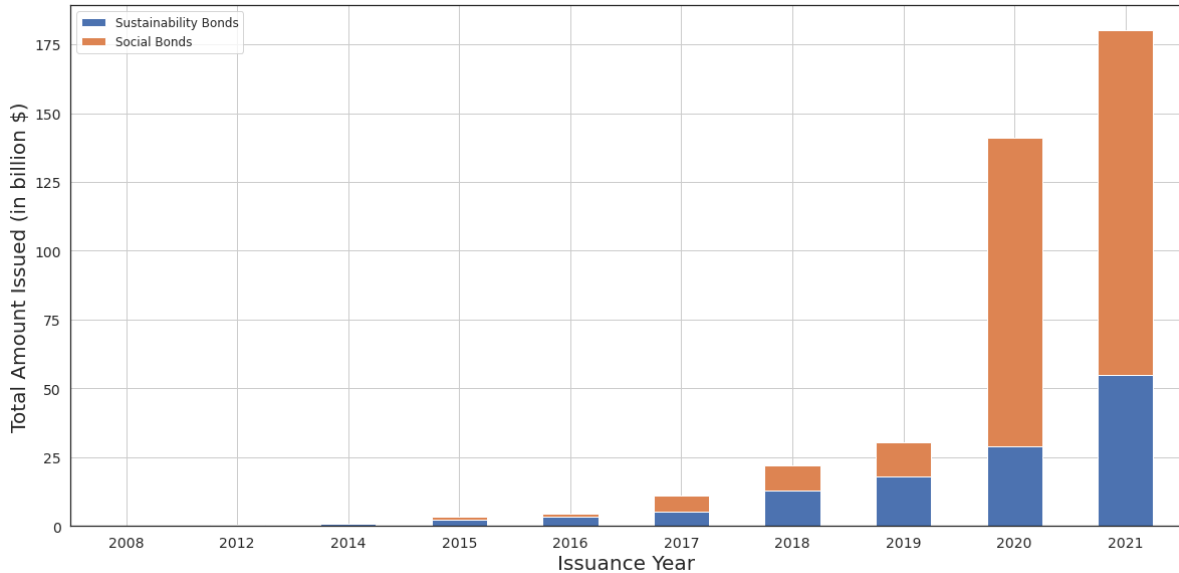
⁹⁹ ‘Sustainability-Linked Bond Principles (SLBP)’, International Capital Market Association, <https://www.icmagroup.org/sustainable-finance/the-principles-guidelines-and-handbooks/sustainability-linked-bond-principles-slbp/>.

¹⁰⁰ ‘Climate Transition Finance Handbook’, <https://www.icmagroup.org/assets/documents/Regulatory/Green-Bonds/Climate-Transition-Finance-Handbook-December-2020-091220.pdf>.

¹⁰¹ ‘Financing Credible Transitions – A framework for identifying credible transitions’, <https://www.climatebonds.net/transition-finance/fin-credible-transitions>.

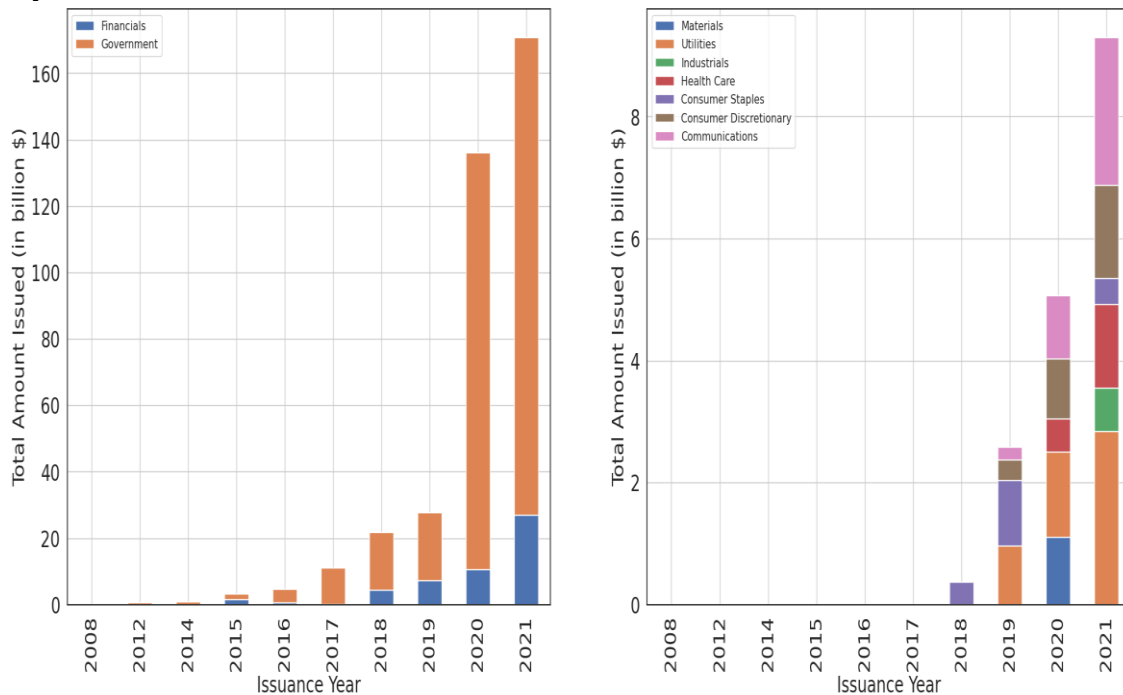
Similar to green bonds, sustainable bonds are ‘use of proceeds’ bonds with funding allocated to one or more project with a clear climate and social objective, or to a green project which also has clear social benefits. Figure (13) shows the strong growth in issuance of EUR-denominated sustainable bonds between 2020 and 2021, which has been mostly driven by refinancing used by firms and governments in the aftermath of the COVID-19 pandemic. Figure (14) shows EUR-denominated sustainability bonds issued since 2008 by economic sector level and highlights the predominant role of government issuers in this market segment.

Figure 13: The total issuance in USD billions of social and sustainability bonds between 2008 and 2021



Source: Bloomberg Fixed Income Database and Author computation.

Figure 14: The total issuance in USD of EUR-dominated sustainability bonds between 2008 and 2021 by BICS Level 1



Source: Bloomberg Fixed Income Database and Author computation.

Note: Left panel shows Government and Financial issuers as they rank among the largest issuers. Right panel shows corporate bond issuers by BICS Level 1 sectors.



8.3. Sustainability-linked bonds/loans

Sustainability-linked bonds (SLB) – which differ compared to the ‘use of proceeds’ approach of green bonds – provide an issuer-level financing instrument, with the objective of incentivizing and aligning issuers’ climate objectives with financing terms and conditions. This alignment is achieved via transparent and regularly monitored *Key Performance Indicators* (KPIs) and *Sustainability Performance Targets* (SPTs).

According to the ICMA Sustainability-Linked Bonds framework, *Sustainability-linked Bonds* are defined as: ‘*Sustainability-Linked Bonds (SLBs) are any type of bond instrument for which the financial and/or structural characteristics can vary depending on whether the issuer achieves predefined Sustainability/ESG objectives. In that sense, issuers are thereby committing explicitly (including in the bond documentation) to future improvements in sustainability outcome(s) within a predefined timeline. SLBs are a forward-looking performance-based instrument.*’

Given the growing interest in SLB, ICMA has developed the *Sustainability-Linked Bond Principles* (SLBP), a voluntary set of guidelines to assist issuers in designing SLBs that are aligned with best practices in terms of reporting and transparency.

The SLBP are constituted of five core principles:

1. *Selection of Key Performance Indicators (KPIs)*: KPIs need to be (i) credible, in other words, they should represent material objectives for the firm’s sustainability and business strategy and might address environmental, social, and/or governance challenges, (ii) measurable and based on a consistent methodological basis, (iii) externally verifiable, (iv) benchmarkable in order to assess SPT ambitions and be comparable across time and other issuers.
2. *Calibration of Sustainability Performance Targets (SPTs)*: refers to the setting of the level of ambition of the issuer compared to realistic (‘business as usual’) benchmark levels.
3. *Bond characteristics*: refers to bond structure details in terms of financial and/or structural changes in case of trigger events related to KPIs and SPTs. Examples are revaluation of coupon in the form of coupon step ups in case of missing SPTs targets. In particular, calibration of SPTs must include: (i) backward-looking reference of track record on the selected KPIs, (ii) benchmarking of SPTs against industry peers and available standards, and (iii) be science-based in terms of alignment with an internationally endorsed target such as the Paris Agreement and National NDCs.
4. *Reporting*: promote transparency of KPIs, SPTs, and structural details of the bond. Furthermore, issue reporting must provide details on the verification assurance report.
5. *Verification*: issuers are expected to have an external verifier. Importantly, in contrast to SPOs in GBF, post issuance verification is a necessary component for alignment to the SLBP.

As discussed, common structures in SLB entail penalties for missing KPI targets and most often include structures with coupon step-ups¹⁰² to tie issuer KPI-related performance to its cost of capital. In that sense, they have to be intended as forward-looking, performance-driven at entity level financing instruments.

However, market observers such as CBI have noticed that several criticalities remain for sustainability-linked bonds and loans to date, given the still early maturity of the market.¹⁰³ Penalties still remain relatively small, which suggests limited impact and incentives for issuers. Nevertheless, it is possible that on top of built-in penalties from coupon step-ups, other implicit forms of penalties may derive from missing targets – such as loss of reputation and future access to market. The very early nature of the market does not allow a conclusion to be provided either way. Finally, another source of concern often cited is the difficulty of benchmarking KPIs of SLBs against industry peers and/or Paris Agreement goals.

¹⁰² An example is the ENEL SDG-Linked Bond issued in September 2019. The Bond structure includes a coupon step-up of 25 basis points against the target of ‘increasing installed renewable energy generation capacity to 55% of its total capacity by the end of 2021’. See <https://www.enel.com/it/investitori/investimenti/finanza-sostenibile>

¹⁰³ ‘Sustainable Debt Global State of The Market 2020’, Climate Bonds Initiative, https://www.climatebonds.net/files/reports/cbi_sd_sotm_2020_04d.pdf



8.4. Financing the energy sector transition

Transition requires changes in business models and mitigation/adaptation investments. While adoption of green bonds within the high carbon emitting sectors such as the energy industry is still limited, there is a growing momentum for sustainability-linked bonds and loans. Recent market reports¹⁰⁴ show the recent growth in issuance globally in green bonds, sustainability bonds, and sustainability-linked bonds.

Whereas data on sustainability-linked bonds is, to date, notoriously less structured in mainstream fixed income datasets, a recent report from CBI for the first half of 2021 on the state of the green finance market highlights a steady increase in SLB issuance, mostly driven by companies in sectors largely excluded by green bonds. As of H1-2021 only, a total of USD32.9 billion were issued, accounting for approximately 6 per cent of labelled bond issuance in the same period according to CBI (see CBI, 2021). Among the largest SLB transactions, those of *Enbridge Inc.*,¹⁰⁵ and *Eni SpA*¹⁰⁶ stand out, as they represent some of the very early examples of SLB issuance in the energy industry. The comparison between the terms of the SLBs shows the importance of benchmarking by peers when assessing the ambition of KPIs and SPTs.

Enbridge Inc. issued a total of USD1.5 billion in June 2021 with targets of 35 per cent Scope 1 and Scope 2 GHG reduction as of 2030, compared to a 2018 benchmark. The targets are considered by CBI as being limited in showing adequate ambition, as the targets are not extended to Scope 3 emissions and they represent a target which is already almost 70 per cent achieved. *Eni SpA* is targeting lifecycle GHG emissions to reach net zero by 2050, from a 2018 benchmark, which represents a more ambitious strategy though certain caveats remain as highlighted in the CBI report.

After a controversial initial issuance of green bonds in 2017,¹⁰⁷ *Repsol* has returned to market in 2021 with a new green bond, one of the first in its sector. At the same time, the Spanish energy firm has issued two SLBs, marking a debut in this market for the firm and one of the first in its sector.¹⁰⁸ Other recent notable examples in the energy sector are the *TotalEnergies* Hybrid Bonds¹⁰⁹ and *Trafigura* series of SLB/SLL transactions.¹¹⁰ Table (6) shows the Top 5 SLB issuance across H1-2021 and Q3-2021.

These above examples show some of the efforts the energy sector is making to reshape its business model and climate ambitions. The growing trends in green finance, and the growing adoption by energy firms, is indicative of energy industries embracing climate change consideration into their business strategies and financing via green finance.

¹⁰⁴ See for example: 'Sustainable Debt Market Summary Q3-2021', Climate Bonds Initiative, October 2021, https://www.climatebonds.net/files/reports/cbi_susdebtsum_q32021_03b.pdf and 'SUSTAINABLE DEBT Global State of the Market 2020', Climate Bonds Initiative, https://www.climatebonds.net/files/reports/cbi_sd_sotm_2020_04d.pdf. ICMA data also gives a snapshot of the growing adoption of different frameworks.

¹⁰⁵ 'Enbridge raises funds from sustainability bonds in climate-goal push', Reuters, 29 June, 2021, <https://www.reuters.com/business/sustainable-business/enbridge-raises-funds-sustainability-bonds-climate-goal-push-2021-06-29/> Enbridge 'About Us', <https://www.enbridge.com/about-us/our-values/sustainability>.

¹⁰⁶ 'ENI launches the first sustainability-linked bond issue in its sector', eni.com, 7 June 2021, <https://www.eni.com/en-IT/media/press-release/2021/06/eni-launches-first-sustainability-linked-bond-issue.html>.

¹⁰⁷ 'Repsol Returns to Green Bond Market After First Sale Controversy', Bloomberg, 21 June 2021, <https://www.bloomberg.com/news/articles/2021-06-21/repsol-returns-to-green-bond-market-after-first-sale-controversy>.

¹⁰⁸ 'Repsol Fixed Income, Bonds issued by Repsol International Finance BV', <https://www.repsol.com/en/shareholders-and-investors/fixed-income-and-credit-ratings/fixed-income/index.cshtml>, 'Repsol set to raise 1.25 bln euros from sustainability-linked bond', Reuters, 29 June 2021, <https://www.reuters.com/business/sustainable-business/repsol-starts-marketing-debut-sustainability-linked-bond-sale-2021-06-29/>.

¹⁰⁹ 'Total Has Successfully Issued Hybrid Bonds To Finance Its Development Strategy in Renewables', Total Energies, 19 January 2021, <https://totalenergies.com/media/news/press-releases/total-has-successfully-issued-hybrid-bonds-finance-its-development>.

¹¹⁰ 'Trafigura closes a new USD203.5 million US Private Placement, its first sustainability-linked capital markets transaction', Trafigura Press Release, 28 April, 2021, <https://www.trafigura.com/press-releases/trafigura-closes-a-new-usd203-5-million-us-private-placement-its-first-sustainability-linked-capital-markets-transaction/> 'Trafigura Group Pte Ltd closes USD2.4 billion-equivalent Syndicated Revolving Credit Facility and Term Loan Facilities', Trafigura Press Release, 25 October 2021, <https://www.trafigura.com/press-releases/trafigura-group-pte-ltd-closes-usd-2-4-billion-equivalent-syndicated-revolving-credit-facility-and-term-loan-facilities/>.

**Table 6: Top sustainability-linked Bond issuance in H1-2021 and Q3-2021**

Top 5 Sustainability Linked issuers in H1-2021				
Issuer Name	Country	Sector	Amount Issued in H1-2021 (USD) billion	
Enel Finance International NV	Italy	Energy - Power	3.9	
Enbridge Inc.	Canada	Energy – Oil&Gas	1.5	
Fomento Economico Mexicano SAB de CV	Mexico	Consumer	1.5	
Eni SpA	Italy	Energy – Oil&Gas	1.2	
China Construction Bank Corporation	China	Financials	1.2	
Top 5 Sustainability Linked issuers in Q3 2021				
Issuer Name	Country	Sector	Amount Issued in Q3-2021 (USD) billion	
Enel Finance International NV	Italy	Energy - Power	12.1 (11 deals)	
NRG Energy Inc	USA	Energy - Power	2.2 (2 deals)	
Picard Group SAS	France	Investment Holding Companies	1.7 (2 deals)	
Lion/Polaris Lux 4 SA	France	Investment Holding Companies	1.5 (2 deals)	
Repsol SA	Spain	Energy – Oil&Gas	1.4 (2 deals)	

Source: Climate Bond Initiative Market Analysis

9. Conclusions

The urgency and scale of the energy transition requires an increasing flow of capital from both public and private sectors towards green assets and infrastructure. To efficiently channel these funds, green financing instruments are expected to play a major role.

Green bonds have experienced a major growth since their first issuance in 2007 and represent, as of H2-2021, a USD1.5 trillion market. Issuers of green bonds include both corporate and sovereign issuers. Government-backed and supranational institutions, such as multilateral development banks, have played an important role in fostering the initial growth of the green bond market. The euro has become the major currency of issuance for green bonds, mostly driven by a sound policy commitment towards reducing GHG emissions in Europe.

Among the drivers of the fast growth in green bonds, the adoption of a market-driven labelling framework has played a major role in fostering transparency and the well-functioning of the market. The recent initiatives, led by regulators and policy makers around the world and in particular by the European Commission, are expected to provide further fertile ground for green bonds. The growing interest by institutional investors in investing in green assets is one of the demand-side drivers of the fast growth of green bonds and of other labelled transition instruments. In such an evolving and fast-moving landscape,



central banks are expected to play an important role moving forward, with respect to both guidance and the adoption of 'green' central banking principles complementing their monetary policy interventions.

From the issuers' perspective, several incentives motivate the issuance of green bonds, including i) diversifying their investor base, ii) accessing a larger and more stable investor base, and iii) signalling strong commitment to credible decarbonization strategies. These incentives are considered to compensate for the additional costs incurred by third-party verification and enhanced post-issuance reporting. The paper reviews evidences on the 'greenium' – the premium paid by investors on green bonds in primary and secondary market transactions. A growing body of empirical literature has shown an economically significant 'greenium' on primary market transactions, while evidence on secondary market transactions is mostly inconclusive. We conclude that, to date, systematic evidence on the 'greenium' remains mixed.

While green bonds represent an opportunity for economic sectors where a clear path to net-zero carbon emissions exists, they remain challenging for hard-to-abate sectors and for sectors in which a clear path to net-zero is not yet established. Strict eligibility under sector criteria regarding what is defined as a 'green' projects/asset by some of the most adopted green bond frameworks (such as CBI, GBP, EUGBS) makes it more challenging for hard-to-abate sector issuers to select eligible assets.

This lack of green investment opportunities is testified to by the relatively low issuance of green bonds in the oil and gas industry. In contrast, the utility sector, for which renewable energy infrastructures represent an ideal and eligible green asset, is among the largest green bond sectors of issuance.

The challenges related to green bonds have been the motivation for alternative labels under the umbrella of 'transition finance' with the dual objective of i) offering broader financing instruments for those sectors of the economy that, although not directly fitting the strict requirements of green bonds, need to find proper decarbonization pathways; and of ii) including projects and assets which combine social and environmental benefits. The two primary instruments in terms of adoption at government and corporate levels are respectively Sustainability Bonds and Sustainability-Linked Bonds/Loans (SLB/SLL).

Sustainability Bonds and Sustainability-Linked Bonds/Loans are of greater importance for the energy sector. They differ from the 'use of proceeds' design and instead provide an 'entity-wide financing' design with financial incentives from the perspective of the issuer, linked to the achievement of credible decarbonization targets. The steep growth in SLB/SLLs and their adoption in particular by the energy industry and by other hard-to-abate sectors, has shown the potential of these instruments. The recently developed frameworks by ICMA and CBI provide the adequate transparency needed in the SLB/SLL markets. However, given the infancy of this market, certain challenges remain such as i) heterogeneity in key performance indicators (KPIs) and sustainability performance targets (SPTs); and ii) lack of sector benchmarks. Future developments and adoption in that respect are expected to bring further improvements in these aspects.



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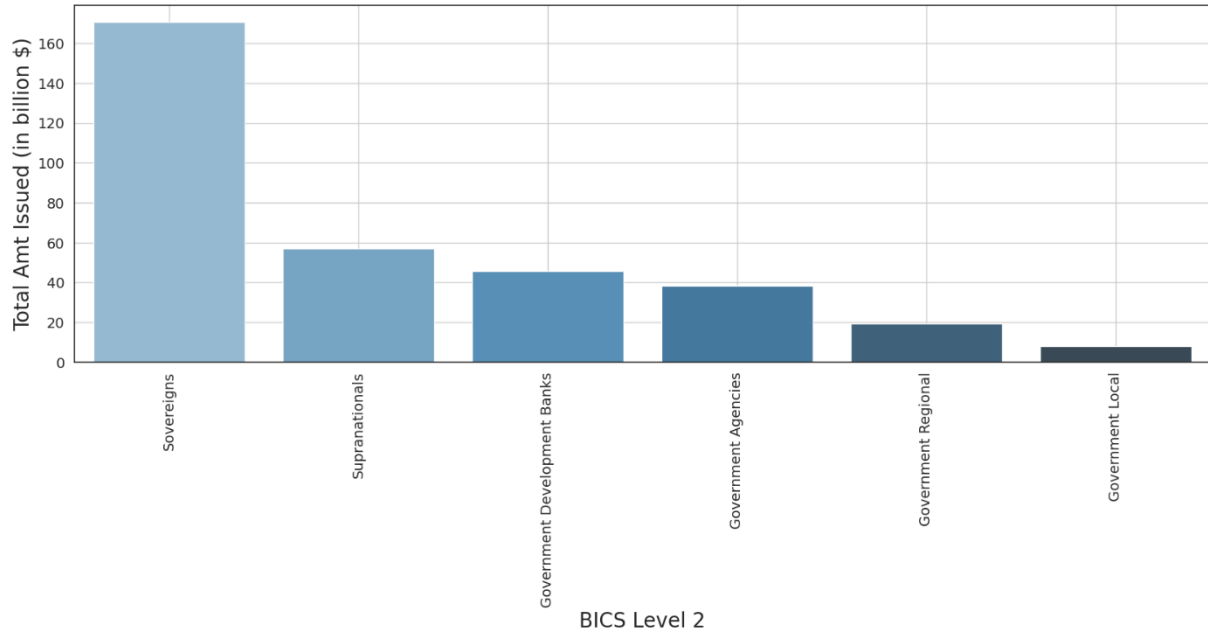
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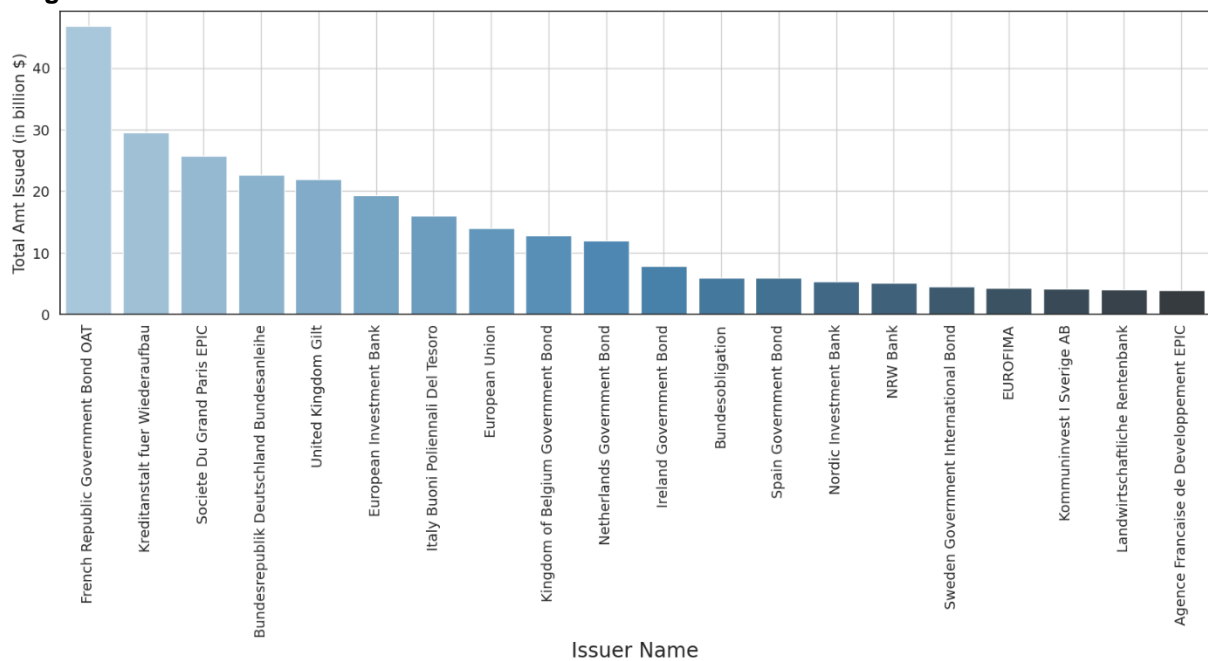
Appendix A: Additional Figures

Figure A-1: The total issued amount of EUR-denominated green bonds by sovereign and government backed entities in USD billion as of 2021



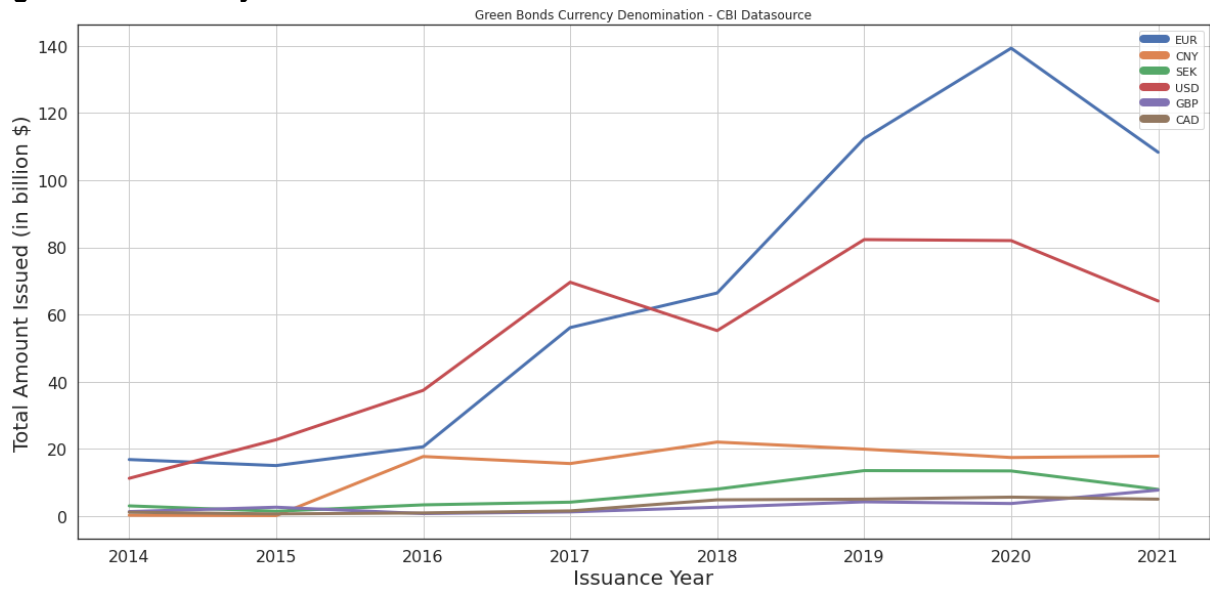
Source: Bloomberg Fixed Income Dataset and authors' calculation.

Figure A-2: The total issued amount of EUR-denominated green bonds by the top 20 sovereign and government backed entities in USD billion as of 2021



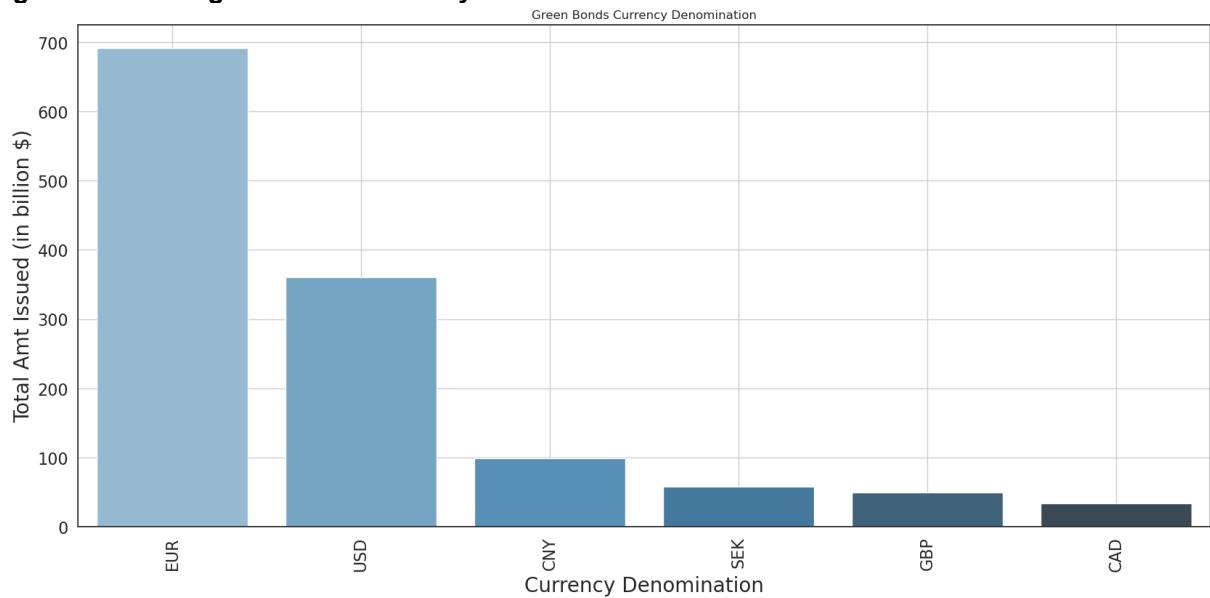
Source: Bloomberg Fixed Income Dataset and authors' calculation.

Figure A-3: Currency denomination of Green Bonds issued between 2014 and 2021.



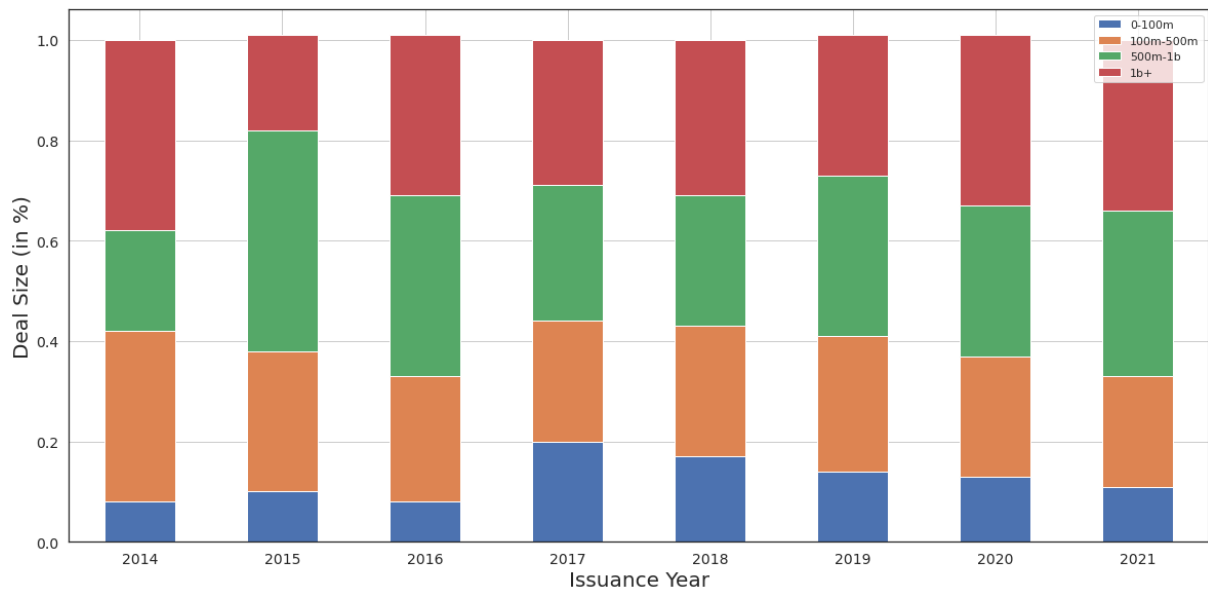
Source: Climate Bond Initiative.

Figure A-4: Total green bond currency denomination issuance between 2008 and 2021.



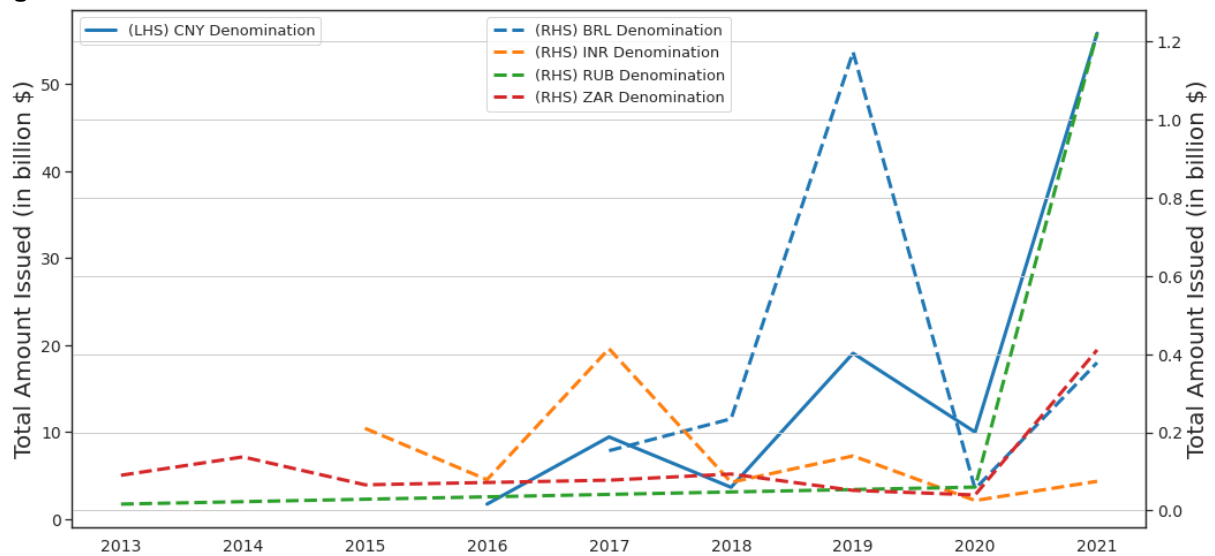
Source: Bloomberg Fixed Income Dataset.

Figure A-5: Deal size (in %) of total green bond issuances per issuance year between 2014 and 2021.



Source: Climate Bond Initiative.

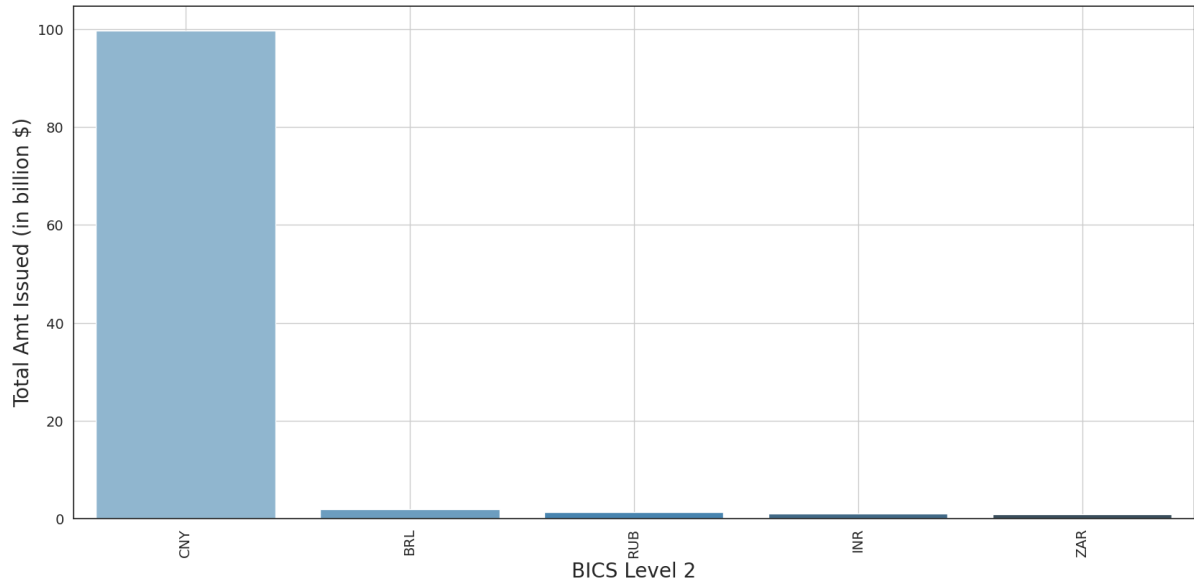
Figure A-6: Green bond issuance in BRICS countries between 2013 and 2021.



Source: Bloomberg Fixed Income Database and authors calculations.

In particular, left hand side shows green bonds issuance in CNY whereas right hand side shows green bond issuances in BRL (Brazil), INR (India), RUB (Russia) and ZAR (South Africa).

Figure A-7: The aggregate green bond issuance in BRICS countries between 2013 and 2021 expressed in USD billion



Source: Bloomberg Fixed Income Database and authors calculations.