Investor protection

Environmental impact and liquidity of green bonds

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Summary

The European green bond market is attracting a growing number of corporate issuers, which has implications for the environmental impact of these instruments and their liquidity. This article first investigates the carbon dioxyde emissions of green bond issuers. We show that, between 2009 and 2019, energy firms, utilities and banks that issued a green bond were much more likely to disclose emissions data, and they have on average reduced their carbon intensity to a larger extent than other firms – confirming the view that green bonds act as a signal of firms' climate-related commitments. We then compare the liquidity of green and conventional EUR corporate bonds from green bond issuers using proxy indicators. Green bond liquidity appears to be tighter, but the differential with conventional bonds has remained small and broadly constant during the COVID-19 turmoil, suggesting no particular vulnerability for the green segment of the corporate bond market.

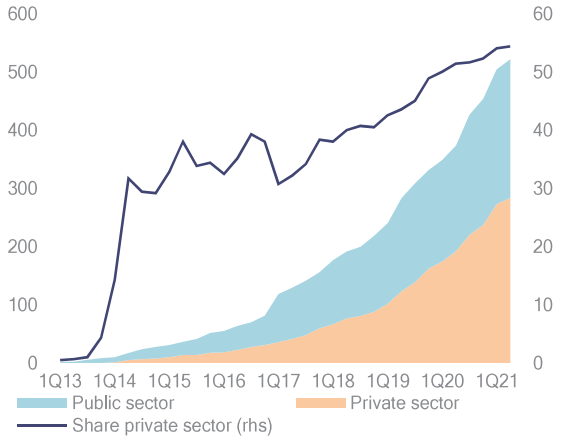
Introduction

Since the EIB issued the world's first climate bond in June 2007, green bonds have experienced a remarkable development. From almost nothing 10 years ago, the global green bond market has grown to nearly EUR 1 tn today.[187]

One major change that has taken place in recent years is the emergence of a deep private-sector green bond market (RA.1). While this supports the development of green finance and brings diversification benefits, it also has significant implications for the environmental impact of green bonds and their liquidity.

As the EU is set to launch its own green bond label, this article investigates the environmental impact of green bonds, and features several indicators to monitor the liquidity risk attached to these instruments. Initially a niche market involving a small number of supranational issuers, from 2013 the green bond market saw a growing number of local government issuers. Several EU countries have since had their first sovereign green bond issuances.[188]

RA.1
Green bonds outstanding in the EU
Private sector share above 50 %



Note: Outstanding amount of green bonds in the EEA30 by sector, EUR bn, and share of private sector (rhs), in %.
Sources: Refinitiv EIKON, ESMA.

The size and success of these auctions contributed to the reputation of green bonds.

[186] This article was authored by Julien Mazzacurati, William Paris and Alexandra Tsiotras.

[187] EIB (2017) and CBI (2020); the EIB issues green bonds under the label 'Climate awareness bonds'.

[188] Early issuers include the World Bank, the Nordic Investment Bank and the EBRD; see World Bank (2019) and EBRD (2021). Local government issuers in 2012 include three regions in France; see CBI (2018). Sovereign issuers include FR, BE, DE, HU, NL, PL and SE.

Auctions in FR, NL and DE involved volumes of below EUR 7 bn and attracted orders in excess of EUR 20 bn (EUR 33 bn in DE). [189]

Another important turning point came with the first green bond issuances from state-owned banks and utilities.[190] The success of these endeavours led to a flurry of other corporate issuers tapping the market. As volumes increased, the growing availability of higher-yielding debt financing green projects helped to expand the universe of potential buyers. In 2Q21, the private sector represent 54 % of the market (EUR 284 bn), with the financial sector accounting for more than half of the volumes outstanding. In total, corporate green bonds amounted to around 3 % of the broader EU corporate bond market. One sign of the positive dynamic underway is the growing share of issuers returning to the market: almost two thirds of the corporate green bonds sold in 2020 were from firms that had already issued a green bond.

Environmental impact and industry standards

The success of green bonds can to a large extent be explained by the growing prominence of climate-related issues, and a gradual realisation that humans bear some of the responsibility in global warming (Boffo et al., 2020). The 2015 Paris Agreement set out quantitative objectives to combat climate change, paving the way for the European Green Deal. In 2019, the European Commission estimated that EUR 260 bn per year in additional investments would be needed to achieve the 2030 climate and energy targets.[191] With more stringent targets announced since, the financing needs are now likely to be higher.

A significant share of these investments will need to be financed by the private sector, and green bonds have a key role to play: in 2020, EU issuers raised a net EUR 127 bn through green bonds – almost half of the estimated investment needs – including EUR 79 bn in corporate debt.

A fundamental question is whether green bonds bring clear environmental benefits. This would require two conditions: that green bonds finance projects benefitting the environment; and that green bond issuers do not perform economic activities otherwise harmful to the environment.[192]

Assessing this remains a challenge for several reasons: granular information on the projects being financed or their impact is scant, while broader data on companies' environmental impact (e.g. through climate-related disclosures) remain insufficient despite recent improvements.[193]

The absence of a legal framework and definitions further complicates this assessment. While a growing green bond issuer base helps channel money into green projects, it "also allows a very broad church of firms to issue green bonds, each deemed to be green for different reasons" (Ehlers et. al., 2020). Recent anecdotal evidence shows that there is indeed some misalignment between investor expectations and reality.[194]

Greenwashing concerns in the context of very strong market growth eventually led to the development of industry standards, including mainly the Climate Bond Standards and the Green Bond Principles,[195] which have brought a degree of transparency and standardisation to the market. By spelling out the types of projects eligible for green bond financing, these standards were a first step towards ensuring that green bonds have a positive environmental impact and were met with significant success, with 90 % of the global green bond market using one of these two labels (RA.2).

Under the Green Bond Principles, there are four key aspects involved in the issuance of a green bond (ICMA, 2018):

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[189] Data from Agence France Tresor, Deutsche Finanzagentur and Dutch State Treasury Agency.

[190] The public utility Electricite de France and the municipal bank KBN started issuing green bonds in 2013.

[191] European Commission, "The European Green Deal", December 2019.

[192] For example, Korea Electric Power Corp. faced criticism for issuing a USD 500mn green bond while investing in new coal-fired power plants in Southeast Asia.

[193] See for example TCFD (2020).

[194] See for example "Bond investor Revolt Brews over Bogus Green Debt Flooding Market", Bloomberg, 29 March 2021; "Investors probe ESG credentials of bond sellers on 'greenwashing fears", Financial Times, 28 October 2020.

[195] Climate Bonds Initiative, "Climate Bonds Standard – International best practice for labelling green investments", and International Capital Markets Association, "Green Bond Principles – Voluntary process guidelines for issuing green bonds".

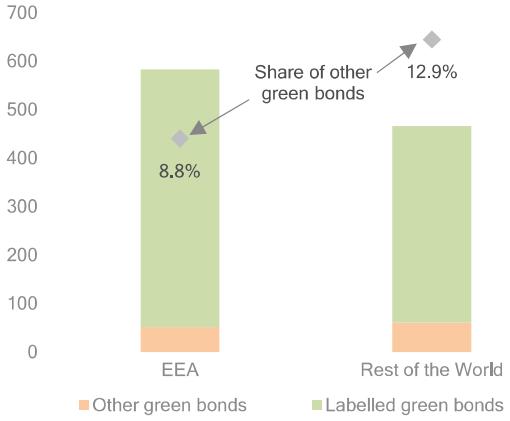
— Use of proceeds: Description of the utilisation of proceeds, including a distinction between new project financing and re-financing; achievement of expected environmental benefits and contribution to environmental objectives;

— Process for project evaluation and selection: Description of the process used to determine how the project fits into the eligible green project categories, eligibility criteria, and use of existing standard or certification; recommendation to appoint an agent to provide an external review to confirm alignment with the Principles;[196]

— Management of proceeds: Tracking of net proceeds allocated to eligible green projects and of temporary placement for unallocated funds; recommendation to use a third party (e.g. auditor) for verification purposes;

— Reporting: Annual reporting on proceed allocation until funds are exhausted, including list of projects, and expected impact; recommendation to use performance indicators.

RA.2
Global green bond market outstanding
Green bond labels are the norm



Note: Total outstanding amount of global green bonds by issuer region, EUR bn, as of 30 April 2021. Labelled green bonds are certified by the Climate Bonds Initiative or aligned with the ICMA Green Bond Principles. Other green bonds are bonds with an environmental purpose but without one of these two labels.
Sources: Climate Bonds Initiative, Refinitiv EIKON, ESMA.

These steps are intended to ensure that the money raised through green bonds finances projects eligible for funds under the Green Bond Principles and that benefit the environment (RA.3). Recourse to an external verifier further strengthens the project's credibility but is expensive, at an estimated EUR 40,000 per review.[197] However, these standards are purely voluntary and non-binding, while the absence of a penalty mechanism means that issuers face limited consequences (other than reputational effects) if the bond proceeds are misallocated or the projects bring no environmental benefit.

RA.3
Green Bond Principles
Eligible green projects

Category	Description
Renewable energy	Production and transmission of renewable energies; use in appliances and products
Energy efficiency	In new buildings, renovation, energy storage, smart grids, etc.
Pollution prevention and control	Emission reduction or control, waste prevention or reduction, recycling, etc.
Management of natural resources and land use	Sustainable agriculture, fishing, and forestry, biological crop protection, reforestation, etc.
Biodiversity conservation	Protection of coastal and marine environments
Clean transportation	Electric, hybrid or non-motorised transportation, and infrastructure for clean energy vehicles
Water and wastewater management	Infrastructure for clean water and wastewater treatment, sustainable drainage and flood mitigation
Climate change adaptation	Climate observation, early warning or other information support systems
Eco-efficiency and circular economy	Sustainable products with eco-label or environmental certification, resource-efficient packaging and distribution
Green buildings	Certified buildings

Source: ICMA.

Green bonds and carbon emissions

Although the success of green finance is a testament to firms' and investors' the growing awareness of on climate change, one key question is whether it effectively contributes to a reduction of global greenhouse gas (GHG) emissions, including carbon dioxide (CO2).[198]

At company level, assessments are hindered by the lack of disclosure on GHG emissions. However, transparency rules and voluntary disclosure by firms are increasing the availability and reliability of this information over time, with a

[196] The Green Bond Principles identify four main types of external review: second-party opinion, verification, certification and green bond scoring or rating.

[197] "Establishment of an EU Green Bond Standard", European Commission, Inception impact assessment, June 2020.

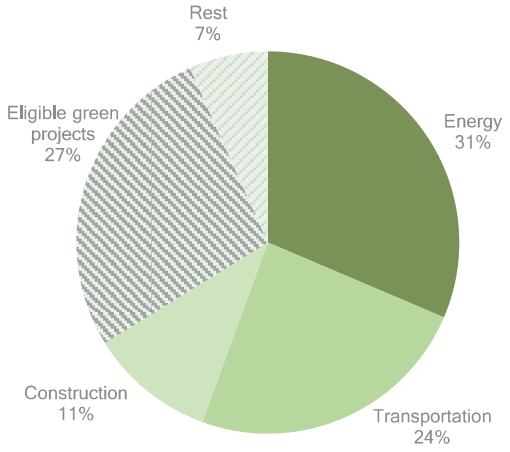
[198] According to the US Environmental Protection Agency, carbon emissions are responsible for 81 % of overall greenhouses gases emissions. Here we rely on a measure of CO2-equivalent emissions, i.e. including other greenhouse gases such as methane.

growing number of firms reporting data on emissions under pressure from regulators, investors and consumers. In several jurisdictions, lawmakers have imposed mandatory reporting on firms. At the same time, non-governmental organisations are encouraging and helping business to prepare these disclosures.[199] Commercial data providers are also collecting data on CO2 emissions, or using models to estimate them where data are not available – although third-party estimates tend to be less consistent than information reported by companies (Busch et al., 2020).

Impact on firms' CO2 emissions

As data availability improves, research on the potential drivers of emission reduction, including green bonds, expands. Corporate green bonds can impact firm-level GHG emissions through two main channels: by financing projects leading to a reduction in emissions (e.g. through lower energy consumption or the development of cleaner products), and by incentivising improvements in firms' environmental behaviour (e.g. through their supply chain or internal policies). In Europe a majority of private sector green bond issuances finance projects that should lead to lower emissions, including renewable energy projects, energy efficiency improvements, clean transportation and green construction (RA.4).

RA.4
EEA corporate green bonds by purpose
Limited details available on green projects



Note: Share of EEA-30 corporate green bond amount outstanding by purpose. 'Eligible green projects' include bonds for which the specific purpose is not available or financing several projects (incl. e.g. energy or transportation).
Sources: CBI, Refinitiv EIKON, ESMA.

However, CO2 emissions are usually reported at firm level (rather than project level), and therefore establishing a clear causality link is not straightforward. First, green bonds usually account for a limited share of issuers' total borrowing and may only impact a small part of their overall business, which would not be visible in firms' total emissions. Second, projects may reduce economy-wide GHG emissions without impacting a firm's own emissions. For example, companies building wind turbines help reduce a country's emissions for a given amount of electricity consumption by feeding clean energy into the power grid, but increase their own carbon footprint. Third, the impact of clean energy products such as electric vehicles only materialise in Scope 3 emissions[200], but these are notably inconsistent (Busch et al., 2020) and may take years to materialise.

Reflecting this, Ehlers et al. (2020) do not find clear evidence that green bond issuance is associated with any reduction in firms' overall carbon intensity, highlighting that "issuers may be (and often are) heavily engaged in carbon-intensive activities elsewhere." This is the case in particular for the high-emitting utilities sector

[199] For example, the Greenhouse Gas Protocol Initiative has developed accounting standards for GHG emissions, and the Partnership for Carbon Accounting Financials helps financial institutions assess and disclose GHG emissions of loans and investments.

[200] According to the Greenhouse Gas Protocol, Scope 1 includes all direct GHG emissions; Scope 2 includes indirect GHG emissions from electricity consumption; and Scope 3 includes all other indirect emissions (including e.g. "transport-related activities in vehicles not owned or controlled by the reporting entity").

where "green bond issuers have, on average, achieved smaller reductions in carbon intensity".

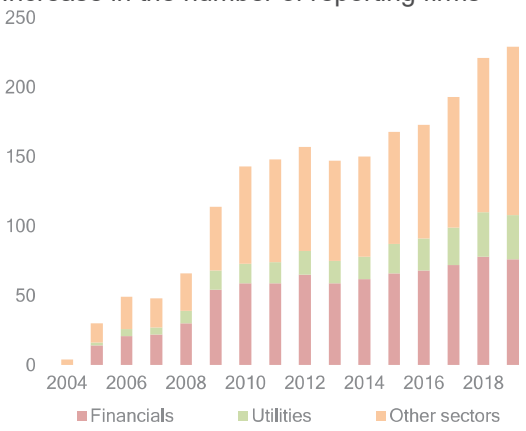
In contrast, Fatica and Panzica (2021) find that, compared to conventional bond issuers with similar financial characteristics and environmental ratings, firms borrowing in the green segment witness a larger decrease in the carbon intensity of their assets, up to 2 years after the bond issuance. This reduction is larger for green bonds that have an external review, suggesting that green bonds may serve to signal firms' climate-related engagement.

Green bond issuers and GHG emissions

Building on the literature, our analysis in this section follows two different approaches. Firstly, we look at the evolution of carbon emissions over time for EEA issuers of green bonds and compare them with those of other firms within the same sectors. A better environmental performance from green bond issuers would support the view that green bonds are used as a signal by virtuous firms. Next, we investigate whether a firm's 'maiden' green bond issuance of a firm is followed by a more pronounced reduction in its carbon intensity over time – which would potentially point to a more direct causal link between green bond issuance and GHG emissions.[201]

There are 1,258 corporate issuers of green-labelled bonds, including 396 domiciled in the EEA. Data on firms' sector and annual GHG emissions are obtained from Refinitiv EIKON. In line with the literature, for GHG emissions we rely on both absolute emissions and carbon intensity, which is calculated as the ratio of Scope 1 and 2 emissions (in metric tonnes of CO2-equivalent emissions) over the total revenues (in USD million) – i.e. CO2 gram per USD. This ratio offers a better representation of a firm's carbon efficiency, as at an equal level of activity a firm may achieve lower carbon emissions using greener technologies and resources (Ehlers et al., 2020). However, it also introduces another source of variability into the data since intensity changes based on annual sales.[202]

RA.5
Corporate green bond issuers: CO2 data availability
Increase in the number of reporting firms



Note: Number of green bond issuers reporting Scope 1 CO2-equivalent emissions, by sector and year.
Sources: Climate Bonds Initiative, Refinitiv EIKON, ESMA.

The share of green bond issuers reporting CO2 data remains low, with 23 % of EEA issuers and 16% of non-EEA issuers disclosing Scope 1 and 2 emissions in 2019. Financial sector issuers account for more than a third of firms reporting CO2 data (RA.5).

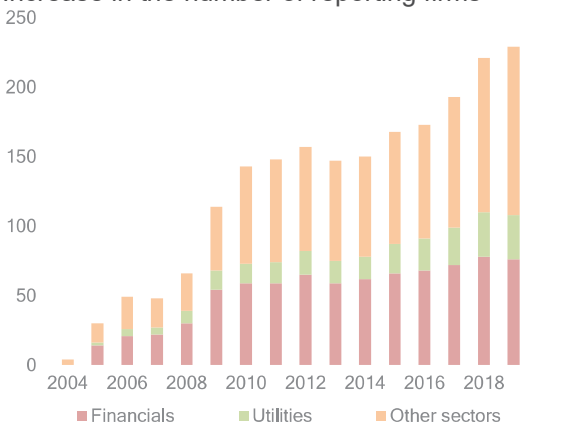
Reporting of GHG emissions remained voluntary in most countries until recently, which may introduce a self-selection bias – a problem compounded by the fact that some firms do not report every year. Finally, reporting inconsistencies across sectors due to different measurement approaches, and across firms within the same sector (e.g. from choices in reporting perimeter), create a high level of uncertainty due to limited data reliability.

Our analysis focuses on green bond issuers domiciled in the EEA that disclose emissions data. Green bonds issued by companies based in other regions can indeed have less of a focus on climate change. This is the case for example in China, one of the largest issuers of green bonds, where domestic guidelines pay closer attention to pollutant reduction, resource conservation and ecological protection (CBI, 2019).

[201] Due to data limitations (see below), we are not testing for causality between green bond issuance and firm-level GHG emissions. Instead, maiden green bond issuance is used as a simple benchmark, as in Ehlers et al. (2020).

[202] This implies a potential disconnect with GHG emissions from the production process. For example, a decline in sales compensated by stockpiling would lead to a temporary increase in emissions intensity.

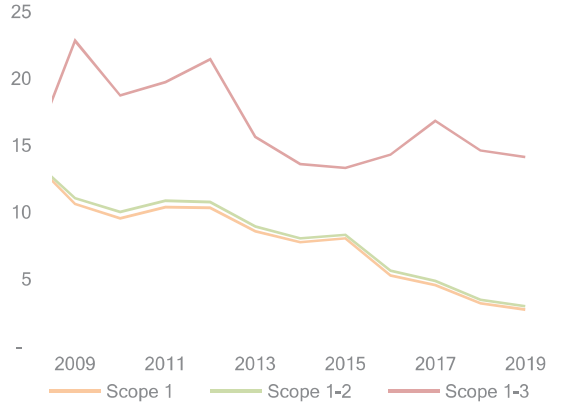
RA.6
Corporate green bond issuers: CO2 data availability
Increase in the number of reporting firms



Note: Number of green bond issuers reporting Scope 1 CO2-equivalent emissions, by sector and year.
Sources: Climate Bonds Initiative, Refinitiv EIKON, ESMA.

Given differences in the carbon footprint of different sectors, we further restrict the sample to 67 firms belonging to three sectors of particular relevance: energy, utilities and banks.[203] The share of issuers in these sectors disclosing CO2 data is much higher, at 75 % in 2019.

RA.7
Average GHG emissions of green bond issuers
Overall reduction in GHG emissions



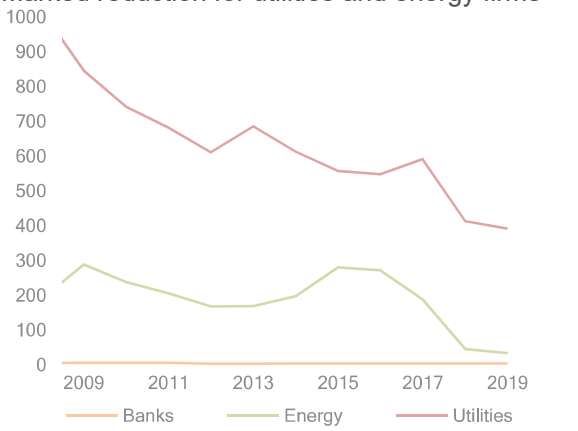
Note: Average greenhouse gas emissions of green bond issuers by emissions scope, in millions of metric tonnes of CO2-equivalent emissions. The number of firms for which data are available varies each year.
Sources: Climate Bonds Initiative, Refinitiv EIKON, ESMA.

The average GHG emissions of EEA green bond issuers show a significant decrease between 2009 and 2019, ranging from 74 % for Scope 1 emissions to 5 % for Scope 3 emissions (RA.6).

However, Scope 3 emissions data averages are particularly sensitive to changes in sample composition due to large differences across sectors: in 2019 Scope 3 emissions were three times higher than Scope 1 emissions for utilities but 268 times larger for financials.[204] Overall, green bond issuers' average reduction in total GHG emissions over ten years amounted to 38 %.

A similar decline in the average carbon intensity of green bond issuers can be observed over time (- 35 %). This is true across sectors, with average reductions of 39 %, 31 % and 22 % respectively for energy firms, utilities and banks (RA.7). The overall trend is confirmed using medians, with the decrease most pronounced in the utilities sector – one of the largest GHG emitting sectors. The very low carbon intensity of banks in the next two figures reflects the absence of financed (Scope 3) emissions from this measure, due to poor availability and quality of Scope 3 data.

RA.8
Median carbon intensity of green bond issuers
Marked reduction for utilities and energy firms



Note: Median Scope 1 and Scope 2 emissions intensity by sector, calculated as metric tonnes of CO2-equivalent emissions over revenues (in USD million).
Sources: Climate Bonds Initiative, Refinitiv EIKON, ESMA.

We then compare the carbon intensity of EEA-domiciled green bond issuers from these three sectors with other EEA firms that are from the same sectors tbut have never issued a green bond.[205] The latter group suffers from similar potential self-selection bias inconsistencies to green bond issuers and even greater data limitations. Within this group, 45 % of firms

[203] Energy firms and utilities have a particularly high carbon footprint, making them relevant to our analysis, while banking sector trends are important to analyse given the high share of bank loans in EEA corporate borrowing.

[204] Median values across the entire sample cannot be used due to financial sector overrepresentation in the sample of green bond issuers reporting CO2 data.

[205] The sample of firms that have never issued green bonds includes 271 firms.

disclose CO2 data , i.e. 30 percentage points lower than green bond issuers in these sectors. Green bond issuers further display a consistently lower median carbon intensity across sectors and have achieved larger reductions in carbon intensity over time than other firms (RA.8).

RA.9
Carbon intensity of green issuers vs. other firms
Lower carbon intensity for green bond issuers

	Green bond issuers			Other firms		
	2009	2019	% change	2009	2019	% change
Banks	6.1	4.0	-36%	9.4	7.6	-20%
Energy	289	33	-88%	352	255	-27%
Utilities	846	392	-54%	1,308	640	-51%

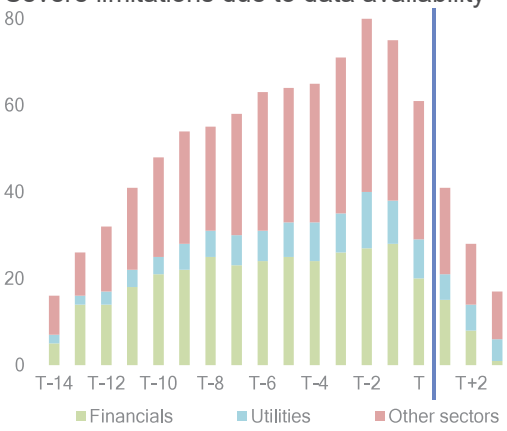
Note: Median carbon intensity of corporate green bond issuers vs. other firms by sector, and % change in median carbon intensity between 2009 and 2019.
Sources: CBI, Refinitiv EIKON, ESMA.

Despite caveats due to data limitations, the higher emissions data disclosure rate of green bond issuers, their lower carbon intensity and the greater reductions they have achieved over time confirm the view that green bond issuers use green bonds to signal their climate-related commitment.

The final part of our analysis focuses on whether firms' maiden green bond issuance leads to a material reduction in carbon intensity. There is nothing in practice that prevents firms from reducing GHG emissions, even in the absence of green bonds. The question is whether *debut* green bond issuances are associated with other changes within a company that would lead it to increase its efforts to reduce its carbon intensity.

One crucial point is that in the context of very strong corporate green bond market growth, almost two thirds of global green bond issuers had their debut issuance in either 2019 or 2020. With the last CO2 data point in 2019, this imposes even more severe limitations on our ability to assess changes post-issuance. Indeed, the number of firms reporting CO2 data two years after their maiden green bond issuance is 28, or just 2 % of all green bond issuers (RA.9).

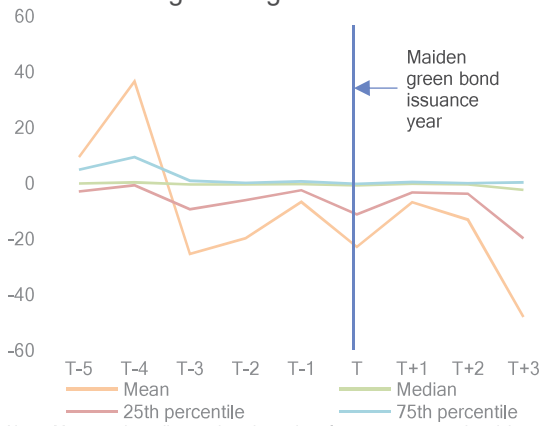
RA.10
Number of firms with data around time of maiden issuance
Severe limitations due to data availability



Note: Number of firms reporting emissions data before and after their maiden green bond issuance. T=maiden issuance year.
Sources: Climate Bonds Initiative, Refinitiv EIKON, ESMA.

Focusing on EEA firms again, we see no clear evidence to suggest that firms intensify their emissions reduction efforts after issuing a green bond, with more than half of the distribution displaying no or very small reductions (RA.10). However, the robustness of the analysis is impaired by the decreasing sample size after issuance reflecting the on-going expansion of the green bond market.

RA.11
Changes in carbon intensity around maiden issuance
No clear change after green bond issuance



Note: Mean and median carbon intensity of corporate green bond issuers domiciled in the EEA before and after maiden green bond issuance. T=maiden issuance year. The sample size changes over time.
Sources: CBI, Refinitiv EIKON, ESMA.:

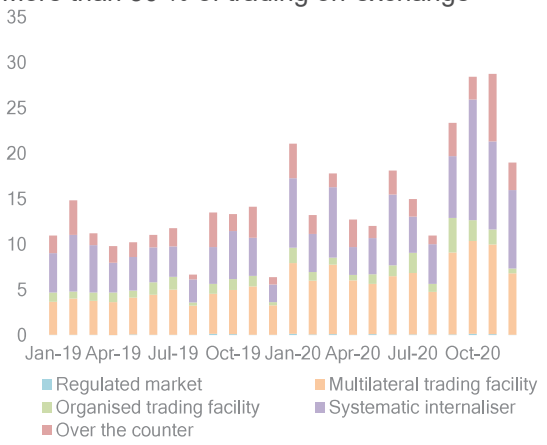
Corporate green bond liquidity

A well-known feature of corporate bonds is their illiquidity, which worsened in recent years in Europe when broader market conditions

deteriorated (i.e. when volatility increased).[206] With corporate bonds becoming the largest part of the green bond market, and green bonds covering an increasingly larger share of the European bond market, a question that naturally arises is whether investors experience higher liquidity when investing in corporate green bonds.

There are several features to green bonds that are relevant in this context: large oversubscriptions in primary markets and relatively low turnover in secondary markets – at least until recently – indicate a tendency by investors to hold these instruments until maturity (Fender et al., 2018). This suggests lower secondary market depth with access to green bonds possibly impaired, even as high demand should make it relatively easy for green bond holders to liquidate their positions.

RA.12
Green bond trading volumes by market type
More than 50 % of trading on-exchange



Note: Monthly corporate green bond trading volume by market type, EUR bn.
Sources: Climate Bonds Initiative, FIRDS, FITRS, ESMA.

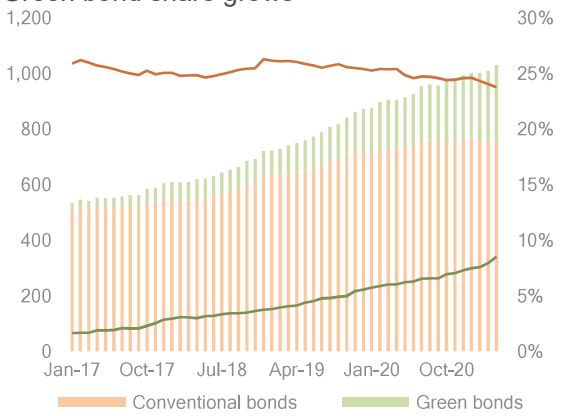
Moreover, the data on trading volumes reported to ESMA under MiFID II shows that the share of corporate green bonds traded on exchange is high compared with conventional bonds, and continues to increase (RA.11). Trading of green bonds over the counter and through systematic internalisers amounted to around 50 % of overall trading volumes in 2019 and 2020, compared with 75 % for conventional bonds.[207] Green bond segments have been launched by 22 trading venues (12 in Europe) , reflecting intensifying competition for a market with high growth potential.[208] Higher trading on exchange is usually considered positive for market liquidity.

Measuring liquidity

Liquidity is generally measured along five main dimensions: tightness, immediacy, depth, breadth and resilience. Some of these dimensions require order-level data, but proxies based on trade-level data can be used to measure tightness (the possibility of executing transactions at a low cost), depth of the order book (for which volumes can be used as proxy), and breadth (the ability to transact large volumes with minimum impact on prices).[209]

The liquidity indicators presented below are based on data for EUR-denominated investment grade corporate bonds that are part of the Markit iBoxx Overall EUR index.[210] We identify green bonds by matching these instruments with the list of green-labelled bond ISINs from the Climate Bonds Initiative.

RA.13
Markit iBoxx EUR index composition
Green bond share grows



Note: Number (left axis) of green and conventional bonds issued by green bond issuers and included in the Markit iBoxx EUR Overall index, and % share (right axis) in total number of bonds included in the index.
Sources: Markit iBoxx, ESMA.

Our approach is to systematically benchmark green bonds against conventional bonds issued by green bond issuers (henceforth conventional bonds'), thus providing a natural control group. The share of green bonds included in the index has quadrupled in three years (to 272 green bonds in 2021, or almost 9 % of all corporate

206 De Renzis et al. (2018).

207 In 2019 off-exchange trading in EU sovereign and corporate bonds amounted to 73 % and 86 %, respectively. See ESMA (2020).

208 For the list of venues, see Green Bond Segments on Stock Exchanges.

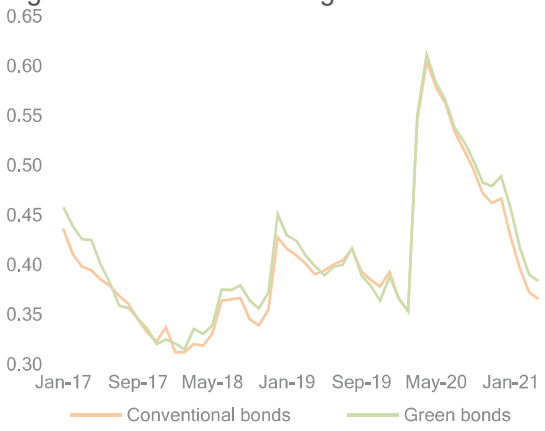
209 For a comprehensive overview of liquidity measures see Sarr and Lybeck (2002).

210 As at April 2021 there were 2,156 bonds in the index.

bonds in the index) as green bond issuers allocated a growing share of their total borrowing to green bonds (RA.12).

We start by measuring liquidity tightness using bid-ask spreads, i.e. the difference between the bid price (the maximum price a buyer is willing to pay for a security) and the asking price (the minimum price at which a seller is willing to trade a security).

RA.14
Bid-ask spreads of green and conventional bonds
Higher transaction cost for green bonds

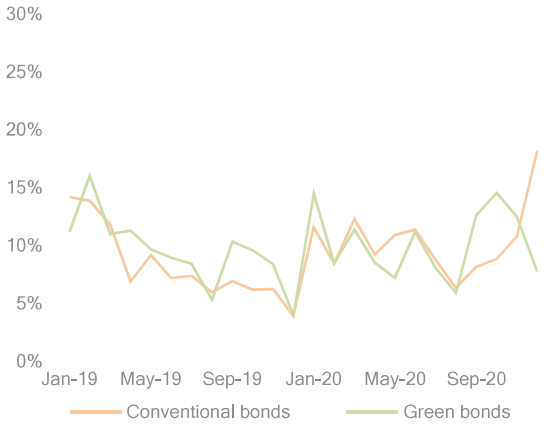


Note: Bid-ask spread for green bonds and conventional bonds issued by green bond issuers included in the Markit iBOXX EUR Overall index, in EUR.
Sources: Markit iBoxx, ESMA

Bid-ask spreads have been on average wider for green bonds since 2017 by about EUR 0.01, indicating higher transaction costs and signalling tighter liquidity. Corporate bond bid-ask spreads deteriorated significantly in March 2020 due to COVID-19 related turmoil, but the differential between green and conventional bonds remained constant, suggesting no particular vulnerability for green bonds during selloffs (RA.13). Trading volumes of corporate green bonds haveincreased in line with market growth, from EUR 18 bn per month in 1H19 to EUR 22.5 bn in 2H20 (RA.11).

On the other hand, turnover ratios (measured as trading volumes over outstanding issued amount) do not reveal a clear structural difference between green and conventional bonds (RA.14).

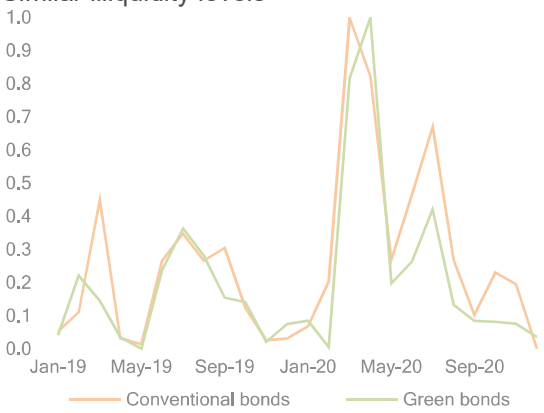
RA.15
Turnover ratio of green and conventional bonds
No structural difference



Note: Turnover ratio of green and conventional bonds issued by green bond issuers, measured as monthly trading volumes over total issued amount, in %.
Sources: FITRS, Refinitiv EIKON, ESMA.

To measure depth and breadth, we then use the widely used Amihud ratio defined as the average of absolute daily returns on a security to trading volumes over a given period.[211] The idea behind the indicator is that excess returns represent an illiquidity premium.

RA.16
Amihud illiquidity index
Similar illiquidity levels



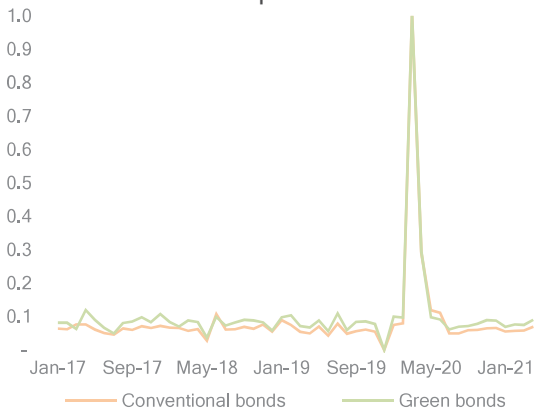
Note: Monthly Amihud illiquidity index for green and conventional bonds issued by green bond issuers, monthly averages. Normalised between 0 and 1.
Sources: Markit iBoxx, FITRS, ESMA.

In this respect, the Amihud ratio is positively correlated with the illiquidity of a security. The monthly Amihud ratio (based on daily returns and volumes for each bond averaged over one month) does not suggest that green bonds are more illiquid than conventional ones (RA.15).

[211] See Amihud (2002).

Lastly, the Bao Pan Wang index (BPW) indicator is based on the autocovariance of prices.[212] It is based on the assumption that the transitory impact of illiquidity leads to price reversals. The BPW indicator displays slightly higher illiquidity for green bonds throughout most of the observation period (RA.16).

RA.17
Bao Pan Wang index
Green bonds more illiquid



Note: Illiquidity of green bonds and conventional bonds from green bond issuers, normalised between 0 and 1 over the sample period. Based on Bao et al. (2010).
Sources: Markit iBoxx, ESMA.

Conclusion

The expansion of the green bond market over the last decade is a significant development for European bond markets. By funnelling private-sector capital into green projects, green bonds can play an important role in the transition to a low carbon economy under the European Green Deal. The growing number of firms issuing green bonds further marks a key milestone in the development of this market. However, high demand for these instruments combined with the absence of a legal framework increases the risk of corporate greenwashing.

In this context, the environmental impact of green bonds – in particular on climate change – has come into focus. Our analysis shows that only a fifth of firms issuing green bonds worldwide disclose data on GHG emissions. EEA energy firms, utilities and banks tend to disclose emissions data at a much higher rate. We further find evidence at firm level of an overall reduction in the direct and indirect carbon emissions of these firms, as well as in their carbon intensity, between 2009 and 2019 – with the decline most pronounced in the high-emitting utilities sector. Moreover, green bond issuers have lower median carbon intensity than other firms, have achieved larger reductions over time, and are much more likely to disclose emissions data. These findings confirm that green bonds may serve to signal firms' climate-related engagements.

We then look into the carbon intensity of green bond issuers after their 'maiden' issuance. The existence of a potential causal link is not clear since green bonds finance long-term green projects that do not have a direct impact on the firm itself, while we rely on GHG emissions measured at firm level. We do not find clear evidence that issuing a green bond leads firms to intensify their carbon reduction efforts – but the robustness of these findings is severely hampered by data limitations.

Lastly, we turn to the liquidity of corporate green bonds, which we compare with that of conventional bonds from green bond issuers using proxy indicators. These suggest that green bond liquidity is tighter, without any clear difference in depth or breadth. Moreover, the differentials are small and have remained broadly constant during the COVID-19 crisis, suggesting no particular vulnerability in the green segment of the corporate bond market.

Overall, our findings support the further development of the green bond market. The future EU Green Bond Standard should strengthen the potential environmental benefits of these instruments and their credibility. Improving the availability and consistency of climate-related disclosures, and in particular Scope 3 emissions for the financial sector, would support future assessments of the impact of green bonds on firms' carbon emissions. Meanwhile, lower green bond liquidity does not appear to expose corporate investors to materially greater liquidity risk as a result of their green bond holdings.

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