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The Impact of the Low-Carbon Transition on Financial Markets

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Introduction

The climate crisis is a major challenge that will be at the centre of policymaking in the coming decades. To support the transition to a low-carbon economy, sweeping reforms will be needed which will transform the efficiency and competitiveness of the European and Belgian economies. In this process, the financial system has three important tasks, namely it is responsible for (1) ensuring an efficient allocation of capital to promote the transition, (2) helping hedge climate risks, including transition risks, and (3) increasing transparency to avoid greenwashing and facilitate price discovery.

To allow the financial system to play a conducive role in the transition, substantial progress has to be made on several fronts. On the one hand, the quantity and quality of information and data on firm greenhouse gas (GHG) emissions and other analytical metrics will need to be substantially improved, particularly in terms of transparency, comparability and robustness. This will allow investors to direct funding efficiently, according to their goals, and favour the correct pricing of risks. On the other hand, the transition will inevitably have destabilising effects as some assets will become stranded. As the OECD (2021) has pointed out, certain policy actions can support the resilience of the financial system to sudden devaluations generated by the transition. In this regard, two comments should be made. First, these actions should be directed at limiting the concentration of losses across financial institutions over time and, second, policy actions that promote the transition but could exacerbate losses may have to be counterbalanced by actions that reduce financial stability risks.

With this in mind, this article provides a detailed overview of the impact the low-carbon transition is expected to have on financial markets. First, we summarise the latest research on the pricing of transition risks by financial markets (Section 1), starting with an overview of the main types of climate risk to which financial markets are exposed. We then examine research into the greenium on stocks and bonds and the most recent regulatory developments relating to green finance at the European and Belgian levels before briefly discussing the characteristics of the most-used standards for green bonds (Section 2). Finally, we turn to developments on the green bond market in Belgium and three neighbouring countries (Germany, France and the Netherlands). In this regard, we shed light on the supply and demand for these instruments (Sections 3 and 4), focusing on the issuance of green bonds by governments, financial institutions and non-financial corporations and the uptake of such bonds by various economic agents (households, non-financial corporations, monetary institutions, pension funds and others). [1]

1 Due to confidentiality concerns, we do not present data relating to holdings in the Netherlands.

Finally, the main conclusions of our study are presented in Section 5. These are as follows. First, the literature points to the existence of a greenium. On stocks, there is some evidence of a greenium, but much depends on the context of the study and more systematic research is required. On bonds, the premium is small but growing. Overall, there is some evidence that the markets are pricing climate risks. Second, our empirical study specifically shows that the issuance of green bonds, by both governments and corporations, has been growing in Belgium and neighbouring countries. The uptake of these instruments is increasing as well, mostly by insurance companies, pension funds and other financial corporations.

1. The pricing of climate risks by financial markets

The literature on green finance has identified two main types of climate risk affecting asset prices. First, climate change increases the risk of natural disasters – floods, typhoons and fires, for instance – which can negatively impact productive capital, such as factories and real estate. This type of climate risk is generally referred to as **physical risk**. In this regard, using two centuries of UK temperature data, Donadelli *et al.* (2017) have shown that rising temperatures are negatively associated with productivity and have non-negligible welfare costs.

The theoretical macroeconomic models that integrate physical risk rely on different assumptions regarding the impact of climate disasters. Some studies, such as that by Bansal *et al.* (2016), have assumed that these low-probability disaster events have permanent negative effects on the economy. Others, such as that by Barreca *et al.* (2016), assume that the economy has the ability to adapt and recover from climate-related losses quickly. This distinction has important implications for the pricing of physical risk in a theoretical framework.

The second major type of climate risk affecting asset prices is referred to as **transition risk**. This is the risk of loss due to policy action, technological change or a shift in consumer preferences resulting from the transition to a low-carbon economy. Such a loss can be associated with carbon-intensive assets becoming "stranded" (i.e. losing value) or redundant. Examples of transition risks include the introduction of new regulations banning certain polluting machinery and environmentally induced technological change that disrupts competition in a particular sector. Broader definitions of transition risk cover reputational impacts and shifts in market preferences.

The Network for Greening the Financial System (NGFS)[1] has developed four scenarios to highlight the potential paths of physical and transition risks (Figure 1). In the most optimistic scenario, there is an *orderly* transition of the economy thanks to the early implementation of climate policies which gradually become more stringent. In this case, both physical and transition risks remain subdued. The remaining three scenarios represent negative outcomes. First, in the *disorderly* scenario, the transition risks are high as policies are delayed and divergent across countries. Second, in the *hot house world* scenario, some countries implement climate policies, but global efforts are insufficient, leading to temperatures above the critical threshold and severe physical risks. Finally, in the *too little, too late* scenario, late transition gives rise to both significant transition and physical risks. Overall, these scenarios highlight the risks to the financial system posed by an accelerated and disorderly transition[2].

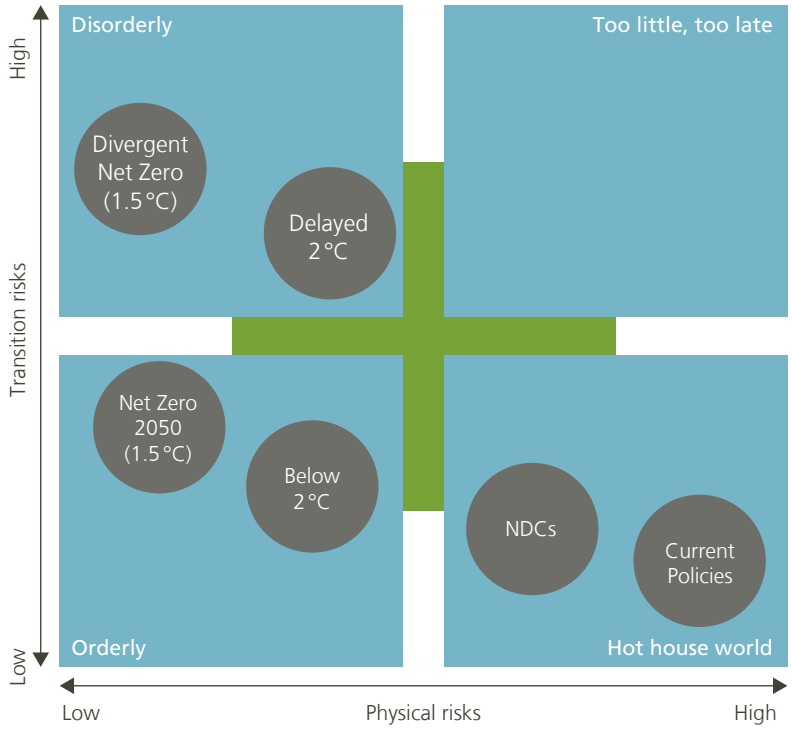
Most of the empirical literature on green finance focuses on the pricing of one of these two types of climate risk and verifies whether the prices of different classes of assets (e.g. equities, bonds and real estate) account for both types. Before examining these empirical studies in more detail, we briefly mention a particular climate risk that has recently come to the forefront of the policy debate, namely *liability risk*. This risk has been defined by Mark Carney (2015), former governor of the Bank of England, as the impact "that could arise tomorrow if

1 The NGFS is a group of central banks and supervisors willing to share best practices and contribute to the development of environmental and climate risk management in the financial sector and to mobilise mainstream finance to support the transition to a sustainable economy. The NBB is a member of the NGFS.

2 Several studies have postulated the possibility of a negative correlation between physical and transition risks. For example, the introduction of more stringent environmental regulations represents the realisation of a transition risk, but works to decrease physical risks.

Figure 1

NGFS scenarios for physical and transition risks and their impact on the financial system



Source: NGFS (2022).

Note: The positioning of the scenarios is approximate and based on an assessment of physical and transition risks until 2100. "NDCs" stands for nationally determined contributions.

parties who have suffered loss or damage from the effects of climate change seek compensation from those they hold responsible. Such claims could come decades in the future but have the potential to hit carbon extractors and emitters – and, if they have liability cover, their insurers – the hardest". Liability risk is also referred to as litigation risk and is considered a facet of both physical and transition risk by the NGFS (2021).

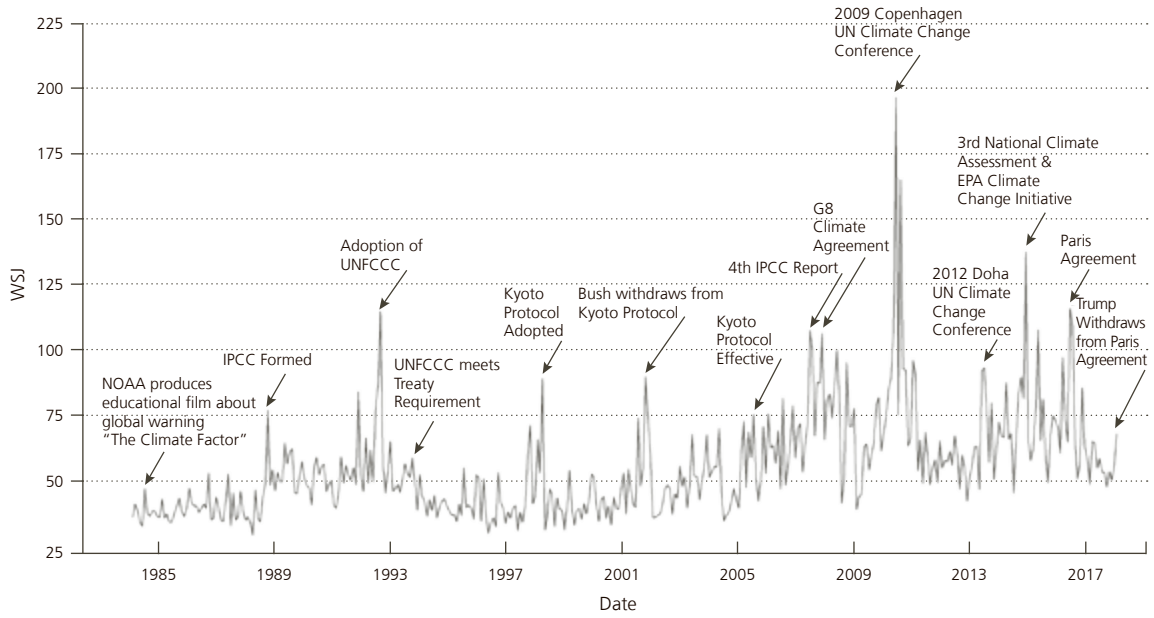
1.1 The greenium in equity markets

Empirical studies have examined whether climate risk is priced into stocks. In terms of asset pricing theory, climate change may be considered a common risk factor for assets. Alternative methods are proposed in the literature to estimate the common risk factor for climate change.

For example, Engle *et al.* (2020) use sentiment analysis to proxy for the climate risk factor and study how it relates to US stock returns. The underlying assumption is that since there is no true measure of climate (physical and transition) risk factors, sentiment indicators may provide a proxy for how this type of risk is perceived by the public. They developed a climate change news index to track the frequency of climate change vocabulary in the *Wall Street Journal*. The index, available online and covering the period up to mid-2018, does not explicitly

Chart 1

Wall Street Journal (WSJ) Climate Change News Index for the period 1984-2018



Source: Engle *et al.* (2020).

Note 1: NOAA stands for National Oceanic and Atmospheric Administration, IPCC is the Intergovernmental Panel on Climate Change, UNFCCC refers to the United Nations Framework Convention on Climate Change, the G8 consists of France, the United States, the United Kingdom, Russia, Germany, Japan, Italy and Canada, the UN is the United Nations and the EPA is the Environmental Protection Agency.

Note 2: Roughly speaking, the WSJ Climate Change News Index indicates the percentage of the WSJ news corpus on the topic of climate change each day. For more information, see Engle *et al.* (2020).

distinguish between physical risk and transition risk. However, as can be seen in Chart 1, it appears to closely track environmental regulatory shocks[1].

Using environmental scores, also known as "E" scores, Engle *et al.* (2020) constructed portfolios to hedge against their measure of climate risk. They found that their hedge portfolio was positively correlated with the WSJ Climate Change News Index and that this correlation could not be explained by industry characteristics. They demonstrated that these results continued to hold in an out-of-sample exercise in which climate news was hedged in real time[2].

As an alternative approach, Alessi *et al.* (2021) assumed that the climate risk factor could be constructed as a portfolio strategy that is long on green and transparent stocks and short on brown stocks. To identify green and transparent stocks, the authors relied on a combination of two indicators, namely (1) firm emissions data (for greenhouse gases or, alternatively, carbon dioxide) to measure "greenness" and (2) E scores to measure transparency[3].

1 A similar approach to that of Engle *et al.* (2020) was adopted by Bua *et al.* (2021), who developed a sentiment indicator which explicitly distinguishes between transition risk and physical risk.

2 An alternative approach to measure physical and transition risk, based on sentiment analysis, has been developed by Bua *et al.* (2022).

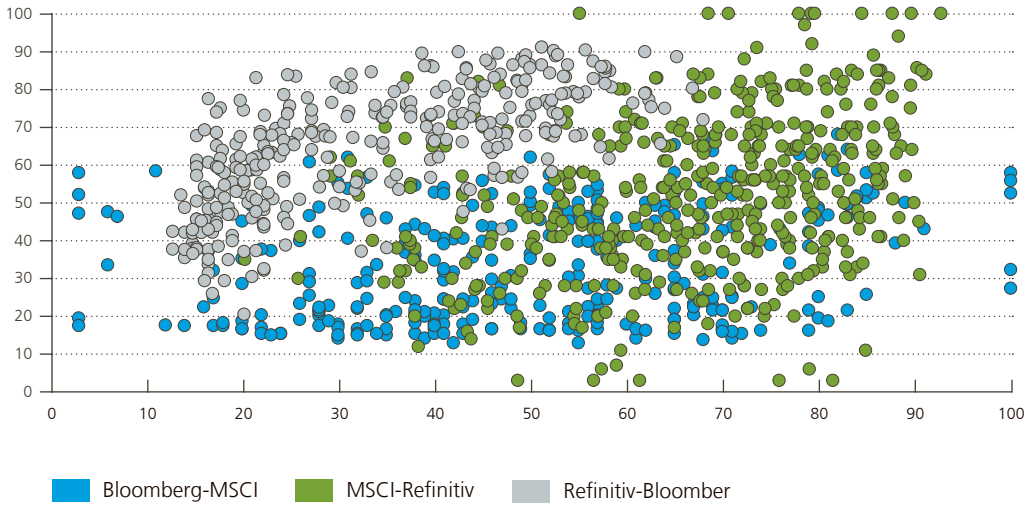
3 The E score used in the study by Alessi *et al.* (2021) was the Bloomberg environmental disclosure score, which captures various environmental aspects of a company's business, including carbon emissions, air and water pollution, etc.

In their study, focusing on large-cap European stocks, Alessi *et al.* (2021) found that their climate risk factor was associated with a negative risk premium, i.e. a greenium. They interpreted this as evidence that the markets are willing to earn lower returns for greener and more transparent stocks, which offer a hedge against transition risk. Importantly, the risk premium disappears when the climate factor is constructed using only one of the two indicators (greenness or transparency). This means that the market values these aspects jointly.

Both Engle *et al.* (2020) and Alessi *et al.* (2021) made use of new data on various E scores, supplied by market providers such as Bloomberg, MSCI, Refinitiv and Sustainalytics. E scores are often accompanied by other measures, to capture a firm's performance on aspects such as social (S) and governance (G) issues. Although these data can prove useful, there are several issues that limit their reliability. As pointed out in a recent OECD (2021) report, as well as in studies by Berg *et al.* (2022) and Billio *et al.* (2021), ESG scores from alternative data providers are computed using different methodologies and give contrasting signals (Chart 2). Further, the report shows that there is limited alignment between E scores and environmental metrics, such as CO_2 revenue-adjusted emissions. In this regard, high E scores may reflect an ambitious transition plan rather than the actual attainment of objectives. In short, the informative value of E scores is difficult to assess.

Chart 2

Correlation of S&P 500 ESG scores across rating providers



Source: OECD (2021).

Note: In the legend, the first provider's name corresponds to the Y axis, and the second provider's name to the X axis, e.g. for Bloomberg/MSCI (blue), Bloomberg is represented on the Y axis and MSCI on the X axis. For the full methodology, please refer to the source.

Another potential hurdle faced by studies examining the pricing of climate risk into stocks is that investors have only recently, i.e. in the past 10 to 15 years, become aware of the financial risks associated with climate change. Prior thereto, it is unlikely that investors considered climate risk when constructing a portfolio. As has been evidenced by recent studies, institutional investors today consider climate-related issues when selecting investments (Krueger *et al.*, 2020). For example, institutional investors and asset managers now routinely assess the impact of a company's activities on the environment and its efforts to contribute to climate goals. It is plausible that the pricing of climate risk evolves over time, as agents become more concerned about the environment. As explained by Giglio *et al.* (2021), these dynamics may mean that during the initial stages of the transition, green assets, including stocks, will earn a positive premium, as capital flows to more environmentally friendly firms. Once the initial stages of the transition have passed, the greenium is expected to decline to negative levels, capturing the price of transition risks.

One possibility to get around the short time span of the data is to focus on the cross-sectional dimension. Rather than a common risk factor approach, it is possible to use a characteristic-based approach to measure the relationship between stock returns and transition risk. This was the approach adopted by Bolton and Kacperczyk (2021), whose international study examined a cross-section of 14 400 firms in 77 countries. They found that company carbon emissions were associated with a brown premium, i.e. higher stock returns. In their view, this is related to the greater transition risk faced by brown firms. The study also examined how the brown premium varies from country to country and found that it was only weakly related to a country's level of development. Rather, factors such as democratic accountability, climate policy, energy dependence and share of renewables played a more important role in determining the carbon premium.

The studies mentioned above concur that climate risk is priced into stocks and that this gives rise to a greenium or brown premium. However, more evidence is needed to explain these findings. The studies posit that the greenium is due to the desire of market agents to hedge transition risk. However, as Fama and French (2007) suggest, taste may also help to determine asset prices. As public awareness evolves, it is plausible that investors seek to rebalance their exposures in favour of environmentally friendly assets.

In this regard, Aramonte and Zabai (2021) recently examined trends on ESG markets and expressed concern about the creation of potential bubbles. These claims have been analysed by Jourde and Stalla-Bourdillon (2021), who concluded that, according to company fundamentals, green stocks, identified through a battery of E scores, are undervalued compared to brown stocks. These results contrast somewhat with studies uncovering a greenium and show that there is still no widespread consensus in the literature.

1.2 The greenium in bond markets

As is the case for green equities, there is no unanimously agreed and commonly used definition for green bonds. In general, the term "green bond" is used to describe a fixed-income financial instrument used to raise funds for a green project. Section 2 provides more information on some initiatives that attempt to define this term more precisely. In this subsection, we describe the findings of several studies analysing the greenium in green bond samples.

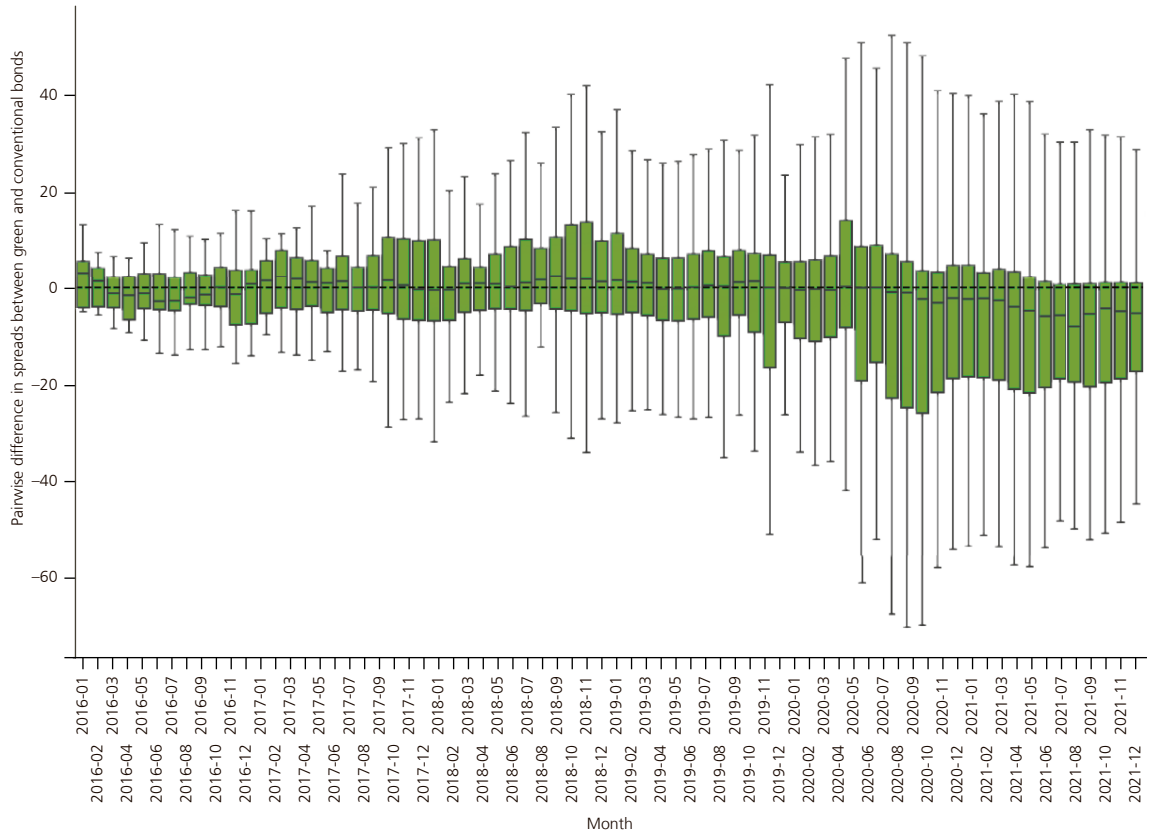
According to the literature, for bonds and other fixed-income instruments, the greenium is the yield spread between green bonds and comparable "brown" or conventional bonds. Usually, for ease of comparison, the greenium spread is measured at bond issuance. We focused on studies that used this definition. The greenium is usually a negative value, implying a funding cost advantage for the issuer of green bonds. According to the studies, the greenium (at issuance) in corporate bond markets ranges from 0 to –22 basis points. Some bonds are associated with a larger greenium. For example, a study by Fatica *et al.* (2021) revealed a greenium of –80 basis points for green bonds issued by supranational bodies. In this case, the magnitude of the greenium can be explained by the strong reputational advantage of supranational bodies, which were among the first issuers of green bonds.

The green bond greenium varies widely depending on several aspects. For example, the market seems to attach a higher greenium to certified or externally reviewed green bonds, as opposed to those that are only self-labelled (Baker *et al.*, 2018; Fatica *et al.*, 2021; Pietsch and Salakhova, 2022). Indeed, certification and external review increase the credibility of green claims and are rewarded by investors.

Some studies attribute a stronger greenium to European green bonds, compared with US green bonds (Kapraun *et al.*, 2021). Caramichael and Rapp (2022) attribute this to a more advanced regulatory framework in the European Union (EU), combined with more comprehensive and credible action plans, such as the EU Sustainable Finance Action Plan, which demonstrate a strong commitment by the EU to tackling climate change. Moreover, the green bond greenium has been found to be growing over time. Chart 3 presents the analysis of Pietsch and Salakhova (2022) and shows the distribution of option-adjusted spreads between

Chart 3

Spread between green and conventional bonds



Source : Pietsch and Salakhova (2022).

Note : The chart shows the distribution of option-adjusted spreads between matched green and conventional bonds of the same issuer. The green boxes correspond to the interquartiles of the spreads, i.e. the ranges range between the 25th and 75th percentiles.

matched green and conventional bonds of the same issuer. These results could be due to both market awareness of climate risk, which fuels investor demand for green financial instruments, and the development of more credible and clearer action plans, better demonstrating the commitment of companies and countries to tackling climate change.

The greenium for green bonds appears to vary across sectors. According to Caramichael and Rapp (2022), the greenium is more persistent for green bonds issued by banks. The authors propose two possible explanations for this finding. First, banks may be rewarded for the cost of certifying, extending and monitoring green loans to customers. Second, the banking sector has significantly increased the volume and quality of climate-related disclosures, especially in Europe, which translates into an even stronger greenium amongst European banks in the sample. Fatica *et al.*, 2021, however, show that, on average, financial sector issuers do not enjoy a greenium on their green bonds, unless they have committed to certain environmental principles, such as the United Nations Environment Programme Finance Initiative (UNEP FI). They argue that since the core lending business is inherently based on evaluating private information, banks may find it more difficult to send credible signals to the market regarding their engagements in terms of green activities. In keeping with these findings, Pietsch and Salakhova (2022) show that banks subscribed to the UNEP FI enjoy a larger greenium. Again, credibility and commitment appear to play an important role in determining the greenium. The importance of credibility is further supported by evidence of a higher greenium for firms operating in the alternative energy sector, as

this group of issuers is considered more credible given their contribution to the low-carbon transition (Pietsch and Salakhova, 2022).

Collectively, the studies uncover evidence that the market rewards green bonds in the form of lower yields. However, several crucial limitations and caveats should be noted.

As highlighted by Caramichael and Rapp (2022), it is difficult to generalise the results across (i) market segments (municipal vs corporate bonds), (ii) periods (longer vs shorter and recent) or (iii) samples (the US vs global markets) or using (iv) different empirical methodologies (fixed effects regression vs matching). Moreover, samples of green bonds are generally significantly small due to the relative novelty of these instruments[1]. Therefore, matching samples of green bonds with conventional bonds can prove challenging.

Given the heterogeneity of empirical settings, it is not surprising that several studies have uncovered evidence disproving the existence of a greenium (Tang and Zhang, 2020; Larcker and Watts, 2020). As with the literature on an equity greenium, research has yet to provide unitary evidence of a greenium for green bonds.

Finally, further research could focus on the promising role of certification and external review. In particular, it would be helpful to determine whether the greenium could cover the costs of certification and external review. As Caramichael and Rapp (2022) note, these costs can be particularly high for small firms and first-time issuers. In addition, certification may help to further reduce CO_2 emissions. Ehlers *et al.* (2020) did not find a significant relationship between bond certification and a reduction in GHG emissions, although Fatica and Panzica (2020) have shown that only certified green bonds are associated with a reduction in issuer emissions. It thus appears that more research is needed given the importance of this discussion and the ambiguity of the existing evidence.

2. The regulation of green finance

The European Union has high ambitions when it comes to sustainability and is currently putting in place a regulatory framework for sustainability[2] which will have several dimensions: the identification of sustainable activities, disclosure and reporting by companies, the inclusion of environmental and climate risks in prudential supervision, standards for sustainable financial products, etc. Obviously, European regulations are applicable in Belgium, but the Belgian financial sector has also taken the initiative of developing a sustainability label for green investments.

2.1 Initiatives at EU level

Several actions have already been taken within the European Union in the area of green finance[3]. In this context, the report of the European Commission's High-Level Expert Group on Sustainable Finance (HLEG), published in 2018, and Action Plan on Financing Sustainable Growth (EC, 2018), which includes an EU Sustainable Finance Strategy, play an important role. The renewed Sustainable Finance Strategy, adopted in July 2021, which builds on the 2018 Action Plan, proposes new actions to boost private investment in sustainable projects. The strategy also includes several initiatives to support the European Green Deal, including the development of a harmonised taxonomy for sustainable activities, disclosure requirements, the development of benchmarks and labels, a green

1 Liberati and Marinelli (2021) studied a large sample of 19 203 bonds with an outstanding amount of € 3.37 trillion.

2 This section draws heavily on Van Tendeloo and Zachary (2022).

3 This article was completed at the end of October and, therefore, does not take into account any regulatory developments that may have occurred since then.

BOX 1

EU regulations on sustainable finance

Taxonomy
- Regulation (EU) 2020/852
- Commission Delegated Regulation (EU) 2021/2139 of 4 June 2021

Disclosure
- Non-financial Reporting Directive (Directive 2014/95) (NFRD)
- Proposal for a directive on corporate sustainability reporting (CSRD)
- EU Taxonomy Article 8 delegated act (Disclosures Delegated Act)
- Sustainable Finance Disclosure Regulation (2019/2088) (SFDR) and Regulatory Technical Standards (6 April 2022)

EU Climate Transition Benchmarks
- Regulation (EU) 2019/2089 amending Regulation (EU) 2016/1011 as regards EU Climate Transition Benchmarks, EU Paris-aligned Benchmarks and sustainability-related disclosures for benchmarks

Inclusion of ESG risks in the prudential framework
- Capital Requirements Directive (2013/36/EU) and Capital Requirements Regulation (575/2013)
- Solvency II
- Related rules adopted by the EBA and EIOPA

Commission proposal for a European green bond standard
(draft regulation with voluntary standards)

bond standard, as well as the management and integration of environmental, social and governance (ESG) risks into the financial system. An overview of the key EU regulations on sustainable finance is shown in Box 1.

2.1.1 Taxonomy

The Taxonomy Regulation[1] lays the foundation for the development of sustainable finance. The regulation sets out criteria to determine whether an economic activity can be considered environmentally sustainable.

The Taxonomy Regulation establishes 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, and (6) the protection and restoration of biodiversity and ecosystems. To be consistent with the taxonomy, an activity must contribute substantially to one of these six environmental objectives, not seriously impair the other five and be carried out in compliance with social safeguards[2].

1 Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on establishing a framework to facilitate sustainable investment and amending Regulation (EU) 2019/2088, OJ L 198, 22.6.2020, 13–43.

2 The OECD Guidelines for Multinational Enterprises and the UN Guiding Principles on Business and Human Rights, including the International Labour Organisation (ILO) Declaration on Fundamental Principles and Rights at Work, the eight fundamental conventions of the ILO and the International Bill of Human Rights.

The taxonomy covers not only sustainable activities but also those that contribute to the transition to a sustainable economy and those that facilitate green activities. Nonetheless, there was substantial criticism that the taxonomy did not sufficiently take into account activities that further the low-carbon transition. In response to this feedback, the Commission's Sustainable Finance Platform examined whether the taxonomy could be further expanded. Indeed, investments that make certain activities less harmful and as such contribute to reducing emissions, even though they do not meet the threshold to be considered sustainable, are also useful and necessary to support the transition.

The Taxonomy Regulation requires the EU and Member States to use the taxonomy as the basis for all EU or national labels for green corporate bonds or financial products that fall within the scope of the Sustainable Finance Disclosure Regulation (SFDR), such as the EU Environmental Label for Retail Financial Products, the EU Eco Label for Financial Products, the EU Green Bond Standard and the EU Climate Benchmarks [1].

The harmonisation introduced by the Taxonomy Regulation could increase demand for sustainable products and create new opportunities for financial institutions. Moreover, the taxonomy is expected to ensure consistency, transparency and comparability and consequently help combat greenwashing. In addition, it could encourage and support efforts by companies and financial institutions, in terms of both engagement and the setting of more sustainable goals.

2.1.2 Disclosure

Disclosure is important to enable stakeholders to better understand and compare an entity's activities and the risks to which it is exposed. In this way, climate risks and opportunities can be better assessed. The EU has launched several disclosure-related projects that are relevant to financial institutions. First, the Non-Financial Reporting Directive (NFRD) [2] and its supplement on climate-related information,[3] which are based on the recommendations of the Financial Stability Board's Task Force on Climate-related Financial Disclosures (TCFD, 2017), provide a starting point for a number of climate-related indicators. The NFRD applies to large public-interest entities, such as banks and insurers, as well as listed companies. For financial institutions in particular, the availability of information from their counterparties is crucial to asse exposure to ESG risks. Therefore, the NFRD will be revised to extend its scope to large unlisted companies and possibly also (listed) SMEs.

Moreover, the reporting of ESG information will be standardised, made mandatory and monitored to ensure the quality, comparability, usability and completeness of the information provided. Provisions to this effect were included by the Commission in its proposal for an EU directive on corporate sustainability reporting (CSRD),[4] published in April 2021. The proposal also provides for the development of sustainability reporting standards by the European Financial Reporting Advisory Group (EFRAG, 2022).

Second, the disclosure requirement set out in Article 8 of the Taxonomy Regulation requires entities covered by the NFRD, and in future the CSRD, to provide information on how and to what extent their activities qualify for and are compliant with the taxonomy, i.e. meet the technical criteria [5]. In this context, the Commission asked

1 Regulation (EU) 2019/2089 amending Regulation (EU) 2016/1011 as regards EU Climate Transition Benchmarks, EU Paris-aligned Benchmarks and sustainability-related disclosures for benchmarks.

2 Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014 amending Directive 2013/34/EU (Accounting Directive) as regards the disclosure of non-financial and diversity information by certain large companies and groups, OJ L 330, 15.11.2014, 1-9.

3 European Commission, Communication, Guidelines on non-financial reporting : supplement on climate reporting, C(2019) 4490 final, 17 June 2019. This publication complements the Guidelines on financial reporting adopted by the Commission in 2017 (C(2017) 4234 final, 26 June 2017).

4 Proposal for a Directive of the European Parliament and of the Council of 21 April 2021 amending Directive 2013/34/EU, Directive 2004/109/EC, Directive 2006/43/EC and Directive (EU) No 537/2014 on sustainability reporting by companies, COM(2021) 189 final.

5 Financial institutions need only report on the alignment of their activities with the taxonomy if they are required to submit a non-financial statement or a consolidated non-financial statement pursuant to Article 19a or Article 29a of Directive 2013/34/EU, as the case may be.

the three European supervisory authorities (ESAs) to issue an opinion[1]. Based on these opinions, a delegated regulation on taxonomy reporting was published in July 2021[2].

The third initiative is the Sustainable Finance Disclosure Regulation (SFDR)[3]. This regulation requires financial market participants, such as investment advisers and institutional investors, to disclose information on (i) adverse sustainability impacts at entity and product level, (ii) the integration of sustainability risks into the investment process or advice and (iii) whether financial products meet environmental or social objectives. With regard to the latter, the Taxonomy Regulation also requires the provision of information on the extent to which financial products are sustainable according to the EU taxonomy, in both periodic website publications and pre-contractual disclosures. On 6 April 2022, the European Commission adopted regulatory technical standards to be used by financial market participants when disclosing sustainability-related information under the SFDR.

Finally, the disclosures required of financial institutions under pillar 3[4] of the prudential framework for credit institutions and insurance and reinsurance companies were extended to include a requirement to provide information on ESG risks. To this end, Articles 434a and 449a of CRR2[5] empowered the European Banking Authority (EBA) to develop implementing technical standards (ITS) on the inclusion of ESG risks in the pillar 3 disclosure requirements for large credit institutions. In January 2022, the EBA published these ITS, which entered into effect on 28 June 2022, subject to a transition period running until June 2024 for certain indicators and counterparties. In keeping with the Taxonomy Regulation, banks must disclose the extent to which their exposures can be considered sustainable under the EU taxonomy as from 2024. The new prudential regulatory alignment proposals include similar reporting obligations for smaller and unlisted credit institutions (EC, 2021a).

As for insurers, EIOPA has issued an opinion on sustainability under Solvency II (EIOPA, 2019), addressing the importance of the disclosure of climate-related risks by insurance and reinsurance companies under pillar 3. EIOPA believes that further consideration should be given in the near future to mandatory disclosure requirements for sustainability risks on both sides of the balance sheet.

Finally, the European Commission has issued a consultation document on the creation of a European Single Access Point (ESAP) for financial and non-financial information published by companies (EC, 2021b). The access point, combined with the common taxonomy and a mandatory reporting framework with sustainability standards, will certainly help improve the available data on sustainability and ESG risks.

2.1.3 Governance, risk management and capital requirements of financial institutions

Under the EU Sustainable Finance Action Plan, European supervisory authorities have been entrusted with several tasks regarding sustainable finance and ESG risk management, in addition to the reporting of sustainability information. Various supervisory authorities, at international, European and national levels, are in the process of analysing how to best measure and assess these risks and adapt the prudential framework to better

1 EBA, Report. Advice to the Commission on KPIs and Methodology for Disclosure by Credit Institutions and Investment Firms under the NFRD on How and to What Extent Their Activities Qualify as Environmentally Sustainable According to the EU Taxonomy Regulation, EBA/Rep/2021/03; EIOPA, Insurer's Sustainability Reporting: EIOPA's Technical Advice on Key Performance Indicators under Article 8 of the Taxonomy Regulation, EIOPA-21-184; ESMA, Final Report. Advice on Article 8 of the Taxonomy Regulation, ESMA30-379-471.

2 European Commission, Delegated Regulation supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council by determining the content and presentation of information on environmentally sustainable economic activities to be reported by undertakings not [sic] subject to Article 19a or Article 29a of Directive 2013/34/EU and by establishing the methodology to comply with this reporting obligation, C(2021)4987 final, 6 July 2021.

3 Regulation (EU) 2019/2088 of the European Parliament and of the Council of 27 November 2019 on sustainability-related disclosures in the financial sector.

4 The prudential framework for credit institutions and insurance and reinsurance undertakings consists of three pillars: capital requirements (pillar 1), governance, risk management and supervision (pillar 2) and disclosure and reporting (pillar 3).

5 The Capital Requirements Directive (CRD) introduced a European supervisory framework mirroring the Basel I and Basel II rules. In 2013, the regulatory framework was complemented by the Capital Requirements Regulation (CRR), which contains capital calculation rules. Both the CRD and the CRR have been revised over the years. The versions currently in force are CRD 5 (Directive (EU) 2019/878) and CRR 2 (Regulation (EU) 2019/876).

integrate them. However, prudential regulation, including the setting of capital requirements, should always be risk-based. It is therefore important to avoid the introduction of green support factors purely to encourage green investment. Capital requirements can only be adjusted if a difference in financial risk can be demonstrated between "harmful" and "green" exposures for certain assets.

This does not mean that financial institutions should not be encouraged to contribute to the transition to a sustainable economy. After all, a greener financial system will reduce future risks. Supervisors can support this process by ensuring that banks adequately measure and manage ESG risks and take them into account in their business models and strategies as well as in their governance and risk appetite frameworks, which indirectly guide their commercial choices and financing and investment decisions. Moreover, a lack of alignment of financial institution strategies with the Commission's sustainability objectives will also give rise to risks. Therefore, in future, banks will be expected to align their strategies with the EU transition path or otherwise take into account the risks deviation will entail (EC, 2021a).

2.1.4 Proposed European standard for green bonds

In June 2021, the European Commission published a proposal for a regulation on an EU standard for European green bonds (EC, 2021c). This proposal is based on the recommendations of the Commission's Technical Expert Group (EU-TEG) on Sustainable Finance (EU-TEG, 2019) and is supplemented by a number of guidelines (EU-TEG, 2020) on the use of the standard. Companies and governments will be able to make the standard applicable on a voluntary or non-voluntary basis and thus finance ambitious sustainable projects. The standard is intended to ensure enhanced transparency and comparability and give investors more certainty that they are indeed investing in sustainable projects so that the risk of greenwashing can be reduced. The legislative proposal includes a requirement that the funding raised by green bonds be allocated entirely to projects classified as sustainable under the EU taxonomy and disclosed with full transparency. Furthermore, all European green bonds will have to be audited by an external assessor, to ensure compliance of funded projects with the standard and the EU taxonomy. The European Securities and Markets Authority (ESMA) will oversee the quality of services provided by and the reliability of assessors.

2.2 Initiatives at Belgian level

In the absence of harmonised definitions, several countries have developed their own sustainability labels for investment products. For Belgium, this takes the form of the "Towards Sustainability" initiative. Created in 2019 by the Belgian Financial Sector Federation (Febelfin) in cooperation with partners from academia (ICHEC and the University of Antwerp) and stakeholders, this initiative provides a standard to identify sustainable and socially responsible financial products and investments.

The initiative provides guidance to both institutional and retail investors on sustainable investment. The label combines three requirements: transparency, a positive contribution to society (as confirmed by an ESG analysis) and the exclusion of certain sectors and activities deemed harmful (an obligation to do no harm). All types of investment and savings products offered on the Belgian market are eligible (investment funds, insurance funds, bonds and savings products).

The standard is dynamic and subject to biennial review. The idea is to encourage investors, market players and companies to move towards sustainable investing. The first revision was published in May 2021 and entered into force in January 2022. It aimed, amongst other things, to align the label with the European regulations on sustainable finance, including with regard to transparency and taxonomy. Reporting was also strengthened, with an obligation to publish information not only on the sustainability strategy of the financial product but also on certain indicators, including the green share of the fund in accordance with the EU taxonomy, and information linked to the Disclosure Regulation (the percentage of sustainable investments, as defined in Article 2, etc.).

To obtain the label, a financial product must be based on three investment strategies (do no harm, a positive impact and transparency) and at least one additional strategy of the issuer's choosing, which may vary in terms of the selection criteria or focus (e.g. best-in-class/universe selection, impact investment, thematic funds, etc.).

Finally, a central certification agency (the Central Labelling Agency) has been set up to award the label and to check that the policy used to manage a sustainable product meets the requirements of the quality standard. It is also tasked with selecting and appointing the independent third party responsible for verifying that the management and portfolio of a product comply with the chosen sustainability policy.

2.3 Main standards

2.3.1 The Green Bond Principles

The Green Bond Principles (GBP) were first published in 2014 by a group of commercial banks and are now overseen by the International Capital Markets Association (ICMA). They were a key catalyst in the development of a green bond market and have several benefits for issuers and investors. The GBP help issuers communicate about their sustainability strategy and broaden their investor base and help investors develop better-informed strategies and facilitate the implementation of long-term climate strategies.

The GBP govern : (i) the use of proceeds, (ii) the process for project evaluation and selection, (iii) the management of proceeds and (iv) reporting. First, the use of proceeds for eligible green projects must be described in the legal documentation and the green project must have clear environmental benefits, assessed and quantified by the issuer. The GBP explicitly recognise several broad categories of eligible green projects which contribute to environmental objectives such as climate change mitigation, climate change adaptation, natural resource conservation, biodiversity conservation and pollution prevention and control. Second, the issuer must communicate about the sustainability objectives of the project and the process it uses to determines how the project fits into the eligible categories. Third, the proceeds from the issuance should be tracked in an appropriate manner, so that the issuer can confirm that the amounts raised are allocated to the green project. Fourth, issuers are committed to providing and maintaining up-to-date and easily accessible information on the use of proceeds. In addition, the GBP recommend the use of qualitative performance indicators and, where feasible, quantitative performance measures.

While the GBP define a process for project selection and the allocation of funds, there is no clear definition for green economic activities and an external review is only recommended, two aspects that form part of the Climate Bonds Standard.

2.3.2 Climate Bonds Standard

The Climate Bonds Initiative is a London-based NGO dedicated to promoting green bonds. It released the first version of its Climate Bonds Standard (CBS) in 2011. The CBS seeks to assess the green eligibility of projects by providing a taxonomy of eligible assets as well as disclosure and reporting criteria and promoting the use of labelling through market certification. It aims to provide an approach to verifying that the funds raised are being used to finance projects and assets consistent with a low-carbon, climate-resilient economy.

The key features of certification include : (i) full alignment with the GBP and other standards (such as the proposed EU Green Bond Standard), (ii) clear requirements for the use of proceeds, the selection of projects and assets, the management of proceeds and reporting, (iii) sector criteria to determine the low-carbon and climate-resilient credentials of projects and assets and (iv) independent verifiers, including pre- and post-issuance certification.

The CBS defines what is green and can be used to ensure that financed projects have a positive impact on climate change. It supports investors in aligning investment decisions with climate objectives.

BOX 2

International and Belgian standards

Green Bond Principles (GBP)
- Launched in 2014, now managed by the International Capital Markets Association (ICMA)
- Guidelines focus on the process for the management and reporting of the use of proceeds and evaluation procedures (rather than providing a definition of "greenness")
- Guidelines for issuers
- Issuers determine what is green
- Adherence is voluntary

Climate Bonds Standard (CBS)
- Developed by the Climate Bonds Initiative, an investor-focused NGO
- Robust taxonomy to define climate-aligned assets and projects (definition of "green")
- Certification scheme (pre- and post-issuance validation)
- Designed to help investors select green projects

Towards Sustainability
- Launched in 2019 by Febelfin, the Belgian Financial Sector Federation
- Aims to provide guidance to investors
- Based on three principles: transparency, positive impact (based on an ESG analysis of all portfolios) and the exclusion of certain sectors deemed harmful.

3. Issuance of green bonds in Belgium and neighbouring countries

3.1 Total number and volume of green bonds issued in Belgium and neighbouring countries

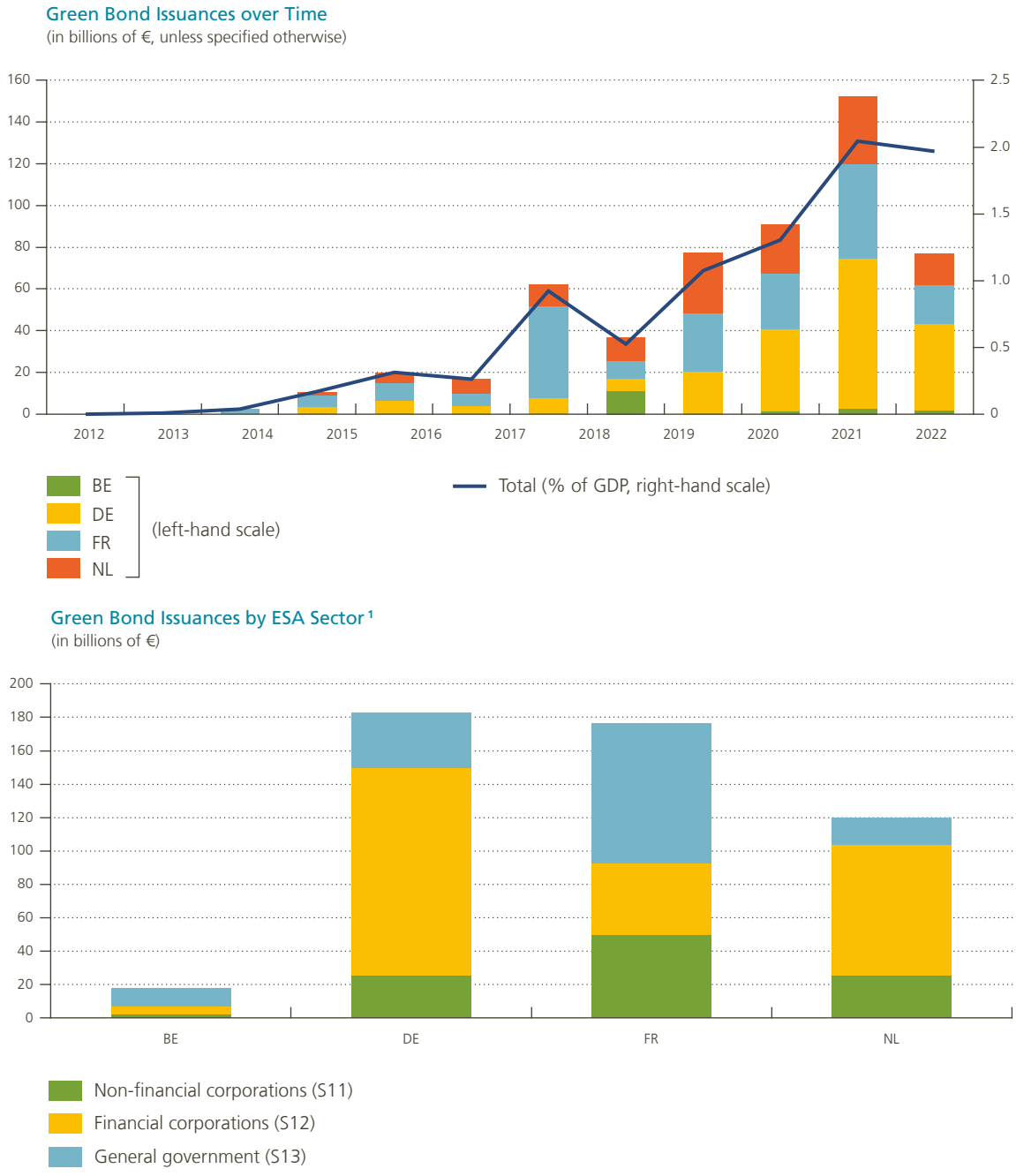
We analysed the issuance of green bonds in Belgium, France, Germany and the Netherlands (based on the issuer's country of domicile) using the sample of green bonds identified in the Refinitiv database [1]. We restricted our analysis by excluding green bonds that were "cancelled before the initial settlement" [2] and bonds issued by supranational organisations, such as the European Commission. Table 1 presents a summary of the data, showing the total number and volume of issued green bonds (both on a cumulative basis) and the percentage of issued green bonds that are *still active*, i.e. not matured, funged, defaulted or called/exchanged/cancelled.

The upper panel of Chart 4 shows total issuances of green bonds (in billions of euros) across countries and years. Relative to the total GDP of the selected countries, the issuance of green bonds has been rapidly accelerating and reached 2 % of total GDP at the end of 2021. Germany and France are pioneers and clear leaders in terms of the volume of issued green bonds. The first green bond in the sample was issued in 2008 by a German commercial

1 The data were extracted in July 2022.
2 Four out of 1 265 green bonds were cancelled before initial settlement.

Chart 4

Green bond issuances



Source: Refinitiv.

1 Issued volume of active bonds (i.e., not matured, funged, defaulted or called/exchanged/cancelled) for the period 2008-2022.

bank; several local French government entities followed suit in 2012. In 2021, the issuance of green bonds[1] by entities domiciled in Germany and France reached € 71 billion and € 45 billion, respectively. Dutch issuers joined the green bond market in 2014. Since then, the issuance of green bonds in the Netherlands has been remarkably high, comparable with that of France. Belgium joined the market rather late (2016), and its issued volumes have been modest, reaching € 11 billion in 2018, when the Belgian federal government issued a large green bond[2].

The lower panel in Chart 4 illustrates the total volume of active green bonds by country and ESA sector[3]. Whereas the market in Germany and the Netherlands is dominated by financial institutions (S12), public authorities were the most important issuers in Belgium and France for the period 2008-2022. This could be due to the fact that Germany and the Netherlands entered the green bond market early or to efforts made by the Belgian and French governments to fund the transition. For example, at COP 21 (held in Paris in 2015), the French government committed to issuing green bonds to finance the energy and ecological transition. The first French green bond was issued in 2016, followed by two more in 2021 and in 2022. These issuances are in line with French commitments to implement the Paris Agreement. Likewise, the first issuance of a green OLO by the Belgian authorities in 2017 demonstrated their strong commitment to addressing global environmental challenges and taking a lead in the development of the green bond market, by providing a large and liquid benchmark and stimulating investor demand.

Table 1

Cumulative issuance of green bonds

	Number of bonds	Issued volume (in € million)	Still active (in %)
Belgium	25	17 516	100
Germany	619	200 831	92
France	428	193 984	93
The Netherlands	189	134 544	91
Total	**1 261**	**546 876**	**92**

Source: Refinitiv, data coverage for the period January 2008 – July 2022.

The upper panel in Chart 5 shows the distribution of green bond issuances by original maturity, i.e. maturity at issuance. Most green bonds mature in the mid- to long-term. Only a negligible share of green bonds have a maturity of less than one year. In Belgium, the majority of green bonds have a maturity between 10 and 20 years. We noticed that French issuers prefer longer maturities, in excess of 20 years. In Germany and the Netherlands, the vast majority of green bonds have a maturity between five and 10 years.

The lower panel in Chart 5 shows the distribution of issuers according to the Thompson Reuters Business Classification. Whereas the largest share of issuances in Germany, France and the Netherlands are by financial companies, in Belgium, the government and real estate sector account for most green bond issuances in terms of volume. Issuers in the utilities sector also make up a substantial share of green bond issuers in every country. In France, industrial companies are the second-largest group of green bond issuers.

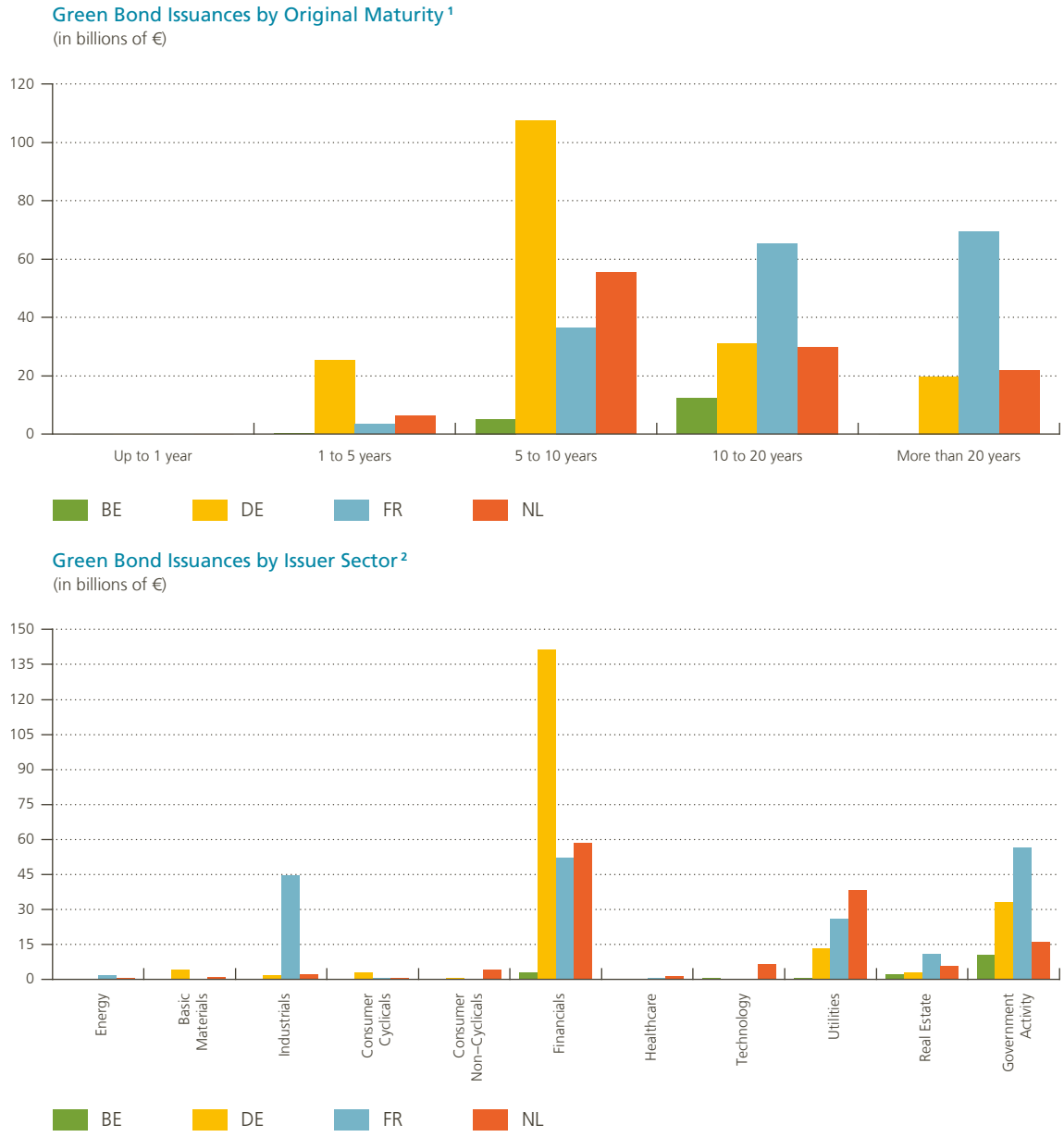
1 The volume or issued amount is based on the latest reported value and includes additional issuances that took place after the initial issuance.

2 An important clarification is that the Belgian government initially issued a € 4.5 billion green bond in 2018. This amount increased in the following years following additional issuances.

3 Please note that the total issued amount obtained by adding the amounts across S11, S12, S13 sectors is somewhat lower than the true total issued amount. This is due to the fact that the ESA breakdown is not available in the Refinitiv database. The ESA classification was obtained from SSHS data (more information on this database is presented in the following section). As a result, a limited number of issuers identified in Refinitiv could not be matched with the SSHS dataset.

Chart 5

Green bond issuances – breakdown by original maturity and issuer sector



Source: Refinitiv.

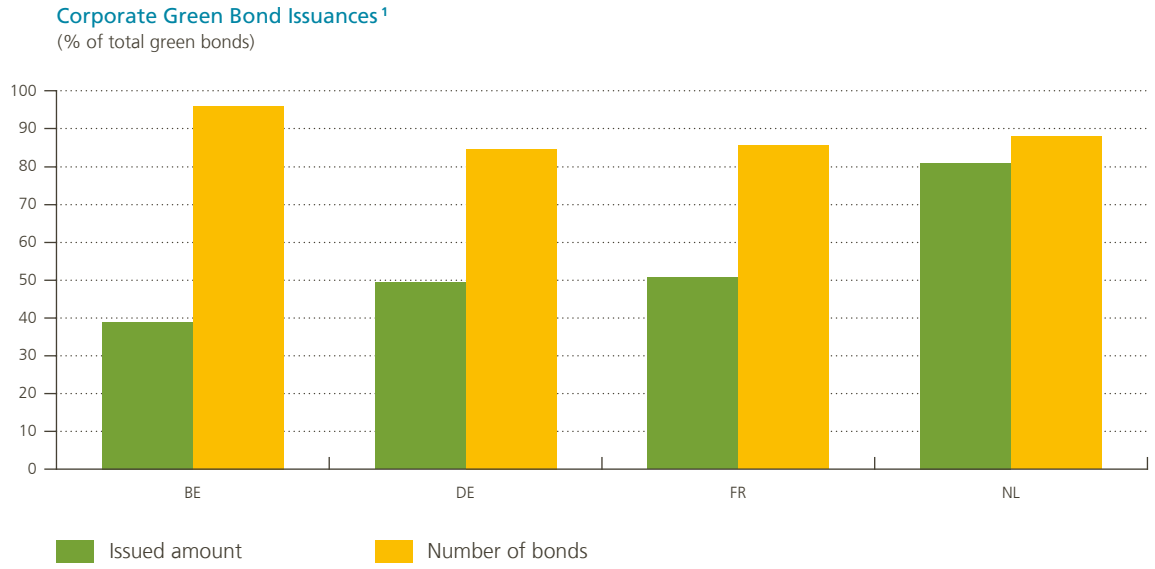
1 Issued volume of active bonds (i.e., not matured, funged, defaulted or called/exchanged/cancelled) for the period 2008-2022.

2 Issued volume for the period 2008-2022, by Thompson Reuters Business Classification.

Chart 6 shows that the volume of green bonds issued by corporates varies considerably across countries. In the Netherlands, corporate issuers have accounted for over 80 % of total green bond issuances since 2014. In Germany and France, however, the public and corporate sectors hold approximately equal market shares. In Belgium, the public sector has dominated the green bond market thus far, which could be due to the limited number of Belgian non-financial corporations issuing debt securities to finance

Chart 6

Green bond issuances – breakdown by percentage of corporate issuances



Source: Refinitiv.
1 For the period 2008-2022.

their operations [1] In terms of the number of issued bonds, however, the corporate sector accounts for over 80 % of green bond issuances in all countries, suggesting that corporate green bond issues are on average much smaller.

Finally, a majority of green bonds issued in all four countries are denominated in euros. In Belgium, all green bonds are euro denominated, while in the Netherlands about 24 % of issued amounts are denominated in currencies other than the euro.

3.2 More insight into green bonds

Refinitiv also provides information on the alignment of green bonds with various green taxonomies. Table 2 shows the number of green bonds aligned with one of the three most widely used taxonomies: the ICMA's Green Bond Principles (GBP), the Climate Bonds Standard (CBS) of the Climate Bonds Initiative (CBI) [2] and the EU Green Bond Standard (GBS). It is, however, important to mention that this information was added to the Refinitiv database only recently and, as a result, may be incomplete. Therefore, the findings presented in this subsection should be interpreted with caution.

Most green bonds are aligned with either the GBP or the CBS. The GBS was introduced relatively recently, which could explain why so few green bonds in the sample were aligned to this standard. Many issuers request an opinion from an external company, confirming that their green bond is aligned with a particular standard.

1 For more information on the issuance of debt securities by Belgian non-financial corporations, see Geraci *et al.* (2021).
2 The Climate Bonds Taxonomy identifies assets and projects needed for a low-carbon economy and GHG emissions screening criteria consistent with the 1.5 °C global warming limit set by the COP21 Paris Agreement. More information is available at https://www.climatebonds.net/standard/taxonomy.

This can help to increase the bond's credibility. At least 28 % of green bonds in the sample benefitted from such a second-party opinion [1]. In this regard, it should be noted that the market for second-party opinions has a limited number of players. More specifically, only nine companies issued second-party opinions for the green bonds in the sample, of which four are clear leaders: Sustainalytics BV, Institutional Shareholder Services, Inc., Moody's ESG Solutions France SAS and Cicero Shares of Green AS.

It should be mentioned that only a limited number of green bonds in the sample were certified in accordance with the CBS [2]. Furthermore, only six external companies acted as certifiers for these bonds, including the same four dominant players mentioned above. The limited number of certifiers can be explained by the fact that they must be approved by the CBI, and issuers have to select an approved certifier from the published list [3].

The low number of certified green bonds in the sample suggests that many issuers of green bonds prefer to avoid the additional cost of certification, which is in line with the argument of Caramichael and Rapp (2022). Despite a potentially stronger greenium thanks to certification, the additional cost involved in the process may outweigh the benefits.

The CBI has outlined the cost of certification [4]. In short, the total cost can be divided into internal and external costs. Internal costs relate to internal processes and controls to prepare for a green bond issuance. These costs are specific to each company and hard to estimate. It is safe to assume, however, that they are lower for larger companies (thanks to their more varied and often more advanced management processes and systems) and repeat green bond issuers (thanks to their acquired expertise).

The external costs of certification include the engagement of an approved verifier and the certification fee. The latter is rather limited, only $ 2 000 for issuers in developed countries and $ 1 000 for issuers in developing countries. For subsequent issuances, a variable fee equal to one-tenth of a basis point of the issuance amount is charged. The fees of approved verifiers, however, are much higher than the certification fee and vary widely across verifiers and issuers. In addition, even though annual reports on the use of proceeds – *which are mandatory to maintain CBI certification* – do not need to be audited by a verifier, certain issuers decide to fulfil this formality nonetheless, which further increases the cost of certification.

1 We say "at least" because Refinitiv underreports cases in which a second-party opinion is provided. Hence, the actual share of green bonds benefitting from a second-party opinion is likely larger. Importantly, even if a bond in the sample is "self-labelled, it is often the case that the bond is aligned with one of the green bond standards, thus implying the need for a second-party opinion.

2 CBI certification is the only formal certification procedure available for green bonds.

3 The list of CBI-approved certifiers can be found at https://www.climatebonds.net/certification/approved-verifiers.

4 Please refer to the CBI's website for more information on the cost of certification.

Table 2

Alignment with green bond standards

	Belgium	Germany	France	The Netherlands
Total green bonds	25	619	428	189
of which:				
Aligned with GBP	24	589	296	169
Aligned with CBS	20	519	288	174
CBI certified	3	17	32	25
Aligned with GBS	1	156	5	4

Source: Refinitiv, data coverage for the period January 2008 – July 2022.

4. Holdings of green bonds

In this section, we analyse holdings of green bonds, looking initially at the trend in total holdings of green bonds in the selected countries. To do so, we combined two data sources. First, we selected all globally issued green bonds flagged in the Refinitiv database. We then matched this selection of green bonds with the ECB's Securities Holdings Statistics by Sector (SHSS) database using international securities identification numbers (ISIN). After applying relevant filters to the data, the matched dataset was found to consist of 2 692 globally issued green bonds held by residents of Belgium and neighbouring countries. For details of the SHSS database, please refer to the Annex. Due to confidentiality concerns, we do not present data relating to holdings of the Netherlands.

Chart 7 plots the aggregate amount (in € million) of green bonds held by residents of Belgium and neighbouring countries. In absolute terms, France is the largest holder of green bonds, with holdings in excess of € 111.7 billion in Q2 2022. In Germany and Belgium, holdings reached € 94.6 billion and € 9.4 billion, respectively.

Both the absolute value of green bond holdings and the share of green holdings in each country's bond portfolio have been rising. By 2021, this share exceeded 3 % for France, whereas for Belgium it reached 1.6 %. Although still lagging behind other countries, the share of green bond holdings has been rising rapidly for Belgium.

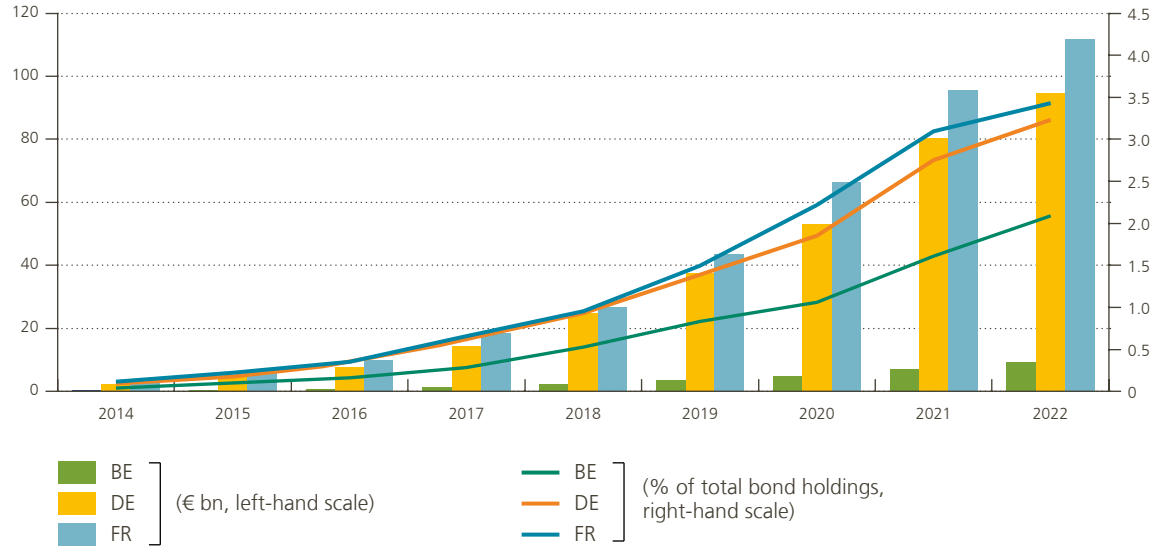
4.1 Breakdown of holdings by sector

We then analysed the breakdown of total green bond holdings by sector. For each country, Chart 8 plots the total nominal value of green bonds held by given ESA sectors, with a comparison of the values for 2018 and 2022. It is important to note that until 2014, green bonds were limited to a handful of instruments, mostly issued by international and supranational organisations, such as the International Bank for Reconstruction and Development and the European Investment Bank.

Chart 7

Green bond holdings of Belgium, France and Germany

(in billions of € and % of total country bond holdings, as specified in the legend)



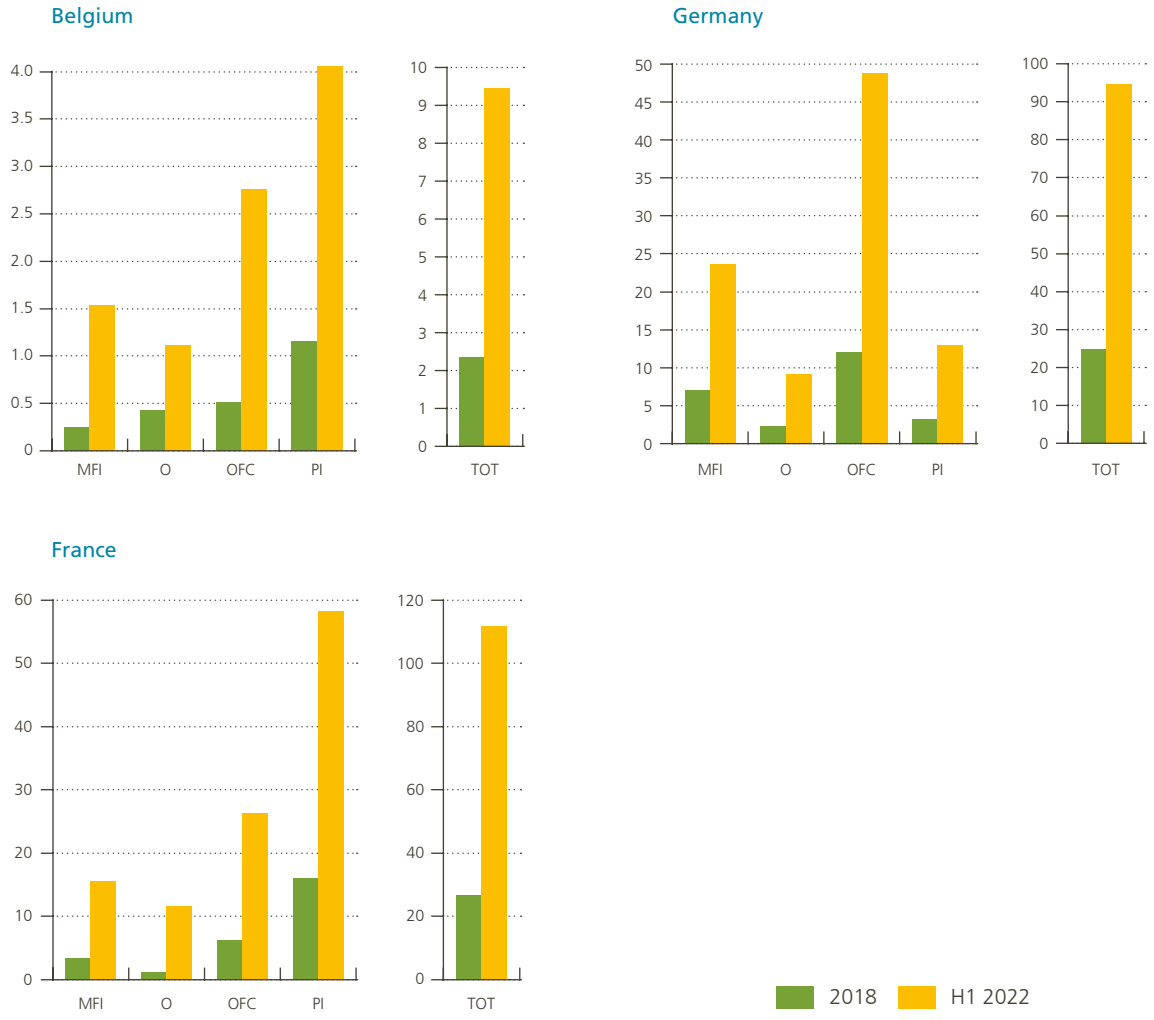
Source: SHSS.

Chart 8 shows that the nominal value of green bond holdings has increased substantially across all sectors, but that this increase is particularly significant in sectors holding the largest volume of green bonds. For Belgium, green bonds are mostly held by pension funds and insurance companies, followed by other financial corporations and monetary financial institutions. Compared to other countries, the green bond holdings of individuals as a share of total green bond holdings is substantially larger for Belgium than for its neighbours.

Chart 8

Green bond holdings of Belgium, France and Germany by ESA sector

(in billions of €, quarterly averages for 2018 and H1 2022)



Source: SHSS.

Note: "G" stands for governments, "I" stands for individuals, "MFI" stands for monetary financial institutions, "NFC" stands for non-financial institutions, "O" stands for other, "OFC" stands for other financial institutions, "PI" stands for pension funds and insurance companies and "TOT" stands for total. See Table A1 in the Annex for more information.

For Germany, the vast majority of green bonds are held by other financial corporations[1], followed by monetary financial institutions and pensions funds and insurance companies. For France and the Netherlands, pensions funds and insurance companies hold the lion's share of green bonds, followed by other financial corporations and monetary financial institutions.

4.2 Breakdown by issuer sector and country

The upper panel in Chart 9 shows the breakdown of green bond holdings for the selected countries based on the ESA sector of the bond issuer. For the sake of readability, this breakdown ignores the time dimension and presents the average volume for the period 2018 until 2022.

Belgian residents tend to hold more green bonds issued by NFCs, followed by those issued by governments, other financial corporations and monetary financial institutions. The latter three groups account for approximately equal shares of the total holdings. French residents follow a similar holding pattern, with green bonds issued by NFCs accounting for the largest share of French holdings, followed by those issued by governments, other financial corporations and monetary financial institutions.

For Germany, green bonds issued by monetary financial institutions account for the largest share of total green bond holdings, followed by those issued by NFCs, governments and other financial corporations. Finally, for the Netherlands, government-issued green bonds make up the largest share, followed by those issued by MFIs, OFCs and NFCs.

The lower panel in Chart 9 presents a breakdown of green bond holdings by issuer country. Over 20 % of Belgian green bond holdings can be attributed to French issuers. A similar share of green bond holdings in Belgium is attributable to issuers of other EU countries. We also observed a home bias, with Belgian green bonds representing a significant share of Belgian green bond holdings. Abroad, Belgian green bonds are not held to the same extent.

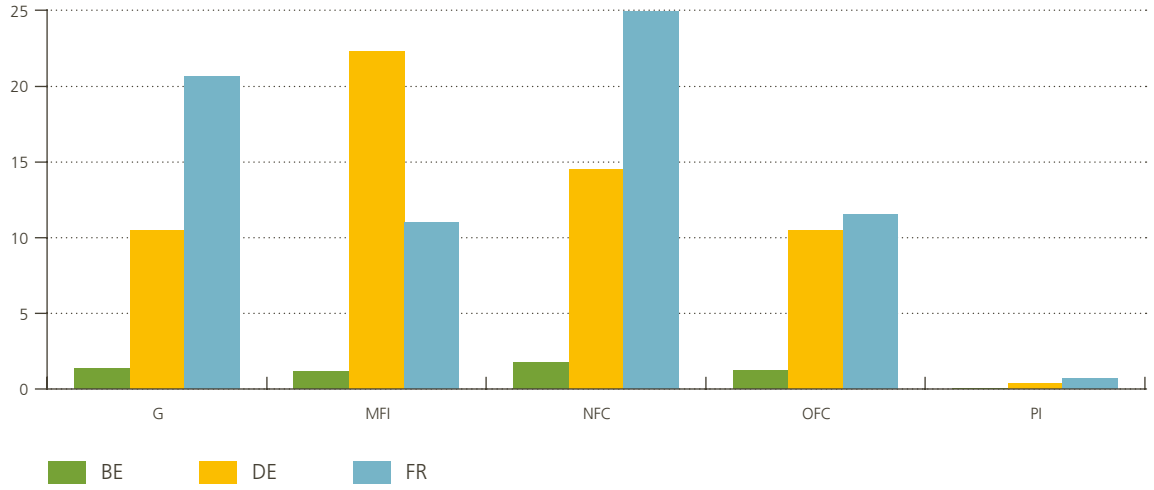
Likewise, German residents tend to hold bonds issued by domestic entities, although green bonds issued in other EU countries, France and the Netherlands also represented a large share of German green bond holdings. For France, green bonds issued by French issuers and those issued in other EU countries account for, respectively, approximately 50 % and 10 % of green bond holdings. This suggests that, based on our sample of green bonds, French investors have a strong preference for home issuances. Finally, the Netherlands was found to have the most diversified portfolio, with a large share of both French and Dutch green bond holdings.

1 The category "Other financial corporations" includes (i) non-MMF investment funds (e.g. real estate investment firms), (ii) other financial intermediaries (e.g. companies created to provide funding to a parent holding company), (iii) financial auxiliaries (e.g. holding companies of large international banking groups) and (iv) captive financial institutions (e.g. certain real estate developers).

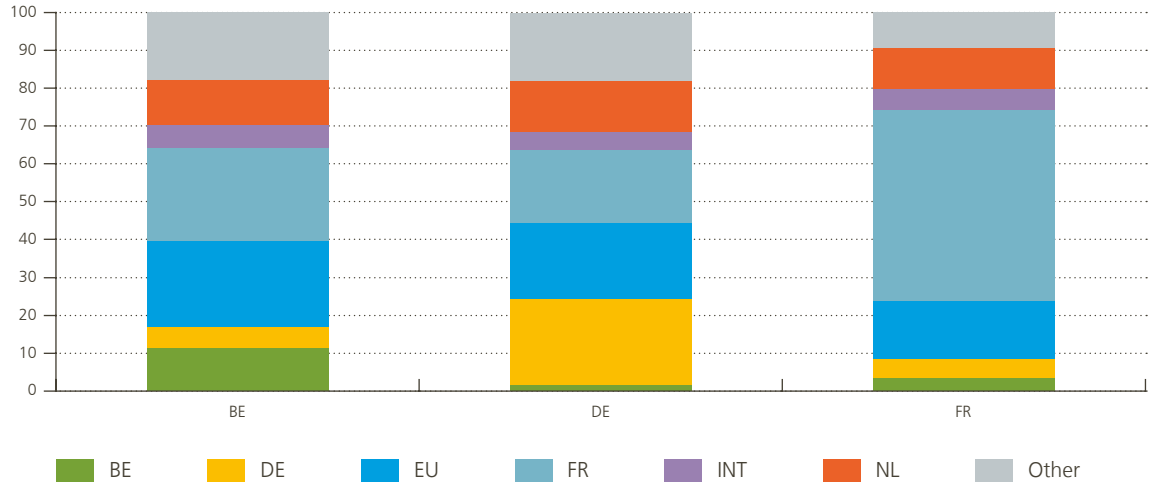
Chart 9

Green bond holdings of Belgium, France and Germany by issuer sector and country

Green Bond Holdings of Belgium, France and Germany by Issuer Sector [1]
(in billions of €, average for the period Q1 2018 - Q2 2022)



Green Bond Holdings of Belgium, France and Germany by Issuer Country [2]
(% of total green bond holdings, average for the period Q1 2018 - Q2 2022)



Source: SHSS.

1 "G" stands for governments, "MFI" stands for monetary financial institutions, "NFC" stands for non-financial institutions, "OFC" stands for other financial institutions and "PI" stands for pension funds and insurance companies. See Table A2 in the Annex for more information.

2 "EU" refers to the EU countries except for Belgium, Germany, France and the Netherlands, "INT" stands for international organisations. See Table A3 in the Annex for more information.

BOX 3

Who holds Belgian green bonds?

To answer this question, we matched the ISIN of Belgian green bonds with SHSS holding data without imposing a filter for the holder country.

Surprisingly, most Belgian green bonds are not held by Belgian investors. As of 2021, total holdings of Belgian green bonds, according to SHSS data, were split between France, the Netherlands, Germany, Luxembourg and Belgium. It should be noted that total holdings of Belgian green bonds, as reported by the SHSS data, amounted to only 62 % of the outstanding volume in 2021. This means that a large portion of Belgian green bonds is in the hands of holders not covered by the SHSS data[1].

1 SHSS data offer only a partial view of total holdings. The data do not include holdings by the Eurosystem and custodial holdings outside the euro area or participating non-euro area countries (Bulgaria, the Czech Republic, Denmark and Romania).

Conclusion

Recent academic and policy discussions have highlighted certain aspects of the impact of the low-carbon transition on financial markets. In particular, the question of the existence of a greenium (i.e. a green premium) in stock and bond markets has been widely discussed in the literature. Several studies have provided convincing evidence of a greenium for green assets and revealed the dimensions over which it varies. The high variability of the greenium makes it difficult to generalise results across studies and calls attention to limitations that should be addressed in the future. For example, an important area for further research, touched upon in this article, is the use of environmental scores (or E scores) to measure climate risk exposure.

In parallel, advances have been made in recent years at both the EU and national levels in terms of the regulation of climate finance. These developments aim to redirect financial flows to sustainable activities and a low-carbon economy, while increasing investor confidence in the underlying assets (through the use of a taxonomy, reliable and comparable information and standards). At the EU level, a taxonomy has been developed to help identify economic activities considered environmentally sustainable. Moreover, several directives and regulations have been adopted to increase transparency by financial product providers and to harmonise the disclosure of sustainability information by companies. Yet other directives target investors and require financial institutions to collect their sustainability preferences before offering financial products. At the Belgian level, as well, initiatives have been taken to provide guidance to both institutional and retail investors on green and sustainable investing.

We studied the issuance and holding of green financial instruments in Belgium, France, Germany and the Netherlands. In particular, we focused on green bonds, whose popularity has increased in recent years. We showed that both the issuance and holding of green bonds have risen, evidencing growing supply and demand. Compared to Belgium, the green bond markets of neighbouring countries appear more developed and offer a wider selection of bonds. Whereas initial issuances were mostly by governments, in recent years we

have seen a growing share of issuances by financial and non-financial corporations. This is occurring in Belgium, too, albeit at a somewhat slower pace. In terms of uptake, we found that investors are devoting larger shares of their debt securities portfolios to green bonds. This is especially true in neighbouring countries where, according to our data, green bonds represent between 3 % and 4 % of total bond holdings. However, Belgium is rapidly catching up, with green bonds accounting for about 2 % of total bond holdings in 2022.

In conclusion, we would like to express two final thoughts on future avenues for policy and research. First, as outlined by many international and private institutions, including the OECD (2021), policy actions can facilitate the correct pricing of climate risks by improving data quality and standards. Better data provide investors with more accurate information, which they can use to measure their exposure to climate risks, and favour price discovery. Policy actions can also help to improve the transparency, comparability and interoperability of various environmental metrics, including GHG emission measures and E scores. Further, better data on green assets can help to reduce the risk of greenwashing and determine the pervasiveness of this phenomenon. Second, in terms of research, studies should take advantage of data advances to shed light on critical issues. For example, efforts should be made to better understand the drivers of green investment and whether they are linked to a desire to hedge climate risks or a shift in preferences.

Annex

SHSS sample selection for Section 4

The sample was comprised of bonds flagged as "green" in the Refinitiv data[1]. Based on the ISIN, the sample of green bonds was matched with SHSS data. Several filters were applied when constructing the matched sample:

- The "holder country" category includes Belgium, the Netherlands, France and Germany. No filter was imposed on the issuer country.
- The sample included only green bonds classified as *debt instruments* in the SHSS database[2].

Certain securities may be held by countries other than Belgium, the Netherlands, France and Germany, which would explain why not every green bond identified by Refinitiv is matched. SHSS data cover securities holdings by financial and non-financial holders from euro area countries[3]. Some information is also reported by participating non-euro countries (Bulgaria, the Czech Republic, Denmark and Romania). In view of the foregoing, the SHSS offers only a partial view of securities holdings. For financial institutions (i.e. monetary financial institutions, investment funds, financial vehicle corporations, insurance corporations, custodians and some pension funds), information on securities holdings is reported directly by them to the ESCB. For the remaining holder sectors, which are mainly non-financial institutions (for the most part households, general government entities and non-financial corporations), information is reported by custodians (indirect reporting). For a given security, holdings of the Eurosystem are not reported. The reporting of holdings may be subject to statistical discrepancies.

To facilitate presentation of the findings, the holder sector and issuer sector were regrouped into more aggregate categories in accordance with the classification suggested in the SHSS.

To further facilitate presentation of the findings, the issuer country variable was regrouped into more aggregate categories. Several important or large countries were kept stand-alone. These countries include Belgium, the Netherlands, Germany, France, the US, the UK, Canada and China. The table below provides more information on the grouping of the remaining countries.

1 Namely, 5 458 unique globally issued green bonds were identified in Refinitiv, of which 5 146 have an ISIN identifier. Of these, 2 692 could be matched with the SHSS database.

2 Some hybrid instruments (such as certain convertible bonds) are considered debt securities by Refinitiv, but classified as equity in the SHSS database.

3 The data also cover holdings by non-euro area holders of securities issued by euro area issuers held in custody with euro area custodians.

Table A1

Holder sector groupings (in Chart 8)

Category in the final dataset	Included categories	
Monetary financial institutions (MFI)[1]	S_122	Deposit-taking corporations except central banks
	S_123	Money market funds (MMF)
	S_12KU	Monetary financial institutions (sub-sector not identified)
Other financial institutions (OFC)	S_124	Non-MMF Investment funds
	S_125W	Other financial corporations excluding financial vehicle corporations
	S_125A	Financial vehicle corporations
Pension funds and insurance companies (PI)	S_128	Insurance corporations
	S_129	Pension funds
	S_12QU	Other insurance corporations and pension funds
Other (O)[2]	S_11	Non-financial corporations
	S_14	Households excluding non-profit institutions serving households
	S_15	Non-profit institutions serving households
	S_1MU	Other households and non-profit institutions serving households
	S_1311	Central government
	S_1312	State government
	S_1313	Local government
	S_1314	Social security funds
	S_13U	Other general government
	S_16	Non-financial investors excluding households (to be reported if third-party holdings)
	U	Unallocated

Source: SHSS.

1 In principle, this category should include "S_121 Central banks", but this sector is not covered by the SHSS for confidentiality reasons.

2 The "Other" category is not suggested by the SHSS documentation. It includes non-financial corporations, individuals, and governments.

Table A2

Issuer sector groupings (in Chart 9)

Category in the final dataset	Included categories	
Non-financial corporations (NFC)	S_11	Non-financial corporations
	S_11001	Public non-financial corporations
	S_11002	National private non-financial corporations
	S_11003	Foreign-controlled non-financial corporations
Monetary financial institutions (MFI)	S_122	Deposit-taking corporations, except the Central Bank
	S_12201	Public deposit-taking corporations, except the Central Bank
	S_12202	National private deposit-taking corporations, except the Central Bank
	S_12203	Foreign controlled deposit-taking corporations, except central banks
	S_123	Money market funds
	S_12301	Public money market funds
	S_12302	National private money market funds
	S_12303	Foreign controlled money market funds
Other financial institutions (OFC)	S_124	Non-MMF investment funds
	S_12401	Public non-MMF investment funds
	S_12402	National private non- MMF investment funds
	S_12403	Foreign controlled non-MMF investment funds
	S_125	Other financial intermediaries, except insurance corporations and pension funds
	S_12501	Public other financial intermediaries, except insurance corporations and pension funds
	S_12502	National private other financial intermediaries, except insurance corporations and pension funds
	S_12503	Foreign controlled other financial intermediaries, except insurance corporations and pension funds
	S_126	Financial auxiliaries
	S_12601	Public financial auxiliaries
	S_12602	National private financial auxiliaries
	S_12603	Foreign controlled financial auxiliaries
	S_127	Captive financial institutions and money lenders
	S_12701	Public captive financial institutions and money lenders
	S_12702	National private captive financial institutions and money lenders
	S_12703	Foreign-controlled captive financial institutions and money lenders
Pension funds and insurance companies (PI)	S_128	Insurance corporations
	S_12801	Public insurance corporations
	S_12802	National private insurance corporations
	S_12803	Foreign-controlled insurance corporations
	S_129	Pension funds
	S_12901	Public pension funds
	S_12902	National private pension funds
	S_12903	Foreign-controlled pension funds
Governments (G)	S_13	General government
	S_1311	Central government excluding social security
	S_1312	State government excluding social security
	S_1313	Local government excluding social security
	S_1314	Social security funds

Source : SHSS.

Table A3

Issuer country groupings (in Chart 9)

Category in the final dataset	Included countries
European Union (EU)	EU countries excluding Belgium, Germany, France and the Netherlands
International organisations (INT)	International Bank for Reconstruction and Development, International Finance Corporation, European Investment Bank, European Commission, Inter-American Development Bank, African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Nordic Investment Bank, Central American Bank for Economic Integration, Andean Development Corporation, European Company for the Financing of Railroad Rolling Stock
Other (O)	Other countries

Source: SHSS.

Data transformation

The SHSS data are recorded quarterly. The analysis uses yearly average holding amounts computed as a simple average of the quarterly holding amounts in a given calendar year.

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Conventional signs

%	per cent
e.g.	*exempli gratia* (for example)
€	euro
et al.	*et alia* (and others)
etc.	*et cetera*
i.e.	*id est* (that is)

List of abbreviations

Countries or regions

BE	Belgium
DE	Germany
EU	European Union
FR	France
NL	The Netherlands
UK	United Kingdom
US	United States

Abbreviations

AS	Aksjeselskap
BV	Besloten vennootschap
CBI	Climate Bonds Initiative
CBS	Climate Bonds Standard
CO_2	Carbon dioxide
COP21	21st Conference of the Parties
CSRD	Corporate Sustainability Reporting Directive
EBA	European Banking Authority
EC	European Commission
EFRAG	European Financial Reporting Advisory Group
EIOPA	European Insurance and Occupational Pensions Authority
EPA	Environmental Protection Agency
ESA	European System of Accounts
ESAP	European Single Access Point
ESAs	European Supervisory Authorities
ESG	Environmental, Social and Governance
ESMA	European Securities and Markets Authority
EU-TEG	European Commission Technical Expert Group
Febelfin	Belgian Financial Sector Federation
G8	Group of France, the United States, the United Kingdom, Russia, Germany, Japan, Italy and Canada
GBP	Green Bond Principles
GBS	Green Bond Standard

GDP	Gross domestic product
GHG	Greenhouse gas
HLEG	European Commission's High-Level Expert Group on Sustainable Finance
ICHEC	Institut catholique des hautes études commerciales
ICMA	International Capital Markets Association
ILO	International Labour Organisation
Inc.	Incorporation
IPCC	Intergovernmental Panel on Climate Change
ISIN	International Securities Identification Number
ITS	Implementing technical standards
MFI	Monetary and financial institution
MMF	Money market funds
MSCI	Morgan Stanley Capital International
NFC	Non-financial corporation
NFRD	Non-Financial Reporting Directive
NGFS	Network for Greening the Financial System
NGO	Non-governmental organisation
NOAA	National Oceanic and Atmospheric Administration
OECD	Organisation for Economic Co-operation and Development
OFC	Other financial institution
OLO	Obligation linéaire / Lineaire obligatie
S&P	Standard and Poors
SAS	Société par actions simplifiées
SFDR	Sustainable Finance Disclosure Regulation
SHSS	Securities Holdings Statistics by Sector
SME	Small and medium enterprise
TCFD	Task Force on Climate-related Financial Disclosures
UN	United Nations
UNEP FI	United Nations Environment Programme Finance Initiative
UNFCCC	United Nations Framework Convention on Climate Change
WSJ	Wall Street Journal

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