GREEN FINANCE IN EUROPE: ACTORS AND CHALLENGES

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BANK OF GREECE
EUROSYSTEM

Economic Bulletin
ISSN 1105 - 9729 (print)
ISSN 2654 - 1904 (online)

ABSTRACT

Addressing climate change through mitigation and adaptation measures requires changes in policies, technologies and consumption behaviours towards a low-emissions model of growth. These structural changes require appropriate financial solutions, in order to scale up financial flows that support sustainable growth. This paper focuses on the European dimension and considers the role of financial markets in the process of reducing greenhouse gas (GHG) emissions and promoting climate change mitigation and adaptation. Global green bond markets have grown rapidly in recent years. Based on issue- and issuer-specific data, we find that the global market activity for financing projects within the scope of a green bond issuance has accelerated during the last years, with the aggregate amount of bonds issued in the period 2019-21 almost tripling compared with the period 2014-18. Moreover, we show that European markets and issuers lead this development, while private sector entities are increasingly making use of green bond markets as a source of funding. On the other hand, funding from green bond markets has been directed to few sectors of the economy, underlining the need for some policy-related initiatives. The increase in green bond issuance has come during a period of easy financial conditions, which could further highlight the need for policy initiatives aimed at enhancing the provision of incentives to investors towards green financing in the present changing financial market landscape. The improvement of the credibility, comparability and transparency of ESG ratings and assessments of CRAs is important to support sound investment decision-making and risk management, including those of central banks, which are increasingly incorporating climate change issues in their operations.

Keywords: green bonds; green finance; ESG; credit ratings; greenwashing

JEL classification: G10; G20; O16

DOI link: https://doi.org/10.52903/econbull20225504

ΠΡΑΣΙΝΗ ΧΡΗΜΑΤΟΔΟΤΗΣΗ ΣΤΗΝ ΕΥΡΩΠΗ: ΑΝΑΠΤΥΞΗ ΚΑΙ ΠΡΟΚΛΗΣΕΙΣ

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ΠΕΡΙΛΗΨΗ

Η αντιμετώπιση της κλιματικής αλλαγής μέσω μέτρων μετριασμού και προσαρμογής απαιτεί αλλαγές στις πολιτικές, τις τεχνολογίες και τις καταναλωτικές συμπεριφορές προς ένα μοντέλο ανάπτυξης χαμηλών εκπομπών. Αυτές οι διαρθρωτικές αλλαγές απαιτούν και τις κατάλληλες χρηματοοικονομικές λύσεις, προκειμένου να αυξηθούν οι χρηματοοικονομικές ροές που στηρίζουν τη βιώσιμη ανάπτυξη. Η παρούσα μελέτη εστιάζει στην Ευρώπη και εξετάζει το ρόλο των χρηματοπιστωτικών αγορών στη διαδικασία μείωσης των εκπομπών αερίων του θερμοκηπίου και στην προώθηση του μετριασμού και της προσαρμογής στην κλιματική αλλαγή. Οι παγκόσμιες αγορές πράσινων ομολόγων έχουν αναπτυχθεί ραγδαία το τελευταίο διάστημα. Με βάση δεδομένα για την έκδοση και τον εκδότη, διαπιστώνουμε ότι η δραστηριότητα της παγκόσμιας αγοράς για τη χρηματοδότηση έργων στο πλαίσιο έκδοσης πράσινων ομολόγων έχει επιταχυνθεί τα τελευταία χρόνια, με τα συνολικά ποσά των ομολόγων που εκδόθηκαν την περίοδο 2019-21 σχεδόν να τριπλασιάζονται σε σύγκριση με την περίοδο 2014-18. Επιπλέον, δείχνουμε ότι οι ευρωπαϊκές αγορές και οι Ευρωπαίοι εκδότες ηγούνται αυτής της εξέλιξης, ενώ οι οντότητες του ιδιωτικού τομέα χρησιμοποιούν όλο και περισσότερο τις αγορές πράσινων ομολόγων ως πηγή χρηματοδότησης. Ωστόσο, η χρηματοδότηση από τις αγορές πράσινων ομολόγων κατευθύνεται σε λίγους μόνο τομείς της οικονομίας, γεγονός που υπογραμμίζει την ανάγκη ανάληψης πρωτοβουλιών από την πλευρά της πολιτικής. Η αύξηση της έκδοσης πράσινων ομολόγων σημειώθηκε σε μια περίοδο ευνοϊκών χρηματοπιστωτικών συνθηκών, γεγονός που ενισχύει περαιτέρω την ανάγκη για πρωτοβουλίες πολιτικής με στόχο την παροχή κινήτρων στους επενδυτές για πράσινη χρηματοδότηση στο παρόν μεταβαλλόμενο τοπίο της αγοράς. Οι επενδυτικές στρατηγικές επικεντρώνονται πλέον σε κριτήρια περιβαλλοντικά, κοινωνικά και διακυβέρνησης (ESG), έτσι ώστε οι επιχειρήσεις να αναδεικνύουν την καλύτερη διαχείριση του κλιματικού κινδύνου, το βελτιωμένο περιβαλλοντικό αποτύπωμά τους, αλλά και την αξία που δημιουργούν για την κοινωνία. Η αύξηση της αξιοπιστίας, της συγκρισιμότητας και της διαφάνειας των αξιολογήσεων ESG των οργανισμών πιστοληπτικής αξιολόγησης είναι σημαντική για την ορθή λήψη επενδυτικών αποφάσεων και διαχείριση κινδύνων εκ μέρους των επιχειρήσεων, αλλά και εκ μέρους των κεντρικών τραπεζών, οι οποίες ενσωματώνουν ολοένα περισσότερο παραμέτρους της κλιματικής αλλαγής στις δραστηριότητές τους. Η ανάπτυξη κοινών προτύπων, σημάτων βιωσιμότητας και κριτηρίων αξιολόγησης πιστοληπτικής ικανότητας θα συμβάλει σε πιο εμπεριστατωμένες αξιολογήσεις και αποφάσεις για τη χρηματοδότηση και θα ενισχύσει την αξιοπιστία των αγορών, ενώ θα μειώσει τον κίνδυνο χρήσης ψευδεπίγραφης οικολογικής ταυτότητας (greenwashing). Παράλληλα, η εφαρμογή ψηφιακών τεχνολογιών στην πράσινη χρηματοδότηση μπορεί να στηρίξει τη βιώσιμη ανάπτυξη, μέσω της αύξησης των χρηματοδοτικών πόρων και της μείωσης του κόστους πράσινης μετάβασης.

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I INTRODUCTION

Climate change is one of the most pressing issues of our time. The Paris Agreement, a legally binding international treaty on climate change that was adopted by 196 parties in 2015, aims to limit global warming to well below 2 degrees Celsius (preferably to 1.5˚) compared with pre-industrial levels. Meeting the Paris objectives requires sustained action over many decades to reduce or prevent the emissions linked to human activities and demands a reshaping of the global economy towards a more sustainable growth model. Realising deep decarbonisation of economies to mitigate climate change needs innovative approaches, coupled with financial solutions to scale up financial flows that support sustainable development.[1]

The EU's initial commitment was to reduce greenhouse gas (GHG) emissions by at least 40% by 2030 compared with 1990. In September 2020, the European Commission (EC) proposed to raise the 2030 GHG emissions reduction target to at least 55% relative to 1990. The 40% target is implemented through the EU Emissions Trading System (EU ETS), the world's first major carbon market set up in 2005.[2] The EU ETS has proven to be an effective tool in driving emissions reductions cost-effectively: installations covered by the system reduced emissions by 42.3% in the period 2005-20. However, the tightening of the overall EU emissions target to 55%, compared with 1990, necessitates steeper GHG emissions reductions.

Largely focusing on the European dimension, this paper considers the respective role of financial markets in the process of mitigating GHG emissions and promoting adaptation to climate change. Well-functioning and integrated capital markets would complement banks as an effective source of financing sustainable growth and would thus improve the allocation of capital in the economy, facilitating entrepreneurial, risk-taking activities and investment notably in green technologies and other long-term projects. Green bonds can play a significant role when it comes to financing a more sustainable European economy.

The EU green capital markets are dynamic and rapidly growing, which may foreshadow the intensification of investment efforts in sustainable projects and the increase of green bond issuance in the future. The EU green bond markets are characterised by a higher degree of integration and investors' preference for cross-border holdings (limited "home bias"), which may also be attributed to the lack of domestic supply of green bonds (European Central Bank 2022). Furthermore, investment funds that meet environmental, social and governance (ESG) criteria appear to be more stable, as, compared with other types of collective

* Warm thanks are extended to Hiona Balfoussia, as well as to all participants in the Economic Analysis and Research Department meetings for their very useful remarks and comments. The views expressed in this article are of the authors and do not necessarily reflect those of the Bank of Greece. The authors are responsible for any errors or omissions.

1 Communication from the Commission, The European Green Deal, 11.12.2019.

2 The EU ETS operates in all EU countries plus Iceland, Liechtenstein and Norway, limits emissions from around 10,000 installations and covers around 40% of the EU's greenhouse gas emissions. It is a "cap and trade" system whereby, within a cap set on the total amount of certain greenhouse gases than can be emitted by the installations covered by the system, installations buy or receive emissions allowances, which they can then trade with one another as needed. The system operates in trading phases and is currently in Phase IV (2021-30). See https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets_en.

investment undertakings, investors are less likely to withdraw their investments after a negative performance (Alogoskoufis et al. 2021; Capota et al. 2021).

In this paper, we describe the development of green bond markets during the past decade, by using a large security-level dataset, including issue- and issuer-specific characteristics. We find that the market activity for financing projects within the scope of a green bond issuance has accelerated over the past few years, with the aggregate amount of bonds issued in 2019-21 standing at about three times the aggregate amount of bonds issued in 2014-18. Moreover, we also find that (a) Europe, as a location of both green bond markets and green bond issuers, has a leading role in this development and (b) private sector entities are increasingly making use of green bond markets as a source of funding. On the other hand, we also find that funding from green bond markets has been directed to few sectors of the economy; a finding that may underline the need for policy-related initiatives, in order to involve more sectors of the economy. Finally, we note that the increase in green bond issuance has come during a period of easy financial conditions; this stylised fact may highlight the need for policy initiatives providing investors with incentives to continue their green financing in the present changing market landscape.

The rest of the paper is structured as follows: Section 2 describes briefly the green capital markets in the European Union, outlining EU actions on financing sustainable growth and the landscape of the EU green bond market. Section 3 investigates how ESG criteria are embedded in the current credit ratings and how they are related to green bonds. Section 4 addresses some forward-looking issues related to the risk of greenwashing, describing a number of EU initiatives in this direction, explains the role of central banks in combatting climate change and touches on the role of digital finance. Finally, Section 5 presents the concluding remarks of this study.

2 GREEN FINANCING

2.1 EU ACTION ON FINANCING SUSTAINABLE GROWTH

The EU's main growth strategy to transition to a sustainable economic model is the European Green Deal presented by the EC on 11 December 2019, with a promise to make Europe the first climate-neutral continent by 2050, while ensuring that no one is left behind.[3] In July 2021, the EC released the 2030 Climate Target Plan to further reduce net GHG emissions by at least 55% by 2030 ("Fit for 55").[4] Taking into account that renewables are a cheap, clean and potentially endless source of energy, the present environment of rising energy prices, amid a geopolitical turmoil following Russia's invasion of Ukraine, intensifies the need for a clean energy transition. In this respect, the EU presented REPowerEU, a joint European action for more affordable, secure and sustainable energy and independence from Russian fossil fuels well before 2030.[5]

To achieve the goals set by the European Green Deal, the EC has pledged to mobilise at least EUR 1 trillion in sustainable investments over the next decade, requiring an unprecedented shift in both public and private funds to finance the transition. According to the Sustainable Europe Investment Plan (also known as the European Green Deal Investment Plan), private and public sustainable investments will be mobilised over the next decade through the EU budget, together with additional resources under the InvestEU programme.[6] It is also estimated that Europe will need around EUR 350 billion of annual extra investment to meet its

3 Communication from the Commission, The European Green Deal, and Annex to this Communication, 11.12.2019.
4 Communication from the Commission, "Fit for 55": delivering the EU's 2030 Climate Target on the way to climate neutrality, 14.7.2021.
5 REPowerEU: Joint European action for more affordable, secure and sustainable energy, press release of 8.3.2022.
6 Communication from the Commission, Sustainable Europe Investment Plan, 14.1.2020. The plan is accompanied by the Just Transition Mechanism, which will mobilise investments of at least EUR 143 billion to support the regions which are heavily reliant on emission-intensive activities to transition to new economic activities, as it is important that no one is left behind towards the path to a climate-neutral Europe by 2050.

2030 emissions target in energy systems alone. This is in addition to around EUR 130 billion for other environmental goals. A combination of funds from the EU budget, as well as public and private investments is therefore required. The EC has emphasised that it will continue to work on how to further mobilise resources to meet the objective of climate neutrality. Capital markets are thus an integral part of this process.

To help improve the flow of direct investments towards financing the transition, the EC has adopted a new strategy for financing the transition to a sustainable economy, which includes actions in a number of areas.[7] Furthermore, sustainability, along with digital growth, is at the heart of the EU's recovery plan from the coronavirus (COVID-19) pandemic towards a greener, more digital and more resilient Europe.[8] Through its 2021-2027 long-term budget (Multiannual Financial Framework – MMF) and the NGEU instrument, the EU intends to spend up to EUR 605 billion in projects addressing climate crisis and EUR 100 billion in projects supporting biodiversity. Of the EUR 750 billion allocated for the NGEU, the EC intends to issue up to EUR 250 billion, or 30%, in green bonds by end-2026, making the EU the largest green bond issuer in the world.[9]

Also, emerging technologies could be used to support green finance. The EC has in fact stressed the need to take advantage of the opportunities offered by digital technologies for sustainable finance.[10] Moreover, as highlighted by the objectives and conclusions of the 26th Conference of the Parties on Climate Change (COP26) in 2021, there is a clear link between sustainable finance and technological innovation.[11] Technology provides solutions to channel finance towards sustainability objectives, while deployment of technology could contribute to a better monitoring of compliance with the relevant green standards and requirements.

Overall, the shift to net zero emissions and the digital transition require major investments, and public budgets will fall far short of the required funding.[12] Capital markets can provide innovative tools to close the investment gap. At present, compared with other parts of the world, euro area non-financial corporations seem to rely more on banks than on capital markets for funding, which, among other reasons, might be attributed to the tax bias towards debt finance over equity and the preference for shorter-term funding commitments. However, investments for sustainable growth and innovation technologies have certain characteristics that may be less suited for bank lending such as their relatively high-risk profile and their long maturity, which may not be available in the banking sector (see for example De Haas and Popov 2019). Moreover, cross-border integration of finance in the euro area is limited mainly due to national institutional differences, such as differences in insolvency laws. These create impediments to mobilising all available resources —both banking and non-banking— to finance the green transition. In this respect, additional efforts in deepening and integrating the EU's capital markets through the completion of the Capital Markets Union (CMU) is of strategic importance to the European economy (European Commission 2020).

For the EU to deliver the twin transition towards a green and digital economy, and mobilise the necessary resources to get there,

7 Communication from the Commission, Strategy for Financing the Transition to a Sustainable Economy, 6.7.2021.
8 In particular, the Recovery and Resilience Facility (RRF) Regulation requires each Member State to dedicate at least 37% of its recovery and resilience plan total allocation to climate objectives and 20% to digitalisation objectives.
9 Furthermore, up to EUR 100 billion (of which EUR 91.8 billion had already been disbursed by 22 March 2022) of EU SURE bonds will be issued as social bonds.
10 See footnote 7.
11 The global debate on how emerging technological innovations could be used to support green financing began in 2014, when the United Nations Environment Programme (UNEP) launched an Inquiry into the Design of a Sustainable Financial System. In 2016, green finance attracted the interest of G20 leaders, as the G20 Green Finance Study Group was established under the Chinese chairmanship.
12 The Digital Compass proposed by the Commission sets out the Union's digital targets for 2030. To achieve these ambitions, the EU needs to step up investments in key digital technologies, as well as in the relevant skills. To foster the digital transition, a 2020 estimate shows that additional investments of around EUR 125 billion are needed per year. The digital transition will also contribute to the green objectives, with synergies in many areas of a smart circular economy. See https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1467.

market financing —which is much less developed relative to international peers— should be furthered. It is important to align the financial system with sustainable development and address risks related to climate change. In this respect, in 2018, the EC developed an initial action plan on financing sustainable growth with ten key actions envisaged.[13] Following that, on 6 July 2021, the EC published the Renewed Sustainable Finance Strategy, which includes four areas where additional actions are needed to create the enabling framework for private investors and the public sector to facilitate sustainable investment.[14] The EU since 2018 has been establishing the building blocks for a sustainable financial system, including the Sustainable Finance Taxonomy Regulation (Taxonomy Regulation), the Sustainable Finance Disclosure Regulation, the Corporate Sustainability Reporting Directive and the European Green Bond Standard.

2.2 WHAT IS A GREEN BOND?

In the light of the critical role of the financial sector for providing sufficient funds, sustainable finance is receiving more attention. Sustainable finance is a broad term, which usually refers to the process of taking ESG considerations into account when making investment decisions in the financial sector. Environmental considerations might include climate change mitigation and adaptation as well as other factors, such as the preservation of biodiversity, pollution prevention and the circular economy. In the EU's policy context, sustainable finance has a key role in delivering the EU's commitments on climate and sustainability objectives. It is understood as "finance to support economic growth while reducing pressures on the environment and taking into account social and governance aspects".[15] Within the context of sustainability, there are manifold ways of defining green finance: "Green finance involves collecting funds for addressing climate and environmental issues (green financing), on the one hand, and improving the management of financial risk related to climate and the environment (greening finance), on the other".[16] Green finance is growing fast through various financial instruments available to issuers and investors, such as green bonds, green loans, sustainable bonds, sustainability-linked bonds and sustainability-linked loans, blue bonds, and social bonds.

Green bonds are part of the universe of sustainability-related fixed-income instruments aimed at financing predetermined projects that support environmental objectives. They differ from conventional bonds in that the use of proceeds is specified in their terms when issued, with impact reporting provided thereafter. However, they rank *pari passu* to non-green bonds, as the credit risk is that of the overall company, and not of the individual project (Cong et al. 2020). As such, they are by and large legally binding for the issuer as any other bond, which means that a breach in the terms and conditions of the issue may result in the default of the issuer. This is not to say that if a project financed by the market fails to meet its environmental objectives, this will lead to a default; in fact, there has been no default of a green bond issuer, due to a breach of the environmental purposes of the issue. On the other hand, it is frequent to incorporate a penalty premium to be paid by the issuer, if the environmental goals, set out in the prospectus distributed to investors, are not met. In this way, even indirectly, green bonds incorporate a mechanism to enforce their environmental goals.

There is no official or mandatory labelling framework for green bonds. On the other hand, green bonds may be distinguished into those that are labelled as green by international financial market associations, or other accepted third parties, and those self-labelled as green by the bond issuers. The first category includes those bonds that comply with a framework of principles, such as the Green Bond

13 https://ec.europa.eu/info/publications/sustainable-finance-renewed-strategy_en#action-plan.
14 https://ec.europa.eu/commission/presscorner/detail/en/ip_21_3405.
15 https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/overview-sustainable-finance_en#what.
16 https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/679081/EPRS_BRI(2021)679081_EN.pdf.

Principles of the International Capital Market Association (ICMA)[17] or the Climate Bonds Standard of the Climate Bonds Initiative.[18] These frameworks are based on four pillars: use of proceeds; project evaluation and selection; management of proceeds; and impact reporting. A verification by an external party —for example, from auditors or credit rating agencies (CRAs)— is often obtained to evaluate the compliance of the instrument with the framework at pre- and post-issuance, verifying the allocation of funds to eligible green projects. Reporting is provided on a regular basis to provide information on the use of proceeds, the activities financed and the impact of the financed activities using qualitative and quantitative indicators, where possible.

Three methods are commonly used to label a bond as green: the use of proceeds model; the counterparty profile model; and the hybrid model.

- The use of proceeds model considers how the proceeds of the bond will be used and the issuer may only use the funds raised to finance projects with an earmarked environmental purpose. The proposed European Green Bond Standard is based on this model.

- The counterparty profile model considers how the proceeds of the model will be used to finance the general operations of the issuer (rather than specific projects) with explicit sustainability targets which are linked with the bond terms (for example, achievement of climate-related goals).

- The hybrid model considers both the use of proceeds of the issuance and the issuer's profile. For example, the proceeds from transition bonds may help a company to improve its environmental and sustainability profile.

Despite the fact that the interest in sustainable investment is increasing, the lack of hard and comparable environmental data limits the ability of investors to make informed decisions that reflect environmental issues. In this regard and as a response to the need for establishing a clear set of criteria on how to assess the true "greenness" of green bonds and foster investor confidence, the EC proposed a European green bond standard (EUGBS) in July 2021. In addition, the EU Taxonomy provides a framework with criteria to be considered for labelling activities as "sustainable" although there is still room for improvements, for example in the scope and the application of the framework, in order to facilitate capital flows towards green investments and projects that support transition. The development of common standards and labels for green bonds will increase transparency and comparability, supporting the scaling-up of financing for green investments, and it may enhance the credibility of markets, reducing also the risk of so-called "greenwashing" (for example, if a product is labelled as green when such claim is not true; see also Section 4.1). Furthermore, the improvement of corporate practices for sustainability and the increase of the relevant disclosures, e.g. the obligation of companies to make public their GHG emissions reduction targets and environmental performance, will help to direct investments towards financing the transition to a low-emissions economy.

2.3 GREEN BOND MARKETS

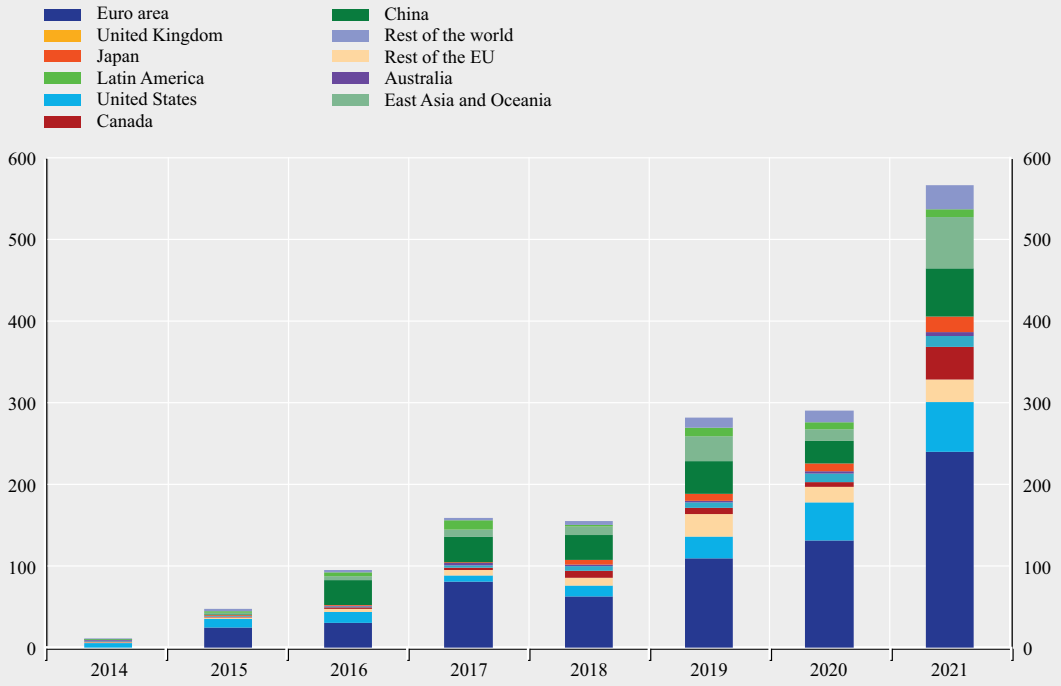
The EU can already be considered to have a lead among the green capital markets. At present, the green bond market displays a higher degree of integration across the euro area than the aggregate bond market. Green bonds are roughly twice as likely as other types of bonds to be held cross-border within the euro area. However, this may be attributed to the lack of domestic supply in those Member States where green bond markets are underdeveloped, since as soon as domestic green bond markets become available, the level of integration decreases for these instruments as well.

At the beginning of 2022, the green bond market has seen a remarkable growth, with USD

17 ICMA, Green Bond Principles, June 2021.
18 Climate Bonds Standard.

Chart 1 Issuance activity in the global green bond markets

(USD billions)



Sources: Refinitiv and Bank of Greece.
Notes: The bars present the annual amounts (in USD billions) raised in bonds that are classified by Refinitiv as green, from 2014 to 2021, per country of residence of the bond issuer and per year of bond issuance. Then, selected countries are grouped according to geoeconomic criteria (e.g. bonds issued by euro area issuers are grouped into the category "Euro area", bonds issued by entities located in Latin American countries are grouped into "Latin America", and so on). In total, 5,531 individual bonds have been grouped into the categories mentioned in the chart label.

1.61 trillion in cumulative issuance since 2014. Global annual issuance has increased each year since 2014, accounting for a total value of USD 470 billion over the period 2014-18 and USD 1.14 billion from 2019 onwards (see Chart 1). In 2021 alone, green bonds totalling USD 567 billion were issued, an amount higher than the total value of issuances for the period 2007-18 and more than double the value of green bonds issued in 2019 and 2020.

It is also worth noting that besides green bonds, sustainability and social bond issuances account for about a third of the outstanding issuances of the green bond market each. For social bonds, France is the largest issuer, followed by supranationals, the United States, South Korea, Chile and Japan. At a regional level, the EU is the leading issuer. For sustainability bonds, supranationals are leading the growth of issuances, followed by the United States, South Korea, France and the United Kingdom. At a regional level, the EU is again the leading issuer (see also Climate Bonds Initiative 2021).

The large growth of the green bond market and the acceleration of the corresponding issuance activity are largely driven by the euro area capital markets. Specifically, in 2021, out of the USD 567 billion of international green bond issues, USD 321 billion was issued in the euro area. Of this, USD 219 billion was issued by euro area issuers in euro area markets, while another USD 21 billion has been issued by euro area residents abroad. Since 2014, USD 703 billion has been issued by euro area governments and companies based in a euro area

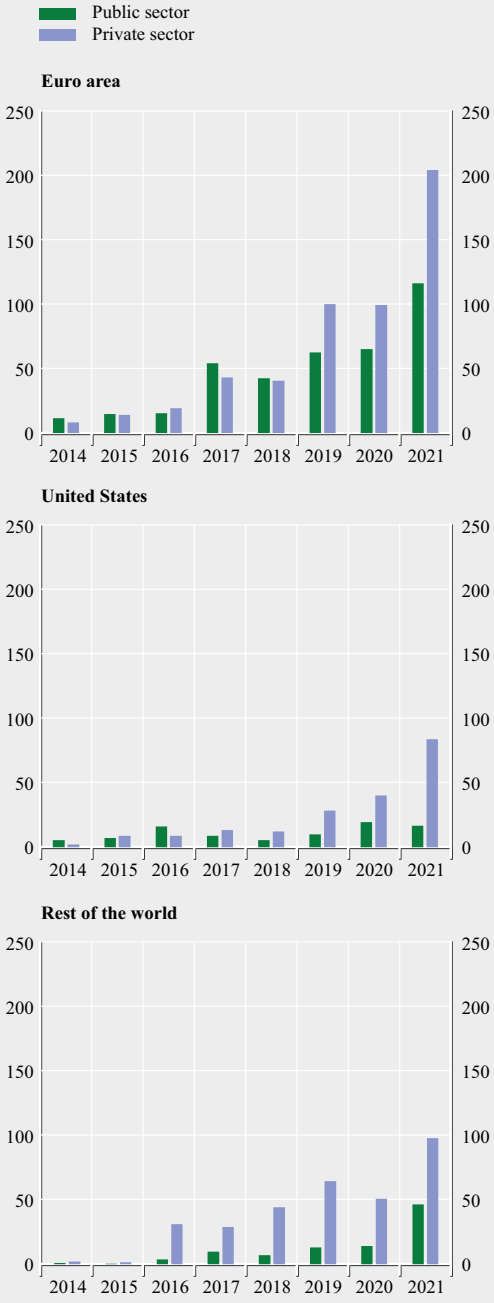
country irrespective of the market of issuance, while USD 564 billion has been issued in euro area bond markets. Including non-euro area bond issuers, green bond issuance in euro area markets in 2014-21 stood at USD 915 billion. This observation shows that the euro area green bond markets have a more international scope. In terms of individual countries, the United States was the largest issuer of green bonds outstanding in 2021, followed by China, Germany, France and the United Kingdom.

Green bond issuances are increasingly carried out by the private sector, while public sector issuances (states, regions and related entities) continue to provide funding for projects and investment programmes related to broader sustainability goals (see Chart 2). This development is encouraging, as long as the trend continues and European companies lead the way in financing sustainable productive activities. From an economic perspective, the heavy bond issuance from the European private sector may be an indication of an acceleration of investments towards achieving the goals of sustainable growth, which these bonds finance. Investments in turn will enable the transition of the underlying economies to more sustainable forms of production. Nevertheless, taking into account that production in today's globalised world is interlinked across regions, the lag of the private sector in other regions of the world is not encouraging with regard to the dynamics of the transition towards greener forms of production on a global scale.

The characteristics of the new bonds issued per year also suggest that the euro area green bond market has the potential to contribute to the economic transition of the European economy towards a greener and more sustainable economic model. In particular, green and sustainable bonds issued by euro area entities have a long-term maturity, with the median maturity of bonds issued since 2013 being 12.6 years. In the years after the signing of the Paris Agreement in 2015, the weighted average maturity of new bonds issued per year rose from 9.9 to 15 years in 2021 (see top panel of Chart 3). The

Chart 2 Green bond issuance per sector of the economy

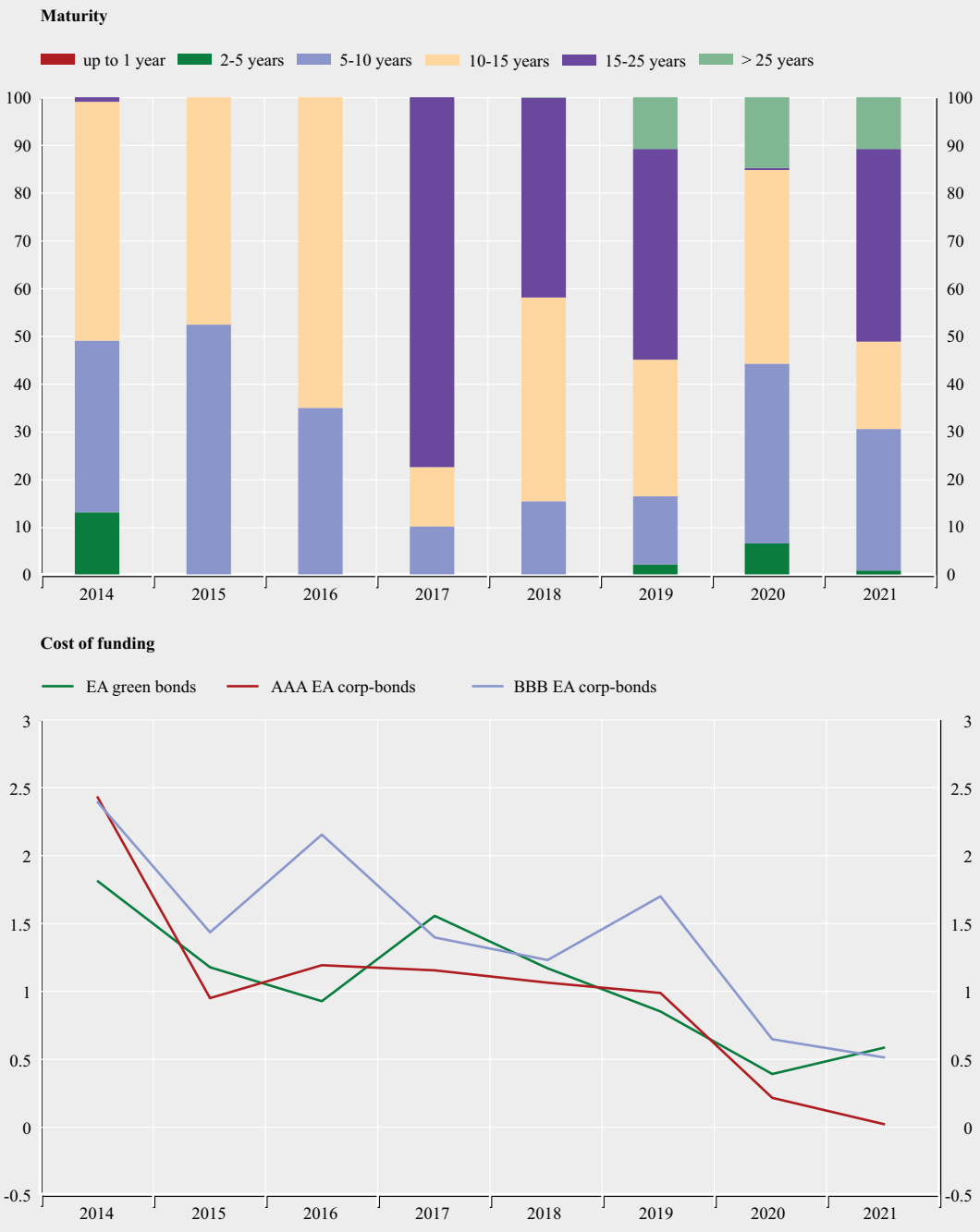
(USD billions)



Sources: Refinitiv and Bank of Greece.
Notes: The chart distinguishes the bond issues presented in Chart 1 into issues carried out by public- and private-sector entities residing in euro area countries (top panel), the United States (middle panel) or other countries (bottom panel). The public sector comprises the general government, as well as sub-sovereign entities, municipalities, regions or federal states, etc. The private sector includes both financial and non-financial corporations.

Chart 3 Characteristics of green bonds issued by euro area entities

(%)



Source: Refinitiv.
Notes: The top panel presents the distribution of the term to maturity at issuance of new bonds issued in the years indicated on the horizontal axis; term to maturity has been classified into maturity buckets according to standard bond market practice. The percentage rates have been calculated based on the sum of the amounts of bonds issued and falling into each maturity bucket to the total amount of green bonds issued in that year. The bottom panel presents the average coupon rate of green bonds issued by euro area entities per year, weighted by the amount at issuance (green line). This is compared with the yield of bonds issued by euro area non-financial corporations (iBoxx EA NFCs: AAA-red line and BBB-purple line).

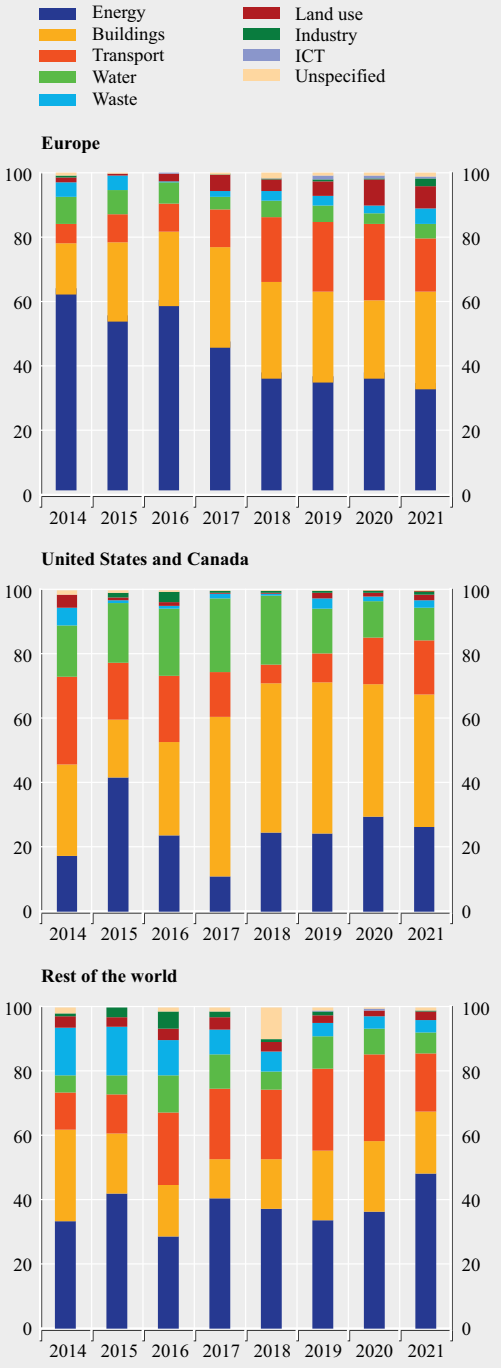
prolonged maturity of the newer bond issuances may have important economic implications, as the longer horizon provides stable funding for long-term investment plans and projects. Thus, it may provide a suitable type of long-term financing to euro area entities towards achieving their energy transition goals for the next decades.

From the bottom panel of Chart 3 it is evident that the coupon rate charged on new green and sustainable bonds issued by euro area entities is firmly lower than the yield of the BBB-rated euro area corporate bonds. This may imply that either the cost of green bond issuance is somewhat better than that of the euro area corporate bonds, on average, or that the companies that issue green bonds are of better credit quality than the average euro area corporation. At the same time, it is evident that the downward trend of the cost of funding of green bonds has been a development that cannot be isolated from the overall market conditions, as our sample only includes a period of exceptionally easy monetary and financial conditions. So, even if there are some indications that the coupon rates of green bonds have declined and that they compare to the yields of investment grade (IG) bonds, the tighter connection to the BBB category and the close association to broader market trends do not support the existence of a "greenium", i.e. a premium paid by investors to the issuing companies, in order to incentivise their transition towards greener forms of production.

According to the latest available report of the Climate Bonds Initiative for 2021, in terms of the activities funded by the issued green bonds (i.e. based on the use of proceeds model), these were mainly concentrated in the sectors of energy, buildings —around one third each— and transport —about one fifth— altogether accounting for 81% of the issuances of green bonds. In order to gauge the contribution of funding to the effort to transform the global economy towards a greener and more sustainable model, Chart 4 shows the sectoral distribution of private sector entities issuing

Chart 4 Corporate green bonds: breakdown by sector of issuer

(%)



Source: Climate Bonds Initiative.
Notes: The chart shows the distribution of green bonds issued by corporate entities according to the issuer's sector. The classifications of geographical regions and corporate sectors are those reported in the Climate Bonds Initiative database, based on the "use of proceeds" filter.

green bonds. The labelled green bonds are consistent with a framework, such as that of the Climate Bonds Initiative, and include commitments to use the proceeds of the bond issuance in activities that are aligned with certain environmental objectives. Thus, a high issuing activity in a particular sector relative to the other economic activity sectors might indicate that this sector is in the lead of investing in green activities.

As shown in Chart 4, the taxonomy of the private sector entities issuing green bonds is quite different across geographical regions. Up to 2015 when the Paris Agreement was signed, the energy sector dominated the green bond issuance activity in Europe. Since then, the construction (buildings) and transport sectors have accelerated their bond issuances and in 2021 they accounted for almost half (47%) of total green bonds issued by the European private sector. The construction sector is also the largest green bond issuing sector in the United States and Canada, while the energy sector remains the main green bond issuing sector in the rest of the world.

The above might provide evidence that in Europe green bond issuance is financing activities related, for example, to (i) the growth of greener energy technologies; (ii) the improvement of the energy-efficiency of buildings; and (iii) the development of greener forms of transportation. In other words, it seems that in the future the European economy could rely more on renewable and green forms of energy, more energy-efficient buildings and a possibly more electrified transport sector, with gradual declines in emissions in line with the targets of the European Green Deal and the "Fit for 55" package for reducing GHG emissions by 55% by 2030 compared with the 1990 level.

3 ESG CRITERIA AND CREDIT RATINGS

ESG criteria represent a significant parameter that has the potential to reward sustainable and responsible business practices. Overall, the term ESG refers to a wide range of issues related to the sustainability of an organisation and to the impact of its business, investments and activities on the environment and the society. Recent literature focuses on whether good performance on ESG indicators, which are relevant to an entity, can reduce corporate risks, generate long-term value for shareholders and improve corporate performance (see among others Eliwa et al. 2011; Goss and Roberts 2011). According to empirical findings, firms with a strong ESG profile tend to have lower idiosyncratic risks and higher risk-adjusted returns. Moreover, key parameters of the ESG criteria, such as strong institutions, seem to play an important role in sovereign borrowing costs (Capelle-Blancard et al. 2019). This is attributable to the improvement of relations among all stakeholders and the achievement of long-term goals.[19] On the other hand, there are indications in the literature that, depending on the economic activity sector, an investment which is based on ESG criteria can achieve a maximum average performance, but can also be less profitable (e.g. Auer and Schuhmacher 2016).

Given the above evidence, financial institutions, asset managers and CRAs consider ESG criteria in their assessments of investment and borrowing costs as important non-financial information (see for example Kiesel and Lücke 2019). Major CRAs have adopted principles for the incorporation of ESG credit factors into their credit rating analysis. Indicatively, some factors taken into account by CRAs when assigning credit ratings are the following: (i) carbon emissions; (ii) demographic and other social trends; and (iii) the quality of institutions of the country of residence. A number of research papers have examined the importance of incorporating non-financial information, including ESG factors, into credit ratings. Corporate governance —proxied by characteristics of board structure and internal procedures— seems to affect firms' creditworthiness (Ash-

19 See *inter alia* Heinemann et al. (2014); Lee and Faff (2009); El Ghoul et al. (2011); Eccles et al. (2014); Verheyden et al. (2016).

baugh-Skaife et al. 2006). There is a strong positive correlation between governance and sovereign/corporate credit ratings, as good governance reduces default risk, lowers agency costs and reduces information asymmetry (Bhojraj and Sengupta 2003). Furthermore, firms that perform better in terms of sustainability are often assigned higher ratings. Overall, there is a positive effect of the ESG scoring on credit ratings.[20] With regard to the impact of the different pillars of ESG scoring on credit ratings, results are mixed in the literature and there seems to be a spatial diversification.[21]

3.1 ESG RATING ASSESSMENTS

Increasing appetite for investments in sustainable financial products and the need for a better monitoring of corporate governance has led to a revision of credit rating methodologies, with a view to incorporating climate and environmental risks. In fact, the environmental pillar, the first pillar of the ESG criteria, has garnered interest from the society, the regulatory and supervisory authorities, as well as the investment community. Legal entities (governments and businesses) that manage environmental issues more effectively are considered as more resilient to long-term risks, while a government's creditworthiness is also influenced by its ability to cope with environmental risks, such as natural disasters, as well as long-term risks related to climate change.

The process for providing ESG data and ratings could by summarised as follows: entities disclose ESG qualitative and quantitative data and information to the public. These may be mandatory (e.g. under the Non-Financial Reporting Directive in the EU[22]) and/or voluntary disclosures (such as disclosures under the UN Principles for Responsible Investment – PRI) and sometimes they are reviewed by an independent party. Data are usually backward-looking but might also include some forward-looking aspects, such as targets for emissions reductions. Data providers collect, analyse and clean data. The ESG data might be supplemented by additional data, for example media reports, other relevant data collected via machine learning and artificial intelligence techniques, third-party data, as well as information obtained from exchanges with entities being assessed. The data may undergo some quality assurance review before sold to rating providers and/or end users. Codes of conduct are typically in place to limit the risk of conflict of interest.

As for the ESG ratings, rating providers typically establish a methodology under which a set of relevant ESG issues is identified for the entity or the instrument being assessed, and some indicators —like Key Performance Indicators— are defined to be used for evaluation. A weighting and scoring process is developed then, in order to perform the assessment. ESG issues are given a weight to reflect their importance on the final rating. A score may be assigned as a grade or point, using qualitative and/or quantitative metrics. ESG ratings may be provided as an entity's score relative to its peer group and/or as an absolute score. Overall, ESG rating providers follow diverse practices, whereby ESG ratings may cover criteria across all or some of the ESG pillars and may be largely distinguished between ratings assessing the exposure to ESG risks and the relevant risk management practices and those assessing the impact of an entity on ESG factors. Providers may review their methodologies and update their ESG ratings annually, or more frequently for some of them.

ESG criteria are integrated into credit ratings, according to the methodology applied by CRAs; essentially, the governance parameters are included directly in the quantitative stage, while environmental and social factors may be

20 For instance, regarding the relationship between ESG measurements and S&P credit ratings in the long term, see Attig et al. (2013) and Cubas-Díaz and Martínez Sedano (2018). It is worth noting, however, that the effect of ESG scores on Moody's credit ratings seems to be small; see Kiesel and Lücke (2019).

21 Both environmental and social scorings seem to have an impact on firms' credit standing in North America, while for firms in Europe this applies only to social scoring. See Dorfleitner et al. (2020).

22 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014L0095.

taken into account as well, by quantifying their impact on the other rating variables. All three parameters are also taken into account during the qualitative assessment phase.[23] However, it should be noted that a direct and full-scale estimation of the quantitative impact of environmental criteria on scoring is an ongoing project. Environmental criteria are integrated into credit ratings mainly during the second stage, at which considerations on the rating of an entity is based on the long-term prospects and risks faced. Each entity is ranked in terms of exposure to environmental risks and the final result of the integration of environmental factors into credit rating may be either positive or negative. For instance, climate change risks negatively affect to a considerable extent states and firms heavily reliant on fossil fuels, but this is not the case for entities whose financial results rely on the production of energy from renewable energy sources. The overall effect on credit ratings in most times is negative, as concerns about the impact of the climate crisis are usually assessed as "credit weaknesses".

For sovereign debt assessments, according to the PRI, environmental factors related to sovereign debt can be grouped into four categories: (i) natural resources; (ii) physical risks; (iii) energy transition risks; and (iv) energy security. Credit rating agencies monitor environmental factors falling under the aforementioned categories. Specifically, they assess country credit risk on the basis of environmental criteria such as: GHG emissions and air quality; energy management; water resources and management; biodiversity and natural resources management; natural disasters and climate change; carbon transition; waste and pollution.

In order to extract the impact of environmental criteria on a firm, the assessment is carried out first at the economy-wide level and then at the sector level. So, besides the environmental footprint of the firm, the assessment of the environmental criteria of the firm's resident economy is also of particular importance. The process includes the scoring of the expected impact on the geographical region or regions in which the firm operates, the sector or sectors from which the largest part of the firm's income is generated, and finally the firm itself. Consequently, it is clear that the assessment of environmental criteria for the economy, which are incorporated to some degree in the credit rating of the respective sovereign entity, has some impact on firms' credit ratings as well. Moreover, sovereign credit ratings are of particular importance for the ratings of firms and financial institutions (both banks and non-banks), as they constitute a point of reference or a country ceiling, on the basis of which the other entities residing or operating in such economies are rated. It is worth noting that in the assessment of environmental criteria, equally important with the frequency of natural phenomena is their prevention and management, i.e. the adaptation measures. Respectively, issues such as the resilience of infrastructures are also considered in the score assigned to a country.

Governance indicators have stood out as the most important ESG factors in credit ratings. Integrating ESG parameters other than governance is more difficult, since so far there is no standardisation in the measurement and disclosure of climate risk-related information by entities. This highlights the importance of harmonising (i) what constitutes a robust ESG assessment and (ii) what ESG metrics and methodology to use, in order to reduce information asymmetries and gaps. At the same time, the pandemic has narrowed the focus on the social pillar, owing to the effects of the crisis on the working population and the civil society.

In terms of the market of ESG rating providers, the European Commission (2021) study on sustainability-related ratings, data and research found that at least 30 to 40 approved ESG rating providers were operating at that time in Europe. The study documented several challenges facing ESG rating providers,

23 For a more detailed analysis of the methodologies for state entities, see Malliaropulos and Migiakis (2020).

such as low transparency, problems with timeliness, accuracy and reliability, bias, conflicts of interest, and the general lack of clear and consistent terminology. This confirms previous research on metrics covering ESG criteria, e.g. Berg et al. (2022), which showed considerable heterogeneity among ESG ratings delivered by different providers. Bingler et al. (2021) studied the convergence of the assessments of firms' exposure to climate risk provided by existing metrics and found significant heterogeneity between different metrics across the sample. In a similar vein, the Aggregate Confusion Project of the MIT (Berg et al. 2022) looked into the ESG ratings from six ESG rating agencies and mapped the different methodologies, decomposing the divergence observed into contributions related to scope, measurement, and weight. The study shows that measurement accounts for 56% of the divergence, scope for 38%, and weight for 6%, with indications of possible biases during assessment, as the overall view of a firm may influence the measurement.

3.2 HOW GREEN ARE GREEN BONDS? RATINGS CAN HELP INVESTORS KNOW

Placing an increased focus on ESG criteria has become a mainstream practice for investment strategies, so that companies can showcase their improved climate risk management and environmental footprint as well as their value creation for the society. CRAs tend to reward with higher ratings entities that score higher in terms of ESG criteria. Hence, companies increasingly focus on evaluating, disclosing and managing sustainability-related risks and opportunities, and integrating ESG criteria into their decision-making process, so as to build creditworthiness and have a positive social impact. Even companies whose core business is in conflict with sustainability principles, such as fossil fuel companies, are striving to adopt sustainable business models for the benefit of the company itself, shareholders and the planet.

Thus, credit ratings are used by investors in order to form opinions about the creditworthiness of bond issuers in an economically meaningful manner and reduce information asymmetry among investors (see Pagano and Volpin 2010). They are a useful tool for making investment decisions (see among others Livingston et al. 2010; Aizenmann et al. 2013), and financial institutions, asset managers and external credit assessment institutions consider ESG factors as important non-financial information (Cash 2017; Amel-Zadeh and Serafeim 2018; Fitch Ratings 2020; S&P Global Ratings 2019). In this regard, CRAs' assessment of green bonds provides information about the quality of such bonds with respect to their creditworthiness.

ESG criteria have a large weight in credit ratings, in particular through the governance criteria. On the other hand, information provided by environmental parameters does not carry an equally important weight. So, credit ratings are not exactly calibrated to reflect environmental-specific factors of high relevance to green bonds, such as GHG emissions, waste management and physical resources management. On the other hand, rating agencies are increasingly integrating the environmental parameters during the quantitative phase of assigning credit ratings, as this phase provides the largest component of ratings, followed by a qualitative-adjustment phase.[24] Such a potential development will increase the weight of environmental factors on credit ratings.

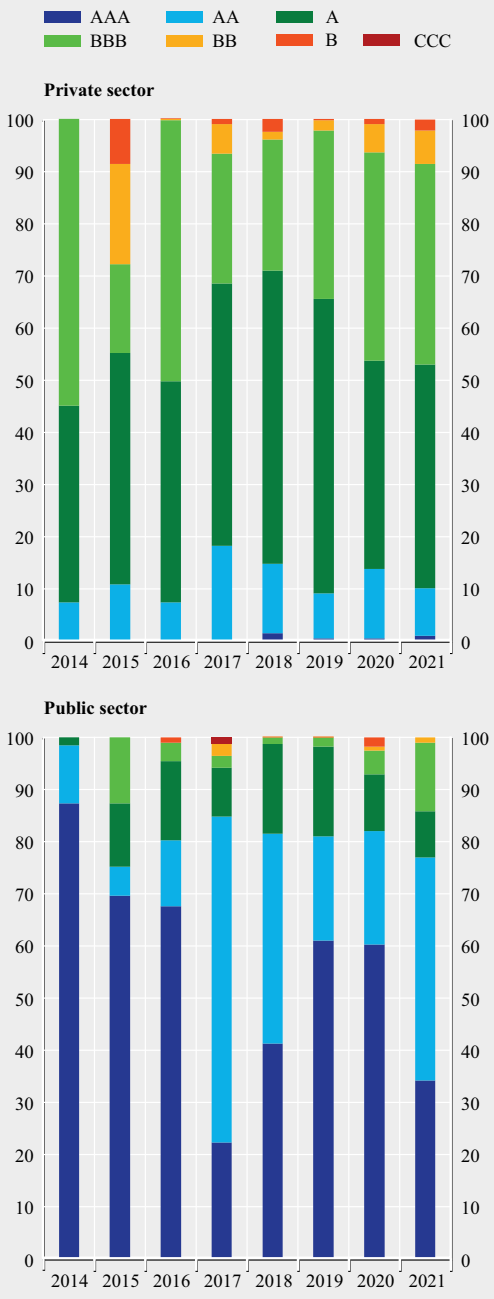
Chart 5 illustrates the distribution of green bonds issuances of the private (top panel) and the public sector (bottom panel) across rating categories.

In Chart 5 it is shown that green bonds are issued mainly by highly creditworthy issuers. In particular, around 82% of the issuers of green bonds within the public sector in the period 2014-21 are rated in the A's categories (i.e.

24 The judgmental stage, which adjusts scores derived from fundamentals, may result in a deviation of the final credit rating from the fundamentals-implied rating (see among others Lennkh and Moshammer 2018). This deviation has led to critiques on the credit rating business, which has been intense especially after the financial crises (see White 2010 and Fulghieri et al. 2013).

Chart 5 Breakdown of green bonds by credit rating

(%)



Sources: Refinitiv and Bank of Greece.
Notes: The chart provides a breakdown of private and public sector green bonds by credit rating category. The date axis denotes the year of green bond issuance. Ratings correspond to the long-term issuer credit ratings assigned by Fitch, Moody's and S&P as of 31.12.2021. The average rating is calculated by weighting ratings by the amount at issuance of the bonds belonging to that category vis-à-vis the total amount issued in that year.

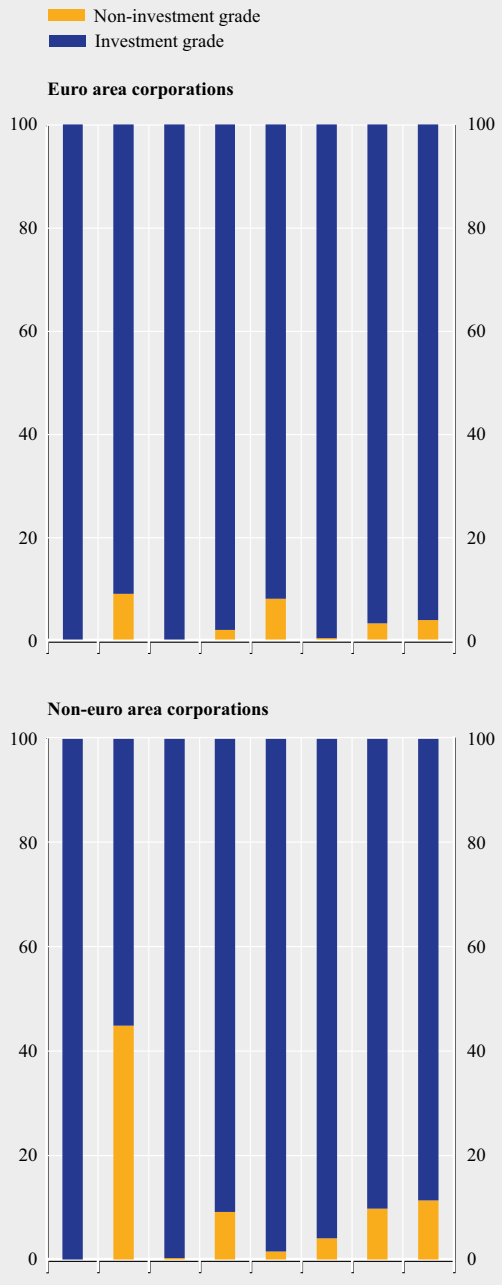
AAA, AA or A). The weighted average rating of public sector green bonds is AA-. This is a clear indication that green bonds are issued by public sector entities of high creditworthiness. The corresponding figure for green bonds issued by the private sector belonging to the A's rating categories stands at around 47% of the bonds issued by private sector entities; still, another 41% is rated above the IG threshold (which includes bonds rated at least at BBB-). Thus, the weighted average rating of private sector green bonds is between A- and BBB+. As a result, the average green bond issuer in the private sector of the economy belongs to a relatively high rating category. On the other hand, this supports the view that there is not much of a greenium in the pricing of green bonds, considering that (a) the average corporate issuer of green bonds is of a rating higher than BBB, while (b) the cost of funding from green bonds issued by these corporations compares to that from BBB-rated corporate bonds. Then at best, the market prices of green bonds are close to the average cost of the issuer's rating.

How do the ratings of green bond corporate issuers compare to those of the average corporate bond issuers? According to the rating agencies, corporate bond issuance in both the United States and Europe is done by issuers belonging to the IG category for more than 90% of total bonds issued.[25] Chart 6 provides a distribution of the credit ratings of euro area and non-euro area green bond issuers from the private sector. The chart indicates that the distribution of corporations issuing green bonds is very similar to that of corporate bond issuers in general.[26] Besides, the comparison of euro area and non-euro area bond issuers suggests that since the Paris Agreement there has been no substantial difference in the distribution of corporate green bond issuers across the two regions. Against this background, we may con-

25 See for example S&P Global Ratings, "Credit trends: Global Financial Conditions: Bond issuance looks set to contract almost 5% in 2022 as conditions tighten quickly", 27.4.2022.
26 For the broader corporate bond market, we refer interested readers to Çelik et al. (2020).

Chart 6 Corporate green bonds: ratings of euro area vis-à-vis non-euro area issuers

(%)



Sources: Refinitiv and Bank of Greece.
Notes: The chart illustrates the distribution of the amounts at issuance of green bonds issued by private sector entities across the investment-grade and the non-investment grade categories, relative to the total amounts of green bonds issued by the private sector. The top panel refers to issuers that are euro area residents and the bottom panel refers to non-euro area issuers.

clude that developments in the green bond market, both in terms of pricing and in terms of credit assessment by rating agencies, are in line with the overall market developments.

4 GOING FORWARD

To develop EU capital markets capable of coping with old and new challenges, it takes a collective effort. The green transition offers a unique opportunity to build a truly European capital market, in other words a green CMU.[27] In fact, it is a necessary step towards the completion of the Economic and Monetary Union and supports the functioning of the Banking Union. It may also support the integration of capital markets by increasing the depth and diversification of available financial instruments, while enhancing risk sharing across the EU financial system. Above all, integrated and well-functioning capital markets may facilitate capital flows towards sustainable activities.

The development of a green CMU is linked to further progress in addressing the weaknesses of the CMU, in harmonising corporate insolvency regimes and investor protection rules, as well as in strengthening the single cross-border market supervision. Timely and decisive regulatory action could help address several impediments related to the incomplete CMU, the lack of comparability and standardisation of information and financial products, and the need for a harmonised regulatory and supervisory framework for sustainable finance.

Furthermore, the improvement of the credibility, comparability and transparency of ESG ratings and assessments of CRAs is important to support sound investment decision-making and risk management, including those of central banks, which are increasingly incorporating climate change issues in their operations. From the issuers' perspective, the increasing incorporation of ESG performance in credit

27 Speech by ECB President Christine Lagarde, "Towards a green capital markets union for Europe", May 2021.

assessments can be a driver for increasing further the motivation of issuers to address sustainability issues and support the transition towards a more sustainable growth model. International collaboration and coordination of actions is also key to scale up sustainable finance at a global level and avoid fragmentation across markets and geographies.

The following two subsections include some issues, which are considered of particular importance for scaling up green finance in the EU and may support the creation of a green CMU.

4.1 THE RISK OF GREENWASHING AND EU INITIATIVES

An important element of a green CMU includes measures to enhance comparability and standardisation of information and financial products, for example through transparency standards (on which companies are required to disclose sustainability data), EU-certified green financial products (such as the proposed regulation on an EU Green Bond Standard)[28] and a harmonised regulatory and supervisory framework for sustainable finance. Indeed, the EU has taken several legislative initiatives, which are directly related to the financial system, also supporting sustainable finance through capital markets, and which can address the risk of greenwashing.[29] In particular, greenwashing is a practice which may occur when considering a product or service as one with a positive or no impact on the environment or as less damaging to the environment, when such claims are not true or cannot be verified (see for example European Commission 2021). The lack of transparency, taxonomies of sustainable activities and regulation of sustainable markets and rating providers may increase the risk of greenwashing. Greenwashing may lead among other things to misrepresentation, mislabelling, misselling and/or mispricing cases, diverting the so-needed financial resources away from investments that are aligned with the sustainability goals.[30]

The development of common standards, labels and credit rating criteria will contribute to more informed assessments and decision-making for financing and will enhance the credibility of markets. The EC's proposal for a voluntary Green Bond Standard (EUGBS) based on the EU Taxonomy is a positive step. The proposed regulation for an EUGBS includes pre- and post-issuance requirements for issuers and verification requirements from external parties. Issuers would be required to publish standardised reports with information on the environmental objectives of the bond to be issued, which need to be fully taxonomy-aligned. A registered external reviewer will validate compliance with the proposed EUGBS. Yearly reports will be published to show how proceeds are being allocated to taxonomy-aligned projects, and at least one report on the overall environmental impact of the bond will be published with post-issuance reviews required. The proposal also establishes a registration system and supervisory framework for external reviewers, managed by the European Securities and Markets Authority (ESMA).

The proposed EUGBS is voluntary. However, there are merits in making this standard mandatory —within a reasonable period of time— in order to enhance the credibility of green investments. Similar initiatives are also necessary for products that finance other aspects of sustainable development, such as other environmental objectives or social objectives, while ensuring relative flexibility in the legal framework for financial innovation. Another important aspect is the need for international collaboration and coordination of actions, in order to limit the room for regulatory arbitrage, unlevel playing fields and fragmentations across markets and geographies.

28 European green bond standard (https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/european-green-bond-standard_en).
29 For example, the Regulation on sustainability-related disclosures in the financial services sector, the (amended) Regulation on EU Climate Transition Benchmarks, EU Paris-aligned Benchmarks and sustainability-related disclosures for benchmarks, the proposed Regulation on European green bonds, and the proposal for a Corporate Sustainability Reporting Directive.
30 ESMA *Sustainable Finance Roadmap 2022-2024.*

The EC published in January 2021 a study (European Commission 2021) identifying, among others things, the lack of transparency in the methodologies of ESG rating providers, the low level of comparability between ESG ratings and potential conflicts of interests, and provided some recommendations on addressing the shortcomings. Furthermore, in the context of the EC's Strategy for Financing the Transition to a Sustainable Economy, there are actions envisaged for improving the reliability, comparability and transparency of the relevant ESG factors and the methodologies used in credit ratings, credit outlooks and ESG research. In this regard, in April 2022, the EC launched a public consultation on the functioning of the ESG ratings market in the European Union and the consideration of ESG factors in credit ratings. On the basis of the feedback from the consultation, the EC aims to perform an impact assessment, in order to assess whether a policy initiative on ESG ratings and on sustainability factors in credit ratings is necessary.[31]

Furthermore, ESMA plans to undertake several actions related to the improvement of the credibility, comparability and transparency of ESG ratings and assessments,[32] besides the publication of the guidelines for the disclosures of ESG issues in CRAs' press releases.[33] As ESMA mentioned in its letter to the EC in January 2021, there are high risks of capital misallocation, product misselling and greenwashing and there are currently no appropriate legal tools to address these risks. ESMA made some initial proposals to the EC to take action around four directions, those being: (a) the establishment of a common legal definition for an ESG rating; (b) registration and supervision of providers of ESG ratings and assessments; (c) introduction of specific product requirements for ESG ratings and assessments; and (d) organisational and conflict of interest requirements subject to proportionality considerations distinguishing larger and smaller entities.[34] ESMA also highlighted that the CRA Regulation could be an informative starting point to design the appropriate legal framework for ESG ratings and assessments. The call for evidence, which was recently launched by ESMA, may provide additional information on the market structure of ESG rating providers in the EU.[35] It is important that the regulatory interventions are completed without undue delay, in order to facilitate effective financing at the scale and speed needed to meet the ambitious targets of the transition plans.

4.2 THE ROLE OF CENTRAL BANKS

Central banks around the world are considering possible ways to incorporate the effects of climate change, whether associated with physical risks or the transition to a low-carbon economy, into their macroeconomic forecasts and financial stability monitoring. Moreover, central banks are already actively involved in integrating climate-related risks into the prudential framework and supervisory approaches, while at the same time they are in constant dialogue with credit rating agencies and financial institutions to ensure that these organisations understand climate risks, disclose them appropriately and take them into account in their overall risk assessment methodologies and lending decisions.

In this respect, the Governing Council of the ECB approved in the summer of 2021 a comprehensive action plan, which includes an ambitious roadmap, with a view to further integrating climate change considerations in its monetary policy. The ECB supports the ongoing EU initiatives to improve the disclosure of climate data, in order to enhance transparency and promote a market for green financial products. A milestone in this roadmap concerns monetary policy operations, in which climate change issues are given greater weight, in order to ensure that climate risks are properly disclosed and that securities

31 EC, Targeted consultation on the functioning of the ESG ratings market in the European Union and on the consideration of ESG factors in credit ratings.
32 ESMA, *Sustainable Finance Roadmap 2022-2024.*
33 ESMA, *Final Report, Guidelines on Disclosure Requirements Applicable to Credit Ratings*, 18.7.2019 (ESMA33-9-320).
34 ESMA letter to the EC on ESG ratings, 29.1.2021.
35 ESMA call for evidence on ESG ratings, 3.2.2022.

market transactions, and thus the balance sheet of the central bank, are greener. The plan envisages also actions on the use of credit ratings for collateral and asset purchases, namely: the assessment of rating agencies' disclosures and understanding of how these incorporate climate change risk in their ratings; the development of minimum standards for internal credit ratings; and the possibility to introduce requirements into the Eurosystem Credit Assessment Framework (ECAF)[36] targeted to climate change risk, if needed.[37] These actions highlight the importance of developing high-quality ESG data, ratings and research for managing climate-related risks and harnessing opportunities from the transition to a low-emissions economy.

4.3 GOING DIGITAL TO PROMOTE GREEN FINANCE

It has been acknowledged that green finance, which is designed to spur investment in green innovation and which can ease financing demands for long-term projects, will support the transition to a low-carbon economy, playing at the same time a role in the digital transition. The application of digital technologies in green finance is perceived as beneficial for its potential to make large amounts of data available at a lower price and at a fast pace, improving the pricing of environmental risks and opportunities, reducing search costs for information, as well as improving the measuring and tracking of sustainability criteria (see Alonso and Marqués 2019). In such a way, green fintech[38] facilitates access to sustainable finance options, unlocks new sources of finance and enables new business models.[39] For example, the use of blockchain for the automation of processes in bond issuance, although not yet widely adopted, has the potential to reduce the costs of designing and financing of green bonds. Big data, machine learning and artificial intelligence would allow data collection from disparate sources, processing of large amounts of data about companies' social and environmental footprints, as well as translation into more standardised and comparable data for investment decision-making. These digital technologies are already being used by organisations in disaster risk management.[40] Blockchain technology also allows the greenness of investments to be verified in a secure and transparent manner, increasing confidence and lowering costs associated with green labelling. Fintech solutions facilitate access to green finance for startups, e.g. through peer-to-peer (P2P) solutions. Green crowdfunding platforms enable investors to directly participate in the financial system, unlocking new sources of sustainable finance.

On the other hand, the challenges that are related with leveraging the full potential of digital finance to mobilise sustainable finance include among other things the high energy footprint of digital technologies, the weak digital infrastructure, the high costs of newer technologies, the quality and use of sustainability-related data for financial decision-making, as well as the limited awareness and understanding of sustainable digital finance.

5 CONCLUSION

The EU has been in the forefront of international efforts to fight climate change. The EC has announced the European Green Deal as a roadmap with actions to transition the EU economy to climate neutrality by 2050. To achieve the goals set by the European Green Deal, the EC has pledged to mobilise at least EUR 1 trillion in sustainable investments over the next decade, requiring an unprecedented shift in both public and private funds to finance the transition. The funds will be generated

36 Eurosystem credit assessment framework.
37 ECB's action plan to include climate change considerations in its monetary policy strategy, 8.7.2021.
38 The term "green financial technology" (green fintech) is defined as "technology-enabled innovations applied to any kind of financial processes and products all while intentionally supporting Sustainable Development Goals or reducing sustainability risks". For a green fintech taxonomy, see https://www.greenfinanceplatform.org/sites/default/files/downloads/resource/GreenFintech-TaxonomyDataLandscaping-v5%20.pdf.
39 https://g20sfwg.org/wp-content/uploads/2021/06/G20_Sustainable_Finance_Synthesis_Report_2018.pdf.
40 The World Bank uses machine learning techniques in its disaster management strategy: https://documents1.worldbank.org/curated/en/503591547666118137/pdf/133787-WorldBank-DisasterRiskManagement-Ebook-D6.pdf.

inter alia under the 2021-2027 Multiannual Financial Framework and through the NGEU instrument, with a total volume of EUR 750 billion. Even though this is a large sum, a huge gap of at least EUR 2.5 trillion remains to be financed predominantly by the private sector.[41] Therefore, the mobilisation of investment resources and the development of appropriate financial instruments are warranted.

In this respect, over the past ten years green bonds have been used in the mainstream of the international capital markets. These instruments have been shown to be critical in helping bridge the massive investment gap required to meet the targets set out in the 2015 Paris Agreement. In fact, global green bond markets have grown rapidly in recent years. Based on issue- and issuer-specific data, we find that the global market activity for financing projects within the scope of a green bond issuance has accelerated during the last years, with the aggregate amount of bonds issued in the period 2019-21 almost tripling compared with the period 2014-18. Moreover, we show that European markets and issuers lead this development, while private sector entities are increasingly making use of green bond markets as a source of funding. On the other hand, funding from green bond markets has been directed to few sectors of the economy, underlining the need for some policy-related initiatives. As argued, the increase in green bond issuance has come during a period of easy financial conditions, which could further highlight the scope for policy initiatives aimed at enhancing the provision of incentives to investors towards green financing in the present changing market landscape.

With environmental, social and governance issues growing in prominence in every sector, ESG criteria represent an increasingly significant parameter in credit ratings, and CRAs tend to reward with higher ratings entities that score higher in terms of ESG criteria. As CRAs are developing their methodologies for the incorporation of ESG credit factors into their analyses, ESG criteria may be of greater importance to credit ratings in the future. For that matter, it is also key that the necessary regulatory interventions on various fronts —including capital markets and disclosures— are completed in a timely manner, in order to facilitate financing at the scale and speed needed to meet the ambitious targets of the green transition plans.

41 https://unctad.org/press-material/developing-countries-face-25-trillion-annual-investment-gap-key-sustainable.

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