

Current Developments in Green Finance

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CURRENT DEVELOPMENTS IN GREEN FINANCE

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Abstract

The transformation of economies towards significantly reduced CO₂ consumption raises high investment and capital requirements. Financial and capital markets can help to mobilize the necessary funds for global investment needs and to steer capital towards sustainable investments. Moreover, potential disruptive impacts of climate change on the financial system have started to become more apparent recently and require central banks, regulators and supervisors to take a conscious look at the risks and opportunities of climate change for financial intermediaries and markets. This article offers a comprehensive discussion on how green finance has been evolving thus far and explores the opportunities and key developments ahead with particular emphasis on four selected highly topical issues: 1) the introduction of German green government bonds, 2) obstacles to the correct pricing of climate-related risks, 3) the EU taxonomy that has recently been put forward to develop a uniform classification of sustainable economic activities as well as 4) the role of central banks in fostering the transition to a low-carbon economy.

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1 Introduction

There is broad consensus on the need for decisive policy action on climate change. Climate change, induced by concentration of greenhouse gases in the atmosphere due to human activity, is likely to bring about substantial changes for societies and economies. It increases the likelihood of more extreme weather events and induces a surge in global average temperature relative to pre-industrial levels. Signatories to the Paris Agreement pledged to reduce greenhouse gas emissions in order to keep the increase in the global average temperature to well below 2°C compared to pre-industrial levels, ideally limiting the increase in temperature to no more than 1.5°C. Policymakers face a variety of options for curbing net carbon emissions, as well as for avoiding them in the first place. Measures range from imposing bans or requirements regarding the technologies to be used, to a CO₂ tax or trading system for CO₂ allowances (Deutsche Bundesbank, 2019a).

Financial markets are related to climate change in two respects. First, financial markets are affected through physical and transition risks. Extreme weather events and climatic changes as well as the sustainable restructuring of the economic system can cause companies to run into difficulties and change their economic basis. The resulting lower profitability as well as devaluations of assets affect financial markets. Second, financial markets are needed to finance climate protection. Both governments and companies are increasingly investing in green projects. To achieve the 2°C objective of the Paris Agreement with a probability of 66%, the OECD (2017) estimates the annual global infrastructure investment requirement for the next fifteen years at 6.9 trillion US Dollar. Green equity and green bonds will have to make an important contribution to these investments. This also generates opportunities to actively meet potential financial stability risks with suitable adaptation strategies. Central banks and financial supervisory authorities have joined in the Network for Greening the Financial System (NGFS) to support the sustainable orientation of the financial markets and promote it within their mandates.

The reflections on the relationship between climate change and the financial system are still in their early stages. Only recently potential disruptive impacts of climate change on the financial system have started to become more apparent, and the risks and opportunities of climate change for financial markets have been discussed more prominently (Bolton et al., 2020; Chenet, 2019; ESRB, 2020). This paper offers a comprehensive discussion on how green finance has been developing thus far and explores the opportunities and key developments ahead with particular emphasis on four selected highly topical issues: First, green sovereign bonds. This fast-growing segment is now being expanded by German green government bonds in the form of twin bonds. This new type of government bonds aims to establish a new benchmark for the green bond market, but it could deter particularly sustainability-conscious investors. A second point that we are particularly interested in is the risk assessment of green assets. The literature increasingly indicates that the physical and transition risks are not adequately priced by market participants (Bolton et al., 2020; Carney, 2015; ESRB, 2020; Krogstrup & Oman, 2019; NGFS, 2018). This type of market failure influences, for example, investment decisions and calls for new approaches by rating agencies. Third, important for the further development of the green

financial market is a uniform definition of green financial products. We discuss the importance of the taxonomy that the EU has recently put forward for this purpose. The role of central banks in fostering the transition to a low-carbon economy has been recently getting increased attention. The Governing Council of the European Central Bank (ECB) has launched a review of its monetary policy strategy in January 2020. As part of this strategy review, the ECB has declared to determine how the issue of climate change can actually have an impact on their policies. Against this background, the fourth selected issue is a possible carbon bias in the ECB’s corporate bond purchases. While some analyses show a distortion of purchases in favour of companies with high CO₂ emissions, our analysis cannot detect a systematic distortion when taking into account the criteria defined by the ECB itself.

The remainder of the paper is organized as follows: Chapter 2 gives an overview of the relevance and the development of green finance markets. In chapter 3 we focus on climate risks and the role of credit ratings. Chapter 4 discusses the regulatory reforms at the European level and in Chapter 5 we discuss the role of central banks and analyse the ECB Corporate Sector Purchase Programme for a possible carbon bias.

2 The Green Finance Market: An Overview

2.1 Increasing Relevance of Green Finance

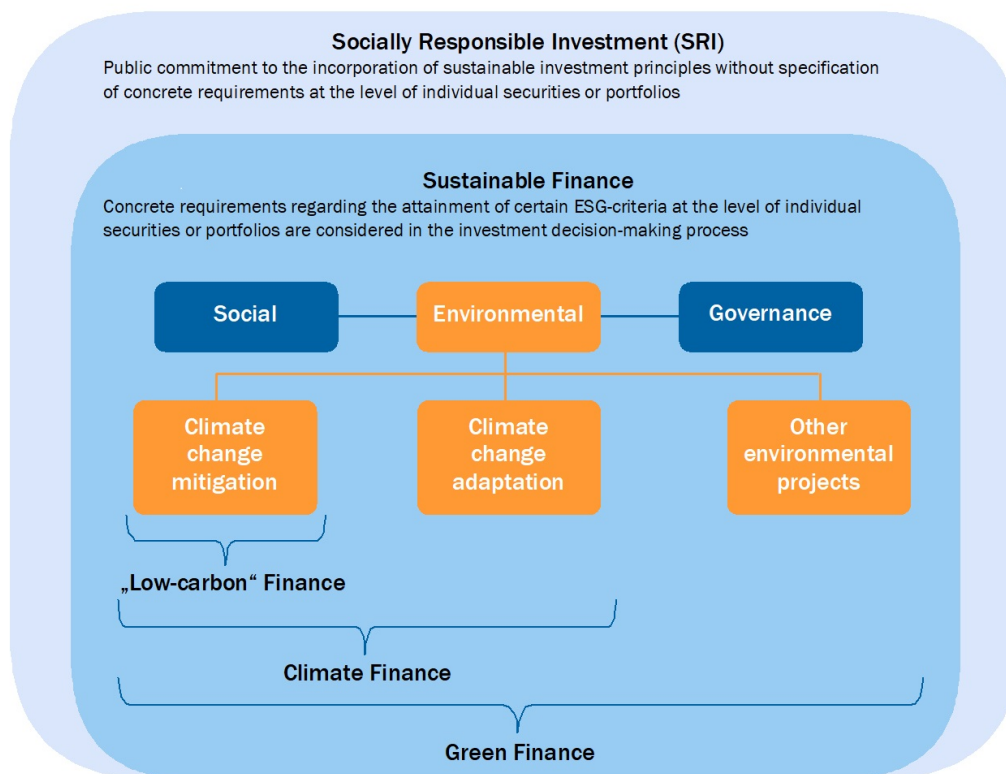
2.1.1 What is Green Finance?

The lack of a common definition of the term “sustainability” gives rise to different kinds of categories of socially responsible and sustainable finance (Chart 1). Institutional investors engage in Socially Responsible Investment (SRI) by publicly committing to the incorporation of sustainability criteria into their investment decisions (PRI, 2020b). However, the mere announcement that a company or institutional investors commits to SRI does not allow to infer the extent to which concrete sustainability requirements are considered in the decision-making process at the level of individual portfolios or securities. As an institutional example for investors’ growing awareness of sustainability in finance, the UN Principles for Responsible Investment (UN PRI) consist of six guidelines for the incorporation of ESG-criteria (Environmental, Social, Governance) into investment decisions. The UN PRI were signed by approximately 3,000 institutional investors that together manage assets worth more than 90 trillion US-Dollar (PRI, 2020b). Evaluating ESG-criteria allows investors to assess the sustainability of a company’s business model, e.g. by shedding light on the energy efficiency of production processes (E), institutional policies promoting gender equality (S) or compliance policies (G).

While Socially Responsible Investment represents a rather unspecific commitment of investors to include sustainability criteria into their investment strategies, Sustainable Finance demands the attainment of concrete ESG-thresholds at the level of issuers, portfolios or securities. The funding raised by sustainable bonds or other forms of sustainable debt must be invested in projects that positively contribute to projects in the three ESG-areas, e.g. wind parks or social housing.

Figure 1

Categories of socially responsible and sustainable finance



Sources: Bundesbank (2019), UNEP (2016)

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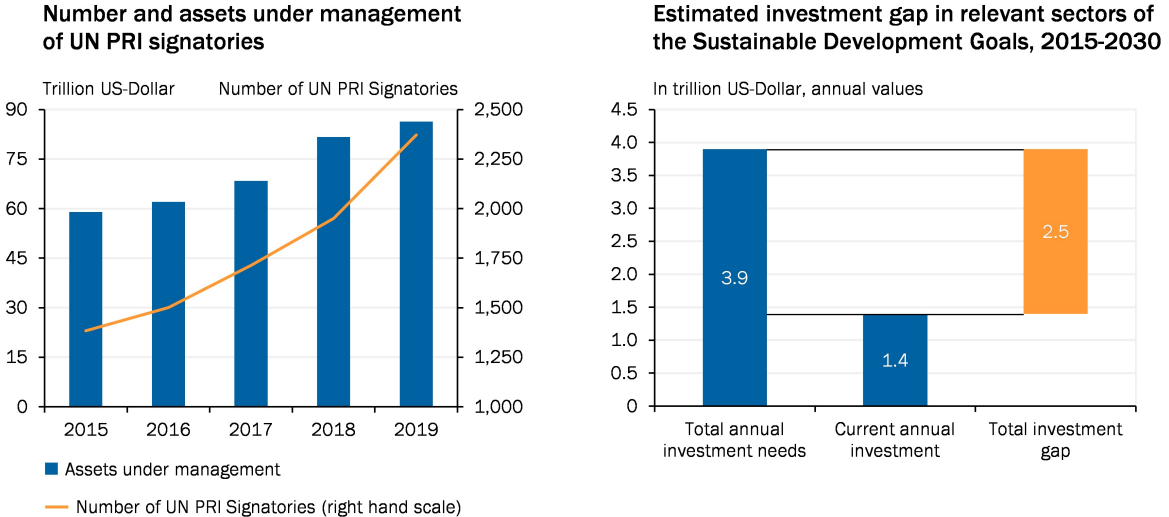
Financial instruments or investments that are considered under the term “Green Finance” distinguish themselves as a sub-category of Sustainable Finance through their exclusive focus on environmental criteria (Deutsche Bundesbank, 2019b). There are plenty of definitions aiming at characterizing the purpose and role of “Green Finance” in the transition to a low-carbon economy. The OECD (2020) characterizes Green Finance as a means of fostering economic growth while reducing negative externalities in form of pollution, greenhouse gas emissions, or waste by promoting resource and energy efficiency. Private investments are seen as crucial. In the case of green bonds or other forms of green debt, Green Finance encompasses investments in projects or securities whose proceeds are used for climate change mitigation and adaptation as well as other environmental projects. “Climate Finance” as a subsector of Green Finance comprises investments and projects related to climate change mitigation and adaptation, while “Low-carbon Finance” focuses solely on investments related to climate change mitigation (Forstater & Zhang, 2016).

2.1.2 Increasing Demand for Green Capital

Demand for socially responsible investments has significantly increased over the last years and continues to grow at a fast pace. The number of institutional investors publicly committing to the UN PRI principles has increased by 71% over the last five years, resulting in a surge of 46% of assets under management aligned with the UN PRI principles (Chart 2, Left). The transformation towards a financial system that directs capital flows towards investments that

foster the transition to a low-carbon, resource-efficient global economy has been primarily driven by the Paris Agreement on Climate Change (2015a) and the UN 2030 Agenda for Sustainable Development (2015b) as well as the Sustainable Development Goals defined there.

Figure 2
Increasing relevance of UN PRI and estimated investment gap to meet Sustainable Development Goals



Sources: Deutsche Bundesbank, PRI, UN, World Bank, World Economic Forum © Sachverständigenrat | 20-202

In the first legally binding global climate agreement, the 195 sovereign signatories of the Paris Agreement (including the European Union) commit to restricting the rise in global average temperature to well below 2°C compared to pre-industrial levels while pursuing to limit the increase to no more than 1.5°C compared to pre-industrial levels. The Paris Agreement explicitly underscores the role of the financial system in climate change mitigation and adaptation by demanding that financial flows should be aligned with a “pathway towards low greenhouse gas emissions and climate-resilient development” (UN, 2015a). The global transition to sustainable long-term economic growth requires significant infrastructure investments from governments, the private sector and other actors. Assuming a 66% chance of meeting the mitigation objective of limiting the rise in global average temperature to 2°C, OECD (2017) estimations suggest an annual global investment need of 6.9 trillion US-Dollar over the next fifteen years. Infrastructure investments would primarily foster the transition to a low-emission, resource-efficient pathway of the transportation and energy sector and would be mainly targeted at developing countries (OECD, 2017).

Another landmark in the global transition towards a sustainable society and economy is given by the UN Sustainable Development Goals (SDGs) (2015b). The SDGs focus on global sustainable development as defined by 17 concrete social, economic and environmental goals that shall be achieved by 2030. Environmental goals encompass clean water and sanitation, affordable and clean energy (incl. renewable forms of energy), as well as actions to mitigate and adapt to climate change in accordance with the Paris Agreement. There are various attempts at calculating the investment need resulting from the implementation of the UN SDGs.

According to the UNCTAD World Investment Report (2014), attaining the SDGs by 2030 will result in an annual global investment need of 5-7 trillion US-Dollar of which 3.3-4.5 trillion US-Dollar are allotted to developing countries (Chart 2, Right). Based on a mid-point estimate of an investment need of 3.9 trillion US-Dollar and current annual investments of 1.4 trillion US-Dollar, the World Bank estimates an annual total investment gap related to SDG-relevant sectors of approximately 2.5 trillion US-Dollar for developing countries (Doumbia & Lauridsen, 2019). Investment needs are particularly large when it comes to transforming the infrastructure associated with a sustainable low-carbon economy. World Bank estimates suggest that 630-950 billion US-Dollar are needed to adjust existing power infrastructures, followed by 550-850 billion US-dollar for climate change mitigation as well as 350-770 billion US-dollar for transport systems (Doumbia & Lauridsen, 2019).

Gaspar et al. (2019) estimate additional financing needs in five SDG-core areas on country-level in 2030 that would be necessary in order to successfully attain the SDGs within the given time frame. Financing needs seem to vary significantly between emerging market economies (2.1 trillion US-Dollar additional spending needed, 4 percentage points of projected GDP) and low-income developing countries (0.5 trillion US-Dollar) in which additional financing needs in 2030 may make up as much as 15 percentage points of projected GDP in 2030. According to Gaspar et al. (2019), the largest financing need will emerge in the Asia-Pacific region (1.5% of 2030 world GDP), followed by Sub-Saharan Africa (0.4%). The authors stress the importance of private investments, foreign financial aid and funding by international financial institutions for developing countries with high levels of public debt (Chapter 3.1).

2.2 Markets for Green Financial Assets

2.2.1 Institutional and Retail Investors

The transformation of an economy towards drastically reduced CO₂ consumption raises high investment and capital requirements. Financial and capital markets can help to mobilize the necessary funds for global investment needs within the framework of international climate policy and to steer capital towards sustainable investments. The markets for green financial assets have been developing increasingly for several years. With regard to the market for green bonds, various types of investors have been responsible for an increasing demand over the last few years. Institutional investors – both conventional and ESG-focused – make up a significant part, along with corporate treasury departments, sovereign and municipal governments and retail investors (Climate Bonds Initiative, 2014). The oversubscription of most green bond issues points to high demand. With a share of 75% in 2018, institutional investors dominate the global market for sustainable investments under professional management, which has an amount of 30.7 trillion US-Dollar. However, retail investments – individual investments in professionally managed funds – have been growing at a fast pace. Making up only 11% in 2012, they accounted for a quarter of all professionally managed assets aligned with sustainable investment in 2018 (GSIA, 2018).

In Germany, the market for sustainable assets has a volume of 269,3 billion Euro. Specialised

banks manage 15% of investments in sustainable assets. The market for sustainable funds and mandates is dominated by institutional investors which hold 154,3 billion Euro or a share of 89% of the outstanding volume in 2019. This represents an increase of 87% since 2017. Among German institutional investors, ecclesiastic and charity organisations account for 27% of sustainable investments, while insurance companies hold a share of 19% and public institutions contribute 17%. Retail investments in sustainable funds and mandates have grown from 8.5 billion Euro in 2017 to 18.3 billion Euro in 2019 which equals a growth rate of 115% (FNG, 2020).

2.2.2 Screening Criteria

Investment in green financial assets severely restricts investment opportunities. The selection of a green investment can be based on various strategies (Deutsche Bundesbank, 2019b). ESG ratings or green labels can be helpful in the selection process. Negative criteria can be used to exclude investment options that are related to countries, industries or companies that contradict fundamental environmental standards. One such exclusion criterion could, for example, be the operation of a coal-fired power plant. The negative criterion can be weakened if, for example, a turnover limit is set. Investments would then be possible if, for example, a company did not generate more than 1% of its turnover from fossil fuels. Further weakening can be made with regard to the inclusion of value chains or suppliers. This distinction is particularly important for the financial sector, as banks and insurers are invested in many different industries. A strict application of the negative criterion could severely restrict their lending opportunities.

The best-in-class approach gives preference to those investments that perform the greenest in their reference group. However, this approach may favor investment in a company that contributes significantly to pollution, but less than other companies in the same sector. Therefore, it is controversial whether investments in energy suppliers should be considered green if the supplier operates coal-fired power plants, but at the same time also renewable energies and thus causes less CO₂ emissions than comparable energy suppliers. This problem also exists for the best-in-process approach. This approach favors investments in companies that have made the best progress reducing their negative environmental impact in recent years. As a result, investments can be considered that fall on companies that were previously particularly polluting and now cause less but still a lot of pollution.

However, all these approaches are likely to contribute to the basic aim of green investment, which is to create competition between companies for greener operations.

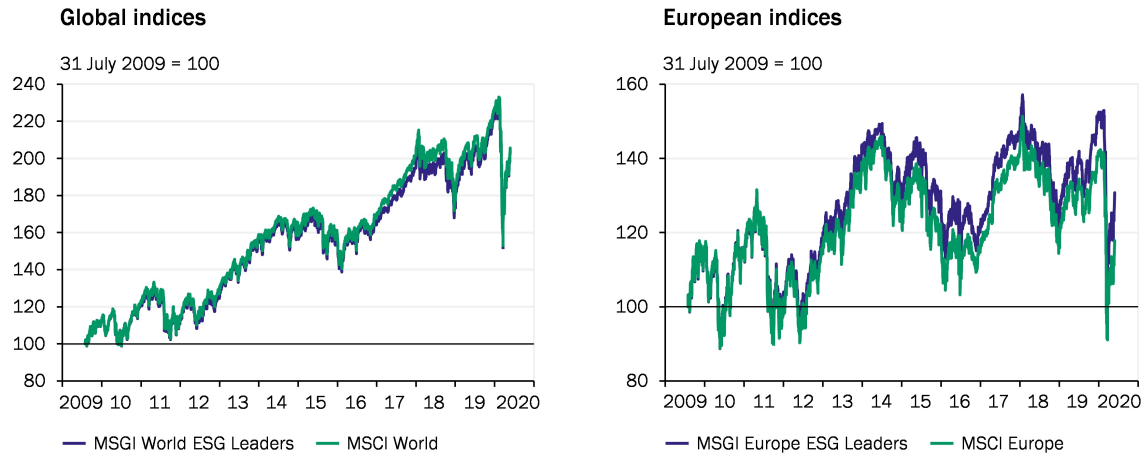
2.2.3 Financial Market Performance

A growing literature deals with yield differences of green financial assets compared to conventional financial assets. The literature comes to no distinct conclusion as to whether green financial assets are likely to generate higher profits. The development of green stock indices is very similar to that of broader stock indices (Chart 3). When comparing the MSCI World ESG Leaders with the MSCI World, the conventional index shows a slight advantage, while the ESG

index performs slightly better for the European indices. However, the differences are hardly meaningful.

Figure 3

Comparison of the performance of conventional and sustainable equity indices



Sources: Refinitiv Datastream, own calculations

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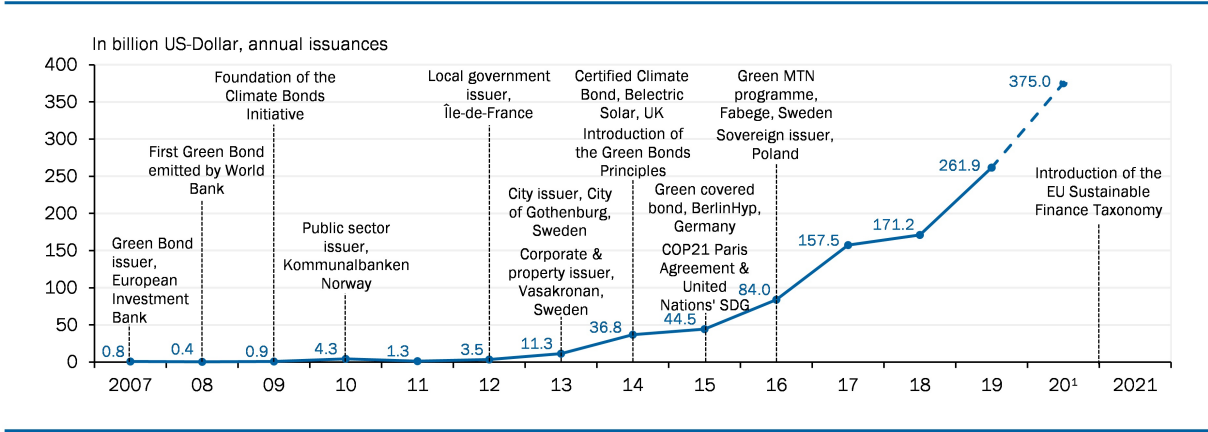
Ibikunle and Steffen (2017) find that European green mutual funds perform worse than European conventional ones for the period 1991-2014. In the last years between 2012 and 2014, however, green funds performed better than conventional ones. Additionally, Silva and Cortez (2016) show that green funds perform worse than conventional ones. However, this affects the European funds more than the US ones. They also find that green funds perform better in times of crisis than in non-crisis periods.

The results for the differences in returns on the bond market are similarly inconclusive. The Climate Bonds Initiative (2017) and the OECD (2017) do not find any significant differences between yields on green bonds and conventional bonds on the primary market. Hachenberg and Schiereck (2018) also find no significant difference for the secondary market. Higher yields of green US municipal bonds in the secondary market are described by Karpf and Mandel (2018). Zerbib (2019) finds indications of financing advantages of green bonds with lower secondary market yields two basis points. According to Kapraun und Scheins (2019), the yield on green government bonds is 30 basis points lower in the primary market and 3 basis points lower in the secondary market. Green corporate bonds have no statistically significant yield differential at issuance, but a 33 basis points higher yield in the secondary market. US municipal and corporate green bond yields are lower according to Baker et al. (2018). Ehlers and Packer (2017) describe an 18 basis points lower issue yield, but no differences on secondary markets. Larcker and Watts (2020) and Flammer (2020) find no evidence for a premium, i.e. a lower yield, of green corporate bonds. Bannier et al. (2019) explain lower returns of investments in stocks of companies with high ESG scores with their insurance function. By contrast, companies with low ESG scores must pay a risk premium.

2.2.4 Green Bonds

The supply of green bonds has increased sharply since 2013. Before that, green bonds were hardly existent. Although the European Investment Bank (EIB) issued the world’s first green bond in 2007, supranational organisations (the Worldbank issued first green bond in 2008) remained the only green issuers in subsequent years (EIB, 2020; World Bank, 2020) (Chart 4). Other issuers in the first few years were government entities in Norway and France. The first green corporate bond was issued in 2013 by the Swedish real estate company Vasakronan (Vasakronan, 2020). The Green Bond Principles (GBP), voluntary guidelines of the International Capital Market Association (ICMA), have given a boost to market development from 2014 onwards through more uniform standards and greater transparency (Ehlers & Packer, 2017). The introduction of the EU taxonomy establishing a uniform classification system of sustainable economic activities as well as the introduction of an EU Green Bond Standard (EU GBS) could further stimulate the market (Chapter 4.1). State development banks or local governments were active in the market for green bonds at a very early stage. However, the first green sovereign bond was issued by Poland in 2016.

Figure 4
Green bonds development



1 - Mid-point of CBI Forecast for 2020.

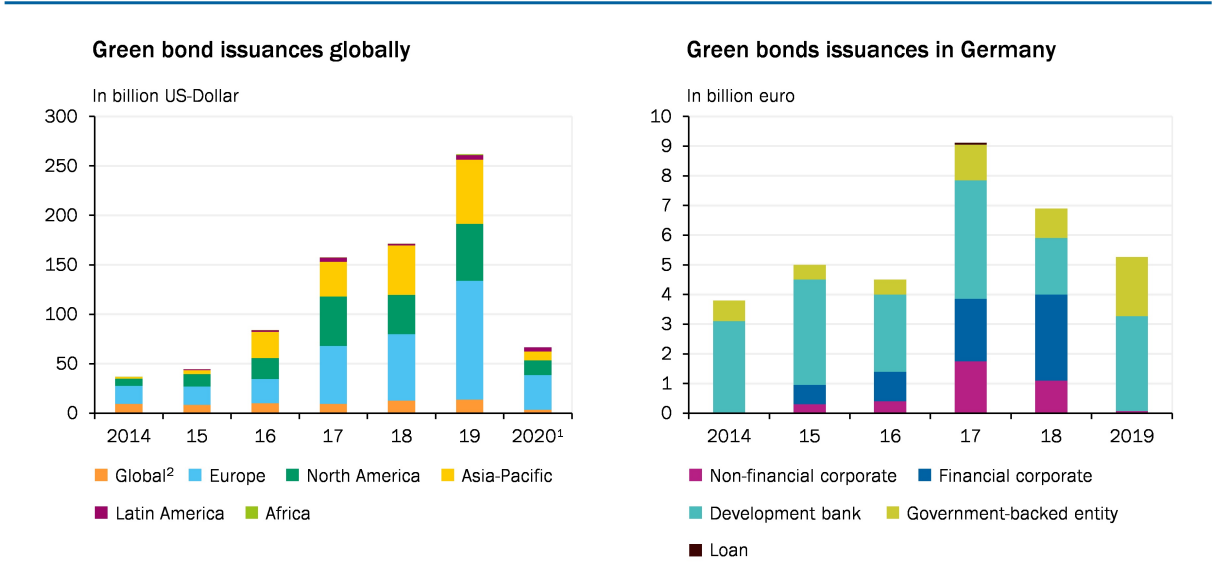
Sources: Climate Bonds Initiative, European Investment Bank, European Union, World Bank

In 2019, the increase in green bonds was 90 billion US-Dollar or 53% higher than in 2018 (Chart 5, Left). However, with a global bond market worth just over 100 trillion US-Dollar, the green bond market (bonds aligned with CBI definitions) with 844.9 billion US-Dollar ever issued is only a niche market. The largest share of new green bonds comes from European issuers. In 2019 more than 120 billion US-Dollar were issued. The second largest increase is from the Asia-Pacific region before bonds from North America. The country with the most annual new green bonds since 2014 is the USA. In 2019, over 50 billion US-Dollar of green bonds were issued there. Only in 2016 were slightly more green bonds issued in China. In 2013 most green bonds with a volume of 2.2 billion US-Dollar came from France.

By the end of May 2020, only 66.6 billion US-Dollar of green bonds had been issued world-

wide (Chart 5, Left). That is just a quarter of last year’s issue volume. One reason for the comparatively low volume may be the still small market. Individual issues can have a large effect. If these are only planned for the second half of the year, there may still be some room for improvement over the year as a whole. Germany, for example, plans to enter the sovereign bond market in the double-digit billion range in the second half of the year (Chapter 2.2.5). Another reason for the reluctance so far could be the introduction of the EU taxonomy, which entered into force in July 2020. Issuers may have waited for legal certainty on this classification system with new bonds adapted to it. In addition, the COVID-19 crisis has created uncertainty and could cause issuers to hold back on green investments in the short term. Conventional bonds with higher liquidity could be preferred in the crisis. In the medium term, however, governments in particular are expected to have higher debts and thus more bonds to issue, some of which could be issued as green bonds. Additionally, many countries are discussing combining economic stimulus packages with investments in climate protection, which could result in more green corporate bonds.

Figure 5
Green bond issuances



1 - 2020 as of May. 2 - International Organisations.

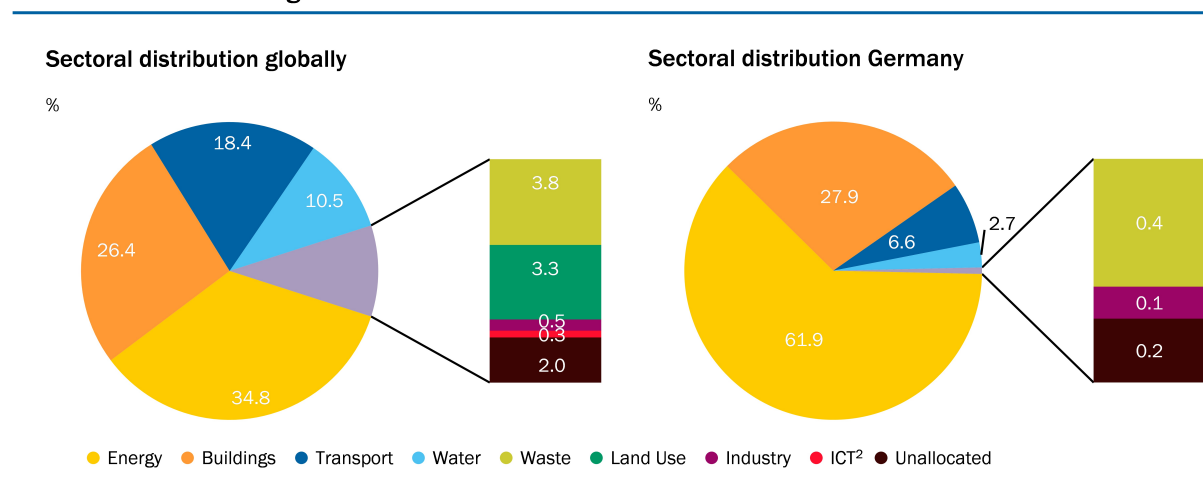
Source: Climate Bonds Initiative

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The capital raised through green bonds is mainly spent on those sectors that contribute most to environmental pollution (IPCC, 2014). Funds flow into the energy sector, followed by the building and transport sector. Only a very small part is used for industry or information and communication technologies (Chart 6, Left). The German sectoral distribution is much more focused on the energy sector with a share of 62 %. Moreover, 28% of green bond issuances in Germany are from the building sector. In comparison to the global sectoral distribution, the low share of the transport sector in green bond issues (6.6%) seems surprising given the relevance of car manufacturing for the German economy (Chart 6, Right). This is probably related to the fact that corporate bonds are very rare in the German green bond market. Instead, the KfW dominates, whose funds hardly flow into the car industry and very strongly into the energy sector.

Figure 6

Sectoral distribution of green bond issuances¹



1 – Cumulated values as of May 2020. 2 – Information and communication technologies.

Source: Climate Bonds Initiative

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2.2.5 Green Sovereign Bonds

After Poland had issued the first green sovereign bonds in 2019, France, Fiji, Nigeria, Indonesia, Belgium, Lithuania, Ireland, Seychelles, the Netherlands, Hong Kong and Chile followed by the end of 2019 (Climate Bonds Initiative, 2020b). In total, these countries have so far issued green bonds worth around 60 billion US-Dollar. That would be almost 8% of all green bonds ever issued. In 2019, with an amount of 24.6 billion Euro, around 10% of all green bonds were issued as government bonds. Cash inflows from green government bonds are mainly used for the sectors energy, transport, buildings and land use. Another nine countries have announced the first issue of green government bonds for 2020: Columbia, Denmark, Egypt, Italy, Kenya, Mexico, Peru, Spain, Sweden. This could boost the market for green bonds.

So far in Germany, only the state-owned development bank KfW and some government-backed entities were active in the market for sovereign green bonds (Chart 5, Right). However, in September 2020 the German government entered the green bond market with an 10-year bond and a volume of 6.5 billion Euro (German Finance Agency, 2020). By the end of the year, green bonds totaling 11 billion Euros are to be issued, including a 5-year bond. This will make Germany one of the largest single issuers of green government bonds. The medium-term goal is a complete green benchmark curve through the issuance of green bonds in all previous standard maturities: 2, 5, 10 and 30 years. Accordingly, green government bonds with different maturities will be available to match the different preferences of investors. Short-term green bonds will then be available to central banks, medium-term ones to investment funds and long-term ones to pension funds. This is intended to create an interest rate reference for the euro area green finance market, so that market participants have access to safe green bonds with the best rating. A further aim is to develop and promote the green finance market (German Finance Agency,

2020). Other government issuers in the euro area such as France or the Netherlands have so far only issued single maturities. In addition, the goal is to attract new investors for German government bonds and thus secure favorable financing terms in the future.

The special feature of this market entry is the construction as twin bonds. Parallel to the green bond, the German government's Finance Agency issues conventional bonds to the same amount, but these are only held in the Agency's own portfolio. This enables them to be represented via the repo market and at the same time keeps liquidity high. As a benchmark for interest rates in the euro area, it is important for the Finance Agency that the liquidity of German bonds is high at all times. The issue of green bonds could reduce the liquidity of conventional bonds. Twin bonds are intended to prevent this problem. In addition, investors can exchange the green bonds for their conventional twin bonds at any time. This is intended to keep the liquidity problem low for green bonds as well.

The green bonds are similar to an existing conventional bond in terms of maturity, coupon and interest dates. The differences are an initially smaller issue volume, issue dates after conventional bonds, a separate ISIN and a statement on the allocation and reporting of green spending in the federal budget. The use of the funds is not restricted to specific green expenses. However, the amount of green bonds that can be issued is limited by the amount of green expenditures in the federal budget. The issuing of these green bonds will therefore initially not change the government's spending behaviour. The expectation of the Finance Agency is that, with all other features remaining the same, an additional green feature will lead to an increased demand and thus more favourable financing conditions. In contrast to previous comparisons between green and conventional bonds, which were based on basically comparable bonds of the same issuer, the yield differentials of these twin bonds should actually represent a kind of premium for the green label given that the bonds are otherwise identical.

When selecting green budget positions, the Federal Government does indeed orient itself to established international market standards, such as the UN Sustainable Development Goals or the Green Bond Principles of the International Capital Market Association (ICMA). However, it cannot be ruled out that green investors may consider bonds based on green spending from the previous fiscal year and with conventional bonds existing in parallel, to be insufficient. Instead, some investors prefer to invest in bonds that are assigned to specific future projects (The World Bank, 2018), as for example the Netherlands with at least 50% of their green bond issuances do (Dutch State Treasury Agency, 2019). Moreover, the form of the twin bond could make it more difficult to distinguish it from conventional government spending. Some investors do not buy bonds with a possibility that the capital could be used, for example, for military spending (The World Bank, 2018). On the other hand, there might be a loss of credibility for the Finance Agency as well as legal problems if green bonds were assigned to specific future projects and afterwards cancelled for political, economic or technical reasons. Alternatively, at least the green bonds could be based on expenditures of the next budget. This would require a buffer between the planned expenditures and the assigned green bonds.

The entry of countries that issue safe bonds, such as Germany, could further develop the market for green bonds. Many financial institutions hold sovereign bonds despite the small margins that can be achieved with them. The reasons for this are often regulatory requirements and portfolio diversification. The composition of an investment portfolio such as a fund is based on a mix of risky and less risky assets. Sovereign bonds are an important asset to control the risk profile. The riskier the portfolio is to be, the more government bonds, in particular of safe issuers such as the USA or Germany, are needed. A lack of green sovereign bonds could hamper the expansion and diversification of green investment portfolios. The limited opportunities due to the lack of green sovereign bonds could make funds shy away from further replacing their portfolios with green investments. This restriction would also limit the growth opportunities of green corporate bonds.

Currently, the market for green-labelled bonds is dominated by bonds issued by development banks and financial companies, followed by non-financial companies. Sovereign bonds play a rather minor role. A CBI (2019) survey of Europe-based fixed income asset managers shows that investors want significantly more green bonds from governments. They are most interested in bonds issued by non-financial corporations, while green bonds issued by development banks are less in demand. This gives another indication that the market is interested in more green sovereign bonds and that governments could support this market with their own bonds.

2.2.6 Green Corporate Bonds

Globally, corporate bonds are the largest green bond segment. While almost no green corporate bonds existed before 2013, an amount of 114.3 billion US-Dollar were issued in 2019 (Climate Bonds Initiative, 2020a). However, the importance of green corporate bonds is extremely low compared to outstanding conventional corporate bonds worldwide, worth 52.9 trillion US-Dollar (Bank for International Settlements, 2019). In 2019, the volume of bonds issued by financial and non-financial corporations was roughly balanced. Compared to 2018, when more bonds came from financial corporations, non-financial corporations doubled their issues. Bonds issued by non-financial companies are dominated by the energy sector. The Ehlers and Packer (2017) shows that issuers from sectors that are exposed to immediate or emerging environmental risk have a larger share of green bond issues compared to their share of total bonds. Similarly, Flammer (2020) argues that companies whose business activities are heavily dependent on the environment or natural resources, such as the energy sector, issue a disproportionately large number of green bonds. Companies from the less ecological sectors could want to send a signal of environmental friendliness with green bonds. Companies with a less polluting economic model, on the other hand, could do without this form of signalling, since the costs for ratings and ESG-Scores are not compensated by the image gain (Chapter 2.2.6).

The largest issuers come from France, the USA and Portugal. In the financial sector, two Chinese and two French banks lead the list of the largest issuers (Climate Bonds Initiative, 2020a). In Germany, non-financial corporations have consistently issued fewer bonds than financial cor-

porations in the past (Chart 5, Right). This also affects the ECB's purchasing programme, as it does not buy corporate bonds from financial institutions because of its non-bank criterion. More green bonds issued by non-financial corporations would meet market demand for these bonds (Climate Bonds Initiative, 2019) and at the same time increase the amount of potential green bonds that the ECB can buy (Chapter 5.2).

Corporates can have several motives for issuing green bonds. First, corporates can be interested in lower financing costs. If the costs are not lower, they might as well issue conventional bonds to finance green projects. However, the evidence is very weak in this respect. Second, corporates could try to use bonds for greenwashing. Green bonds will then only be used to make the company appear greener than it actually is. Third, the corporation uses green bonds to signal a stronger commitment to greener business practices. Flammer (2020) shows that companies indeed become greener after issuing green bonds, their sustainability ratings increase and CO₂-emissions decrease. Nevertheless, corporations might issue green bonds if they know they will become greener and want to signal it. In addition, the ownership structure is changing to greener and longer-term oriented investors. On the contrary, she finds no evidence for the first two motives.

For companies there are costs associated with the certification of green bonds. The Climate Bond Initiative charges a certification fee of 0.1 basis point of the issue volume for its green label. Normal ratings from the major rating agencies are around 3-5 basis points. A similar amount could be expected for an additional green label Ehlers and Packer (2017). Further costs can arise within the company due to reporting and disclosure obligations. The planned EU taxonomy (Chapter 4.1) could at least reduce these costs somewhat through standardization.

In Germany, financial companies play a relatively small role in the market for green bonds. The share of non-financial companies is even smaller, with less than 4 billion Euro of green bonds issued to date. The market is dominated by KfW as the development bank of the federal government and other government-backed entities (Chart 5, Right). One reason for this could be that the corporate bond market is small by international standards. In countries with a smaller economy than Germany, such as France, the United Kingdom, the Netherlands, Australia or Canada, significantly more corporate bonds are issued (Bank for International Settlements, 2019).

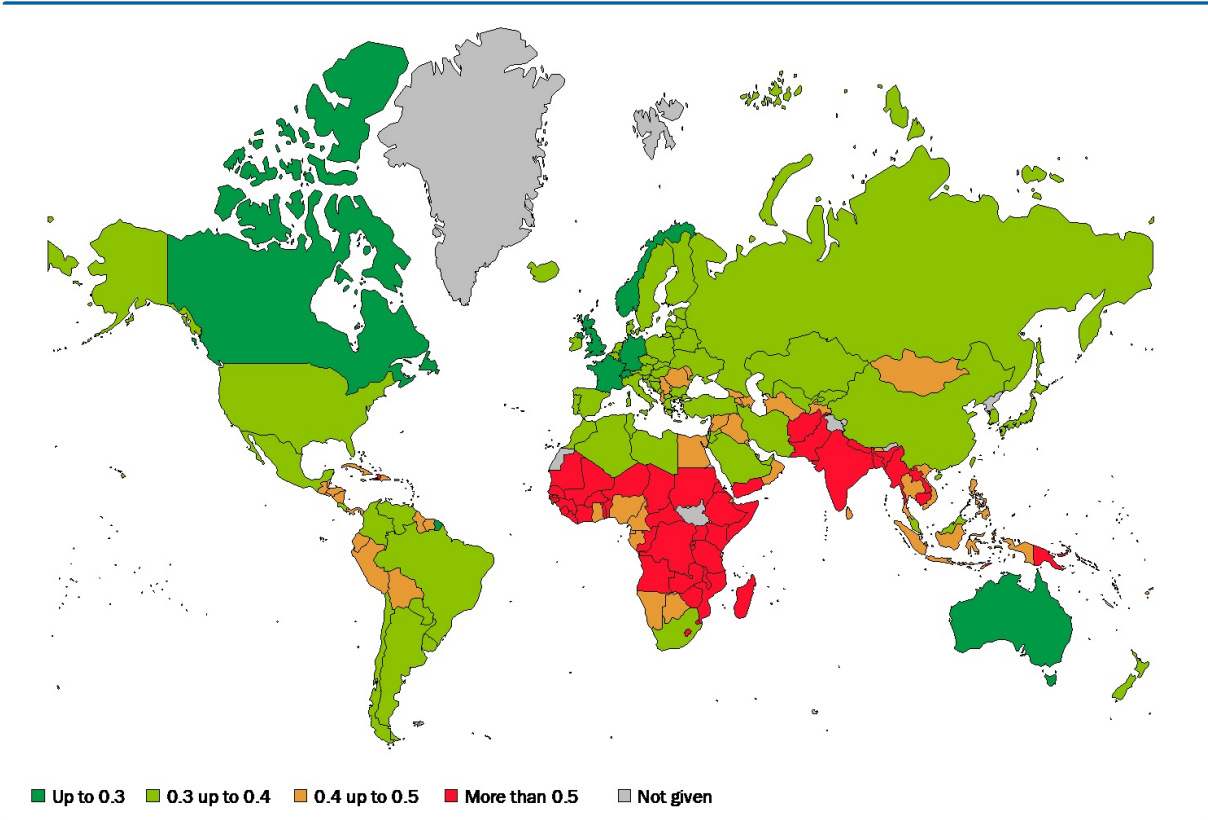
3 Risks Related to Climate Change

3.1 On the Nature of Climate Risks

Climate change constitutes a major challenge, causing both threats and opportunities that will significantly affect the economy and the financial sector. Physical risks stem from climate-related damage due to global warming. Such events can be both acute and more gradual, such as changes in extreme weather variability and rising sea levels. There is significant regional variability in countries' vulnerability to climate risks (Chart 7). The second source of risk arises

from the shift towards a low carbon economy (transition risks). Achieving this transition almost certainly requires intervention by public authorities through regulation and taxation. The economic transformation and the almost inevitable uncertainties surrounding the course of climate policy are a source of significant risk.

Figure 7
Country's vulnerability to climate change based on ND-GAIN Vulnerability Index¹



1 - ND-GAIN Vulnerability Index measures a country's exposure, sensitivity and capacity to adapt to the negative effects of climate change. Overall vulnerability is estimated by considering thirty-six indicators in six life-supporting sectors - food, water, health, ecosystem service, human habitat, and infrastructure. Score ranges from 0 to 1. Lower scores are better. Data from 2017.

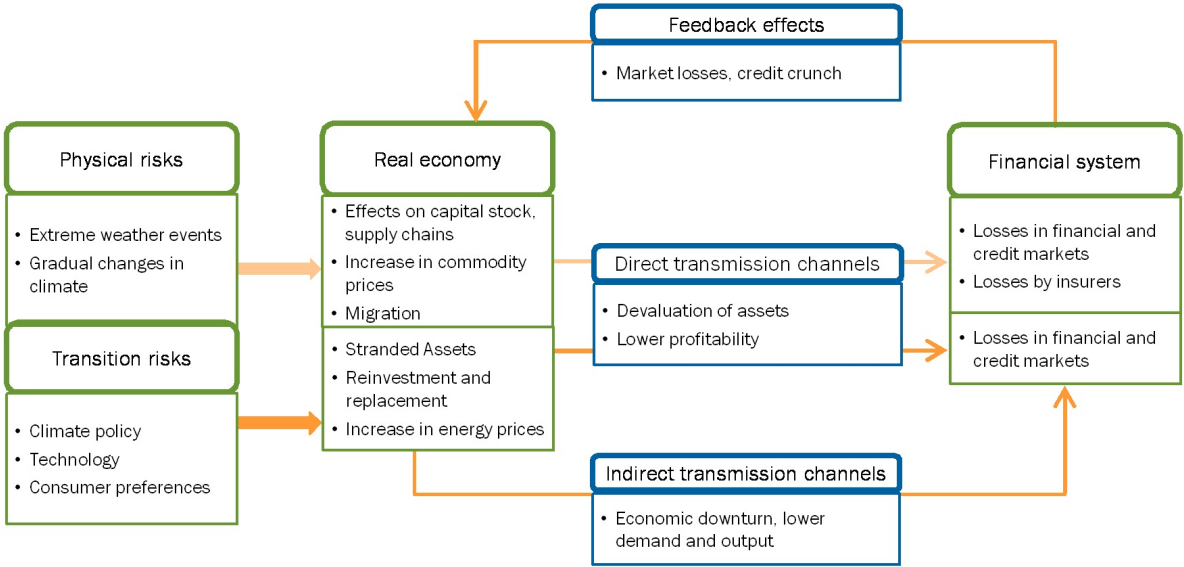
Sources: EuroGeographics for the administrative boundaries, Notre Dame Global Adaption Index © Sachverständigenrat | 20-242

Physical and transition risks are the channels through which climate change can affect macroeconomic conditions and financial stability (NGFS, 2018) (Chart 8). A shift in climate can have both an economic impact and an effect on financial stability through an interplay of supply and demand shocks (Batten, 2018). Insurance liabilities are particularly exposed to the frequency and severity of climate and weather-related events (Albouy et al., 2016; Bunten & Kahn, 2014; Gassebner et al., 2010). On the demand side, extreme climate events could reduce household wealth and therefore negatively impact private consumption (Hallegatte, 2009). Uncertainty about future demand and growth prospects could also lead to higher precautionary savings and lower investment (Parker, 2018). On the supply side, natural disasters can disrupt business activity and trade, and destroy infrastructure, diverting capital from technology and innovation to reconstruction and replacement (Batten, 2018). As has proven to be the case in the past, these macroeconomic and financial shocks can further interact and amplify each other.

Assuming a business-as-usual scenario in which emissions are taken as given, the global “climate value at risk” depicting the 99th percentile of the global financial system’s loss distribution is estimated at 16.9% or USD 24.2 trillion (Dietz et al., 2016).

Figure 8

From physical and transition risk to financial stability risks



Sources: Deutsche Bundesbank, Network for Greening the Financial System

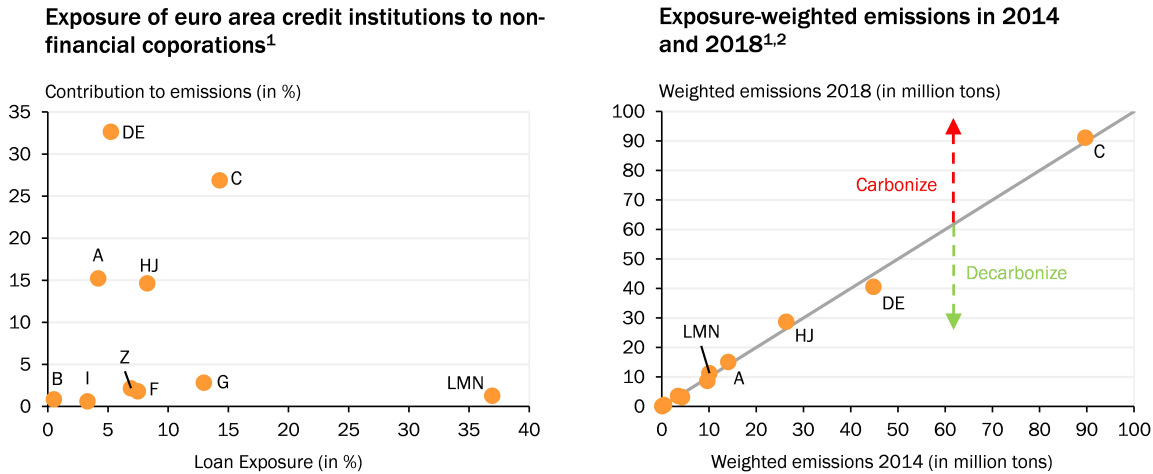
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Adjustments to asset prices induced by physical or transition risks will probably be a key channel of impact over a short to medium-term horizon (Batten, 2018). Systemic risks in the financial system may arise due to institutions’ exposure to carbon-intensive assets that become “stranded” (i.e. unusable). Recent empirical work underscores the importance of asset price bubbles in the build-up of systemic risk – especially during the bust phase (Brunnermeier et al., 2019). In the case of a mispricing (i.e. current overvaluation) of carbon-intensive assets, the introduction of policy measures demanding a sudden transition to a low-carbon economy might provoke such a bust of the “carbon bubble”. McGlade and Ekins (2015) estimate that 82% of global coal reserves, 49% of gas reserves and 33% of oil reserves would turn into “stranded” assets in an economy that successfully restricts emissions to meet the 2°C global warming target. In contrast, Sinn (2012) argues in favor of a “green paradoxon” in which companies would have an incentive to promote fossil energy sources faster and sell them into regions with weak climate policies. As approximately a quarter of global fossil fuel reserves is owned by private companies, a repricing of carbon-intensive assets would imply a drastic reduction in their market valuation and profit. The capital structure of fossil-fuel companies is largely built on debt, underscoring the potential threat to the financial system’s stability imposed by a carbon bubble (Domanski et al., 2017; ESRB, 2016).

To analyse the potential threat of such a carbon bias, the exposure of euro area credit institutions through loans to non-financial companies in the euro area can be compared to the

carbon-intensity of the companies' business (Chart 9). Almost 40% of all outstanding loans at the end of 2018 are granted to companies in the real estate business, or other branches of the service sector which contribute only 1% to overall CO₂- and CO₂-equivalent emissions in the EU in the same year. 14% of all loans are granted to companies from the manufacturing sector which accounts for more than a quarter of all emissions. Credit institutions' loan exposure to other carbon-intensive sectors only surpasses a threshold of 5% in the case of loans made to the transportation and storage sector as well as the (combined) electricity, gas and water supply sector. Overall, loans to sectors that are not particularly carbon-intensive (i.e. each contributing less than 5% to overall emissions) account for almost 70% of credit institutions' loan exposures. These numbers suggest that with regard to loan exposures the potential shock to the euro area banking sector imposed by a carbon bubble might not induce a systemic event. Comparing institutions' loan exposure at the end of 2014 and 2018 suggests that on average exposure-weighted emissions have not significantly changed in recent years, although loans made to the most carbon-intensive sector of electricity and water supply have been reduced (Chart 9, Right). In fact, a sizeable part of emissions concentrates around a very small number of large polluters, but those firms are not necessarily the ones to which banks are most exposed. Using more granular supervisory data, ECB (2019) however shows that few banks hold the bulk of exposures to the most energy-intensive borrowers, whereby the CO₂ emissions of the 20 most polluting firms amount to half of euro area banks' exposures to emitting firms captured in their datasets. In fact, such concentration of risks could also be a source of financial instability, which emphasizes possible limitations in using aggregated data when analyzing credit institutions' exposure to risks.

Figure 9
Exposure of euro area credit institutions to climate risks and decarbonization between 2014 and 2018



1 – According to the Statistical classification of economic activities, NACE Rev. 2: A-Agriculture, forestry and fishing, B-Mining and quarrying, C-Manufacturing, DE-Electricity, water supply and sewerage, F-Construction, G-Wholesale and retail trade, HJ-Transportation and storage; information and communication, I-Accommodation and food service activities, LMN-Real estate; professional, scientific, administrative and support service activities, Z-Other. 2 – Exposure-weighted emissions in tons, end-of-year values, NACE sectors without label: B, F, G, I, Z.

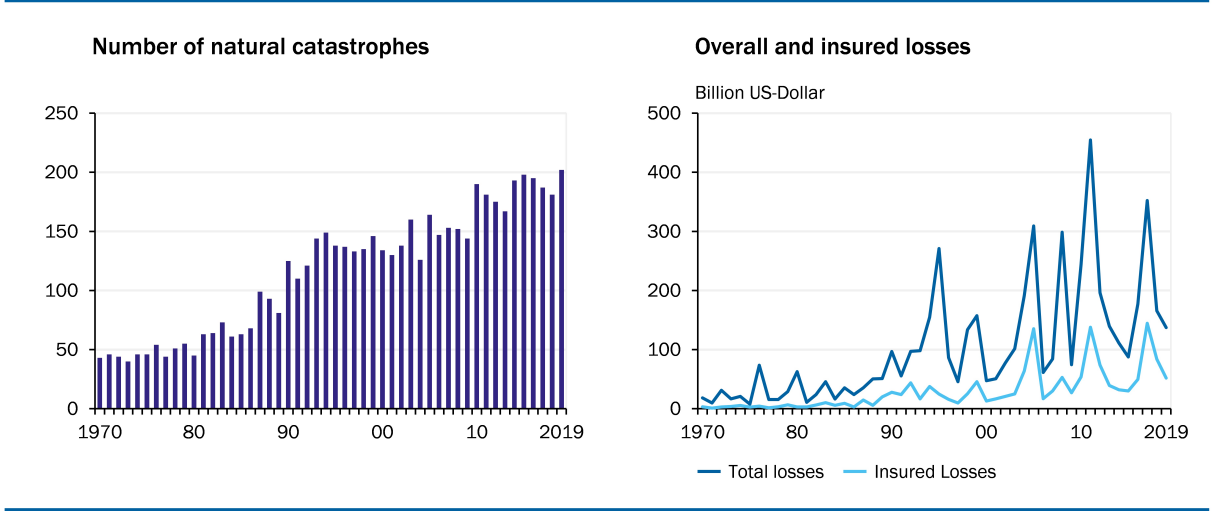
Sources: ECB, Eurostat, own calculations

Based on broader data comprising equity, bond and credit holdings, Weyzig et al. (2014)

estimate the exposure of European financial institutions towards fossil fuel companies that hold reserves likely to become “stranded assets”. Although they estimate exposures of up to 460-480 billion Euro for European banks and up to 260-300 billion Euro for pension funds, the relative share of assets exposed to this source of transition risk amounts to 1.4% of total assets for banks and at most 5% for EU pension funds. It is concluded that the carbon bubble is unlikely to be a primary source of systemic risk itself and may much rather become a threat to the financial system’s stability in a scenario of general macro-economic and financial fragility. Based on data covering approximately 10% of the German banking sector’s exposure, the Bundesbank (Deutsche Bundesbank, 2019a) finds evidence indicating that German banks are not particularly affected by a transition to a low-carbon economy through loans.

Aside from long-dated predictions, actual measurement of physical risks to date suggests that physical and transition risks are already playing a growing role in eroding the collateral and asset values of insurers. The number of natural catastrophes has been steadily increasing since 1970 (Chart 10, Left). A concomitant rise in the incidence of natural disasters may place insurers and reinsurers in a situation of fragility as claims for damages keep increasing. Losses from natural catastrophe have risen steadily between 1980 and 2019 and insurers are now already facing high levels of weather-related costs (Chart 10, Right). Losses from natural catastrophes worldwide amounted to 137 billion US-Dollar in 2019, and only 38% of these were insured, leaving a large insurance protection gap. In the EU, the average number of insured losses between 1980 and 2018 was even slightly smaller (ESRB, 2020). As such, they can pose a significant threat to the solvency of households, businesses and governments, and therefore financial institutions as well (Bolton et al., 2020).

Figure 10
Increase in the number of natural catastrophes and their insurance worldwide, 1970–2019¹



1 - Natural catastrophes are defined as loss events triggered by natural forces, consisting of earthquakes and weather-related events.

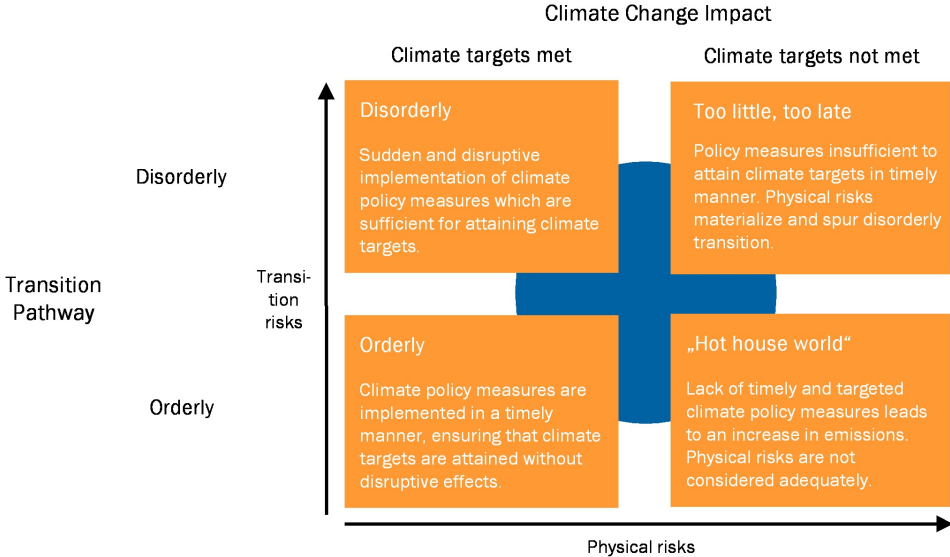
Sources: Munich RE, Swiss Re Institute

Physical and transition risks are not likely to be independent of one another. The costs associated with these risks vary depending on the trajectory chosen for reducing carbon emissions

(Chart 11). While the lack of sufficiently forceful policy measures aggravates physical risks, abundant or misplaced climate policies may intensify transition risks (Vermeulen et al., 2018). In a gradual transition to renewable energy and replenishment of the physical capital stock, carbon-intensive technologies would gradually become unprofitable due to a combination of regulation (such as carbon taxes) and technological development (i.e. economies of scale that drive down the costs of renewable energy). However, if policy intervention is delayed, the reduction in emissions may have to be sharper to reach negotiated climate targets, resulting in a disorderly, disjointed and more disruptive transition for the economy. In a sudden and disorderly transition scenario, the re-evaluation of assets in the fossil fuel sector might lead to severe imbalances in the economy and financial markets (Bolton et al., 2020; Cahen-Fourot et al., 2020; McGlade & Ekins, 2015).

Figure 11

Trajectory for reducing carbon emissions



Source: Network for Greening the Financial System

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3.2 Climate-related Risks in Credit Ratings

Environmental risks can affect the possibilities of an entity to meet its financial obligations. To some degree, credit rating agencies have always considered such risks when assigning credit ratings, but they only recently started to explicitly consider and incorporate them into their assessment processes. Environmental risks have already played an increasingly important role in credit rating decisions in recent years. In 2017, Moody’s downgraded the city of Cape Town, South Africa, after a major drought threatened the municipality’s ability to provide water to the community. Earlier this year, Trinity Public Utilities District in California was downgraded due to the elevated risk of wildfires. Regarding a downgrade of Ford in September 2019, Moody’s cited the potential for “large emission penalties in 2020 and 2021” as part of the reason for docking the carmaker to junk status. In April 2020, Moody’s downgraded Exxon Mobile, the

biggest energy company in the world by market capitalisation, from AAA to Aa1 quoting the “growing efforts by many nations to mitigate the impacts of climate change through tax and regulatory policies that are intended to shift global demand towards other sources of energy or conservation” as one of the reasons for the rating decision (Moody’s Investors Service, 2019). However, major rating agencies still estimate that in general ESG risks, especially climate risks, have a low level of direct impact on credit ratings (Fitch Ratings, 2019; S&P Global, 2019). In relative terms, governance is said to be the most relevant ESG factor (Fitch Ratings, 2020; S&P Global, 2019).

Credit rating agencies play a central role in the proper pricing of environmental and climate risks. The three major rating agencies, Moody’s, Fitch, as well as S&P have all signed the “ESG in credit risk and ratings statement” (PRI, 2020a). By doing so, the signatories recognise that ESG factors can affect borrowers’ cash flows and the likelihood that they will default on their debt obligations. Consequently, they commit to incorporating ESG-criteria into credit ratings and analyse them in a systematic and transparent way. In addition to integrating ESG evaluations into their existing credit ratings, major rating agencies (as well as specialized rating agencies like Sustainalytics and ISS-oekom) provide ESG assessments in which they evaluate the ESG performance of companies and individual securities. Such ESG assessments are demanded by a growing number of institutional investors, asset managers, financial institutions and other stakeholders.

Moody’s cited ESG risks as material credit considerations in 33% of the 7,637 private-sector rating actions published in 2019 (Mutua, 2020). In an internal analysis, S&P (2017) examined where and how environmental and climate factors had driven corporate rating actions in the past. They document that between July 2015 and August 2017, such factors were an important component of the analysis in 10% of the 9000 rating actions under review. However, climate risks or opportunities were one of the key reasons for the rating action in only 1 percent of all cases. Out of these, 41% were downgrades, but at least 19% were upgrades, which also illustrates that environmental factors do not only bear a diverse range of risks but also opportunities for the rated entities. As such, organizational efforts to mitigate and adapt to climate change through increasing resource efficiency, the adoption of low-emission energy sources or by building resilience along the supply chain can become a strategic imperative for firms.

Despite this, major rating agencies have been improving their capacity to better analyse how climate change can factor into the financial stability of companies and governments around the world in recent years. By doing so, agencies acknowledge that the importance of climate risks for credit ratings differs along multiple dimensions and might well be of high relevance for single entities. Moreover, the question where and through which channels environmental risks arise critically depends on factors that are beyond the control of the rated entity. As such, chances to effectively manage climate risks are limited.

Rating agencies take different actions to develop a better understanding on how environmen-

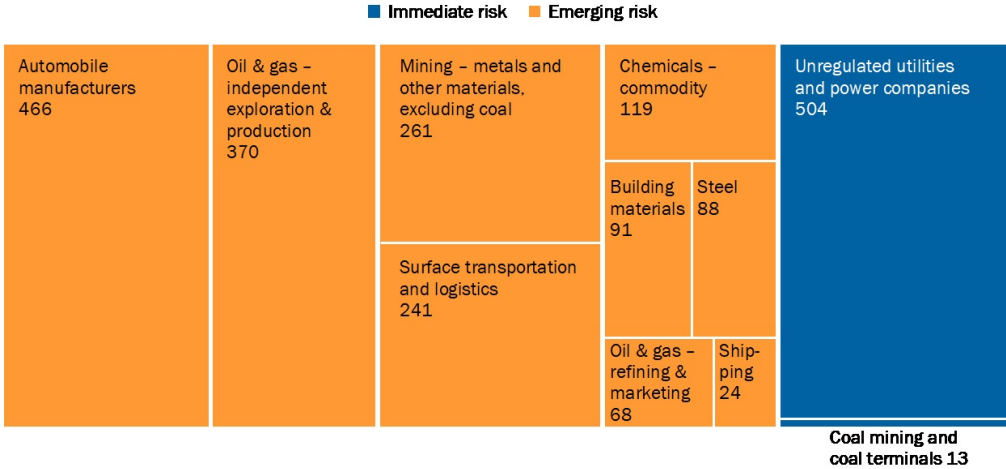
tal and climate factors can be incorporated into rating actions. For instance, Fitch introduced so-called ESG Relevance Scores that document the relevance of individually identified ESG risk elements to a given rating decision in 2019 (Fitch Ratings, 2019). Moody's developed a Heat Map, S&P introduced an ESG Risk Atlas to gauge which areas and industries face the highest exposure to the physical impacts of climate change, as well as which industries are risking transitional impacts as the demand for renewable energy rises. Moreover, major rating agencies have recently acquired firms that measure the physical risks of climate change, which can be considered as a major step on the way to incorporating ESG criteria into the rating process. In 2016, S&P acquired Trucost which offers a dataset that assesses the exposure of more than 15,000 companies' to physical risk at asset level. In 2019, Moody's bought a majority share in Four Twenty Seven, a California-based company that measures a range of hazards - including extreme rainfall, hurricanes, heat stress and sea level rise - and tracks their impact on 2,000 companies and 196 countries. The purchase is the most recent in a series of steps by rating agencies to better account for the effects of climate change.

The relevance of climate risks for credit ratings varies along multiple dimensions. First, it depends on the rating class, although agencies disagree on the extent to which environmental and climate factors matter for certain rating classes. While S&P considers environmental risks to be particularly relevant for corporate ratings, Fitch considers it to be more material for the ratings of sovereigns than for all other asset classes (Fitch Ratings, 2019). All major rating agencies consider banks not to be considerably exposed to environmental and climate risks due to a high degree of portfolio diversification. Nonetheless, a simulation analysis measuring the impacts of a credit rating downgrade of one notch for banks' exposures to the highest polluting firms within economic sectors suggests credit losses that could reach up to 10% of total assets (ESRB, 2020). In an analysis by Moody's Investors Service (2020b), only 32% of large banks even partially disclose how climate risk would affect their financial performance under global warming stress scenarios.

With regard to corporate ratings, environmental credit risks are particularly relevant in specific sectors. According to Moody's heat map, the top industries with elevated environmental risks are unregulated utilities and power companies, the automobile industry, the oil and gas refining market and the transportation industry. In 2018, they identified 11 sectors, with a combined 2.2 trillion US-Dollar in rated debt, as being in danger of a downgrade owing to tightening of CO2 regulatory regimes (Moody's Investors Service, 2020a) (Chart 12).

Moreover, there are regional differences in the relevance of climate risks for credit ratings. This can either be due to regional vulnerabilities to physical risks or to global differences in the level of enforcement of environmental policies. Although climate change, on average, poses a negligible direct risk to sovereign ratings of advanced economies, ratings for many emerging sovereigns would likely come under significant additional pressure over time (Chart 7). In a globalized world, distortions in emerging and developing countries can have indirect repercussions for advanced economies as well, for example, through trade and migratory flows. Under

Figure 12
Sectors most exposed to climate impact on credit ratings¹



1 – Debt rated by Moody's in billion US-Dollar (as of 2018).

Source: Moody's

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strict environmental policies, sustainability becomes a strategic imperative for forward-looking firms. However, the global regulatory response has been disjointed and politically volatile. Given substantially more aggressive environmental policies in Europe, European utilities for example show a greater rating sensitivity to coal-fired generation than US utilities (Fitch Ratings, 2020; S&P Global, 2019).

Lastly, the relevance of climate risks in credit ratings critically depends on the time horizon that agencies take as a basis for their assessments. The time horizon to incorporate credit risks into the rating process is typically about three to five years, which is not compatible with the large time lags before climate damages become apparent and irreversible (Bolton et al., 2020). Consequently, this leads agencies to conclude that currently climate risks do not yet have a big impact on credit ratings and that this type of risk will mainly be relevant in the decades to come (Fitch Ratings, 2020; Moody's Investors Service, 2017; S&P Global, 2019). On the one hand, this time lag provides agents with some capacity to take mitigating actions (Moody's Investors Service, 2017). However, factors that are beyond control of the rated entity account for a significant share of climate risks. For example, tightening global emissions legislation can have severe impacts for the automotive industry. Moreover, the adoption of electric vehicles as a means of hedging against environmental risks critically depends on the development of charging infrastructure. Consequently, regulatory responses can critically influence business models long before physical risks of climate change become apparent. Near term-risks are typically more meaningful and are considered to have a more direct impact on ratings. As the time frame lengthens, the probability and impact of risks becomes less certain, which confronts agencies with an increasing difficulty of assessment. This is even more problematic in the context of climate risks, where there is no scientific agreement about the precise quantitative impact that could be incorporated in rating models by agencies (S&P Global, 2017). This bears the peril that risks remain understated.

3.3 Obstacles to the Correct Pricing of Climate-related Risks

It is in every market participant's interest to be properly protected against climate risks. According to Miroshnychenko et al. (2017), the financial performance of companies that implement measures to reduce their own environmental impact improves. A positive relation between companies' ESG-compliant efforts and performance is also found in various other papers (Eccles et al., 2017; Flammer, 2013; Flammer et al., 2019; Guenster et al., 2011). Krueger (2015) and Flammer (2013) show that stock markets react positively to environmentally friendly behaviour of companies. Still, the possibility to comprehensively take environmental risks into account is partly beyond control of market agents. There is a huge mismatch between the causes of climate change and its impact, both in terms of timing and geography. The interdisciplinary nature of climate-related challenges adds considerably to complexity when it comes to analysing climate-related risks and their possible implications. A potential underpricing of transition risk could for example emerge when the strategic horizon of investors is shorter than the horizon over which they expect the transition to occur (Carney, 2015; Krogstrup & Oman, 2019; NGFS, 2018). At the same time, market pricing is hampered by the lack of granular and comparable information on climate change-related risks. Moreover, financial risks are often priced based on historical distributions of outcomes, but this approach does not capture climate change risks, which have no historical precedents. Pricing of climate risks must rely on the science of climate change, requiring a whole new risk pricing framework and new competencies of financial risk pricing experts (Krogstrup & Oman, 2019). There is empirical evidence of underpricing of climate risk in financial markets (Addoum et al., 2019; Batten et al., 2016; Hong et al., 2019).

Therefore, two factors are crucial for quantifying and correctly pricing climate-related risks. First, information is needed on the carbon intensity of individual assets. Enterprises, investors and financial institutions need this information because otherwise they are unable to adequately incorporate transition risk into the decisions they make. Second, an extensive pool of data is needed to allow experts to estimate how an expected increase in extreme weather and natural events might affect the economy and the financial system. At present, market agents lack this necessary information because of disclosures that are incomplete, inconsistent, and insufficient (ESRB, 2020). Incompleteness relates to the voluntary nature of current disclosures, which bears the risk that information provided suffers from a selection bias. Moreover, in the absence of a widely accepted benchmark taxonomy, "greenwashing" can lead to an inadequate accreditation for green labelled products. In particular, financial institutions fail to encompass the climate risk inherent in their asset portfolios (ESRB, 2020). Disclosure requirements can help support and improve the transparency and the pricing of climate risks. Moreover, limited data availability and a lack of consistency among data sources poses an additional substantial obstacle to adequate risk assessment. While seemingly willing to price climate-related risk, this means that rating agencies are partly unable to fully reflect climate-related risks in their credit ratings.

Consequently, different initiatives such as the G20 Green Finance Study Group, the United Nations Environment Programme (UNEP) and the Network for Greening the Financial System (NGFS) have repeatedly recommended that public authorities make data which is relevant

for climate risk assessment publicly available. To better understand how climate factors can translate into financial risks and opportunities, an ongoing exchange of expertise and experience between institutions, academia and financial market participants is essential.

4 Regulatory Reforms at the European Level

4.1 Action Plan on Sustainable Finance and Reforms to Legislation

In the context of its measures to complete the Capital Markets Union, the European Commission (EC) seeks to ensure that the financial system takes due account of environmental and social considerations in investment decisions. It is supposed to provide substantial contributions to the investments that are necessary to achieve the EU's climate and environmental goals by increasing investments in longer-term and sustainable activities. For this purpose, the EC adopted an Action Plan on Sustainable Finance in March 2018 (European Commission, 2018a). The action plan is based on the work of a High-Level Expert Group on Sustainable Finance (HLEG), that has been appointed by the EC. In January 2018, the HLEG published its final report comprising strategic recommendations and actions targeted at specific sectors of the financial system (HLEG, 2018). Whereas the HLEG provided advice on sustainable finance, the EC's Action Plan mainly focuses on green finance and climate change.

The Action Plan on Sustainable Finance aims to achieve three goals and contains ten measures that are considered necessary for their achievement (Chart 13).





The first goal is to redirect capital flows towards sustainable investment. According to the EC, the lack of a common understanding regarding what constitutes a sustainable investment is an obstacle for such investments. Therefore, the introduction of a unified EU classification system (taxonomy) aims to provide clarity on which economic activities can be considered sustainable. Since other measures will build on the taxonomy, it is the central element of the Action Plan. Standards and labels for green financial products, which build on the taxonomy, are intended to facilitate the access for investors seeking sustainable investments and to protect the integrity of markets for those products. By increasing the capacity to develop and implement infrastructure projects and further measures, the EC aims to foster investment in sustainable projects. In addition, financial intermediaries should mandatorily incorporate sustainability aspects in the provision of financial advice. Moreover, the Action Plan comprises the development of sustainability benchmarks.

The second goal is to limit the financial impact of environmental risks. To accomplish this goal, the Action Plan envisages to improve the consideration of sustainability factors in credit ratings and market research. In addition, asset managers and institutional investors should be obliged to take sustainability aspects into account in their investment decisions and to disclose to their investors how they consider those criteria in their investment decisions, in particular their exposure to sustainability risks. Moreover, the EC seeks to incorporate sustainability factors in the prudential regulation of banks, insurance companies and pension funds. This measure does

not only aim to better reflect risks related to climate change and other environmental factors in prudential regulation, but also seeks to redirect funds to sustainable investments.

The third goal of the Action Plan is to promote transparency and long-term orientation. It should be achieved by strengthening the disclosure requirements on sustainability and promoting sustainable corporate governance.

Figure 13
Action Plan on Sustainable Finance

Objectives	Redirect capital flows	Limit financial impact of environmental risks	Promote transparency and long-term orientation
Measures	 Taxonomy	Consideration of sustainability in ratings and research	
	Standards and labels for sustainable financial products	 Disclosures by financial market participants	
	Fostering investment in sustainable projects	Incorporate sustainability in prudential regulation	
	 Incorporate sustainability in financial advice	Strengthen disclosure requirements on sustainability for corporates	
	 Develop sustainability benchmarks	Promote sustainable corporate governance	

Source: own illustration based on European Commission (2018a) © Sachverständigenrat | 20287

As a follow-up to its Action Plan on Sustainable Finance, the EC put forward three legislative proposals in May 2018 (European Commission, 2018b). The first draft legislation aimed at clarifying disclosure requirements related to sustainable investments and sustainability risks. In December 2019, the corresponding regulation on sustainability-related disclosures in the financial services sector entered into force (European Parliament & Council of the European Union, 2019a). It specifies how financial advisors and market participants, such as asset managers, insurance companies and pension funds, have to integrate ESG risks in their decision-making as part of their obligation to act in the best interest of clients. The regulation also includes homogeneous rules that specify how those agents have to inform their clients about their compliance with the integration of ESG risks. Moreover, it obliges financial advisors and market participants to disclose adverse impacts of investments on ESG matters (European Commission, 2019d).

The second legislative proposal pursued the objective to create benchmarks helping investors to compare the carbon footprint of their investments. A regulation regarding EU Climate Transition Benchmarks, EU Paris-aligned Benchmarks and sustainability-related disclosures for benchmarks entered into force in December 2019 (European Parliament & Council of the European Union, 2019b). Those benchmarks seek to give additional assurances to avoid greenwashing and

to help investors wanting to adopt climate-conscious investment strategies (European Commission, 2019a). Whereas the Climate Transition Benchmarks are supposed to offer low-carbon alternatives to commonly used benchmarks, the Paris-aligned Benchmarks will only include companies that can prove that they are aligned with limiting global warming to 1.5°C. Based on the advice of a Technical Expert Group on sustainable finance (TEG), the EC will propose delegated rules that provide further details on the composition of the benchmarks.

The third proposal sought to establish a unified EU classification system for sustainable economic activities (taxonomy). It aims to help economic actors and investors to make more informed decisions by providing clarity on which activities are considered as sustainable (European Commission, 2018d). The Action Plan on Sustainable Finance envisages that future standards and labels for sustainable financial products will be based on the taxonomy. The regulation providing the basis for the taxonomy entered into force in July 2020 (European Parliament & Council of the European Union, 2020).

4.2 Progress on the Taxonomy for Sustainable Economic Activities

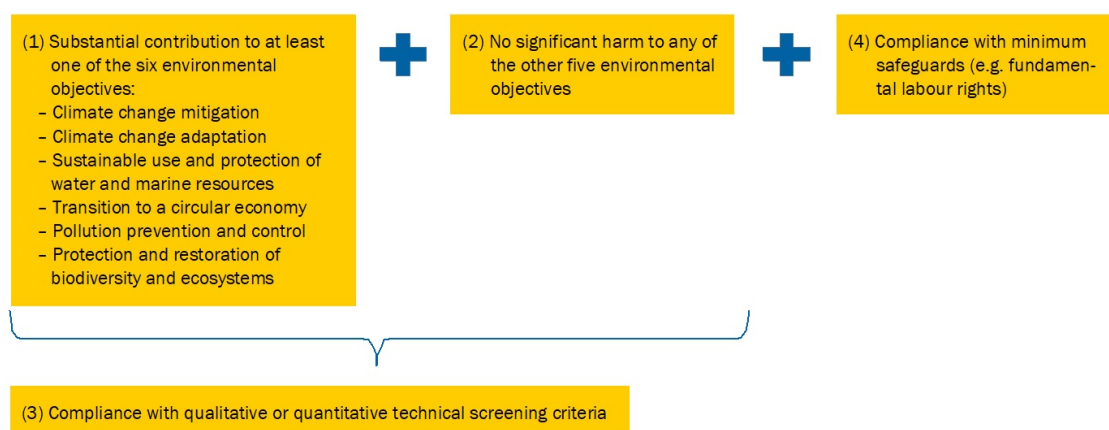
Up to now, there had been no common definition at EU or global level what constitutes environmentally sustainable economic activities. By establishing a uniform classification system for sustainable economic activities (taxonomy), the EC seeks to overcome fragmentation that may result from market-based initiatives and national practices. Moreover, the taxonomy aims to work against greenwashing, i.e. the marketing of financial products as sustainable although they do not satisfy fundamental environmental standards (European Commission, 2019c). The taxonomy regulation includes mandatory criteria for assessing whether an economic activity and thus also investments in it are environmentally sustainable. Whereas the taxonomy regulation initially restricts sustainability to environmental objectives, further dimensions of sustainability such as social objectives may be added at a later date (European Parliament & Council of the European Union, 2020).

Economic activities have to comply with four requirements in order to be classified as environmentally sustainable (Chart 14). First, they have to contribute substantially to at least one of the six environmental objectives specified in the taxonomy regulation. In addition to climate change mitigation and climate change adaptation, it specifies the sustainable use and protection of water and marine resources, the transition to a circular economy, pollution prevention and control as well as the protection and restoration of biodiversity and ecosystems as environmental objectives. Second, economic activities must not significantly harm any of the other environmental objectives. Third, they have to comply with technical screening criteria that will be the basis for the assessment whether the two aforementioned requirements are satisfied. Fourth, environmentally sustainable economic activities have to be carried out in compliance with minimum safeguards regarding employment protection.

For each environmental objective, the taxonomy regulation (European Parliament & Council of the European Union, 2020) defines criteria under which economic activities are considered to

Figure 14

Requirements according to the taxonomy regulation



Source: own illustration based on European Parliament and Council of European Union (2020)

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contribute substantially to the achievement of the respective objective. Moreover, an economic activity qualifies as contributing substantially to one or more of the environmental objectives if it directly enables other activities to make substantial contributions to one or more of those objectives (“enabling activities”). However, to qualify as enabling activities, economic activities must not lead to a lock-in of assets undermining long-term environmental objectives and they have to have a substantial positive environmental impact on the basis of a life-cycle consideration. In addition, an economic activity for which there is no feasible low-carbon alternative can qualify as contributing significantly to climate change mitigation if it facilitates the transition to a climate-neutral economy (“transition activities”), has greenhouse gas emissions corresponding to the best performance in the sector, does not hamper the establishment of low-carbon alternatives and does not lead to a lock-in in carbon-intensive assets.

The EC will define technical screening criteria for each environmental objective through delegated acts. Those criteria will be used to develop actual lists of environmentally sustainable activities. The taxonomy on climate change mitigation and climate change adaptation is scheduled to be established by the end of 2020 to ensure its application by the end of 2021. For the other environmental objectives, the taxonomy is supposed to be established by the end of 2021 and will apply by the end of 2022. The taxonomy regulation explicitly rules out that power generation using solid fossil fuels qualifies as environmentally sustainable economic activity. Because the TEG was unable to make an assessment whether nuclear energy does not significantly harm other environmental objectives, it did not recommend to include this economic activity into the taxonomy at this stage (TEG, 2020). However, the European Commission requested its Joint Research Centre to prepare a technical report on the “do no significant harm” aspects of nuclear energy, which will not be available before the beginning of 2021 (European Commission, 2020d). Accordingly, it is currently not ruled out that nuclear energy could be included in the list of environmentally sustainable activities according to the taxonomy.

The taxonomy regulation pledges financial market participants, issuers and companies to

apply the taxonomy. If corporate bonds or financial products are made available as environmentally sustainable, they have to comply with the taxonomy.

Moreover, the taxonomy regulation substantiates the disclosure requirements that apply according to the regulation on sustainability-related disclosures in the financial services sector. In order to comply with transparency requirements in relation to financial products that conduct sustainable investments, financial market participants and financial advisers have to disclose to which of the environmental objectives the investment contributes. Furthermore, they have to provide information on the share of investments underlying a financial product that are environmentally sustainable according to the taxonomy, including information on the share of enabling and transition activities. In case of financial products that promote environmental characteristics, comparable disclosure requirements apply. However, the disclosure has to include information that the remaining part of the investment does not comply with the criteria of the taxonomy and that adverse effects on other environmental objectives cannot be ruled out. The criteria of the taxonomy do not have to be applied to other financial products, but information that those products do not consider the EU criteria for environmentally sustainable activities has to be disclosed.

In addition, the taxonomy regulation requires undertakings that are subject to an obligation to publish non-financial information, i.e. all banks and insurance companies, listed companies, and other companies that meet certain criteria, to augment their already existing reporting by disclosing information to which extent their economic activities are environmentally sustainable. In particular, those undertakings have to disclose the proportion of their turnover, capital expenditure and operating expenditure associated with economic activities that fulfill the requirements of the taxonomy concerning environmentally sustainable activities. The European Commission shall adopt a delegated act by June 2021, which specifies the content and presentation of the information to be disclosed.

4.3 Discussion on a Green Bond Standard and Changes to Sector Specific Regulation

Green bonds are an important instrument to finance the transition to a low-carbon economy. However, a uniform green bond standard does not exist in the EU. The HLEG recommended the establishment of such a standard and the EC subsequently included the creation of standards and labels for green financial products in its Action Plan. In June 2019, the TEG published a recommendation for an EU Green Bond Standard (EU GBS) and updated its recommendation in its March 2020 report (European Commission, 2020b).

The EU GBS aims to increase the comparability, credibility, effectiveness and transparency of the green bond market. Moreover, it is supposed to stimulate financial market participants to issue and invest in EU Green Bonds. According to the recommendation of the TEG, the EC should create a voluntary, non-legislative standard for EU Green Bonds. The TEG proposes that any listed or unlisted capital market debt instrument, that is issued by a European

or international issuer and fulfills the criteria of the EU GBS can be labelled as an EU Green Bond (TEG, 2019). The TEG argues that the standard should build on market practices and comprise four major elements. First, the EU GBS should be closely linked to the taxonomy, i.e. proceeds from EU Green Bonds should be used to finance economic activities that comply with the taxonomy. Second, a Green Bond Framework that requires issuers to provide details on the proposed use of proceeds, its green bond strategy, processes and reporting. Third, issuers have to report on the use of proceeds (allocation report) and on the environmental impact (impact report). Fourth, the Green Bond Framework and the allocation report have to be verified by an external reviewer. The EC is currently assessing the possibility of a legislative initiative for an EU GBS. It will base its decision on how to proceed on this issue on the outcome of ongoing consultation processes. This decision will be taken in the context of the EC's Renewed Sustainable Finance Strategy.

Another focus is on adapting existing regulations to ensure that financial market participants take ESG risks into account appropriately in their decisions and processes. By amending existing delegated acts under the relevant directives or by adopting new delegated acts, the EC intends to specify how asset managers, insurance companies, and investment or insurance advisors have to integrate sustainability risks in risk management, operating conditions, organization requirements or target market assessment. For this purpose, it has requested technical advice from the European Insurance and Occupational Pensions Authority (EIOPA) and the European Securities and Markets Authority (ESMA) (European Commission, 2018c). In April 2019, EIOPA provided technical advice to the EC on the integration of sustainability risks and sustainability factors in the delegated acts under Solvency II and the Insurance Distribution Directive (EIOPA, 2019). At the same time, ESMA published its advice on integrating sustainability risks and factors in the UCITS Directive and the AIFMD (ESMA, 2019b) as well as in the MIFID II (ESMA, 2019a). Despite those specific proposals, the corresponding delegated acts have not yet been implemented.

The revised Capital Requirements Directive (CRD V) and Capital Requirements Regulation (CRR 2) include three mandates for the European Banking Authority (EBA) with respect to sustainability risks. First, it is supposed to examine the inclusion of ESG risks in the supervisory review and evaluation process that is conducted by banking supervision. The CRD V requires the EBA to publish a report on its findings by June 2021. Moreover, it *inter alia* specifies that the EBA's assessment has to include the development of a uniform definition of ESG risks and the development of qualitative and quantitative criteria to examine the impact of ESG risks on the stability of individual banks. Second, the CRR 2 requires the EBA to develop a technical standard that implements the requirements for banks with publicly listed securities to disclose information on ESG risks. Third, the EBA is called to assess whether a specific prudential treatment of exposures which are substantially related to environmental or social objectives may be justified. While those changes to pillar 1, 2 and 3 requirements will be implemented in the coming years, the EBA encourages banks to act proactively in considering ESG risks. For this purpose, it published expectations concerning the consideration of those risks in banks' strategy

and risk management, disclosures, scenario analyses and stress testing as part of its action plan on sustainable finance (European Banking Authority, 2019).

In the context of the European Green Deal, the EC has announced the European Green Deal Investment Plan, which is supposed to mobilize at least 1 trillion Euro of sustainable investments over the next ten years (European Commission, 2020c). To ensure that the financial system supports the transition towards sustainability, the EC has announced that it will present a Renewed Sustainable Finance Strategy. It is supposed to support the objectives of the European Green Deal Investment Plan by facilitating sustainable investments for private investors and the public sector. The Renewed Sustainable Finance Strategy will be based on the EC’s Action Plan on Sustainable Finance as well as the reports of the TEG. The EC (European Commission, 2020a) currently holds a public consultation on the Renewed Sustainable Finance Strategy and has announced that it will present it in September 2020 (European Commission, 2019b).

5 Central Banks and Climate Change

5.1 Central Banks, Monetary Policy and Climate Risks

As monetary policy is usually mandated to conduct stabilization policy while fiscal authorities are responsible for long-term structural and redistributive policies, monetary policy has not traditionally been considered relevant for long-term climate change mitigation efforts. However, the role of central banks in fostering the transition to a low-carbon economy has been recently getting increased attention. In the euro area, the ECB has announced that implications of climate change for monetary policy and possibilities for the ECB to support the transition to a sustainable economy will be discussed in its ongoing strategy review (ECB, 2020a). Moreover, ECB President Lagarde called the debate on how central banks and banking supervision might effectively contribute to climate change mitigation a “mission critical” (Arnold, 2019). Still, whether central banks should use their instruments to actively promote the fight against climate change is an ongoing and controversial question (Honohan, 2019). To date, only the People’s Bank of China (PBoC) has a dedicated policy to promote green finance via monetary policy (NGFS, 2019).

Adaptation to climate change is relevant for monetary policy. First, climate risks can have implications for financial stability (Chapter 3.1), pointing to a role for prudential regulation. So far, the risk assessment of monetary policy makers (and investors) may not adequately incorporate risks that are related to climate change (Chapter 3.3). Central banks themselves as well as related literature stresses that climate-related risks fall within the supervisory and financial stability mandates of central banks and supervisors, but are currently not sufficiently addressed (Bank of England, 2017; Dietz et al., 2016; Cœuré, 2018b; NGFS, 2018; Rudebusch, 2019; Volz, 2017). Second, climate change affects monetary policy by its implications for price stability. Extreme weather conditions, such as droughts, tsunamis or hurricanes have already occurred more frequently in recent years (Chart 10), which demonstrates that even in the short run, climate-change related aspects have to be taken into account. Physical risks and mitigation

policies are likely to increasingly affect the frequency and amplitude of supply shocks. Higher temperatures may slow growth in several sectors and spending on climate change resilience may hamper productive capital accumulation (Batten, 2018; Rudebusch, 2019). These factors in turn can affect credit spreads, precautionary saving, real interest rates and financial instability, all affecting inflationary pressures, to which monetary policy responds. Negative supply shocks with inverse effects on output and prices complicate the conduct of monetary policy (Bremus et al., 2020; Brunnermeier & Landau, 2020).

When evaluating the role of monetary policy instruments to achieve climate stabilization, critics argue, that central banks would be going beyond their mandate if they were to tweak their instruments of monetary policy to allocate resources and direct credit. This seems to be the position taken by the Federal Reserve (Fed). Chairman Powell stated recently that “Climate change is an important issue but not principally for the Fed” and that the Fed will leave the decision on society’s response to this global challenge to elected officials (Dmitrieva, 2019). The situation may, however, be more complex for the ECB. Compared to the Fed, its mandate is both more hierarchical – where price stability is the priority objective – and more complex. According to the Treaty on the Functioning of the European Union, the ECB should “support the general economic policies in the Union with a view to contributing to the achievement of the objectives of the Union” (Treaty on the Functioning of the European Union, Article 127, 1) provided that price stability is not affected. To the extent that price stability is not compromised, and fighting climate change is a major priority of the EU, this can be interpreted to also include climate change mitigation considerations.

On the other hand, there is a clear trade-off between legitimacy and independence. Its legitimacy might be challenged if the central bank picks and freely selects its preferred secondary objective (Tucker, 2018). Focusing on climate change may give rise to a discussion why the central bank prefers this issue over other potential secondary objectives. Moreover, enlisting monetary policy to support environmental policies may generate political pressure and rent-seeking behaviour (Fay et al., 2015). Simultaneously, if formal guidance by elevated officials is requested, central banks’ independence may be questioned. Under all circumstances, the central bank needs to carefully navigate between the risks and refrain from any action that compromises its first-priority objective – price stability.

5.2 Central Bank Tools for Climate Change Mitigation

Given their advisory role in politics as well as their perceived role as anchor investors, central banks can serve as catalysts for further market growth. Their enormous market power and independent constitution obliges them to act responsibly and to be accountable. The literature has pointed to ways in which central banks could support the transition to a low-carbon economy. Among the spectrum of interventions, some are more uncontroversial, others more innovative or intrusive. Central banks’ potential role differs depending on their function as a supervisor, as an investor and as a conductor of monetary policy.

Central banks can make an important contribution by defining rules and standards that pave the way for the development of green financial markets. Integrating climate-related risks into financial stability monitoring and microprudential supervision is an obvious obligation, given the effects that climate risks can have for the real economy and the financial system (Chapter 3.1). Despite the difficulties to adequately capture climate risks, prudential policies should adapt to recognize these risks—for example, by requiring financial institutions to incorporate climate risk scenarios into their stress tests (Brunnermeier & Landau, 2020). Macroprudential policies can moreover internalize systemic climate risk by including reserve, liquidity and capital requirements, loan-to-value ratios and caps on credit growth, as well as sectoral capital buffers targeting credit to sectors that are particularly exposed to climate-related risks (Krogstrup & Oman, 2019). The Bank of England (BoE) is incorporating climate change scenarios into stress tests of insurance firms (Bank of England, 2019). The Dutch National Bank (DNB) has also conducted preliminary transition risk stress tests for the Netherlands (Vermeulen et al., 2018).

In their role as regulators, central banks could actively promote demand for green assets using financial regulatory tools. Under the Basel III prudential framework, capital and liquidity requirements do not explicitly include climate related risk assessments for bank exposures (BCBS, 2010; ESRB, 2016). As a consequence, climate risks may be much “cheaper” for regulated institutions in terms of capital requirements than what might be desirable from a systemic financial stability perspective. The EU HLEG (2018) raised the prospect of introducing a “green supporting factor” or a “brown penalizing factor” in prudential rules that would increase banks’ demand for financing green investments and reduce their demand for carbon-intensive investments. Some countries have already implemented regulatory policies comprising lower capital requirements for climate-friendly loans or green bonds: Banque du Liban differentiates banks’ reserve requirement ratios depending on lending allocated to green projects (Banque du Liban, 2010), the People’s Bank of China (PBoC) is incorporating green financing into its Macro-Prudential Policy Assessment framework (PBoC, 2018). Aglietta and Espagne (2016) call for the introduction of international requirements of a minimum amount of ‘green’ assets on bank balance sheets as an alternative regulatory instrument to promote green finance.

However, when considering adjustments in the prudential framework, it is crucial to ensure that the efforts to bring in climate risk strengthen, rather than weaken, prudential regulation. Giving sustainable investments preferential treatment by reducing capital requirements could easily backfire (Campiglio et al., 2018; Grippa et al., 2019; Krogstrup & Oman, 2019). Supervisory regulations should not be used to channel capital flows towards green investments without proof that such investments are less risky than others. Otherwise, this could pose a risk to financial stability. Given the substantial risks that may be associated with climate change and mitigation policies (Chapter 3.1) appropriately accounting for climate risks in the balance sheet of the central bank may be part of the first line of defense (Krogstrup & Oman, 2019). By integrating sustainability factors into own portfolio management central banks can lead by example in their own operations and thereby contribute to scaling up green finance.

Several ways have been discussed in which monetary policy could actively support the transition to a low-carbon economy. These range from adapting haircuts applied on collateral to set incentives for green assets (Cœuré, 2018b) to granting more favorable refinancing terms for banks that fund green projects. Campiglio et. al. (2018) propose that the incorporation of climate-related risks into the collateral framework of central banks might positively incentivize the issuance of financial instruments that are aligned with climate goals and thereby contribute to the transition to a low-carbon economy. Some have suggested taking it one step further and recalibrate asset purchase programs to exclude carbon-intensive assets and favour low-carbon assets (Anderson, 2015; Bernardo et al., 2013; Olovsson, 2018; van Lerven & Ryan Collins, 2017), or to implement parallel asset purchase programs focused on low-carbon assets (Krogstrup & Oman, 2019). Green quantitative easing (Green QE) could be used to actively boost the demand for green assets.

Other proposals recommend that central banks steer the allocation of assets and collateral toward low-carbon sectors. For this purpose, they could provide guarantees to support the financing of the investments needed for the transition to a low-carbon economy (Dasgupta et al., 2019) or ensure better access to funding schemes for commercial banks that invest in green projects (Aglietta et al., 2015). Alternatively, central banks could purchase low-carbon bonds issued by national or multilateral development banks (De Grauwe, 2019) or use forward guidance policies to guide market expectations regarding green investments (Campiglio, 2016) .

5.3 Analysis: Selection Criteria and Emission Intensity of Asset Purchases under the Corporate Sector Purchase Programme (CSPP)

The Eurosystem is buying eligible green bonds as part of its asset purchase programme (APP). Under the corporate sector purchase programme (CSPP), the ECB holds 20% of the outstanding volume of eligible green bonds (ECB, 2018). However, a controversial question is whether the ECB should go beyond current efforts and be more proactive and forceful in greening its asset purchases. Matikainen et al. (2017) have argued that asset purchases conducted under the CSPP are skewed towards carbon-intensive sectors. The authors claim that a “carbon bias” might be negatively contributing to a mispricing of carbon-intensive assets by further increasing their prices and leading to a surge in debt-financing in sectors which are most likely to be affected by transition risks in the near future. Some argue that this justifies central banks to correct this bias because it is against mandates not to reflect risks appropriately (Monnin, 2018). Similarly, non-governmental organizations have been advocating for a paradigm shift in monetary policy towards “green” quantitative easing programs aimed at purchasing securities that positively contribute to climate change mitigation (FT, 2019). We will discuss empirical evidence on the impact of CSPP-specific selection criteria on the emission intensity of asset purchases in the following section. Following Matikainen et al. (2017), we analyse publicly available information on the ECB’s holdings of corporate bonds that have been acquired within the CSPP as of May 1, 2020 and compare them to a self-constructed benchmark universe of corporate bonds that fulfils the ECB’s CSPP-selection criteria. As the ECB does not publish the amounts purchased of each security but only claims to hold 20% of the outstanding volume of CSPP-eligible bonds

(ECB, 2018), analysing the carbon bias in greater detail is hampered.

5.3.1 Selection Criteria and CSPP-eligibility

In order to be eligible for asset purchases under the APP, securities have to be listed as eligible collateral for refinancing operations conducted by the Eurosystem and may not resemble a form of subordinated debt (ECB, 2020b). The CSPP was launched in June 2016 and is conducted as part of the APP. Under the CSPP, six national central banks engage in purchases of euro-denominated, corporate bonds issued by corporations domiciled in the euro area. The ECB defines further selection criteria that eligible debt instruments have to meet in order to be considered for purchases under the CSPP. Eligible assets must be issued by non-bank corporations which implies that neither the issuer nor its parent company may be a bank or a credit institution that is supervised in accordance with the Capital Requirements Regulation (CRR). Moreover, assets must fulfil requirements regarding the remaining maturity: given an initial maturity of 366 days or less, assets must have a minimum remaining maturity of at least 28 days, while the remaining maturity of assets with an initial maturity of 367 days or more must lie between 6 months and 30 years and 364 days. Furthermore, only issuers domiciled in the euro-area are considered to be eligible, while the location of their parents' headquarters is not taken into consideration. In addition, all CSPP-eligible assets must have an investment grade rating by one of the major rating agencies. Emission, issuer and guarantor ratings might be considered in the decision process (ECB, 2020b).

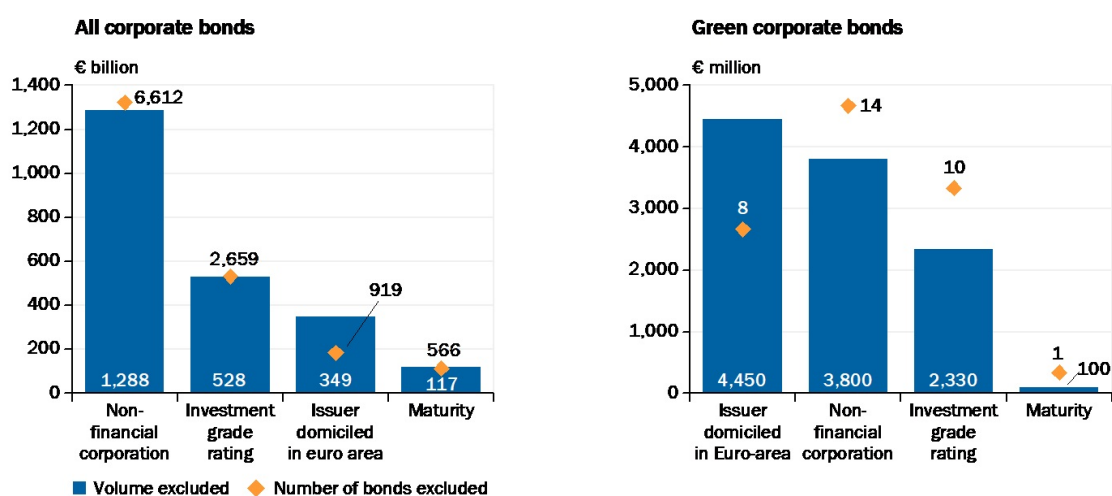
We aim to contribute to the ongoing discussion on the emission intensity of the ECB's CSPP-purchases. To do so, we perform a targeted search of potentially buyable euro-denominated corporate bonds issued by non-financial corporations that fulfil the ECB's CSPP-selection criteria in a first step. Data is retrieved from Refinitiv Eikon and the benchmark universe consists of all CSPP-eligible bonds as of April 30th, 2020. CSPP-eligibility criteria narrow the overall universe of 9.005 active, euro-denominated, non-subordinated corporate bonds which are considered as eligible collateral for Eurosystem refinancing operations down to ultimately 1.822 bonds which constitute the benchmark universe of CSPP-eligible bonds. Bonds contained in this benchmark universe are issued by 337 non-financial corporations and jointly account for an outstanding volume of 1,094 billion Euro. In comparison, actual CSPP-holdings as of May 1st, 2020, comprise 1,415 bonds issued by 297 non-financial corporations with an outstanding volume of 974 billion Euro.

CSPP-selection criteria vary in the extent to which they restrict the universe of potentially buyable corporate bonds (Chart 15). Applied to the overall universe of corporate bonds, the non-financial criterion is the most restrictive selection criterion, both in volume and number of excluded securities. The exclusion of assets issued by banks, credit institutions or asset management companies alone reduces the number of potentially buyable corporate bonds by 73%, corresponding to a decrease in the outstanding volume of 48%. This finding reflects the structure of the euro area corporate bonds market which to a large extent consists of securities issued by financial corporations. The ECB does not explicitly communicate the rationale behind

each CSPP-selection criterion.

Figure 15

Application of CSPP-selection criteria to the overall universe of corporate bonds¹



1 – Each CSPP-selection criterion is independently applied to the overall universe of corporate bonds (as defined in the text).

Sources: ECB, Refinitiv Datastream, own calculations

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The requirement that assets must be rated investment grade in order to be CSPP-eligible (solely) accounts for the exclusion of almost 30% of all corporate bonds contained in the overall universe and approximately 20% of the outstanding volume. Bonds excluded are mainly issued by companies engaged in financial and insurance activities (75% of the excluded outstanding volume), the manufacturing (10%) or service sector (11%). Rating requirements ensure that all CSPP-eligible bonds possess a minimum credit quality in accordance with the ECB’s collateral framework and its requirements for marketable assets. Issue ratings have priority over issuer or guarantor ratings (ECB, 2020b). Due to limited data availability, we rely on guarantor ratings (i.e. the parent company’s issuer rating) in our analysis.

10% of all assets contained in the overall universe are Euro-denominated but not issued by companies domiciled in the euro area – which (solely) implies a reduction in the outstanding volume of 13%. 52% of the outstanding volume of bonds excluded by this criterion is issued by financial or insurance companies, followed by the manufacturing (16%) and the information and communication (12%) sector. By requiring the issuer to be incorporated in the euro area, the ECB aims to ensure that CSPP-purchases improve financing conditions of businesses operating in the euro area and thereby contribute to stimulating overall economic growth across the euro area. Ultimately, requirements regarding the remaining maturity of CSPP-eligible assets seem to be the least restrictive criterion, accounting for the exclusion of only 6% of all bonds comprised in the overall universe (equalling a reduction in the total outstanding volume of 4%).

Green Bonds only make up a small fraction of the overall universe. This is compatible with the proportion of green bonds to all corporate bonds. 109 green corporate bonds account for a share of 2.5% of the outstanding volume of 2,662 billion Euro. 85 green corporate bonds with

an outstanding volume of 59.68 billion Euro are identified as CSPP-eligible, while actual CSPP-holdings comprise 74 green corporate bonds with a total amount outstanding of 51.93 billion Euro. In the case of green bonds, the requirement that issuers must be domiciled in the euro area seems to be the most restrictive selection criterion, (solely) excluding 8 bonds that account for 6.6% of the outstanding volume (Chart 15, Right). Bonds excluded are mainly issued by companies from the electricity and gas sector. Secondly, 14 green corporate bonds accounting for 5.6% of the outstanding volume are issued by financial corporations and thus considered as ineligible. Moreover, the requirement that assets must be rated investment grade (solely) excludes 10 bonds that make up 3.4% of the outstanding volume and are issued by financial and insurance companies or firms from the electricity and gas sector. Ultimately, requirements regarding the remaining maturity of CSPP-eligible corporate bonds do not seem to strongly affect the quantity and volume of potentially buyable green corporate bonds.

5.3.2 The Sectoral Distribution of ECB’s CSPP-holdings

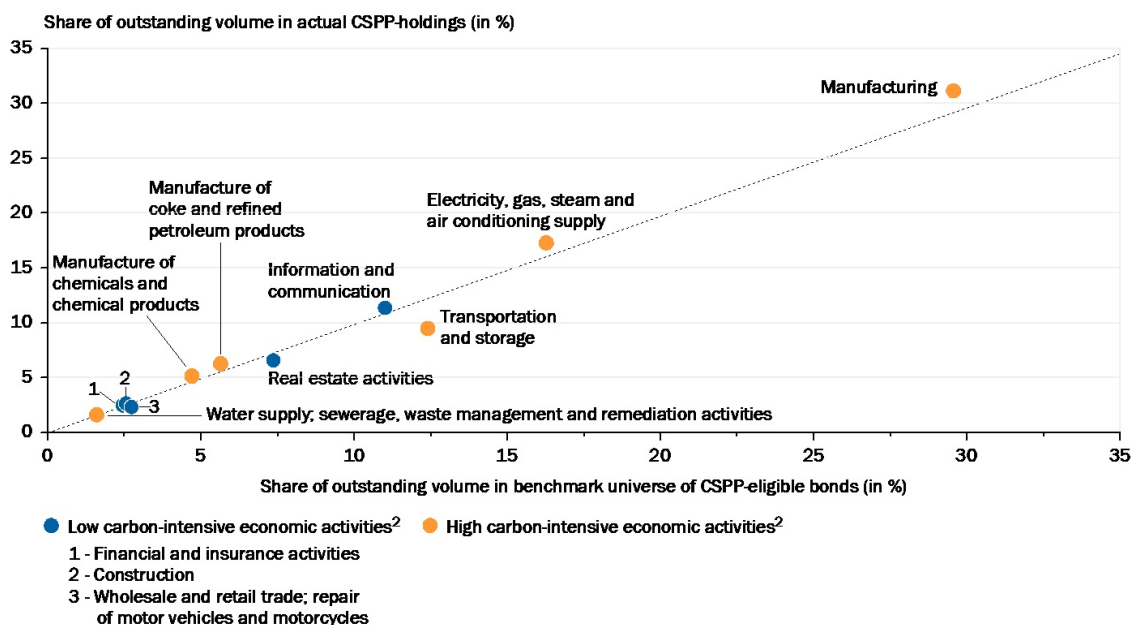
When comparing asset purchases under the CSPP to the sectoral distribution of the benchmark universe of CSPP-eligible corporate bonds, we find no clear evidence for a structural carbon bias in CSPP-holdings (Chart 16). Bonds issued by corporations from the CO₂-intensive manufacturing sector make up 31.1% of the outstanding volume of the CSPP-purchases, whereas they account for a slightly smaller share in the benchmark universe of CSPP-eligible bonds (29.6%). Similarly, asset purchases from issuers of the electricity and gas sector make up 17.3% of actual CSPP-holdings, while their share among the CSPP-eligible bonds is lower by one percentage point. Although CSPP-purchases in the two most CO₂-intensive sectors seem to slightly exceed the relative share they make up in the benchmark universe, actual CSPP-purchases are less concentrated in the third most CO₂-intensive sector which is transportation and storage. Within this sector, the relative outstanding volume of bonds in the benchmark universe surpasses the share of actual CSPP-holdings by 2.9 percentage points, making up 12.4% of the outstanding volume. Thus, we conclude that there does not seem to be a systematic bias towards carbon-intensive sectors leading to a significant deviation from the sectoral composition of the benchmark universe of corporate bonds that fulfil the CSPP-selection criteria. In contrast to Matikainen et al. (2017) we argue within the CSPP selection criteria and initially take these as given.

ESG-scores intend to quantify a company’s or asset’s performance in terms of environmental, social and governance criteria. To gain further insights, we use isolated environmental scores, which assess the performance of an issuers’ parent company regarding resource use, emissions and (environmental) innovation. We compare the environmental scores of bonds in the ECB’s actual CSPP-holdings and the benchmark universe of CSPP-eligible bonds (Chart 17). We find that the distribution of (volume-weighted) environmental scores of issuers’ parent companies does not significantly differ between actual CSPP-purchases and the benchmark universe of CSPP-eligible bonds. This underlines our previous finding that the “greenness” of the ECB’s asset purchases is basically a result of the self-defined eligibility of securities for its purchase programmes. However, both the benchmark universe of CSPP-eligible bonds as well as ac-

Figure 16

Carbon intensity of CSPP purchases¹

Comparison between the benchmark universe of CSPP-eligible bonds and actual CSPP-holdings



1 – Only economic activities accounting for at least 1 % of the outstanding volume in the benchmark universe of CSPP-eligible bonds and actual CSPP-holdings are depicted. Manufacturing excluding subsectors C19 and C20. 2 – Euro area carbon and carbon-equivalent emissions by economic activity in 2018.

Sources: ECB, Eurostat, Refinitiv Datastream, own calculations

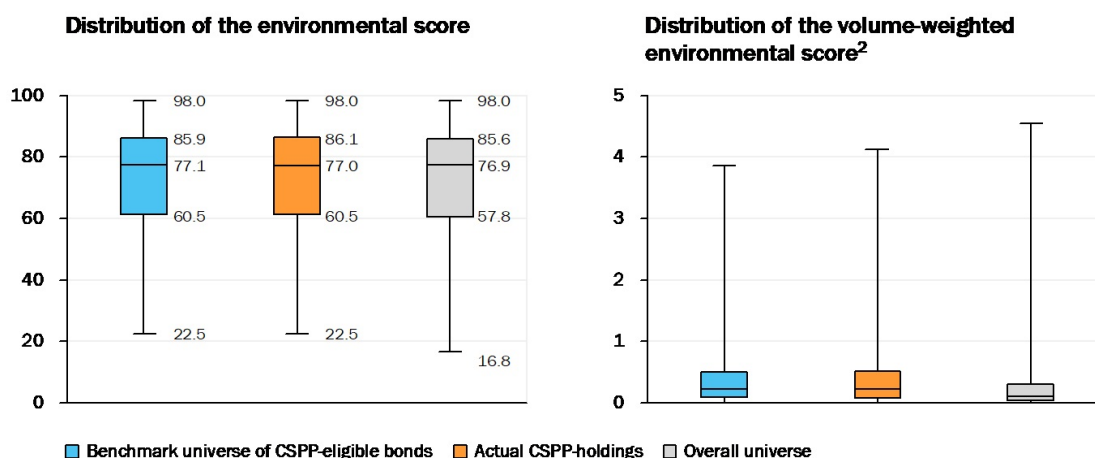
tual CSPP-holdings seem to perform marginally better in terms of the environmental impact of issuers than the overall universe of corporate bonds that comply with the ECB’s collateral framework.

The evidence that we present, seems to be in contrast to earlier results which provide evidence of excessive carbon intensity in the portfolios purchased in APP. Matikainen et al. (2017) identify a „carbon-intensive skew of purchases” that is, however, based on a disproportionately high share of CO₂-intensive sectors in the ECB’s CSPP purchases in contrast to their relatively small contribution to the gross value added (GVA). However, this does not take into account that carbon-intensive corporate bonds could be used for the transformation to green production. For example, energy companies use conventional (and so far only in some cases green) bonds to fund their renewable energy business.

Based on a sectoral comparison of CSPP-eligible bonds and actual CSPP-holding, we do not identify a systematic skew in asset purchases. In contrast, we find that actual CSPP-holdings as of May 1st, 2020 do closely follow the benchmark universe of potentially buyable bonds in accordance with the ECB’s CSPP-selection criteria and collateral framework . Notwithstanding, corporate bonds issued by companies in carbon-intensive sectors such as manufacturing, electricity and gas as well as transportation and storage make up the largest share of purchases.

Figure 17

Comparison of issuers' environmental performance¹



1 – Environmental scores refer to the issuer's parent company. 2 – Environmental scores are weighted by the issuers' relative share of the outstanding volume

Sources: ECB, Refinitiv Datastream, own calculations

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5.3.3 Should CSPP Purchases Become Greener?

Right now, green criteria are not per se an eligibility criterium of the ECB's APP. But the introduction of a unified EU classification system (taxonomy) will mitigate the risk of greenwashing and as part of the ongoing monetary policy strategy review, there will be new opportunities for the ECB to reconsider its engagement in green QE. Even if not for correcting a systematic bias towards carbon-intensive sectors in its purchases, one could still argue for prioritising green assets over regular ones in ECB's purchasing policies as green QE could help to reduce the financial risks associated with climate change and contribute to a transition of a low-carbon economy.

However, although increasing, the pool of green bonds that comply with the ECB's eligibility criteria is to date relatively shallow. Besides others, De Galhau (2019) argues that large transactions by the ECB in this narrow and emerging segment could push up the prices of these assets and thus lead to undesirable and damaging distortions. Based on ECB (2018) and supplemented by own calculations, we estimate that the outstanding volume of CSPP-eligible green corporate bonds has grown by 68% from 31 billion Euro in August 2018 to approximately 52 billion Euro in May 2020. Over the same period, the share of green bonds in the overall benchmark universe of CSPP-eligible bonds has increased by one percentage point to 5%. This development is attributable to the overall growth of the green bond market and the increasing share of green bonds in the euro area bond market. As discussed previously, Europe has recently been one of the fastest growing markets for green bonds (Climate Bonds Initiative, 2020a). However, ECB calculations estimate that green bonds make up a share of only 1% in the overall market for euro-denominated bonds (ECB, 2018). Moreover, the European market is dominated by issuers from the public sector, especially government-backed or supranational entities such as the KfW or EIB or sovereign issuers (Climate Bonds Initiative, 2020a). Bonds issued by these issuer types are not eligible under the CSPP, but may be considered for purchases under the PSPP. Hence,

an increased acquisition of green corporate bonds under the CSPP might be severely limited by their relatively low supply. In addition, a particularly strong role played by the central bank in the green bond market could hinder the further development of a secondary market in particular.

As we have argued before, to date the structure of CSPP purchases are basically a reflection of the structure of the euro area corporate bond market and the selection criteria formulated by the ECB. This means that, as the green bond market segment grows and develops, the Eurosystem will likely purchase more green bonds (ECB, 2018; Schnabel, 2020). An increased targeting of green corporate bonds would therefore be associated with loosening the neutrality approach, as the high carbon-intensive sectors of electricity and gas as well as transportation and storage jointly account for 87% of green bond issuances in the benchmark universe of CSPP-eligible bonds, while representing only 28% of the overall outstanding volume of CSPP-eligible bonds.

While some may argue that risk considerations speak for softening central banks' (self-given) principle of market neutrality, the ECB's collateral framework substantially limits the eligibility of green corporate bonds for purchases under the CSPP. In our analysis, we take as basis an overall universe of 9,005 active euro-denominated corporate bonds which is already constrained by the requirements that assets must be considered as eligible collateral for refinancing operations conducted by the Eurosystem and may not resemble a form of subordinated debt. However, these basis criteria for asset purchases under the APP already put substantial constraints on the availability of green bonds in the set of approximately 60,000 active euro-denominated corporate bonds which is retrieved via Refinitiv Eikon. Of the 278 green corporate bonds contained, 46% (accounting for 35% of the outstanding volume) are not accepted as eligible collateral for refinancing operations conducted by the Eurosystem. That being said, to allow for the purchase of more green bonds under the CSPP, the ECB would have to revise its criteria for eligible assets, raising concerns over the impact of green asset purchases on central bank portfolios.

Lastly, QE has been designed to be temporary, and aimed to help central banks achieve price stability (Mersch, 2018; Weidmann, 2019). Restricting asset purchases to low-carbon assets may restrict the eligible asset universe, reducing the effectiveness of QE when monetary policy is otherwise restricted by the zero-lower bound. Moreover, the transition to a low-carbon economy is a long-term goal. Using QE to support this transition might create institutional pressure to sustain QE as a regular practice. Any expectation of an exit from QE could lead to great uncertainty in the green bond market.

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