



DECARBONISING IS EASY

BEYOND MARKET NEUTRALITY IN THE ECB'S CORPORATE QE

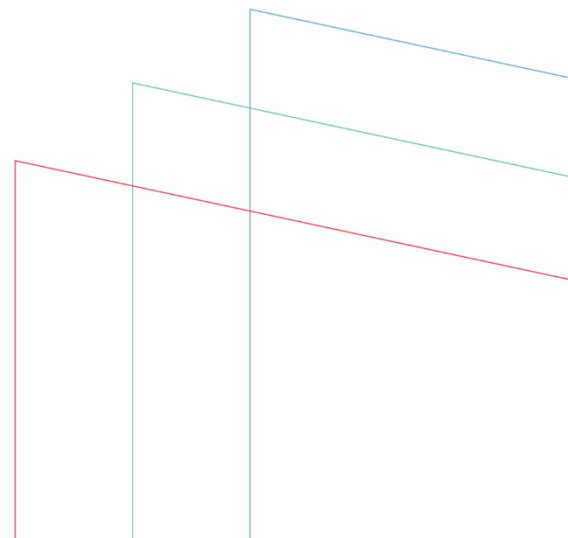
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Published: October 2020

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NEF is a charitable think tank. We are wholly independent of political parties and committed to being transparent about how we are funded.

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EXECUTIVE SUMMARY

Christine Lagarde, the President of the European Central Bank (ECB), has recently promised to explore every avenue for greening the ECB's operations, including its quantitative easing (QE) programme. Yet the current corporate QE programme remains biased towards carbon-intensive sectors: these sectors are over-represented in the ECB purchases, when compared to their contribution to the euro area employment and economic activity. An important consequence of the carbon bias is that it may lower the cost of borrowing (an implicit subsidy) and encourage more debt issuance by the most carbon intensive firms relative to low-carbon firms. By favouring access to finance for highly polluting companies, this carbon bias is an important barrier to the decarbonisation of the euro area economies.

We argue that the ECB should abandon its market neutrality approach, the key driver of this carbon bias, and adopt alternative low-carbon strategies. We suggest two such strategies in which carbon-intensive bonds are replaced with more climate-friendly bonds. These strategies would significantly reduce the climate footprint of the ECB corporate QE and would make companies' access to finance more aligned with the targets of the Paris Agreement.

1. INTRODUCTION

In July 2020, Christine Lagarde, the President of the European Central Bank (ECB), promised to explore every avenue for greening the ECB's operations, including the asset purchase scheme undertaken to help stimulate the Eurozone economy.¹ Indeed, the rapid and profound economic devastation brought on by the coronavirus pandemic illustrates the vulnerability of our economies to catastrophic shocks and should prompt central banks to hasten progress towards a low-carbon transition. The ECB simply cannot afford to address one crisis whilst neglecting – if not worsening – another.

Central banks in general are hardly the only game in town when it comes to tackling environmental breakdown. Yet they do have a critical role to play in structurally realigning our financial sector with the challenges and risks posed by the climate crisis.² Responsible for monetary policy and large swathes of financial regulation, the ECB's operations heavily influence the allocation of financial flows and market prices. Now is the time to consider how Europe's most powerful economic institution can ensure its operations are aligned, rather than at odds, with the goals of a green transition.

In this brief, we first document the ECB's ongoing carbon bias in one key pillar of its Quantitative Easing (QE) program – corporate bond purchases. The ECB does hold a significant amount of green bonds (debt instruments earmarked specifically to finance climate and environmentally friendly projects).³ But overall its corporate purchases are structurally misaligned with EU commitments to the Paris Climate Agreement and do not adequately reflect climate-related financial risks. In fact, by implicitly creating better financing conditions for carbon-intensive activities, the Corporate Sector Purchase Programme (CSPP) biases the allocation of capital towards the most carbon-intensive sectors. Therefore, it is particularly significant that the ECB does explore every avenue available to decarbonise its monetary policy operations and align them with democratically defined objectives of a green transition. It has already taken the welcome step of including sustainability-linked bonds in the list of assets that it accepts as collateral for lending operations.⁴ But it needs to go further, faster.

To do so, we argue, it needs to reconsider the so-called 'market neutrality', the underlying principle that guides corporate asset purchases and hardwires a carbon bias into its unconventional purchases. The ECB has recently admitted that market neutrality might be problematic as a benchmark given that the markets have failed to produce climate-efficient outcomes.⁵ We agree with that and we suggest two alternative scenarios that would reduce significantly the climate footprint of the ECB's corporate QE purchases. In the 'lower-carbon' scenario, the ECB stops buying bonds issued by fossil

fuel companies and by companies with relatively high carbon intensity⁶ that belong to the energy-intensive, non-renewable utilities and carbon-intensive transportation sectors. Instead, the ECB would purchase bonds of potentially green and renewable sectors, as well as green bonds and bonds of 'other' non-carbon-intensive sectors. The second, 'low-carbon' scenario excludes all the bonds issued by carbon-intensive sectors, apart from green bonds, but relaxes the investment grade criterion.

Implementing these would not only be in line with the climate emergency that we are currently facing but would also support climate-related financial stability objectives.

2. THE ECB'S CORPORATE SECTOR PURCHASE PROGRAMME (CSPP)

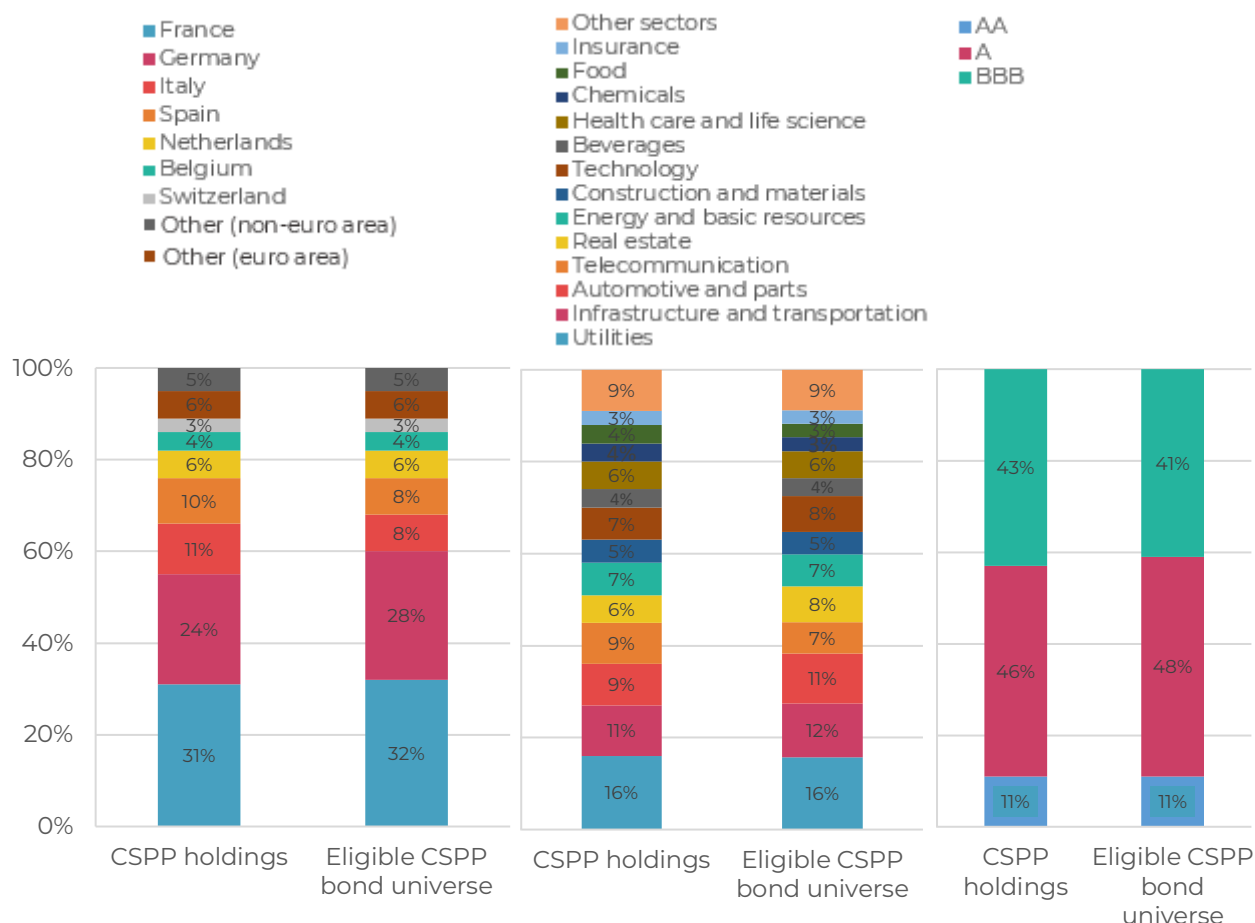
The CSPP is core to the ECB's QE interventions. It was launched in June 2016 and by early 2020, the ECB's corporate bond holdings had exceeded €200bn – roughly 13% of all the euro-denominated non-bank corporate bonds eligible under its programme. Then in March 2020, as part of its Pandemic Emergency Purchase Programme (PEPP), the ECB announced the increase in the holdings of corporate bonds and the expansion of the range of eligible assets under the CSPP. By the end of July 2020, the CSPP/PEPP corporate bond holdings amounted to €241.6bn⁷ - roughly 16% of all the bonds eligible under its programme.

Why did the ECB introduce the CSPP? As its main policy tool – the overnight interest rate – reached the zero lower bound, traditional rate cuts could not, according to the ECB, further boost aggregate demand (spending and investment). To stimulate the economy, the ECB began targeting long-term interest rates by intervening directly in financial markets through the purchase of government bonds, corporate bonds, asset-backed securities and covered bonds. CSPP purchases were expected to increase demand for corporate bonds and lower the cost of borrowing for bond issuers, encouraging companies to increase their bond issuance and investment.⁸ Overall, it was intended that bond purchases would raise aggregate demand and achieve an inflation rate of below, but close, to 2%.

The ECB decides its corporate QE purchases by first specifying a target for the value of bonds that it wishes to hold on its balance sheet. It then identifies the eligible bond universe by applying a set of criteria to the entire universe of euro-denominated, non-bank corporate bonds. Bonds should have been issued by euro area non-bank corporations, should be of a specific maturity and should be investment grade (see Appendix A1 for more details). Once it establishes the eligible bond universe, the ECB buys a proportion of the bonds included in this universe based on the target that it has set about its holdings. Its bond purchases are driven by the 'market neutrality' principle (see section 4): the composition of CSPP holdings is generally intended to reflect the existing eligible bond market structure. The ECB applies this approach by ensuring its purchases mirror the eligible CSPP bond universe by country, sector, and rating group. Figure 1 illustrates that: the breakdown of CSPP holdings in the first quarter of 2020 mirrors closely the breakdown of the eligible CSPP bond universe. For example, the 'Construction and materials' sector represents 5% of the value of bonds in the eligible bond universe (the latter is the 'market' in the 'market neutrality' principle) and as a

result, the ECB buys bonds issued by this sector such that the 'Construction and materials' sector represents 5% of the CSPP holdings.

Figure 1: CSPP holdings and eligible CSPP bond universe, by country, sector and credit rating, as of Q1 2020

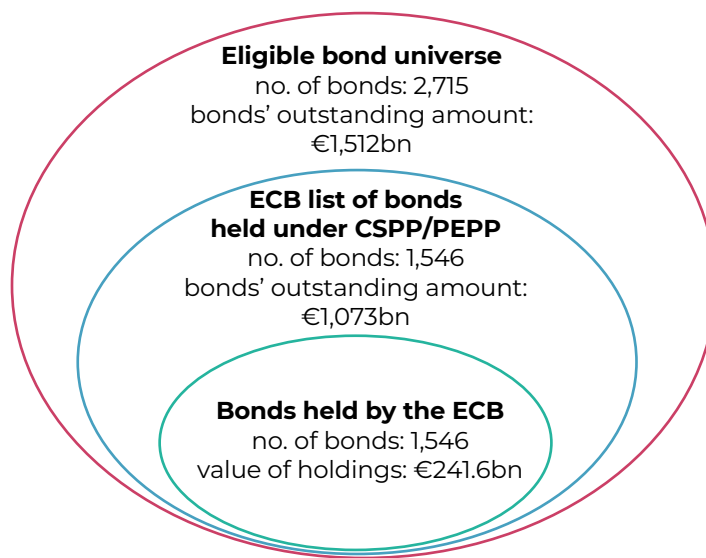


Source: ECB, <https://www.ecb.europa.eu/mopol/implement/omt/html/index.en.html>

The sectoral data provided by the ECB does not allow us to establish the carbon intensity of its corporate bond purchases, or to identify alternative (greener) pathways for corporate bond purchases. To do so, we take a granular approach. We first apply the ECB's eligibility criteria to data for bonds that we have downloaded from Thomson Reuters (TR) Eikon. We thus obtain the eligible bond universe, which consists of 2,715 bond issues with a total value of about €1,512bn (see Figure 2). We identify the 1,546 bond issues that the ECB has purchased under CSPP/PEPP (this information is available on the website of the ECB), which we term the ECB list (as of July 2020). Using TR Eikon, we calculate the outstanding amount of all bonds that are in the ECB list, which is equal to around €1,073bn. Problematically, while the ECB publishes the bond issues that it holds and the names of the companies that have issued these bonds, it does not

publish the exact volumes of each bond issue that it holds. For example, we know that the ECB holds 18 bonds issued by Royal Dutch Shell, but we do not know the volumes of each issue that the ECB has bought. This means that we do not know the exact financial support that the ECB provides to this company. The ECB only publishes the total value of holdings which, as of July 2020, were €241.6bn.

Figure 2: Eligible bond universe, ECB list and bonds held by the ECB, as of July 2020



Sources: ECB (number of bonds in the ECB list as of 31 July 2020; value of ECB holdings as of 31 July 2020) and TR Eikon (bond outstanding amount; number of bonds in the eligible bond universe, July 2020)

In the following sections we analyse the carbon footprint of the bonds in the ECB list. Our granular approach allows us to demonstrate that the ECB list exhibits a pronounced carbon bias: **more than half of the outstanding amount of the bonds included in the ECB list are issued by carbon-intensive sectors**. The carbon bias, we argue, is the consequence of the application of the market neutrality principle, a principle inconsistent with the urgent need for a low-carbon transition. We show that if the ECB stops applying this principle, it can replace the carbon-intensive bonds in its list with more climate-friendly bonds, reducing the climate footprint of the QE programme.

3. THE CARBON BIAS IN CORPORATE QE

The sectoral breakdown of the outstanding volume of the bonds included in the ECB list at the end of July 2020 shows that sectors with a high contribution to greenhouse gas (GHG) emissions are over-represented, when compared to euro area employment and Gross Value Added (GVA) (see Table 1). For example, 'Electricity, gas and steam and air conditioning supply' and 'Manufacturing' are two of the highest polluting sectors in the economy, accounting for 54.8% of euro area GHG emissions. Collectively these sectors contribute only 13.8% to euro area employment and just 19% to euro area GVA, but account for 58.9% of the outstanding amount in the ECB list.⁹

Table 1: Sectoral breakdown of the ECB list of corporate bonds held under CSPP/PEPP (outstanding amount), euro area GHG emissions, euro area employment and euro area GVA

NACE code	Sector	ECB list of bonds - contribution to outstanding amount (%)	Contribution to euro area GHG emissions (%)	Contribution to euro area employment (%)	Contribution to euro area GVA (%)
A	Agriculture, forestry and fishing	0.1	15.2	3.1	1.6
B	Mining and quarrying	1.0	0.8	0.1	0.3
C	Manufacturing	43.1	26.9	13.4	17.2
D	Electricity, gas, steam and air conditioning supply	15.8	27.9	0.4	1.7
E	Water supply; sewerage, waste management and remediation activities	1.6	4.7	0.7	0.9
F	Construction	1.3	1.8	6.0	4.9
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	2.5	2.8	14.5	11.1
H	Transportation and storage	9.2	14.4	4.9	4.9
I	Accommodation and food service activities	0.6	0.6	5.4	3.0
J	Information and communication	11.4	0.3	2.9	4.9
K	Financial and insurance activities	2.8	0.2	2.4	4.8
L	Real estate activities	6.5	0.1	1.0	11.1
M	Professional, scientific and technical activities	1.0	0.5	6.7	6.7
N	Administrative and support service activities	0.6	0.6	7.3	4.8
O	Public administration and defence; compulsory social security	0.0	0.9	6.7	6.5
P	Education	1.7	0.5	6.4	4.7
Q	Human health and social work activities	0.6	1.0	11.1	7.5
R	Arts, entertainment and recreation	0.0	0.3	1.7	1.3
S	Other service activities	0.4	0.3	2.9	1.7
T	Activities of households as employers; undifferentiated goods & services producing activities of households for own use	0.0	0.0	2.2	0.4
Total		100.0	100.0	100.0	100.0

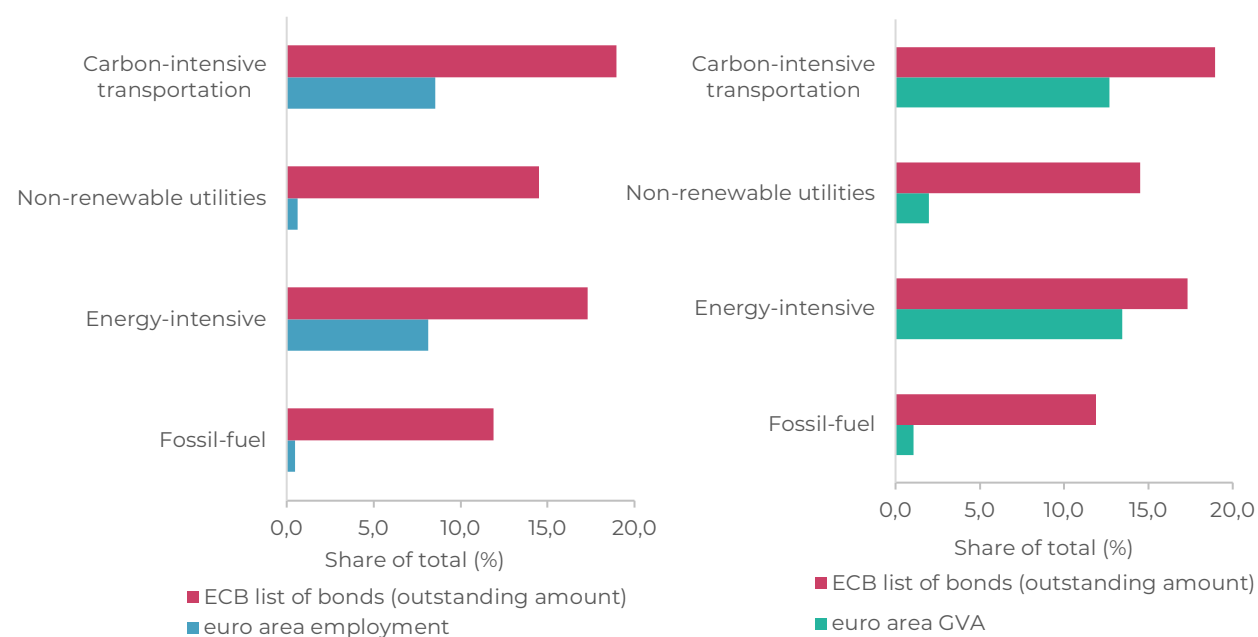
Sources: ECB (bond ISIN codes, as of 31 July 2020), TR Eikon (bond outstanding amount, July 2020), Eurostat (employment [2018], GVA [2018] and GHG emissions [2018])

Following on from a similar analysis for the Bank of England's corporate bond purchase programme,¹⁰ we apply a more granular classification of sectors to further illustrate the carbon bias within the ECB's holdings. Accordingly, we identify four carbon-intensive sectors:¹¹

- (a) Fossil-fuel sectors that perform activities like the extraction of natural gas, the mining of hard coal and the manufacture of refined petroleum products;
- (b) energy-intensive sectors, most of which undertake manufacturing activities;
- (c) non-renewable utilities that are involved for example in the production and distribution of electricity;
- (d) carbon-intensive transportation sectors which are those sectors engaging in activities related primarily to car, air and sea transportation.

These carbon-intensive sectors comprise approximately 62.7% of the value of corporate bonds in the ECB list.¹² However, the contribution of these sectors to euro area employment and GVA is just 17.8% and 29.1% respectively. The sectoral allocation of purchases does not mirror the sectoral make-up of the euro area when it comes to employment and GVA share, and is significantly skewed towards the most carbon-intensive sectors.

Figure 3: Contribution of carbon-intensive sectors to the ECB list of bonds held under CSPP/PEPP (outstanding amount), euro area employment and euro area GVA



Sources: ECB (bond ISIN codes, as of 31 July 2020), TR Eikon (NACE 4-digit sectors and bond outstanding amount, July 2020), Eurostat, Annual detailed enterprise statistics for industry (employment [2017] and GVA [2017]) and authors' calculations

A closer look at individual bonds purchased by the ECB illustrates in specific detail the carbon skew of the CSPP. The list includes some of the most emission intensive companies in Europe. Bonds purchased include a number of major European integrated oil and gas companies, some of the continent's largest utilities, car manufacturers, airlines and airports as well as companies from diverse, fossil fuel-intensive sectors such as steel, chemicals and cement.

A snapshot of some of the largest fossil fuel companies and utilities by sum of outstanding value, as well as selected companies from energy-intensive industries and carbon-intensive transportation, gives an indication of both the absolute impact these companies and their activities have on the climate crisis. Table 2 illustrates the absolute level of Scope 1-3 emissions and emissions per revenue generated by these high-carbon companies. Scope 1-3 emissions are particularly pertinent indicators for this exercise, given they are standards used to measure and manage a company's emissions designed by the Greenhouse Gas Protocol, where: Scope 1 emissions are direct emissions from owned/controlled sources, Scope 2 are indirect emissions from the generation of purchased energy, and Scope 3 emissions are all indirect emissions (not included in Scope 2) across the entire value chain of the reporting company. The absolute level of emissions and the high level of emissions per revenue of these companies whose bonds are eligible under the CSPP are particularly striking. It is also notable that the renewable energy sector is not sufficiently represented in the ECB purchases, with proportionally fewer bonds of these companies purchased (e.g. WindMW) although they meet all the ECB eligibility criteria.¹³

According to the ECB's own empirical analyses¹⁴, the CSPP has a significant effect on the yields (borrowing costs) of the corporate bonds that happen to be eligible for purchase when compared to their ineligible counterparts.¹⁵ Given the carbon bias in the ECB's holdings, this suggests that the CSPP effectively lowers the cost of borrowing (an implicit subsidy) for the most carbon-intensive firms when compared to low-carbon ones.

Table 2: Scope 1-3 GHG emissions and emission intensity (scope 1-3 emissions per revenue), selected carbon-intensive companies in the ECB list of corporate bonds held under CSPP/PEPP

Carbon-intensive sectors	Company	Emissions (million tonnes of CO ₂ -e)	Emission intensity (tonnes of CO ₂ -e/million €)
Fossil fuel	ENI S.p.A.	296	4,240
	Naturgy Energy Group SA	125	5,417
	OMV AG	137	5,839
	Royal Dutch Shell PLC	656	2,132
	Total SE	455	2,894
Non-renewable utilities	EDF SA	152	2,131
	E.ON SA	69	1,684
	Enel S.p.A.	132	2,430
	Engie SA	183	3,044
	Iberdrola SA	65	1,778
Carbon-intensive transportation	Daimler AG	124	718
	Ryanair Holdings PLC	12	1,521
Energy-intensive	ArcelorMital SA	196	3,111
	BASF SE	121	2,037
	HeidelbergCement AG	100	5,331

Sources: ECB (bond ISIN codes, as of 31 July 2020), TR Eikon (NACE 4-digit sectors [July 2020], Scope 1, Scope 2 and Scope 3 CO₂-e GHG emissions [2019] and revenues [2019]), company reports (Scope 3 CO₂-e GHG emissions [2019] in the case of Royal Dutch Shell PLC and Daimler AG) and authors' calculations

Note: Ryanair Holdings PLC does not report data for Scope 3 CO₂-e GHG emissions. In the case of Naturgy Energy Group SA, Royal Dutch Shell PLC, Total SE and Iberdrola SA, the ECB has bought bonds issued by their financial subsidiaries, which are Naturgy Finance BV, Shell International Finance BV, Total Capital SA and Iberdrola International BV, respectively. EDF SA and Ryanair Holdings PLC are the parent companies of RTE EDF Transport and Ryanair DAC, respectively, which have issued bonds bought by the ECB.

Significantly, the structural carbon skew in the CSPP contravenes the spirit of the Paris Climate Agreement (which the ECB is party to) and the environmental goals set by democratically elected governments. Indeed, as former president of the ECB Mario

Draghi conceded, the ECB did not take into consideration the environmental impact of its policies.¹⁶ It could therefore be at risk of facing litigation for neglecting to evaluate and manage the climate and environmental impact of their policies.¹⁷ Finally, the carbon bias makes CSPP inconsistent with the ECB's policy and commitments surrounding climate-related financial risks and the high prudential standards to which it is attempting to hold other private financial institutions to account.

4. MARKET NEUTRALITY

The carbon bias of CSPP/PEPP is largely the result of the application of the market neutrality principle. The ECB implements this principle by buying corporate bonds that mirror the sectoral decomposition of the eligible corporate bond market. The ECB documents the market neutrality of its CSPP program by showing that the sectoral decomposition of its CSPP holdings is close to the sectoral decomposition of its eligible bond universe (see Figure 1 above).

Table 3: Contribution of the carbon-intensive sectors to the euro non-bank corporate bond market (outstanding amount), the ECB list of bonds held under CSPP/PEPP (outstanding amount) and the euro area GVA

	1: All euro non-bank corporate bonds (%)	2: (1)+euro area (%)	3: (2)+eligible maturity (%)	4: (3)+Investment grade (%) [Eligible bond universe]	5: ECB list of bonds (%)	Share of euro area GVA (%)
Fossil fuel	7.8	7.3	7.1	9.0	11.9	1.1
Energy-intensive	15.8	14.2	14.7	15.1	17.3	13.5
Non-renewable utilities	7.3	8.8	9.1	11.6	14.5	2.0
Carbon-intensive transportation	14.5	17.0	17.1	20.1	18.9	12.7
Carbon-intensive sectors	45.5	47.2	48.0	55.8	62.7	29.1

Sources: ECB (bond ISIN codes, as of 31 July 2020), TR Eikon (NACE 4-digit sectors, bond outstanding amount and other financial and economic variables, July 2020), Eurostat, Annual detailed enterprise statistics for industry (GVA [2017]) and authors' calculations

However, the sectoral decomposition that the ECB provides says little about the carbon footprint of the eligible bond universe and the bonds held by the ECB. Table 3 illustrates step-by-step how the representation of carbon-intensive sectors changes as the eligibility criteria and the market neutrality principle are applied. In the universe of euro non-bank corporate bonds, the share of carbon-intensive sectors is 45.5% (column 1 in the table above). This increases to 55.8% once the eligibility criteria are applied (as we move from column 2 to column 4 in the table above).¹⁸ The increase in the representation of carbon-intensive bonds primarily reflects the fact that bonds issued by carbon-intensive companies tend to receive more favourable evaluations by credit rating

agencies compared to non-carbon intensive companies. The ECB therefore reproduces a market failure, as credit rating agencies do not incorporate climate risks into their evaluations of credit risk. Crucially, when the ECB specifies the bonds that it purchases by applying the market neutrality principle (attempting to mirror the sectoral decomposition of the eligible corporate bond market), the representation increases even more from 55.8% to 62.7% (column 5).

When considering the environmental goals of democratically elected governments, there are at least two reasons why the ECB should reconsider the market neutrality principle. First, by applying the market neutrality principle, the ECB favours carbon-intensive companies and does not create any pressure for them to develop production models that generate less emissions. This is at odds with the climate emergency and the spirit of the Paris Agreement which suggests that all policy institutions should play a strong role in avoiding catastrophic climate change. Importantly, the transition to a low-carbon economy requires a change in the current market structure, which is clearly not aligned with the 2 degrees target, and much less the 1.5 degrees target. By choosing to represent the existing market structure, the ECB's operations are actively inhibiting the transition to a low-carbon economy.¹⁹ They are also inconsistent with the ECB's commitments in the Network for Greening the Financial System.

Second, the implementation of the market neutrality principle in the corporate QE programme is inconsistent with financial stability objectives. In terms of physical risks, the corporate QE finances the generation of emissions that can lead to climate-related events that undermine financial stability in the long run. Also, the existing implementation of the neutrality principle neglects climate transition risks: while credit rating agencies and credit risk models do not explicitly consider these risks²⁰, resulting in carbon-skewed credit ratings, the ECB should consider them in its CSPP/PEPP purchases.²¹

5. ALTERNATIVE SCENARIOS

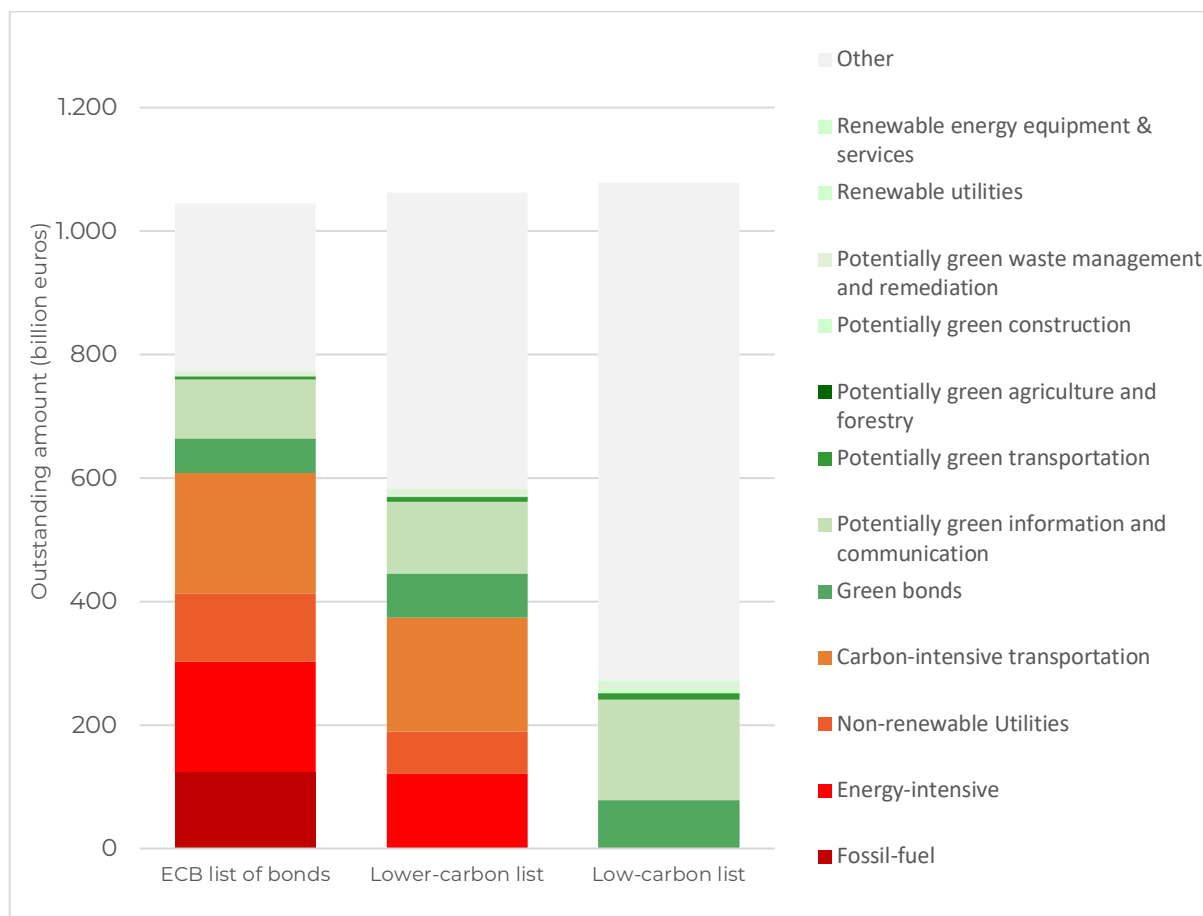
Given the problematic nature of the market neutrality principle from a climate perspective, how could the ECB design and implement its corporate QE programme once this principle is abandoned? In line with recent comments made by President Lagarde, we suggest that the ECB should explore every avenue that minimises the climate footprint of the corporate QE programme, ensuring at the same time that the holdings remain in line with the macroeconomic goal of supporting the eurozone economies during the pandemic.

We propose two alternative scenarios (see Figure 4 below). In the 'lower-carbon' scenario, the ECB keeps the universe of eligible bonds unchanged, but stops buying bonds issued by (i) fossil fuel companies as well as (ii) companies with relatively high carbon intensity²² that belong to the energy-intensive, non-renewable utilities and carbon-intensive transportation sectors. Instead, the ECB would purchase bonds of potentially green and renewable sectors, as well as green bonds and bonds of 'other' non-carbon-intensive sectors (see Appendix A2 for our approach to identifying the climate footprint of bonds).²³ All these changes can take place without modifying the current bond eligibility criteria.

Should the ECB implement this scenario, the outstanding amount of bonds in the ECB list would become slightly higher than in the existing list. This scenario would not therefore constrain the ECB's ability to affect interest rates during the COVID-19 crisis.

We also consider a scenario in which the climate footprint of the ECB bond list is reduced even further – this is labelled 'low-carbon list' in Figure 4. In this scenario (i) we exclude all the bonds issued by carbon-intensive sectors, apart from green bonds and (ii) we include bonds that have been issued in the euro area and are of eligible maturity but are not necessarily of investment grade. As shown in Figure 4, when we do this, the outstanding amount in the bond list increases compared to the existing ECB list. Although this scenario does not keep the investment grade criterion for the eligibility of bonds, it should be kept in mind that, as mentioned above, the existing credit ratings do not reflect climate risks and this criterion should in any case be reconsidered from a climate risk perspective. In addition, if the ECB expands further the CSPP/PEPP programme, it might be unavoidable to include bonds that are not investment grade in the universe of eligible bonds.

Figure 4: Existing ECB list of bonds held under CSPP/PEPP (outstanding amount) vs lower-carbon lists



Sources: ECB (bond ISIN codes, as of 31 July 2020), TR Eikon (NACE 4-digit sectors, bond outstanding amount and other financial and economic variables, July 2020) and authors' calculations

6. CONCLUSION

The ECB is hardly the only game in town when it comes to tackling environmental breakdown – fiscal policy and wider regulation must also play a more prominent role than they are currently doing.²⁴ But the ECB's corporate QE programme does actively lower the borrowing costs for the firms whose bonds are held. In an era of the climate crisis, the ECB should therefore explore every avenue for decarbonising its corporate QE programme, to ensure it is not inhibiting a green transition by disproportionately advantaging carbon-intensive firms. In this brief we have suggested a framework that would allow the ECB to do just this. Our low-carbon scenarios are not only more consistent with the Paris Agreement, but they also support climate-informed financial stability objectives.

The ECB can directly implement our scenarios. However, the transition from the existing holdings to our suggested ones could also take place more gradually in order for carbon-intensive firms to have more time to adjust to the new reality and start issuing more green bonds in order to avoid being excluded from QE altogether.²⁵ To provide a further boost to the green bond market, the ECB could also consider running a permanent QE programme that would hold bonds exclusively from this market alone.²⁶

Our proposals reflect the limits of data availability. For example, a practical limitation that we face is that a large number of companies do not report data about their emissions. However, the implementation of our proposals would place direct pressure on firms to publish more detailed data about their climate footprint. In the future, this would potentially allow the design and implementation of more sophisticated versions of our scenarios. But the longer the ECB delays the decarbonisation of its QE programme, the more firms will delay in providing climate-related data and taking action against the climate crisis itself.

From a broader perspective, the ECB should not only consider the climate performance of firms in the design and implementation of the CSPP/PEPP programme. Other environmental issues (like the effects on biodiversity) should also be taken into account in the future. The ECB should also work with democratically elected officials and consider introducing social-related conditionalities in the support that it provides to companies via both the purchases of bonds and commercial papers. Incremental adjustments to finance are not enough to tackle the monumental challenge of a rapid, sustainable and fair transition to a clean economy. We will need innovative and disruptive reforms that help reshape our financial system, so that it can help sustain our planet and enable us to thrive. The ECB should take a nuanced approach to its role by adopting new ways of economic thinking before it is too late for the current and future generations.

APPENDIX

A1. FROM THE UNIVERSE OF EURO-DENOMINATED NON-BANK CORPORATE BONDS TO THE ECB LIST OF BONDS HELD UNDER CSPP/PEPP

We downloaded data for the universe of corporate bonds from Thomson Reuters (TR) Eikon and we applied the ECB eligibility criteria step-by-step. According to these criteria, the bonds:

- (1) should be denominated in euro and should have been issued by a non-bank corporation (see Column 1 in Table 3);²⁷
- (2) should have been issued by an institution established in the euro area (we use the domicile provided by the TR Eikon) (see Column 2 in Table 3);
- (3) should have a remaining maturity (at the time of the purchase) of at least 28 days (if their initial maturity is less than one year) or of less than 31 years and more than six months (if their initial maturity is more than one year) (see Column 3 in Table 3);
- (4) should be rated investment grade (see Column 4 in Table 3).²⁸

The outstanding amount of the bonds included in the ECB list of bonds held under CSPP/PEPP is shown in Column 5 in Table 3.²⁹ The bonds included in Column 5 are a subset of those of Column 4. The ECB list is determined once the ECB has applied the 'market neutrality' principle to the universe of eligible bonds captured by Column 4.³⁰ Table A1 verifies that the sectoral decomposition in our eligible bond universe is close to the sectoral decomposition in the ECB list.

The ECB list comprises 1,546 bonds whose outstanding amount is €1,073bn (as shown in Figure 2). As explained in A2, our analysis requires the identification of the 4-digit NACE sector of the bond issuer. The bonds for which the NACE sector is not available in TR Eikon are thereby excluded from our analysis. Therefore, the ultimate number of bonds in the Column 5 list of Table 3 is 1,499 (with an outstanding amount of €1,045bn). The match between the bonds and the companies that have issued them is made by using the International Securities Identification Number (ISIN). The eligible bond universe (Column 4) comprises 2,605 bonds whose outstanding amount is €1,473bn (instead of 2,715 bonds of €1,512bn, as shown in Figure 2).

Table A1: Eligible bond universe vs ECB list of bonds held under CSPP/PEPP, Thomson Reuters Business Classification (TRBC) sectoral decomposition (outstanding amount)

Sector	Eligible bond universe (%)	ECB list of bonds (%)
Automobile and auto parts	8	10
Chemicals	3	4
Construction, commercial services and materials	4	5
Energy and applied resources	7	9
Food and beverages	5	6
Health care	5	5
Infrastructure and transportation	16	14
Insurance	4	2
Real estate	7	7
Technology	3	4
Telecommunications services	7	8
Utilities	13	16
Other sectors	18	12
Total	100	100

Sources: ECB (bond ISIN codes, as of 31 July 2020), TR Eikon (TRBC Business Sector Classification and bond outstanding amount, July 2020) and authors' calculations

Note: 'Construction, commercial services and materials' includes the TRBC business sectors 'Industrial & Commercial Services' and 'Mineral Resources'; 'Energy and applied resources' includes the TRBC business sectors 'Energy - Fossil Fuels', 'Renewable Energy', 'Uranium' and 'Applied Resources'; 'Health care' includes the TRBC business sectors 'Healthcare Services & Equipment' and 'Pharmaceuticals & Medical Research'; 'Infrastructure and transportation' includes the TRBC business sectors 'Industrial Goods', 'Industrial Conglomerates' and 'Transportation'; 'Technology' includes the TRBC business sectors 'Technology Equipment' and 'Software & IT Services'; 'Other sectors' includes the TRBC business sectors 'Banking & Investment Services', 'Collective Investments', 'Cyclical Consumer Products', 'Cyclical Consumer Services', 'Food & Drug Retailing', 'Investment Holding Companies', 'Personal & Household Products & Services', 'Retailers' and unclassified companies.

A2. IDENTIFYING THE CLIMATE FOOTPRINT OF BONDS

We use four ways by which we identify the climate footprint of each bond:

- (1) *Whether the NACE 4-digit sector of the issuer corresponds to carbon-intensive activities:* We identify carbon-intensive sectors following Battiston and Monasterolo (2019)³¹. The starting point is the Climate Policy Relevant Sectors (CPRS) classification, presented in Battiston et al. (2017)³² and Alessi et al. (2019)³³. This classification specifies sectors that can be affected by climate policies and are subject to transition climate risks. However, not all of these sectors are necessarily carbon intensive. Battiston and Monasterolo (2019)³⁴ have identified four carbon-intensive sectors, which are a subset of CPRS: (i) fossil fuel companies; (ii) energy-intensive companies; (iii) non-renewable utilities and (iv) carbon-intensive transportation. We have identified NACE 4-digit codes that correspond to carbon-intensive sectors following the rationale of their classification. However, those companies that belong to these NACE 4-digit, but their Thomson Reuters Business Classification (TRBC) activity or industry name is clearly related to renewables are not included in our carbon-intensive list. In particular, we exclude the companies that their TRBC activity name is 'renewable utilities' or 'renewable independent power producers (IPPs)' as well as those companies that their TRBC industry name is 'renewable fuels' or 'renewable energy equipment & services'.
- (2) *Whether the NACE 4-digit sector of the issuer corresponds to potentially green activities or the TRBC activity or industry name corresponds to renewables-related activities:* We use the recently developed EU Taxonomy of sustainable activities³⁵ to specify what we call 'potentially green' sectors. The EU Taxonomy identifies NACE 4-digits sectors that can contribute to climate mitigation via activities that (i) are already low-carbon, (ii) are not low-carbon but can contribute to the transition to a low-carbon economy by reducing emissions, and/or (iii) enable other activities to achieve emissions reductions. We classify the companies into the following categories: 'potentially green agriculture and forestry', 'potentially green waste management and remediation', 'potentially green construction', 'potentially green transportation, 'potentially green information and communication'.

A limitation of the EU classification is that it includes many carbon-intensive sectors; this is so primarily because there are various transition activities that can be undertaken in these sectors. Although we acknowledge the need for promoting activities that reduce emissions in carbon-intensive sectors, we find it misleading to call these activities 'green'. It would be more accurate to argue that these are 'dirty' activities, whose degree of dirtiness can decline. Thus, in our

'potentially green' sectors we include all these NACE sectors that are part of the EU Taxonomy for climate mitigation but are not carbon intensive. We, however, make some exceptions, for example in the case of real estate activities and life insurance. Although these sectors are included in the EU taxonomy and are not carbon intensive, we think it is not accurate enough to call them 'potentially green', since their contribution to emission reduction is likely to be very small.

The reason why our sectors are called 'potentially green' is that we do not have sufficient information to decide if the activities conducted by these sectors are actually green. The EU Taxonomy has specified screening criteria that include thresholds for metrics related, for example, to emission and energy generation. However, we do not have access to such detailed information at a sufficient granular level for all companies that are included in our analysis.

On top of the 'potentially green' sectors, we also identify some renewable sectors taking into account the TRBC activity and industry name of the companies. These are (i) 'renewable utilities' (which comprise the TRBC activities 'renewable utilities' and 'renewable independent power producers (IPPs)'), (ii) 'renewable fuels', and (iii) 'renewable energy equipment & services'.

- (3) *Whether the bond is classified as green:* We use the green bond flag provided by TR Eikon. Eikon defines green bonds as fixed income products that offer investors the opportunity to participate in the financing of large sustainable energy green projects that help mitigate climate change and help countries adapt to the effects of climate change
- (4) *The relative emission intensity of the issuer:* We use the company-level emission intensity provided by TR Eikon. This is equal to the sum of Scope 1 and Scope 2 CO₂ equivalent GHG emissions of the issuers over the company revenues. The data that we use refer to 2019. The relative emission intensity of each company is given by the median emission intensity in the 1-digit NACE sector that the company belongs to.

Note that a large number of corporate bonds are issued by companies that engage in financial service and insurance activities (sectors K.64, K.65 and K.66). Following Battiston and Monasterolo (2019), for the bonds that have been issued by these companies, we use the NACE codes and the emission intensity of the ultimate parent companies.

ENDNOTES

- ¹ See Financial Times (2020). 'Lagarde puts green policy top of agenda in ECB bond buying', 8 July 2020, available at: <https://www.ft.com/content/f776ea60-2b84-4b72-9765-2c084bff6e32>
- ² See for example, van Lerven, F., Jourdan, S. and Bryer, N. (2020). 'The European Central Bank and climate change: Five steps towards a sustainable recovery.' Publication by NEF, Positive Money Europe, and 350.org, available at: <https://neweconomics.org/uploads/files/ecb-climate-change1a.pdf>
- ³ ECB (2017). 'The ECB's corporate sector purchase programme: its implementation and impact', ECB Economic Bulletin, Issue 4/2017, available at: https://www.ecb.europa.eu/pub/pdf/other/ebbox201704_02.en.pdf; De Santis, R.A., Roos, M., Hettler, K. and Tamburrini, F. (2018). 'Purchases of green bonds under the Eurosystem's asset purchase programme', ECB Economic Bulletin, Issue 7/2018, available at: https://www.ecb.europa.eu/pub/economic-bulletin/focus/2018/html/ecb.ebbox201807_01.en.html
- ⁴ See <https://www.ecb.europa.eu/press/pr/date/2020/html/ecb.pr200922~482e4a5a90.en.html>
- ⁵ See Schnabel, I. (2020). 'When markets fail – the need for collective action in tackling climate change', 28 September 2020, available at: https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp200928_1~268b0b672f.en.html
- ⁶ An emission intensity is considered to be relatively high when the relative emission intensity (defined in Appendix A2) is higher than 1.
- ⁷ The ECB held an additional €17bn of corporate bonds and €35bn in commercial paper through PEPP.
- ⁸ QE more broadly would also stimulate demand for corporate bonds via the portfolio rebalancing channel. Van Lerven (2015, pp. 18-19) offers a broader conceptualisation of portfolio rebalancing: 'By buying financial assets with newly-created money the central bank pushes up the price of those assets, which simultaneously pushes down the yield (i.e. returns) earned by holders of these assets. The lower returns should force investors to move their investments into riskier assets with higher yields (such as corporate bonds and shares), hopefully directing more credit and investment towards businesses in the real economy. Similarly, lower yields show lower borrowing costs for businesses that issue bonds, making it cheaper for them to invest or spend more.' Van Lerven, F. (2015). 'Recovery in the Eurozone: Using money creation to stimulate the real economy', Positive Money policy paper, available at: <http://positivemoney.org/wp-content/uploads/2015/12/Recovery-in-the-Eurozone-FINAL-WEB-READY-2015-12-11.pdf>
- ⁹ The fact that the ECB corporate QE suffers from a carbon bias was firstly shown by Matikainen, S., Campiglio, E. and Zenghelis, D. (2017). 'The climate impact of quantitative easing', Policy Paper for Grantham Research Institute on Climate Change and the Environment, May 2017, available at: <http://www.lse.ac.uk/GranthamInstitute/publication/the-climate-impact-of-quantitative-easing/>. Table 1 illustrates that this continues to be the case.
- ¹⁰ See Dafermos, Y., Gabor, D., Nikolaidi, M. and van Lerven, F. (2020). 'Decarbonising the Bank of England's Pandemic QE: 'Perfectly Sensible'', New Economics Foundation, 4 August 2020, available at: <https://neweconomics.org/2020/08/decarbonising-the-bank-of-englands-pandemic-qe>
- ¹¹ In Table 1, high-emissions NACE 1-digit sectors are identified based on the contributions of these sectors to EU emissions. In the more granular approach, we identify NACE 4-digit carbon-intensive sectors based on detailed information about fossil fuel-related activities. For the latter approach, we draw on the Climate Policy Relevant Sectors (CPRS) classification developed by Battiston, S., Mandel, A., Monasterolo, I., Schütze, F. and Visentin, G. (2017). A climate stress-test of the financial system, *Nature Climate Change*, 7 (4), 283-290; see also Alessi, L., Battiston, S., Melo, A. and Roncoroni, A. (2019). 'The EU Sustainability Taxonomy: a Financial Impact Assessment', European Commission, available at: <https://ec.europa.eu/jrc/en/publication/eu-sustainability-taxonomy-financial-impact-assessment>. Carbon-intensive sectors are specified using the approach of Battiston, S. and Monasterolo, I. (2019). 'How could the ECB's monetary policy support the sustainable finance transition?', mimeo, University of Zurich, available at: <https://www.finexus.uzh.ch/dam/jcr:0103ed7b-71e9-4e81-9941->

[ee61feefd851/ECB%20sustainable%20finance%202022%20MarchIM.pdf](https://www.finexus.uzh.ch/dam/jcr:0103ed7b-71e9-4e81-9941-ee61feefd851/ECB%20sustainable%20finance%202022%20MarchIM.pdf). For more details see Appendix A2.

¹² For a similar analysis for CSPP as of 2019, see Battiston, S. and Monasterolo, I. (2019). 'How could the ECB's monetary policy support the sustainable finance transition?', mimeo, University of Zurich, available at: <https://www.finexus.uzh.ch/dam/jcr:0103ed7b-71e9-4e81-9941-ee61feefd851/ECB%20sustainable%20finance%202022%20MarchIM.pdf>

¹³ See also Matikainen, S., Campiglio, E. and Zenghelis, D. (2017). 'The climate impact of quantitative easing', Policy Paper for Grantham Research Institute on Climate Change and the Environment, May 2017, available at: <http://www.lse.ac.uk/GranthamInstitute/publication/the-climate-impact-of-quantitative-easing/> on this.

¹⁴ Abidi, N. and Miquel-Flores, I. (2018). 'Who benefits from the corporate QE? A regression discontinuity design approach', ECB Working Paper 2145, available at: <https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2145.en.pdf>. See also De Santis, R.A., Geis, A., Juskaite, A. and Cruz, L.V. (2018). 'The impact of the corporate sector purchase programme on corporate bond markets and the financing of euro area non-financial corporations', ECB Economic Bulletin, Issue 3/2018 – Articles, available at: https://www.ecb.europa.eu/pub/pdf/other/ecb.ebart201803_02.en.pdf

¹⁵ See also De Santis, R.A. and Zaghini, A. (2019). 'Unconventional monetary policy and corporate bond issuance', ECB Working Paper 2329, available at: <https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2329~62f5d264a5.en.pdf>; Todorov, K. (2020). 'Quantify the quantitative easing: Impact on bonds and corporate debt issuance', *Journal of Financial Economics*, 135 (2), pp. 340-358.

¹⁶ Committee on Economic and Monetary Affairs, 'Transcript of the Monetary Dialogue with Mario Draghi, President of the ECB, Held on 9 July 2018', p. 18, available at: https://www.ecb.europa.eu/pub/pdf/annex/ecb.sp180709_transcript.en.pdf

¹⁷ Solana (2019) highlights that central banks in the EU are bound by the principle of integration laid down in article 11 of the Treaty on the Functioning of the European Union (TFEU), which 'integrates environmental objectives into the mandate of the Eurosystem and requires it to take those objectives into account when designing and implementing monetary policy' (Solana, 2019, p. 547); Solana, J. (2019). 'The power of the Eurosystem to promote environmental protection', *European Business Law Review*, 30 (4), pp. 547-575.

¹⁸ As shown in Table A1 in the Appendix, the eligible bond universe that we have constructed is broadly in line with the market neutrality principle.

¹⁹ On this, see also Matikainen, S., Campiglio, E. and Zenghelis, D. (2017). 'The climate impact of quantitative easing', Policy Paper for Grantham Research Institute on Climate Change and the Environment, May 2017, available at: <http://www.lse.ac.uk/GranthamInstitute/publication/the-climate-impact-of-quantitative-easing/>; Van Lerven, F. and Ryan-Collins, J. (2017). 'Central banks, climate change and the transition to a low carbon economy: A policy briefing', New Economics Foundation, September 2017, available at: <https://neweconomics.org/2017/09/central-banks-climate-change>; and Jourdan, S. and Kalinowski, W. (2019). 'Aligning monetary policy with the EU's climate targets', Veblen Institute for Economic Reforms & Positive Money Europe, April 2019, available at: https://www.veblen-institute.org/IMG/pdf/aligning_monetary_policy_with_eu_s_climate_targets.pdf

²⁰ See Monnin P. (2018). 'Integrating Climate Risks into Credit Risk Assessment: Current Methodologies and the Case of Central Banks Corporate Bond Purchases', Council on Economic Policies, Discussion Note 2018/04.

²¹ For some broader problems with the use of the market neutrality principle by the ECB, see Hercelin, N. (2019). 'Why the ECB should go beyond "market neutrality"', September 2019, available at: <https://www.positivemoney.eu/2019/09/ecb-market-neutrality-doctrine/> and Van't Klooster, J. and Fontan, C. (2019). 'The myth of market neutrality: A comparative study of the European Central Bank's and the Swiss National Bank's corporate security purchases', *New Political Economy*, 1-15.

²² An emission intensity is considered to be relatively high when the relative emission intensity (defined in Appendix A2) is higher than 1.

²³ The 'other' companies include, for example, real-estate companies, healthcare companies, apparel companies and universities.

²⁴ See Dafermos, Y. and Nikolaidi, M. (2019). Fiscal policy and ecological sustainability: a post-Keynesian perspective, PKES Working Paper No. 1912, available at: http://www.postkeynesian.net/downloads/working-papers/PKW1912_09FfXGo.pdf; and Stirling, A., van Lerven, F., Powell, D., (2019) 'Changing the fiscal rules: Unlocking public investment for a Green New Deal', New Economics Foundation, available at: <https://neweconomics.org/2019/07/changing-the-fiscal-rules>

²⁵ See also Schoenmaker (2019) for a titling approach according to which asset purchases should be adjusted depending on whether a company is low-carbon, medium-carbon or high-carbon; Schoenmaker, D. (2019). 'Greening monetary policy', Working Paper 2, Bruegel, available at: <https://www.bruegel.org/wp-content/uploads/2019/02/Greening-monetary-policy.pdf>

²⁶ See Dafermos, Y., Nikolaidi, M. and Galanis, G. (2018). 'Can green Quantitative Easing (QE) reduce global warming?', Foundation for European Progressive Studies, Policy Brief July 2018, available at: <https://www.feps-europe.eu/attachments/publications/feps%20gperc%20policybriefgreenqe.pdf>

²⁷ To apply this criterion we downloaded data for euro-denominated corporate bonds, excluding those that have been issued by (i) companies belonging to the following TR Eikon sectors: banks, independent finance, official and muni, mortgage banking and supranational; (ii) entities that are supervised by the ECB; (iii) entities whose their immediate or ultimate parents are supervised by the ECB; (iv) companies belonging to the NACE 4-digit sectors 64.11 (central banking), 64.19 (other monetary intermediation), 64.92 (other credit granting) and 66.3 (fund management activities), as well as the NACE 2-digit sector 84 (public administration and defense; compulsory social security); (v) companies whose immediate or ultimate parents belong to the NACE 4-digit sectors 64.11 and 64.19.

²⁸ TR Eikon provides a specific variable about the grade of the bonds. If a bond is not assigned as investment grade according to this variable, or the information is not available, we also check the ratings given by Standard & Poor's, Moody's and Fitch. If one of these rating agencies provides a rating of BBB- or higher (in the case of the Standard & Poor's and Fitch) or Baa3 or higher (in the case of Moody's), we include it in the list.

²⁹ The ECB list of bonds that are held by the ECB as at 31 July 2020 is available here: <https://www.ecb.europa.eu/mopo/implement/omt/html/index.en.html#cspp>

³⁰ The ECB list includes a few bonds that are not issued by euro area companies and are not investment grade, as defined above. These bonds have been included in Columns 1-4.

³¹ Battiston, S. and Monasterolo, I. (2019). 'How could the ECB's monetary policy support the sustainable finance transition?', mimeo, University of Zurich, available at: <https://www.finexus.uzh.ch/dam/jcr:0103ed7b-71e9-4e81-9941-ee61feefd851/ECB%20sustainable%20finance%2022%20MarchIM.pdf>

³² Battiston, S., Mandel, A., Monasterolo, I., Schütze, F. and Visentin, G. (2017). A climate stress-test of the financial system, *Nature Climate Change*, 7 (4), 283-290.

³³ Alessi, L., Battiston, S., Melo, A. and Roncoroni, A. (2019). 'The EU Sustainability Taxonomy: a Financial Impact Assessment', European Commission, available at: <https://ec.europa.eu/jrc/en/publication/eu-sustainability-taxonomy-financial-impact-assessment>

³⁴ Battiston, S. and Monasterolo, I. (2019). 'How could the ECB's monetary policy support the sustainable finance transition?', mimeo, University of Zurich, available at: <https://www.finexus.uzh.ch/dam/jcr:0103ed7b-71e9-4e81-9941-ee61feefd851/ECB%20sustainable%20finance%2022%20MarchIM.pdf>

³⁵ See EU Technical Expert Group on Sustainable Finance (2020). 'Taxonomy: Final report of the Technical Expert Group on Sustainable Finance', Brussels, March 2020, available at: https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy_en.pdf