

# Low-carbon allocation in the implementation of monetary policy



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## **Abstract**

This paper analyses how the European Central Bank (ECB) can incorporate climate change considerations into its implementation of monetary policy. It reviews the impact of climate shocks on inflation, and the instruments available to decarbonise the ECB's asset and collateral portfolio. The paper concludes with recommendations to the ECB that would increase the low-carbon allocation in its monetary policy framework. This will in turn speed up the green transition and reduce the euro area's fossil-fuel dependency.

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## LIST OF ABBREVIATIONS

<b>APP</b>	Asset purchase programme
<b>CSRD</b>	Corporate Sustainability Reporting Directive
<b>ECB</b>	European Central Bank
<b>EP</b>	European Parliament
<b>EU</b>	European Union
<b>GDP</b>	Gross domestic product
<b>GHG</b>	Greenhouse gas
<b>HICP</b>	Harmonised index of consumer prices
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>QE</b>	Quantitative Easing
<b>SREP</b>	Supervisory Review and Evaluation Process
<b>TLTRO</b>	Targeted longer term refinancing operations
<b>USD</b>	US dollar

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## EXECUTIVE SUMMARY

- **Climate change can have a major impact on economic activity and prices.** This paper analyses three climate shocks: (1) climateflation: physical risks from climate change, including extreme weather events, leading to bad harvests and higher food prices; (2) greenflation: transition risks arising from green investments leading to higher metals and minerals prices; and (3) fossilflation: rising fossil-fuel prices leading to inflation. We find that volatile energy prices are a major contributor to inflation dynamics.
- **The European Central Bank (ECB) faces trade-offs in its policy response.** To reduce greenflation, the ECB may slow down the implementation of monetary policy instruments that reduce the allocation of its asset and collateral pool to carbon-intensive assets. By contrast, the ECB can implement monetary policy instruments to increase the allocation to low-carbon assets, in line with other European Green Deal regulatory policies. Another trade-off is that high interest rates to combat inflation may hamper green investments, which are sensitive to financing conditions. Paradoxically, the vulnerability to price instability caused by fossil fuels would be preserved in this way. To soften the impact of energy prices on inflation and speed up the energy transition, the ECB can incentivise private banks to lend more money for green investment and/or tilt its assets and collateral portfolio towards low-carbon assets. This would reduce the reliance on fossil fuels.
- **The current euro-area financial system has a carbon bias.** Without adjusting its monetary policy instruments, the ECB would reinforce this carbon bias. Investment in, and lending to, carbon-intensive companies reinforces the long-term lock-in of carbon in production processes and infrastructure. There is thus a need for the ECB to adopt low-carbon allocation in its monetary policies.
- **As the ECB is phasing out quantitative easing (QE), action is now shifting to the ECB's collateral framework.** We find there is scope to expand the already introduced low-carbon allocation from corporate bonds to bank bonds. This would more than double the effect of steering the ECB's collateral pool towards low-carbon assets.
- **The ECB could introduce green Targeted Longer Term Refinancing Operations (TLTROs) to soften the impact of high interest rates on green investment.** Lower interest rate on green refinancing operations would provide an incentive to banks to increase their green lending. This would keep the energy transition on track.
- **A well-functioning financial system is crucial for the smooth transmission of monetary policy.** Climate change shocks may threaten the stability of the financial system. This paper recommends a capital surcharge for high-carbon companies, to reduce the risk of stranded assets for banks and to reduce the systemic risk of climate change. From a financial stability perspective, the ECB should also consider macroprudential limits on carbon-intensive assets.

## 1. INTRODUCTION<sup>1</sup>

Climate shocks have had a major impact on inflation over the last two years. Increased physical risks, including extreme weather events, have caused bad harvests, pushing up food prices. The green transition has led to sharp rises in the prices of metals and minerals, while the rise in oil and gas prices brought about by Russia's invasion of Ukraine has had a major impact on inflation. Climate change considerations are thus relevant for the European Central Bank's primary objective of maintaining price stability.

Higher interest rates are important to combat inflation. But the new 'higher for longer' interest rate environment has a detrimental effect on the green transition, which depends to a great degree on upfront investment. Slowing down the green transition reinforces the current carbon bias in the financial system and the long-term lock-in of carbon in production processes and infrastructure.

The ECB's policy challenge is to regain price stability while not hampering the energy transition, which would reduce the euro area's dependency on fossil fuels and thereby its exposure to volatile energy prices. This paper **reviews the options the ECB has in pursuing a low-carbon allocation approach in its asset and collateral pool (as part of its monetary policy implementation framework)**, while maintaining price stability. **We tackle this review from three angles.**

**First, we analyse the asset and collateral base underlying the ECB's monetary policy implementation procedures.** High-carbon companies are more capital intensive and issue more stocks and bonds than low-carbon companies. **Current monetary policy implementation procedures mirror this carbon bias.** In its quantitative easing strategy, the ECB has started to tilt its asset portfolio towards low-carbon corporate bonds. However, this has been halted, as QE is being phased out. The question is how the ECB can shift its focus to low-carbon allocation in its collateral pool and increase the scope from corporate bonds to bank bonds, which form a major part of the collateral pool.

**Second, we take an investment perspective. High interest rates have a significant impact on the green transition** because it requires major upfront investments in infrastructure, production processes and the built environment (real estate). Therefore, differentiation between the financing conditions for high-carbon investments and low-carbon investments is crucial to prevent a slowdown in green investments. A first question is the division of labour between the government providing subsidised green loans, and the central bank providing lower interest rates for green loans. Another question is how the ECB could provide such lower interest rates, without affecting the monetary policy stance it is taking to combat inflation.

**Third, from a financial-stability perspective, the smooth transmission of monetary policy requires a stable banking system.** Transition risks may lead to abrupt changes in the value of carbon-intensive assets, turning them into stranded assets. The ECB is already conducting stress tests showing the vulnerability of individual banks and the wider banking system. The question is whether the ECB should move from the analysis, monitoring and warning stage, to the action stage to address the risk of stranded assets for the banking system. As a banking supervisor, the ECB could use capital surcharges for high carbon assets, starting through pillar 2. And in its financial stability role, the ECB could introduce macro-prudential limits on high-carbon exposures.

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<sup>1</sup> The author thanks Juan Mejino-Lopez for excellent research assistance and Nathan de Arriba-Sellier and Rens van Tilburg for very useful suggestions and comments.

This paper is structured as follows. Section 2 analyses the impact of climate change on implementation of monetary policy. Section 3 addresses structural factors that are relevant for the ECB to be able to incorporate climate change considerations into its monetary policy framework. Section 4 reviews several monetary policy instruments that the ECB could employ to deal with climate change. Section 5 concludes.

## 2. IMPLICATIONS OF CLIMATE CHANGE FOR THE IMPLEMENTATION OF MONETARY POLICY

Climate change has implications for implementation of monetary policy implementation in several ways. Starting with the economic channel, a major impact is the effect of climate change on price stability (Schnabel, 2022). Rising energy prices and food prices are major drivers of the recent bouts of high inflation, in response to which, the ECB has increased its key interest rates. Rising interest rates have an impact on the financing of renewable energy projects. Investment in renewables is hampered by high financing costs.

Moving to the financial channel, the make-up of the financial system is crucial for the transmission of monetary policy. The current set-up of the European financial system has a bias towards high-carbon assets (Cossmans and Schoenmaker, 2022), which reinforces climate change. The stability of the financial system is also important for a smooth monetary transmission.

### 2.1. Impact of climate change on price stability

Climate change can have a major impact on economic activity and prices<sup>2</sup>. Schnabel (2022) distinguished three separate shocks that put upside pressure on inflation. **The first shock is the impact of climate change itself, dubbed as *climateflation*.** Physical risks from climate change are already happening through natural disasters and extreme weather events, including droughts, floods and storms. The severity of these events has intensified, causing bad harvests, which in turn increases food prices. As food forms a central part 15.7% of the consumption basket (see Table 1), food prices are a major driver of inflation.

**A second shock is related to investments and policies for greening the economy (*'greenflation'*).** The aim of the low-carbon transition is to limit the impact of global warming in the future. As companies shift to low-carbon technologies for their production processes (e.g. power generation or steel production) and their final products (e.g. electric cars), demand will increase for metals and minerals, such as lithium for batteries. As the supply is fixed in the medium term<sup>3</sup>, this increased demand put an upward pressure on metal of 20% on an annualised basis over the 2020-2023 period (see Figure 3)<sup>4</sup>. Climate-mitigation policies put another upward pressure on prices. The European carbon price – based on emissions trading – increased from about €20 in 2018-2020 to more than €80 in 2023 (see Figure 4 in section 3.3). This increase is a direct (and intended) effect of the European Green Deal.

**The third shock refers to fossil-fuel prices (*'fossilflation'*).** Russian's invasion of Ukraine has increased energy prices, as embargos in Europe and the United States have reduced oil and gas imports from Russia. This increase in fossil-fuel prices has led to further increases in prices, given that EU economies are still carbon-intensive. Oil and gas prices have been rising excessively in this oligopolistic market, with artificial supply restrictions (Schnabel, 2022). An important way to mitigate the impact of fossil fuel prices on inflation is to reduce the European economy's reliance on fossil fuels.

<sup>2</sup> See Claeys (2024) for overview of the impact of climate change on economic activity and prices.

<sup>3</sup> It typically takes five to ten years to develop new mines (Schnabel, 2022).

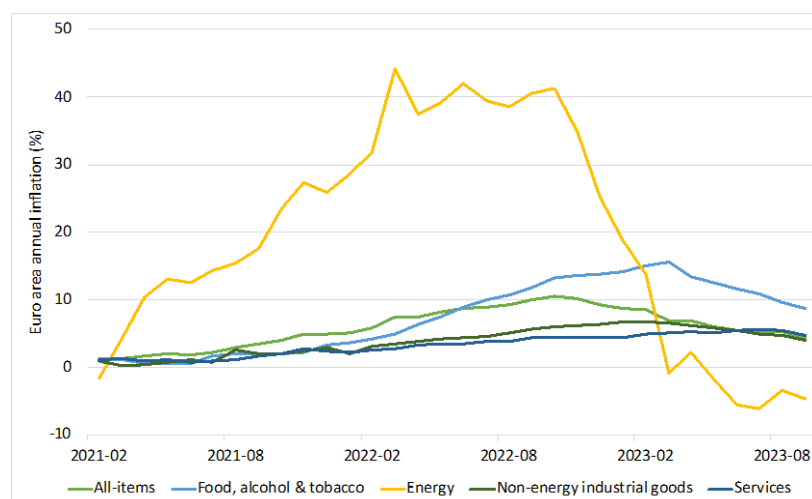
<sup>4</sup> This number is based on global metal prices, so without minerals.

### 2.1.1. Relative importance of shocks

Figure 1 shows the impact of the shocks on the Harmonised Index of Consumer Prices (HICP), which is used to measure consumer price inflation in the euro area. **The bulk of the inflationary pressure has come from the rise in energy prices (fossilflation), with increases of up to 40% on an annual basis.** The inflationary effects of food prices (climateflation) shows increases of up to 15% (which are partly caused by higher input prices for energy). Table 1 shows the relative contributions to annualised inflation during the high inflation period from March 2021 to March 2023. Energy counts for 2.8 percentage points (p.p.) of the 6.2% inflation rate over this period, i.e. almost half. Food contributes 1.1 (p.p.) of the 6.2% inflation rate.

The relative contribution of metal and mineral prices (greenflation) cannot be calculated as this component is not separately counted in the Eurostat HICP statistics. But it is a small category, with a minor contribution to overall inflation. Figure 2 shows the development of global metal prices. Temporary increases in metal prices are not unusual, and happened before in 2007 and 2012.

**Figure 1:** Euro-area annual inflation and its components (2021-2023)



Source: Bruegel calculations based on Eurostat.

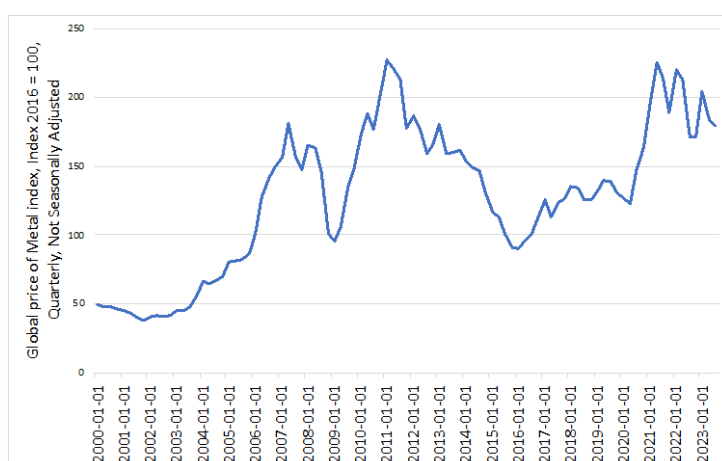
Notes: The inflation data used are the Harmonised Index of Consumer Prices (HICP) for the euro area.

**Table 1:** Size of inflation components (March 2021 – March 2023)

	% of consumption basket (1)	Average annual inflation in % (2)	Contribution to HICP inflation in p.p. (1)*(2)
All items	100.0	6.2	6.2
Food	15.7	6.8	1.1
Energy	10.9	25.6	2.8
Non-energy industrial goods	28.0	3.6	1.0
Services	45.4	2.9	1.3

Source: Bruegel calculations based on Eurostat.

Notes: The first column shows the importance of the inflation component of the HICP consumption basket. The second column depicts the average annual inflation over the March 2021 – March 2023 period. The third column is the relative contribution (in percentage points) to HICP inflation.

**Figure 2:** Global price of metals (2000-2023)

Source: Bruegel calculations based on FRED (Federal Reserve Economic Data).

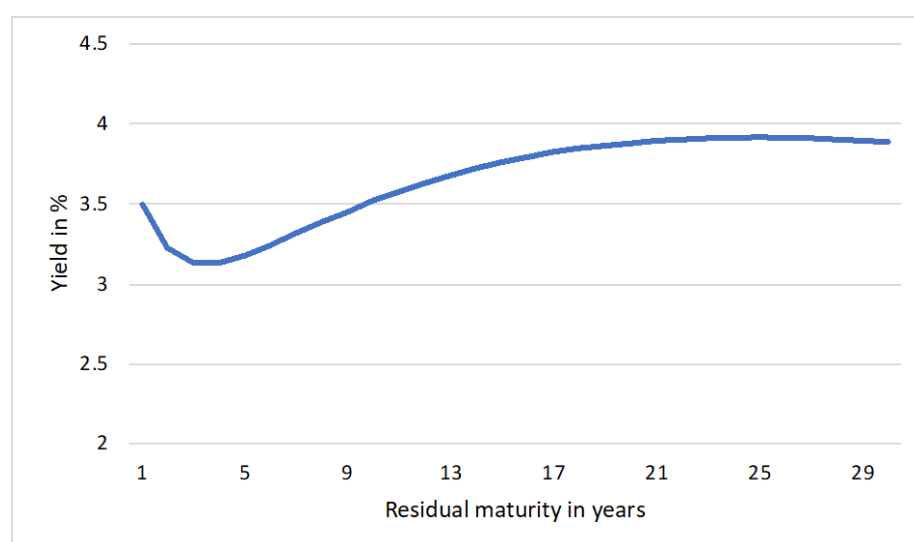
Notes: The data shows the global price of metals index (2016 = 100).

## 2.2. High interest rates for renewables

**The euro-area economy is moving from a ‘low for long’ to a ‘higher for longer’ interest rate environment.** The euro-area yield curve indicates that interest rates are expected to stay high at 3% to 4% for a period up to 30 years (Figure 3). High interest rates increase the capital cost of new investment. When inflation expectations are above target, central banks set high interest rates to reduce new investments. The reduced economic activity will in turn reduce inflationary expectations.

**However, this process hurts investments in renewables more than average.** Renewable energy technologies, like solar and offshore wind projects, and climate adaptation projects, often face high upfront costs, making financing conditions highly relevant (Egli, Steffen and Schmidt, 2018). Rising interest rates combined with rising materials prices undermine significantly the business case for renewables and climate adaptation, leading to sharp declines in green investment projects (Van Tilburg, 2023). Thomson Reuters reports large outflows from global renewable energy funds<sup>5</sup>. As a result of declining green investments, both the energy transition and climate resilience are at risk.

<sup>5</sup> See ‘Renewables funds see record outflows as rising rates, costs hit shares’, Thomson Reuters, 10 October 2023 <https://www.reuters.com/sustainability/climate-energy/renewables-funds-see-record-outflows-rising-rates-costs-hit-shares-2023-10-09/>.

**Figure 3:** Euro-area yield curve (in %)

Source: Bruegel calculations based on ECB.

Notes: The graph shows the average yield of all bonds at different residual maturity on 2 November 2023.

### 2.3. Carbon bias in the financial system

The guiding principle in the implementation of monetary policy has been ‘market neutrality’, whereby the ECB buys sovereign, corporate and bank bonds proportionally to outstanding debt in its asset purchase programme. The idea is that such a market-neutral approach will not disturb (relative) prices. An asset purchase or collateral framework and its criteria and/or requirements should not lead to the preferential treatment of distinct asset classes, issuers or sectors, and should avoid market distortion (Bindseil *et al*, 2017).

**However, there is evidence that the current market-neutral approach towards private companies (buying private securities in proportion to the market index) is not carbon neutral.**

As carbon-intensive companies, such as fossil-fuel companies, utilities, car manufacturers and airlines, are typically capital intensive, market indices for equities and corporate bonds, as well as bank lending, are overweight in high-carbon assets (Cosemans and Schoenmaker, 2022; Colesanti Sennit *et al*, 2023). The ECB’s application of market neutrality thus leads the Eurosystem’s private sector asset and collateral base to be relatively carbon intensive (Matikainen *et al*, 2017; Schoenmaker, 2021). Investment in carbon-intensive companies reinforces the long-term lock-in of carbon in production processes and infrastructure.

### 2.4. Impact of climate change on financial stability

The impact of climate change on financial stability is relevant for monetary policy implementation. **A stable financial system is an important prerequisite for the smooth transmission of monetary policy.**

The second ECB economy-wide stress test introduced granular sectoral dynamics and energy-specific considerations by country relevant to transition risk (Emambakhsh *et al*, 2023). **Banks and other financial institutions are subject to transition risk in so far they have exposures to carbon-intensive companies, energy-inefficient real estate and fossil-fuel related infrastructure.** When the transition sets in, for example induced by higher carbon prices and/or reduced costs of renewables,

these carbon-intensive assets will decline in value. Colesanti Senni *et al.* (2023) find that 80% of bank lending was extended to carbon-intensive companies during the 2020-2021 period.

By comparing different transition scenarios, the ECB stress test showed that acting immediately and decisively would provide significant benefits for the euro-area economy and financial system, not only by maintaining the optimal net-zero emissions path (and therefore limiting the physical impact of climate change), but also by limiting financial risk. The ECB stress test further finds that an accelerated transition to a carbon-neutral economy would be helpful to contain risks for financial institutions, and would not generate financial-stability concerns for the euro area, provided that firms and households can finance their green investments in an orderly manner.

**An important finding is that accelerating the transition reduces overall transition risk.** If action is further delayed, the only way to reduce carbon emissions compatible with net-zero targets is to act more precipitously at a later stage. This 'too late – too sudden' scenario (ASC, 2016) may lead to abrupt changes in the value of carbon-intensive assets, turning them into stranded assets (Caldecott, 2018).

### 3. STRUCTURAL CONSIDERATIONS

Before reviewing the instruments of monetary policy implementation, **we address some structural factors**. We discuss the legal mandate, how to counter the carbon bias, and coordination between fiscal and monetary policy.

#### 3.1. Legal mandate

Article 127(1) of the Treaty on the Functioning of the European Union (TFEU) clearly prioritises price stability: *“The primary objective of the European System of Central Banks (hereinafter referred to as ‘the ESCB’) shall be to maintain price stability. Without prejudice to the objective of price stability, the ESCB shall support the general economic policies in the Union with a view to contributing to the achievement of the objectives of the Union as laid down in Article 3 of the Treaty on European Union.”* The reference to general economic policies means the ESCB’s actions cannot be measured in terms of specific policies, but rather by its support for the underlying trends in economic policy (Smits, 1997).

Article 3(3) of the Treaty on European Union (TEU), meanwhile, specifies that the EU should *“work for the sustainable development of Europe based on balanced economic growth and price stability, a highly competitive social market economy, aiming at full employment and social progress, and a high level of protection and improvement of the quality of the environment.”* This wording leaves room for the greening of monetary policy, as long as it does not contradict the primary objective. It supports a broad definition of economic growth that recognises that economic policies also affect society and the environment, and that sustainability considerations should be included in financial decision-making (Schoenmaker and Stegeman, 2023).

Another key consideration is Article 11 of TFEU, which provides that *“Environmental protection requirements must be integrated into the definition and implementation of the Union’s policies and activities, with a view to sustainable development”* (Solana, 2019).

Following Smits (1997), **we argue that the Eurosystem should refrain from favouring assets of particular sustainable projects, agencies or companies**. Such individual choices are the domain of elected policymakers. **But the ECB can adopt a general approach towards low-carbon assets in support of the EU’s general policies on reducing carbon emissions**. It would only support (instead of hinder) the EU’s Green Deal policies to move to a low-carbon economy. **The ECB’s strategic review indicates that the ECB is ready to move away from a strict interpretation of market neutrality** (ECB, 2021). Schnabel (2021, p. 55) argued that *“it seems appropriate, then, to replace the market neutrality principle with one of market efficiency that more fully incorporates the risks and societal costs associated with climate change [...], taking into account the alignment of issuers with EU legislation implementing the Paris Agreement.”*

#### 3.2. Allocation approach needed for monetary policy

**A fundamental point is whether the ECB should follow only a risk-based approach, which looks at the exposure of an asset to climate-related risks, or an allocation-based approach, which favours allocation towards low-carbon assets**. Green economics, also called ecological economics (Daly, 1996), stresses the need to operate within planetary boundaries and respect ecological constraints. The government is in the driving seat for ‘greening’ the economy. In Europe, the EU institutions – the European Commission, the Council and the European Parliament – have endorsed the European Green Deal, which sets ambitious policy targets for greening the economy (European

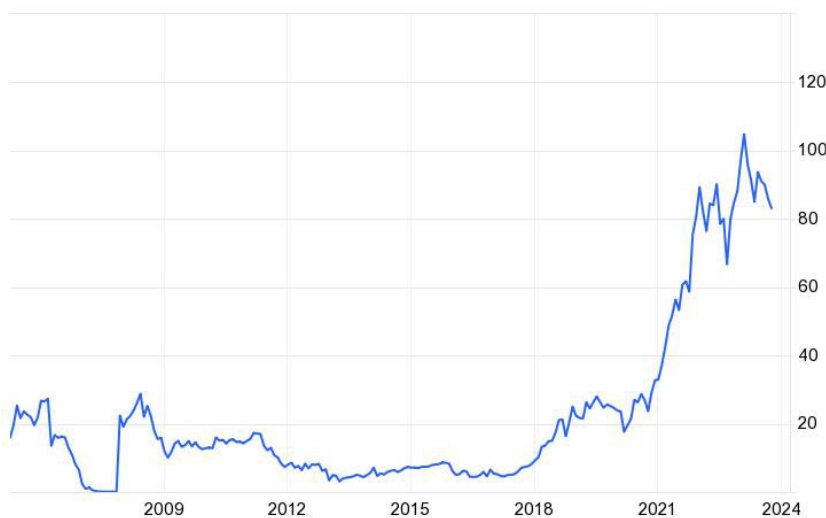
Commission, 2019). Given the primary role of EU institutions, the question is what is the appropriate role for the ECB in addressing the emergent sustainability risks?

**There is consensus that the ECB should help ‘de-risking the financial system’ in its financial policy roles** (see section 3.4). Monetary policy has by nature an allocative impact, influencing supply and demand conditions in the economy with the aim to bring inflation expectations back to target. **The question then is how the ECB can allocate its monetary policy instruments (e.g. purchasing assets under QE or taking collateral in its operations) more to low-carbon assets and less to high-carbon assets**, in order to operate within planetary boundaries.

### 3.3. Coordination between fiscal and monetary policy

**The first-best solution to address climate concerns is to tax the climate change externality caused by carbon emissions.** An appropriate carbon tax provides an ‘official’ price for carbon risk and would spur the move from high- to low-carbon investments. The good news is that the European carbon price – based on emissions trading – has risen from about €20 in the 2010s to about €80 in 2022/23 (Figure 4). Nevertheless, this market price is still below the shadow price of €157, which reflects the abatement cost at which carbon emissions can be reduced to stay within the 2°C temperature rise limit<sup>6</sup>, and covers only around 45% of the EU’s greenhouse gas emissions (Schoenmaker and Stegeman, 2023). **In this second-best world, which lacks a sufficiently high carbon tax, the question is how private companies, investors and public sector bodies (like central banks) can contribute to reducing carbon emissions.**

**Figure 4:** European carbon price in euros (2018-2023)



Source: Bruegel calculations based on Tradingeconomics.com.

Notes: Emissions trading is a market-based approach to controlling pollution. Under the emissions trading scheme (ETS), companies buy or receive emissions allowances or carbon permits, which they can trade with one another as needed.

**Coordination between the fiscal and monetary authorities is needed to come to an ‘appropriate’ carbon tax for the euro area.** What is the optimal fiscal-monetary policy mix? On the monetary policy side, the institutional framework of the ECB allows, in principle, adoption of the monetary policy stance most appropriate for the euro area as a whole. This in turn takes into account the fiscal policy stance

<sup>6</sup> This means that the temperature rise should not exceed 2°C compared to the pre-industrial temperature.

for the euro area as a whole (Orphanides, 2017). In the case of the transition to a low-carbon economy, this means the lower the carbon tax, the stronger the low-carbon allocation in monetary policy (and the higher the tax, the looser the low-carbon allocation). It should be noted that fiscal policy (i.e. setting the carbon tax) and regulatory policy under the Green Deal are far more powerful in mitigating climate change than any monetary policy low-carbon allocation can ever be.

### 3.4. Risk-based approach in a banking-based system

As suggested, **the ECB's approach for the financial system should be risk based.** The structure of the European financial system matters. When market financing dominates, tradeable bonds form a larger part of portfolios and are thus more important for monetary policy implementation. However, when bank financing leads, banks loans are more important. As it happens, Europe is bank-based (Langfield and Pagano, 2016). The bank-market ratio, defined as the ratio of total bank assets to stock and private bond market capitalisation, is close to 4 for Europe<sup>7</sup>. This high ratio suggests that up to 80% of financing takes places through bank loans. By contrast, the bank-market ratio for the United States is less than 1, which indicates markets play a large role. In this United States, markets provide more than 50% of financing and banks less than 50%.

**The bank bias in Europe's financial structure highlights the important role of the banking system in the transmission of monetary policy.** A stable banking system is a precondition for smooth monetary policy transmission. In the review of instruments, we therefore include the ECB policies and instruments to preserve financial stability.

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<sup>7</sup> Europe refers to all European countries, including Iceland, Norway, Switzerland and the United Kingdom.

## 4. WHICH INSTRUMENTS COULD THE ECB EMPLOY?

This section **reviews several monetary policy instruments that the ECB could employ to deal with climate change**. We **also discuss financial policy instruments**, because a stable financial system is crucial for the smooth transmission of monetary policy.

### 4.1. Maintaining price stability remains the priority

**We start with the need to accelerate the energy transition.** According to the Intergovernmental Panel on Climate Change (IPCC, 2023) has indicated that current projections of global greenhouse-gas (GHG) emissions imply the 1.5°C warming limit will be exceeded, and make it harder to keep global warming below 2°C. Our analysis in section 2 shows that volatile energy prices are the main contributor to inflation dynamics. These facts together suggest that green investment should be stepped up to reduce fossil-fuel dependency, and thereby bend the current trend in greenhouse-gas emissions downward.

**The most important contribution that the ECB can make to green investment is a favourable investment climate with stable prices** (Lagarde, 2023). Predictable prices avoid spikes in costs. This is in particular important for green investment, which has a medium- to long-term horizon. The ECB could help the energy transition most by delivering on its primary objective of price stability.

#### 4.1.1. Trade-offs in policy responses

**Central banks may face trade-offs when reacting to the inflationary shocks from climate change**, reviewed in section 2. Climate and fossil-fuel related shocks are supply-side shocks, reducing economic activity while increasing prices (Claeys, 2024). This may lead to difficult trade-offs for central banks. As monetary policy only affects the economy with a lag, central banks adopt a medium-term perspective and ignore temporary supply-side shocks. But when supply-side shocks become more permanent, inflation expectations are dis-anchored and feed inflation further (Coeuré, 2018). Central banks have than no other option than to react with monetary policy to bring inflation expectations back to target. This happened over 2022-2023, when the ECB had to react to the large rise in energy prices by increasing its key interest rates.

Green investment is a demand-side shock. Investments in low-carbon technologies boost economic activity as well as prices. Central banks face no trade-off (Claeys, 2024). They can increase the key interest rates when the demand shock is positive.

Russia's invasion of Ukraine has increased energy prices. This has led to further increases in prices, considering that euro-area economies are carbon-intensive. Higher capital costs through monetary and financial policy instruments for carbon-intensive assets would raise (otherwise high) inflation, which would conflict with the ECB's primary objective of price stability.

Broadly speaking, **two opposite policy responses are possible** (Schoenmaker and Stegeman, 2023). **The first is to slow down the phasing in of monetary and financial policy instruments to reduce the allocation to carbon-intensive assets.** Industry is also advocating a slow-down of the energy transition. However, that is just a postponement of the inevitable energy transition and a continuation of the euro area's exposure to oil price fluctuations. Moreover, fossil-fuel companies currently experience lower costs of capital due to the high profits, while renewables face higher costs of capital because of higher interest rates and rising material costs.

**The second response would be to implement monetary and financial policy instruments to increase the allocation to low-carbon assets**, as scheduled, in line with other European Green Deal regulatory policies. To soften the impact of volatile energy prices on inflation and to speed up the energy transition (reducing the reliance on fossil fuels), the ECB can incentivise private banks to lend more money for green investments and/or tilt its assets and collateral portfolio towards low-carbon assets. These instruments are discussed in the subsequent sections.

## 4.2. Quantitative easing becomes less important

**The ECB strategy review (ECB, 2021) included criteria for allocation towards low-carbon assets in its asset and collateral framework.** The ECB also agreed to perform an assessment of the climate risks embedded in assets, and introduced disclosure requirements for eligible assets (whereby only assets from companies that report under the Corporate Sustainability Reporting Directive (CSRD, 2022/2464/EU) are eligible). **The ultimate aim is to tilt its portfolio towards low-carbon assets by applying carbon factors that favour low-carbon assets, while punishing high-carbon assets** (Schoenmaker, 2021).

In July 2022, **the ECB agreed to tilt its corporate bond portfolio under quantitative easing (QE)** by only reinvesting in low-carbon assets (ECB, 2022a; Lagarde, 2022). Table 2 contains the ECB's holdings of assets under its Asset Purchases Programme (APP). Corporate bonds are only 10.7% of the ECB's APP portfolio. The tilting could also be applied to covered bank bonds and asset-backed securities (as explained in section 4.3), which would add another 9.9%.

But the ECB decided in May 2023 to discontinue its reinvestments. There is thus currently no scope for the ECB to decarbonise its asset portfolio. Nevertheless, **we recommend that the ECB should expand the tilting towards all relevant asset categories (covered bank bonds, corporate bonds and asset-backed securities)**, in case the ECB reintroduces QE in the future.

It should be noted that tilting the collateral framework has always been more important than tilting asset purchases (Schoenmaker, 2021). Tables 2 and 3 contain the ECB's asset and collateral holdings. First, the collateral framework is permanent. Second, the potential for tilting under the collateral framework amounts to EUR 1,590 billion (89% of 1,787 billion in the bottom row of Table 3), while the potential under the APP only amounts to EUR 637 billion (20.5% of EUR 3,109 billion in the bottom row of Table 2)<sup>8</sup>.

<sup>8</sup> Tilting towards low carbon is most relevant for the private sector. Carbon factors in column 4 of Tables 2 and 3 are therefore only applied to private sector securities and claims.

**Table 2:** Outstanding holdings under Asset Purchases Programme, October 2023

Securities	1. Eligible market securities (in € billions)	2. ECB holdings (in € billions)	3. ECB holdings as share of market (2. as % of 1.)	4. Carbon factors applicable (2. as % of total)
Government securities	9,821.0	2,470.6	25.2%	n.a.
Covered bank bonds	1,807.2	292.0	16.2%	9.4%
Corporate bonds	1,901.5	331.2	17.4%	10.7%
Asset-backed securities	597.6	15.3	2.6%	0.5%
<b>Total</b>	<b>14,127.3</b>	<b>3,109.1</b>	<b>22.0%</b>	<b>20.5%</b>

Source: Bruegel calculations based on ECB Eurosystem APP data.

Notes: The second column presents marketable securities that are eligible. The third column presents ECB holdings in the Eurosystem. The fourth column presents ECB holdings as share of eligible market securities. The fifth column indicates whether a carbon factor could be applied to the respective collateral category.

### 4.3. Much scope to expand carbon factors for collateral

**The ECB has been very shy in applying carbon factors to tilt the collateral portfolio.** Initially, the ECB applied a risk-based approach by stressing the need to include climate risk in credit ratings (ECB, 2021). But as argued in section 2, this risk-based approach is not sufficient for monetary policy implementation. Next, the ECB started to apply carbon factors to corporate bonds, which form only a very small fraction (2.9% in Table 3) of overall collateral holdings. Bank loans will be added later, which is the most important category with 33.6% of overall collateral (ECB, 2022a).

So, the ECB only includes bonds from, and loans to, non-financial companies. While the carbon emissions of non-financial companies can be assessed directly, it is more difficult to do for synthetic or financial institution securities. The look-through approach can be applied, whereby the underlying beneficiary instead of the intermediary is assessed (Schoenmaker, 2021). In the case of asset-backed securities, the carbon emissions of the assets in the vehicle (for example, real estate underlying mortgage-backed securities) can be measured<sup>9</sup>. In the case of bank loans, the carbon emissions of the borrower can be assessed<sup>10</sup>. In the more general case of bank bonds, the carbon emissions of a bank's total loan and investment portfolio should be evaluated.

**Our recommendation is that the ECB should expand the CSRD reporting requirement to bank bonds<sup>11</sup> (covered and uncovered) and asset-backed securities. In addition, the ECB should apply carbon factors to these collateral categories.** This recommendation would expand the low-carbon allocation of collateral by 50.4% percentage points, which is made up of 29.9% for bank bonds and 20.5% for asset-backed securities (Table 3).

<sup>9</sup> There are different approaches in place to assess the greenness of a securitisation: use of proceeds versus underlying assets. The look-through approach refers to the underlying assets. The ECB cannot check the use of proceeds in a reliable way when it buys asset-backed securities.

<sup>10</sup> In technical terms, these indirect emissions are called scope 3 emissions from lending and investment activities. These financed emissions are attributed proportionally to a company's financiers.

<sup>11</sup> It should be noted that most banks are already required to report under the CSRD.

**Table 3:** Collateral data of the Eurosystem, October 2023

Collateral categories	1. Eligible market assets (in € billions)	2. Use of collateral in Eurosystem (in € billions)	3. Collateral as share of market (2. as % of 1.)	4. Carbon factors applicable (2. as % of total)
Central government securities	9,821.0	156.6	1.6%	n.a.
Regional government securities	601.7	39.6	6.6%	n.a.
Uncovered bank bonds	1,984.7	81.1	4.1%	4.5%
Covered bank bonds	1,807.2	453.8	25.1%	25.4%
Corporate bonds	1,901.5	52.5	2.8%	2.9%
Asset-backed securities	597.6	364.9	61.1%	20.4%
Other marketable assets	1,391.6	38.1	2.7%	2.1%
Bank loans		600.1		33.6%
<b>Total</b>	<b>18,105.3</b>	<b>1,786.7</b>	<b>9.9%</b>	<b>89.0%</b>

Source: Bruegel calculations based on ECB Eurosystem collateral data.

Notes: The second column presents marketable assets that are eligible as collateral. The third column presents the collateral holdings in the Eurosystem at market values after haircuts applied. The fourth column presents collateral as share of eligible market assets. The fifth column indicates whether the additional carbon haircut could be applied to the respective collateral category.

#### 4.4. Green TLTROs to facilitate green investment

**Green investment is under pressure from the high interest rates to combat inflation.** As discussed in section 2, green projects are feeling the effects of higher interest rates more strongly than other projects because green projects require high upfront investment.

There are several ways to promote green investment. The first option is to provide a government subsidy for green loans. However, many euro-area countries do not have the fiscal space to provide subsidies at scale (Van den Noord, 2023). The second option is to create dual rates via so-called targeted Longer-Term Refinancing Operations (TLTROs). The ECB introduced TLTROs to stimulate economic activity. Banks that met the condition to maintain their lending to households and business got the option of borrowing from the ECB at more attractive rates. In a similar way, **the ECB could grant green TLTROs at reduced rates to banks that maintain green lending** (Van 't Klooster and Van Tilburg, 2020). The Bank of Japan and the People's Bank of China have already introduced green targeted lending operations<sup>12</sup>.

In order to neutralise the negative effects the current high interest rates have on the energy transition, the ECB Governing Council could decide to introduce a lower green interest rate on refinancing operations for banks. This lower green interest rate would incentivise banks to increase their lending for clean-energy production and energy-efficiency operations. Cheaper capital costs for these green investments would directly stimulate the supply of green domestic energy and renovation measures, reducing the reliance on fossil fuels (Van Tilburg, 2023).

<sup>12</sup> See on Bank of Japan: <https://greencentralbanking.com/2022/01/20/japan-green-loans-scheme/> and on People's Bank of China: <https://greencentralbanking.com/2021/11/10/pboc-launches-targeted-green-lending/>.

## 4.5. Improving financial stability

**The financial system plays a key role in the smooth transition of monetary policy.** Climate shocks can threaten the stability of the financial system. As shown in section 2, an accelerated transition may lead to abrupt changes in the value of carbon-intensive assets, turning them into stranded assets (Caldecott, 2018). It is thus important to strengthen the resilience of the euro area's financial system, which is predominantly bank-based.

The ECB is among the frontrunners in addressing climate risks (Grunewald *et al*, 2023). It takes climate risks into account in its Supervisory Review and Evaluation Process (SREP), which is part of the Pillar 2 supervisory review process of the Basel Capital Adequacy Framework<sup>13</sup>. In its 2022 SREP cycle, the ECB reviewed these risks on a qualitative basis, resulting in qualitative measures and feedback to individual institutions. Based on the 2022 SREP, the ECB imposed qualitative measures for climate risk, but no capital add-ons yet (ECB, 2022b). A next step would be to introduce higher capital charges for climate risks into Pillar 1 capital adequacy rules. As these Pillar 1 capital rules are part of the wider Basel Capital Adequacy Framework, **we recommend that the ECB as member of the Basel Committee on Banking Supervision should accelerate the discussion on including climate risks in Basel**<sup>14</sup>. The European Banking Authority (EBA, 2023) has recently made recommendations on enhancing the Pillar 1 framework to capture environmental and social risks. Pending higher Pillar 1 requirements, **we recommend that the ECB imposes Pillar II add-ons for banks that are exposed to carbon-intensive companies**. Under the Capital Requirements Directive (2013/36/EU), the ECB has the powers to impose such add-ons (De Arriba-Sellier, 2021).

**The ECB could also use macroprudential instruments to reduce the financial sector's exposure to climate risk.** Large exposure limits are helpful to reduce the impact of climate risk on banks (Schoenmaker and Stegeman, 2023). Current large exposure rules limit a bank's exposure to individual counterparties to 25% of a bank's eligible capital. Their rationale is to protect the bank against specific shocks, such as the failure of a large counterparty. In the case of climate change, large exposure limits could be set to protect banks against transition shocks and physical shocks. In a joint report on the macroprudential challenge of climate change, the European Central Bank and the European Systemic Risk Board (2022) review several macroprudential instrument to contain large exposures to (also called concentrations in) climate risks. This review includes a macroprudential limit on concentration risk.

To calibrate large climate exposure limits, the ECB needs to identify the appropriate size of the limit and the shocks from its stress-testing. While large exposure rules in banking supervision are set at the micro level against individual companies, large climate-exposure rules for macroprudential purposes are set at the macro level against aggregate exposures. **Higher limits on climate exposures, like 50% or 75% of a bank's eligible capital, are warranted.**

<sup>13</sup> The Basel capital adequacy framework sets the capital requirements for banks. It contains of three pillars. Pillar 1 sets the risk-based capital standards and Pillar 2 refers to the supervisory review of a bank's risk assessment process. A banking supervisor, like the ECB, could apply capital add-ons (as add-on to the pillar 1 requirements) when it observes shortcomings in a bank's risk procedures or considers particular risks which are not sufficiently captured under the pillar 1 requirements.

<sup>14</sup> In the EU, Basel capital adequacy rules are subsequently implemented under legislative procedure through the Capital Requirements Regulation and Capital Requirements Directive.

## 5. CONCLUSION

**This paper has analysed the impact of climate change shocks on monetary policy implementation** and the instruments the ECB could employ to deal with climate change.

**From the perspective of price stability, volatile energy prices have been the major driver of sharp inflation rises in the euro area over the last two years.** The subsequent rises in interest rates to combat inflation have a disproportionate effect on green investment, which requires upfront investment. The policy challenge is to combat inflation in line with the ECB's primary objective of price stability, while not hampering the green transition.

**The financial system has an inbuilt carbon bias** as carbon-intensive companies have greater financing needs and issue more stocks and bonds. Carbon-intensive companies reinforce the long-term lock-in of carbon in production processes and infrastructure. The carbon bias makes a low carbon allocation in monetary policy implementation even more important.

We reviewed **four monetary policy instruments**:

- The ECB's most powerful instrument is to **maintain price stability**. A stable investment climate without run-off costs is crucial for green investments with a medium- to long-term horizon.
- **As QE is phased out, the importance of greening QE is fading.** Nevertheless, we recommend expanding the low-carbon allocation in QE to more asset categories, for future instances of QE.
- **There is much scope to expand the low-carbon allocation of collateral.** The carbon factors for a low-carbon allocation are currently only applied to corporate bonds and bank loans. We recommend **application of carbon factors also to bank bonds and asset-backed securities**, which form half of the collateral pool.
- **Finally, green TLTROs are instrumental in softening the impact of high interest rates on green investment.** We recommend introduction of green TLTROs, which offer a lower interest rate on green refinancing operations. This provides an incentive to banks to increase their lending to clean-energy production and energy-efficiency renovations.

**Climate risk can also hit the financial system, which is crucial for smooth monetary transmission.**

The ECB is already performing climate stress tests. The ECB should now shift gear from analysing and monitoring, to addressing the vulnerability of the financial system to climate risk. Measures for banks are particularly important, as the European financial system is bank-based.

We propose **two financial policy instruments**

- As **banking supervisor**, the ECB enforces the **capital adequacy rules** for banks. The ECB could already apply **capital add-ons** to banks with high climate exposures in the Supervisory Review and Evaluation Process. At the same time, the ECB should make the case for **high capital requirements for climate risk** in Basel and the EU.
- In its role of **maintaining financial stability**, the ECB should set **macroprudential limits on a bank's aggregate exposure to high-carbon companies**. These limits protect the banking system against banks that are overexposed to transition risk.

**The transition to a green economy depends on green investment as well as brown divestment.**

These policy proposals would speed up the allocation towards green investment and the phasing out of brown investments.

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This paper analyses how the European Central Bank (ECB) can incorporate climate change considerations in its monetary policy implementation. It reviews the impact of climate shocks on inflation and the instruments to decarbonise the ECB's asset and collateral portfolio. The paper concludes with recommendations for the ECB to increase the low-carbon allocation in its monetary policy framework. This will in turn speed up the green transition and decrease the euro area's fossil fuel dependency.

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