MONETARY POLICY AND CLIMATE CHANGE
DISTINGUISHING BETWEEN A PROTECTIVE AND A PROACTIVE AGENDA

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INTRODUCTION

Central banks in many economies are striving to take account of climate change in their policies and operations. In its November 2021 Glasgow Declaration, on the occasion of the 2021 United Nations Climate Change Conference (COP26), the Network for Greening the Financial System (NGFS) committed to “deepen its analysis on integrating climate change considerations into monetary policy strategies and frameworks, in the context of the mandates of its members”. About fifty member central banks, as well as numerous financial regulators, published their own strategies linked to that declaration. The COP28 conference held in late 2023 reaffirmed leaders’ commitment to addressing climate change including by transitioning away from the use of fossil fuels. In that context, the NGFS stated that it “is keenly aware of the macroeconomic dimension of climate related developments and is committed to considering the implications of climate change and the transition for monetary policy.”

What does this mean for central banks, as they conduct monetary policy to stabilize the macroeconomy and achieve price stability? It is widely acknowledged that climate change caused by human behavior will have important consequences for the macroeconomy, some of which are already materializing. The transition to lower greenhouse gas (GHG) emissions will also usher in major behavioural and structural changes in the economy. Economic conditions, in turn, have important implications for that transition.

In examining the implications of climate change for monetary policy, it is important to recognize that central banks have different mandates. Many central banks’ mandates require them to focus on price stability, usually represented by an inflation target, in some cases accompanied by maximum employment. In such cases, central banks have a responsibility for assessing how climate change can affect price stability, via the economy’s long-run trajectory and the nature and incidence of shocks. They need to be ready to act appropriately should such shocks materialize. In addition, they need to assess and manage climate-related risks associated with monetary policy operations. This is a protective agenda: it is all about central banks’ addressing climate-related factors that may otherwise impair their ability to achieve their core mandate.

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1 This issue has been on the radar for several years now. See for instance Carney (2015), Lane (2017).
2 NGFS (2023b).
3 Climate-related factors are also relevant to the whole scope of central bank activities, including to the supervision and regulation of financial institutions and infrastructures and to central banks’ own corporate administration, but those are beyond the scope of this paper. Krogstrup and Oman (2019) provide a useful literature review of issues related to macroeconomic and financial policies more broadly.
4 In a recent survey of the membership of the NGFS (2023a), many respondents noted that physical and/or transition effects were already starting to be observed.
5 For simplicity, the rest of the paper will refer to central banks’ “price stability mandate” but the arguments apply equally to those with a dual mandate for price stability and maximum employment. (Some central banks have an objective of “maximum sustainable employment”—the word “sustainable” referring to a level of employment that can be sustained without creating inflationary pressures, rather than to environmental sustainability.)
Some central banks’ mandates go further, requiring them to promote the transition to a lower-carbon economy to the extent that this remains compatible with their core mandate for price stability. With such a secondary objective, the question is, how much scope does a central bank have to pursue a proactive agenda based on climate-related objectives, beyond what is required to fulfill its core mandate? Addressing this question is important, both in identifying what actions a central bank should take under such a secondary mandate and assessing the usefulness of establishing such an objective. It is also relevant to many central banks whose mandates assign them open-ended goals such as promoting general prosperity, which could be construed to include climate-related objectives.

This important distinction—a protective agenda that takes climate considerations into account in pursuing a central bank’s core mandate versus a proactive agenda that includes climate as an additional objective—is often blurred. Central banks themselves, like many private corporations, may wish to signal that they are doing their part to address climate change. Actions designed to achieve price stability in the face of climate change may of course also push in the right direction to support the transition, but that is not their main purpose and there are some trade-offs. On the other hand, central banks’ critics may misrepresent any and all actions to take account of climate as “mission creep”—even those actions that are required to fulfill central banks’ core mission.

This paper discusses the areas in which climate change requires central banks to make substantial additional effort to achieve their core price stability mandate. It then goes on to discuss the scope for central banks to be proactive without undermining core objectives, concluding that such scope is likely to be rather limited. Central banks need to be clear on what their climate-related actions are trying to achieve, both to strengthen their accountability and to avoid public confusion.

**CLIMATE AND MACROECONOMIC STABILIZATION**

While climate science concludes that human behaviour has been playing an important role in driving climate change, there is enormous uncertainty about the magnitude, timing, and incidence of these effects, given the complex and nonlinear interactions at work. This

6 These lines might also be blurred to the extent that a central bank could take actions to promote a smooth climate transition with the ultimate aim of creating conditions for price stability in the long run. It seems reasonable, though, to categorize most such actions as falling under a proactive agenda, especially as price stability is only one, and probably not the strongest, reason a smooth climate transition would be desirable.

7 The discussion in this paper focuses mainly on advanced-economy central banks that are granted a degree of operational independence in achieving price stability. Different issues arise for those central banks that are explicitly involved in sectoral credit allocation as an arm of government—characteristic of many emerging market and developing economies as well as some advanced economies. Such a role is often associated with a degree of financial repression whereby interest rates are kept below market clearing levels and credit is allocated directly. This has its own costs and benefits which are beyond the scope of this paper.

8 See for instance IPCC (2012).
uncertainty, of course, is not an argument for ignoring climate in policy making: on the contrary, when effects are imperfectly understood and inherently difficult to predict, that makes them all the more concerning.

Climate change will in all probability have a negative effect on global economic activity, as rising sea levels, droughts, and recurrent extreme weather events such as wildfires, floods and windstorms reduce productive capacity. Estimates of the economic impact of unfettered climate change are wide-ranging. These impacts are likely to vary considerably across countries and regions, with particularly large declines in South-East Asia, Sub-Saharan Africa, and South Asia—in some cases as large as -80%.9 Adjustments to a lower-carbon economy, consistent with limiting the rise in global temperatures, are also likely to be significant and negative. The NGFS (2019) review of the range of estimates, for instance, concludes that the cost of measures required to limit global warming to 2 degrees Celsius is between 1 and 4 percent of global consumption. According to the NGFS report, conceptually these costs are associated with “investing in R&D, in new facilities and new processes, the depreciation of existing production facilities and other assets, and changes in the relative prices of key inputs such as energy”, although the studies reviewed rely on a variety of methodologies to estimate these costs. While some of these effects are already evident, they are likely to build over coming decades, in most cases becoming of macroeconomic importance only beyond the 2-3 years most relevant for monetary policy. As they progress, they will gradually be incorporated into central banks’ estimates of potential GDP growth.

Beyond the effect on trend or potential GDP growth, both climate change itself and the policies adopted to adjust to net zero are structural changes which can have important implications for macroeconomic dynamics and for the transmission of monetary policy. Economists are starting to model the potential effects (Mann, 2023) and, as they unfold, they will be incorporated in the models used by central banks to guide monetary policy.

One way in which such structural changes may manifest themselves is in the risks around the macroeconomic projections that central banks use to frame their policies. It is not self-evident, however, that climate-related risks pose different challenges from the array of other risks and uncertainties amid which central banks have to conduct monetary policy. As Federal Reserve Governor Chris Waller (2023) succinctly put it: “Risks are risks.”. If climate risk warrants being treated as a separate item on central banks’ agenda, that is because there is evidence that it is different in nature or magnitude from other shocks. Climate science suggesting that climate-related forces could be subject to non-linear effects that could amplify them is surely a reason to explore such risks further—although it does not necessarily mean that they need separate treatment. From a financial standpoint, climate change can contribute to the usual categories of risk—credit, duration, liquidity, and funding risks—that central banks must consider in their monetary policy operations, as will be discussed later.

From a macroeconomic standpoint, the materialization of climate-related risks would normally constitute supply shocks. One example is extreme weather events, typically

9 The range of estimates is reviewed in NGFS (2019) and depends on the specific model used as well as the number of degrees of rise in global temperature. For example, Burke et al (2015) estimates larger impacts using a climate model that captures nonlinear effects.
concentrated in a particular geographic region, which in many cases result in a persistent loss of economic capacity. The structural adjustment to lower carbon emissions also entails supply shocks: many of these adjustments are likely to be unforeseen and discontinuous, as they are associated with rapid technological changes (e.g., Acemoglu et al., 2012). Failure to implement climate policies in a consistent manner—for example, carbon pricing that does not follow a predictable path but switches on and off in response to political pressures—is another likely source of supply shocks in a number of countries. The impact of such policy shocks is in part captured by analysis showing that delays in policy action to address climate change results in a more costly transition.

Supply shocks pose particular challenges to monetary policy in achieving its core mandate for price stability (e.g., McKibbin et al., 2017). Under flexible inflation targeting, the central bank should look through transitory shocks and respond only to ones that are associated with sustained inflationary or disinflationary pressures—although it is often very difficult to distinguish between the two. Supply shocks have complex effects on economic activity and inflation and are typically not well captured by the standard macroeconomic models used by central banks, so central banks have tended to treat them in an ad hoc manner when they occur. To the extent that they impair incomes as well as productive capacity, such shocks can affect demand as well as supply. If these shocks turn out to be large and sudden, they may also elicit a fiscal policy response that needs to be considered in formulating monetary policy.

The challenges of achieving price stability in the face of large supply shocks are exemplified by the experience of many advanced economies during the COVID-19 pandemic. While important elements of that policy response were appropriate—notably the outsize fiscal and monetary stimulus and liquidity provision when the crisis hit—the subsequent upsurge of inflation in 2021-22 indicates a need to learn from this experience. In part, it reflects the difficulty of distinguishing transitory shocks from permanent ones and the unreliability of estimated economic relationships when confronted with new kinds of shocks. The experience also calls for a reconsideration of the role of forward guidance, which was intended to enhance the impact of monetary easing at the height of the pandemic but also complicated policy making and communication as inflationary pressures emerged. The complexity of the adjustment processes set in motion by the pandemic does not contradict the need for strong expansionary fiscal and monetary action when such a shock occurs, but it does also indicate a need for nimbleness when the economy can change in unexpected ways.

Although the policy response was warranted by central banks’ price stability mandates, some have cited the pandemic experience as illustrating that central banks already pursue a broader set of objectives beyond a narrow focus on price stability (e.g., Barkawi and Zadek, 2021), perhaps also demonstrating the need for greater collaboration between monetary and fiscal policy more generally. Enthusiasm for broadening central bank mandates has been dampened, however, by the subsequent upsurge of inflation, which is widely viewed

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10 Some of the factors resulting in the surge in inflation are discussed in Lane (2022).
as underscoring the importance of clarity of purpose and accountability for central banks’ core price stability objective.

The pandemic experience does point to the need for clarity around the rules of engagement between monetary and fiscal policy and a well-formulated exit strategy, to avoid policy errors and maintain central bank credibility. Further assessment of this experience, as well as research on the effectiveness of monetary policy tools and the appropriate policy mix in the face of adverse supply shocks more generally, will be very helpful in guiding the monetary policy response to climate-related shocks that are likely to occur more and more frequently.

In addition, as climate change progresses, central banks are likely to have to pay more attention to a wider range of data, including meteorological data. During the pandemic, many central banks moved rapidly to become more conversant with public health data and policy issues and in future they will similarly need to enhance their knowledge of climate-related developments.

Additional effort is also needed to upgrade central banks’ understanding of the complex structural changes involved in the transition to a lower-carbon economy. While the most attention has been focused on the shift away from coal and other fossil fuels, this transition will ultimately involve economy-wide changes in relative prices, in the composition of economic activity and consumption, as well as the energy intensity of production and the use of different energy sources. Scenario analysis has proved to be a useful tool for analyzing both the physical effects of climate change itself and the transition risks, under a variety of assumptions regarding the transition (NGFS, 2020).

While existing climate models capture key elements of the transition, these are typically based on perfect foresight and also do not capture the discontinuous and disruptive nature of the adjustment. In particular, these models do not incorporate technological changes—which have already played and will continue to play a major role, as relative price changes create incentives for the invention and adoption of new technologies (Acemoglu et al., 2012). Moreover, structural changes and the prevalence of different kinds of shocks often bring about changes in estimated macroeconomic relationships—as exemplified by the unreliability of estimated Phillips Curves in the wake of the pandemic.

Policy uncertainty is another key element: while existing models have been used to illustrate that the transition is likely to be much more costly if action is delayed (e.g., Bank of Canada and OSFI, 2022), they cannot readily capture the uncertainties and disruptions associated with asynchronous policy actions across jurisdictions, reversals of climate action in some jurisdictions, and other shocks and policy shifts that may have important effects on energy costs, use, and production.

It is too ambitious to expect that central banks’ workhorse macro models will be able to capture the full range of structural changes associated with the global transition to a lower-carbon economy, and the risks and uncertainties associated with that transition. There has been considerable progress in modelling economic heterogeneity on other dimensions such as income distribution, and some of those tools and techniques may be applicable to heterogeneity with regard to carbon intensity.
But, as we were reminded during the pandemic, there is no substitute for critical thinking in guiding policy in the face of an unfamiliar set of forces and shocks. It will also be more important than ever to expect the unexpected: recognize that many developments will not be adequately captured by models and turn to a wider than usual set of information and analysis—some of it interdisciplinary—to guide policy. This also involves more thinking about what could go wrong and how, adopting best practices to counter groupthink, and being willing to change positions when new facts and forces emerge.

**CLIMATE RISKS AND MONETARY POLICY OPERATIONS**

Many central banks are also actively exploring how climate-related considerations should be brought into the market operations they use to implement monetary policy. These operations include asset purchases, central bank landing, and collateral policies. While such operations are used to implement monetary policy, they are also used in many cases for financial stability purposes—particularly in crisis situations where financial and macroeconomic stability are closely intertwined. Central banks also promote well-functioning financial markets more generally to support monetary policy transmission as well as financial system stability and efficiency.

A central bank is responsible for prudently managing all forms of risk associated with these operations, including those stemming from physical and transition risks of climate change. Protecting the central bank’s balance sheet from such risks is part of the responsible stewardship of public resources. It is also important in maintaining the central bank’s credibility as well as to avoid distorting the system through moral hazard.

Central banks have been examining options for incorporating climate-related considerations into various aspects of their operations, as summarized in Table 1. Such options could be considered under either a protective or a proactive agenda.

**Table 1. Market Operations - Tools Under Consideration**

<table>
<thead>
<tr>
<th>Asset purchases</th>
<th>Shift purchases</th>
<th>Adjust asset purchases according to climate-related risks and/or criteria at issuer or asset level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative screening</td>
<td>Exclude some assets or issuers from purchases if they fail to meet climate-related criteria</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Central Bank Lending</th>
<th>Pricing</th>
<th>Adjust pricing to reflect counterparties’ climate-related lending</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eligibility</td>
<td>Make access to (some) lending facilities conditional on a counterparty’s activities and/or disclosure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Collateral</th>
<th>Adjust haircuts</th>
<th>Adjust haircuts to better account for climate-related risks.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative screening</td>
<td>Exclude otherwise eligible collateral assets, based on climate-related risk profile or other climate-related factors</td>
</tr>
<tr>
<td></td>
<td>Positive screening</td>
<td>Accept otherwise ineligible collateral based on climate-related considerations</td>
</tr>
<tr>
<td></td>
<td>Align collateral pools</td>
<td>Require counterparties to pledge collateral to comply with climate-related metric at aggregate pool level</td>
</tr>
</tbody>
</table>

Source: NGFS (2021a)
A number of central banks have already begun to incorporate elements of these approaches into their market operations, but most are still considering whether and how best to do so. The European Central Bank and the member central banks of the Euro area have been the most active in this direction. In a recent survey by the NGFS (2023), adjustments to asset purchase programmes were reported to be the most commonly adopted measure, with about one-third of central bank respondents having taken such measures; four-fifths of these were central banks from the euro area, along with a handful from other advanced economies and emerging market and developing economies (EMDEs). About one-third of respondents (mainly from the euro area) reported that they had made adjustments to their collateral frameworks. Only 5% of central bank respondents (mainly EMDEs) reported that they had amended conditions and criteria for credit operations.\(^{12}\)

Let us consider how these market operations work and how central banks could better manage the climate-related risks.

**Asset purchases** have been an important tool of monetary policy in many advanced economies in the past 15 years. Central banks have undertaken large-scale asset purchases to support their economies in the wake of the global financial crisis, and then again in the COVID-19 pandemic.\(^{13}\) Many of these purchases constitute Quantitative Easing (QE), a tool for providing additional stimulus when interest rates are at their effective lower bound. Central banks have also undertaken targeted purchases of particular public and/or private sector assets to address dislocation in particular markets—for instance, purchasing corporate bonds in the face of the collapse of activity in those markets in March 2020.

Some central banks, notably in the US and Canada, keep these as tools mainly to use in emergencies. They ended purchases of private financial assets as soon as financial markets were functioning normally and allowed the assets purchased to run off; similarly, they reversed QE and began Quantitative Tightening (QT) soon after starting to withdraw monetary stimulus. Other central banks, notably in Europe and Japan, which have faced prolonged situations of very low or negative interest rates, have continued large-scale purchases of both public and private sector assets.\(^{14}\)

While asset purchases have been undertaken for pressing macroeconomic reasons, risk considerations are clearly relevant, and these are affected by climate change and the transition. In a crisis, the evident need for bold action often leads these risks to get less attention, which underscores the importance of having clear risk management frameworks in place. Most obviously, assets purchased by central banks may be exposed to credit risk associated with the transition. There is evidence that issuers of assets eligible for corporate bond purchase programs have tended to be more carbon-intensive than the economy as a whole (Matikainen et al., 2017). Eliminating any such bias, or even shifting purchases toward issuers with a lower carbon footprint, which are likely to face less transition risk, could reduce

\(^{11}\) The NGFS reports responses of national central banks that are its members, although decisions related to monetary policy in many cases reflect those of the ECB.

\(^{12}\) These figures probably overstate the uptake so far, since NGFS members tend to be those central banks with a greater interest in climate issues and those members responding to the survey are more likely to be those with something positive to report.

\(^{13}\) Asset purchases during the pandemic and their impact are examined in CGFS (2023).

\(^{14}\) In Europe, large-scale asset purchases were also intended to maintain the integrity of the euro area by providing a market for sovereign bonds whose issuing governments were under pressure.
the climate risk to which the central bank is exposed (Monnin, 2018). Issuers that do not disclose their carbon footprints pose greater risk: a lack of good information on climate exposures is in itself a source of risk. That would be just a normal and prudent application of risk-return considerations in portfolio selection, taking account of climate risk along with other relevant risks. Moreover, the structural changes associated with the transition may make it harder to discern the neutral rate of interest and thus contribute to both duration and funding risks.

The materiality of climate risk associated with central banks’ asset purchases depends of course on the scale of those purchases relative to the central bank's balance sheet. For most advanced economy central banks, the prevailing context in which asset purchases are being undertaken has recently changed. Much of the discussion was framed in a context where inflation was persistently below target and asset purchases were seen as likely to expand further to provide additional stimulus. However, since 2022 with the upsurge of inflation in many advanced economies a number of central banks have been moving in the other direction, undertaking quantitative tightening (QT) by allowing assets to run off their balance sheets and/or through outright asset sales. As central banks’ asset holdings decline, they may well be considering how much attention to give to a problem that is dwindling in importance. However, this is a set of issues that will probably emerge in future crises, so it is important to be prepared. Moreover, as some central banks, notably the ECB and Bank of Japan will continue to have large outstanding stocks of securities for the foreseeable future, it remains important for these central banks to consider how best to reflect climate considerations in managing that stock.16

A central bank’s liquidity provision and its role as lender of last resort should also be examined with regard to climate-related risk. Carbon footprints and disclosure can be considered in determining what institutions have access to central bank windows, at what rate and for what terms. For instance, institutions whose portfolios have less exposure to climate-related risk could be given preferential access, or those with greater exposures or those that do not disclose enough information to make an informed risk assessment could be excluded or faced with a penalty rate. The aim of such policies could be to reduce counterparty risk to the central bank.

A final aspect of market operations is collateral policy: what assets are accepted as collateral for central bank lending, and at what haircuts? For example, adjusting collateral policy to link collateral eligibility to climate risk exposures and/or applying larger haircuts to assets with higher climate risk exposures could reduce the central bank’s exposure to transition-related credit risk, if those differences in risk are meaningful and systematic. In addition, if external credit rating agencies (CRAs) are doing their job, such differences in risk should be captured in their ratings, although those ratings have limitations as discussed below. Such differences in risk could be material for securities issued by entities with different exposures to climate-related risk; in contrast, when green and other bonds are issued by the same sovereign or

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15 For instance, the Bank of England reported that only just over half of bonds issuers eligible for its Corporate Bond Purchase Facility (BOE, 2021a) were publishing disclosures in line with the Task Force on Climate-Related Financial Disclosures (TCFD).

16 The ECB’s methodology for valuation of marketable assets, including with regard to climate, is discussed in Adler et al. 2023.
multilateral institution and backed by the same full faith and credit, those differences are likely non-existent.

Taking account of climate-related risks in market operations requires further information and analysis to assess climate-related financial risk over the relevant time horizon. For many central banks, the relevant time frame for market operations is very short, in contrast to climate exposures that evolve slowly; for others, particularly in Europe and Japan, assets are held over a much longer period. Slow-moving risks can of course materialize suddenly with shifting market perceptions of such risks; risk may then arise from any mismatch between market perceptions and actual climate risk exposures, as such mismatches create the risk that valuations change abruptly when such risks are more fully priced. There is mixed evidence on the extent to which market pricing captures climate related risks (e.g., Acharya, 2022; Bolton and Kacperczyk, 2021; Bolton et al., 2022; IMF, 2020). A central bank, like any financial institution, has to take responsibility for managing risks affecting its own balance sheet using the best information available.

Assessing physical risks requires consistent information on the issuer’s exposure to rising temperatures, e.g., via extreme weather events or flooding. Transition risk may take the issuer's carbon emissions as a starting point, as these will be subject to a rising price of carbon and/or to equivalent regulatory measures. This would give far from the complete picture, though: an issuer’s exposure to transition risk depends not only on its current carbon footprint but on the cost of reducing emissions in response to carbon pricing and/or regulatory action. It will also depend on how its customers, its customers’ customers, and so on will be affected by the transition. The data reported by private companies on their carbon footprints and other Environmental, Social and Governance (ESG) factors provide a starting point but require careful scrutiny and, in many cases, need to be supplemented with other information and analysis to guide a more comprehensive assessment of the risks.17

There is much work to do to gather relevant data and assess these risks, and any such assessment is necessarily imperfect. In this context, central banks need to make a strong start both at building their analytical capabilities and begin applying their assessments to the best of their ability, while recognizing that course corrections will be needed as the quality of these assessments improves. Credit rating agencies (CRAs) should capture the elements of climate risk that are material, but central banks should not use those ratings mechanically: they should be informed customers who also put pressure on CRAs to incorporate material climate-related considerations more fully into their assessments, also supplementing these external assessments with their own analysis as needed (Monnin, 2020). While in most cases, central banks are not the official organization that has the greatest leverage over CRAs—financial and prudential regulators regulate or at least influence them more directly—central banks should lend support to efforts that take a more comprehensive view of risk.

Clearly these problems are not going to be solved overnight. Since policymakers face common challenges in developing appropriate data frameworks and analytical tools, there are likely to be significant benefits from collaboration both within and across jurisdictions (NGFS, 2023). Moreover, central banks are not alone in the analytical challenges they face and should make common cause with other investors and financial institutions. This is one

17 There is also a need to continue to work towards greater consistency in how data are reported, particularly given the obvious incentive for companies to report on a basis that creates a more favorable impression. See for instance Bryan (2023).
important benefit, for example, from the cooperative scenario analysis undertaken by some central banks in collaboration with regulators and commercial banks. Central banks add value to such exercises through their analytical capabilities, notably on the macro modelling side. While extending the data base and building a suitable analytical framework will be a multi-year project, policy makers cannot wait for perfection: they need to act now, based on the best information and analysis currently available.

**WHAT MORE COULD MONETARY POLICY DO TO SUPPORT THE TRANSITION?**

As discussed, central banks have a clear duty to carry out monetary policy in a way that takes account of climate-related forces and shocks if these have material implications for price stability. They also have a clear duty to protect their balance sheets against climate-related financial risks and thus to account for such risks in monetary policy operations. It is less clear, though, how much scope monetary policy has to go further—to play an active role in supporting a green transition without undermining their core responsibility for price stability. Some central banks already have addressing climate change as a secondary objective, which they are to pursue provided that the price stability objective is achieved.

In considering whether monetary policy should play a role in actively supporting or promoting the transition, three key elements need to be examined. First, tools: are there monetary policy tools that have meaningful effects on the climate transition without having adverse effects on other objectives? Second, information: is the central bank likely to have the information that can inform appropriate policy decisions? Third, governance: what are the governance implications of tasking a central bank to pursue climate-related objectives, and how would that impinge on its ability to pursue its price stability objective?

With regard to the tools of monetary policy, we can distinguish between the overall stance of monetary policy and the market operations used to implement it.

**Overall stance**

There has been relatively little discussion of the possibility of calibrating the overall stance of monetary policy—the amount and kind of monetary policy stimulus—to support climate objectives. Policy interest rates and QE are blunt instruments which must be calibrated primarily for their economy-wide impact. They do not have the ability to differentiate between different activities according to the carbon emissions they generate. While in principle a central bank could target lower GHG emissions through a monetary policy that

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19 Some of the considerations discussed here are reminiscent of earlier discussions of whether monetary policy should “lean against” the buildup of imbalances and vulnerabilities in the financial system as opposed to taking these vulnerabilities as given and addressing their macroeconomic consequences (White 2009). Without delving into that question here, one could note that monetary policy has a direct connection with financial stability, as monetary policy is transmitted to the real economy, at least in part, by creating incentives for increased leverage and risk taking. In contrast, the overall stance of monetary policy affects climate change mainly though its effects on the entire economy.
consistently undermines economic growth, no central bank is advocating or pursuing this. It’s clearly not the best way of addressing climate issues.

Some observers have argued that climate considerations should argue for an easier monetary policy, on the basis that monetary tightening is detrimental to the transition because it raises the cost of green investment. But here again, monetary policy is a blunt instrument and its use to promote a green transition is likely to undermine the achievement of price stability. A higher cost of capital also applies to many less climate-friendly investments such as large-scale oil and gas extraction projects. Moreover, pursuing a laxer monetary policy based on the supposition that this would promote the transition would result in higher and more variable inflation which, if anything, would tend to complicate the transition. Any effect on the real interest rate is unlikely to be sustained. For these reasons, there has been little uptake of this argument among central banks. On the contrary, low, stable, and predictable inflation provides a supportive environment for the structural adjustments and investments needed for the transition to a lower-carbon economy.

### Market operations as proactive tools

There has also been consideration of whether central banks' market operations can be used proactively to promote the transition without undermining the achievement of their price stability and financial stability objectives. This would mean going beyond the risk considerations already discussed: the central bank could also use its operations to create incentives for capital to move toward greener activities and promote the development of financial markets that can efficiently support the transition. The aim here could be to push up the cost of capital for firms and industries whose operations are more carbon-intensive, thereby channelling financing away from them and toward other uses. It could also be used to encourage firms to develop plans to reduce their emissions by rewarding those that have such plans.\(^{20}\)

Using market operations to promote the transition sometimes, but not always, goes in broadly the same direction as the risk-based adaptations already discussed. For instance, both could involve shifting corporate bond purchases away from companies with higher emissions: under a protective agenda, this would be to manage the greater risks that high emitters may face in the adjustment to lower economy-wide emissions; under a proactive agenda, it would be actively to promote that transition by making financing more expensive for higher emitters. But these agendas have very different implications for how these policies are supposed to work, how they should be calibrated, what information is required, and how their success or failure should be gauged.

With these considerations in mind, let us consider the various tools central banks have at their disposal in their market operations.

*Asset purchases* have generally received the most attention. The large volume of asset purchases in the wake of the 2008 financial crisis has prompted the idea of “green QE”: in contrast to the usually-stated objective of “market neutrality”, it is proposed that for a given total amount of QE stimulus delivered, its composition would be tilted towards debt that supports the transition.\(^{21}\) Research has shown that in the past, in some jurisdictions, central

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\(^{21}\) See for instance Vestergaard (2022).
bank asset purchases guided by market neutrality have tended to tilt in the other direction—
giving disproportionate support to more carbon-intensive sectors such as utilities.\textsuperscript{22}

Open market purchases and sales traditionally involve predominantly government bonds. Here, there has been discussion of giving preference to \textit{green government bonds} in asset purchases.\textsuperscript{23} But both green and non-green bonds backed by the full faith and credit of the same issuing government in most cases essentially differ only in their branding. Government decisions on investments in green infrastructure are not determined by the proceeds from the sale of green bonds. While green bond proceeds are often notionally earmarked for financing climate-related expenditures, such expenditures are typically (and appropriately) determined through budgetary processes rather than being conditional on the proceeds from sale of green bonds. A hypothetical exception would be a case where all additional green expenditures are being financed through green bonds, so that the yield on green bonds determines the marginal cost of such expenditures; in that case, if there is a material “greenium” on green bonds, it could influence government decisions on green infrastructure relative to other budgetary priorities. Preliminary evidence presented by Meyer and Henide (2021) found a statistically significant greenium for corporate green bonds, amounting to a few basis points; however, this greenium seems to reflect primarily the scarcity of green bonds, suggesting that it may diminish or disappear if issuers were to rely on green bonds to finance a stepped-up volume of green investments. In all, it seems unlikely that central bank purchases of green government bonds would be a significant tool for promoting green public investment, beyond whatever value a gesture of support may have.\textsuperscript{24}

Greening of central bank purchases or sales of private sector assets offer more scope to shift investment in the economy meaningfully in a way that would support the transition. This could include purchasing corporate bonds or asset-backed securities whose issuers have lower carbon footprints (either in absolute terms or relative to industry standards) and/or purchasing only the bonds of companies that disclose climate-related information. At a more sophisticated level, asset purchases could favour borrowers that have credible and appropriate transition plans, possibly even making continued financing conditional on implementation of these plans. Such purchases could also exclude those that fail to meet environmental criteria, e.g., those that produce fossil fuels or some specific products such as thermal coal.\textsuperscript{25} The scope for such tilting, however, is conditioned by the composition and purpose of those transactions as well as their scale. With QE, by definition the main macroeconomic impact comes from the total quantity of purchases, so there may be scope to adjust their composition to pursue green objectives without sacrificing macroeconomic objectives. In cases where the central bank purchases are directed to markets that are

\textsuperscript{22}E.g. Matikainen et al. (2017). This likely reflects these industries’ greater weight in the relevant securities market than in the economy as a whole.

\textsuperscript{23}See e.g., Fender et al. (2020).

\textsuperscript{24}Hypothetically, in a currency union the central bank could also adjust the composition of purchases of the bonds of different member governments based on their carbon footprints. That could be meaningful, both for reducing the central bank’s exposure to climate risk and for channelling financing to lower-carbon entities, but almost certainly too politically sensitive for a central bank to tackle. The same argument could be applied to the purchase of bonds issued by sub-national levels of governments, with the same drawbacks.

\textsuperscript{25}For example, the Bank of England (2021b) issued guidelines for its Corporate Bond Purchase Facility excluding companies that mine thermal coal and requiring those in energy-intensive sectors and/or using thermal coal to have published targets for emission reductions.
dislocated, as in many economies in 2020, adding climate change to the mix may overdetermine the operations.

Much of the discussion of the implications of climate change for asset purchases took place in the decade prior to 2022, where in many cases it was presumed that inflation would remain chronically below target and there would be an ongoing need for stimulus. Needless to say, things are different now, as many advanced-economy central banks are shrinking their balance sheets to remove monetary policy stimulus in the face of above-target inflation. It is telling, for example, that the Bank of England announced that it would take climate considerations into account in the composition of its corporate bond purchases and then, three months later, announced that it would be ending purchases and start reducing its holdings through asset sales. With a shrinking balance sheet, climate-related considerations will still help guide the pace at which different assets are run off, e.g., through the reservation prices set in auctions for assets offered for sale. But it seems less likely that they could be an important tool to support the transition. Many of the investments needed for the transition will not be one-off but sequential, requiring financing that is sustained over time—not switched on and off depending on whether monetary policy stimulus is being stepped up or down.

The central bank’s lending operations, including access to lender of last resort facilities and liquidity provision, could also be used as tools for tilting the flow of financing towards issuers with lower carbon footprints, beyond what is implied by the risk management considerations already discussed.

Another available tool is collateral policy. Adjusting the acceptance of assets or the haircuts applied, beyond what is needed to reflect climate-related risk to the central bank’s balance sheet, could be viewed as a way of boosting the liquidity of those bonds and thus influencing their pricing. The literature on central bank collateral policy identifies a “pledgeability premium” for assets that are accepted, and some central banks have used their collateral policies deliberately as a tool for this purpose. More favourable pricing, in turn, could potentially encourage large financial institutions to green their own portfolios and attain a higher standard of climate-related disclosure. However, if collateral policies are adjusted beyond what is consistent with the risks, that necessarily involves either exposing the central bank to greater risk than otherwise, or restricting financial institutions’ access to central bank windows, or both. There may be trade-offs between pursuing climate objectives beyond a rather limited scale, and central banks’ effectiveness in pursuing their core mandates.

In discussing such proactive use of central bank operations for climate transition, the distinction between crisis conditions and normal times is important. In a crisis, the logic of central bank operations is to forestall the crisis dynamic whereby the self-protective behaviour of private financial institutions results in a cascading series of financial stresses. Thus, central bank lending and liquidity provision is intended not just to help the immediate recipient but to forestall adverse spillovers throughout the economy and financial system. For instance, if corporate bond purchases are aimed at preventing bond markets from freezing up, refusing to purchase bonds issued by less-green corporations would risk bringing down the green ones too, and thus would not be a credible policy. Arguably, promising to restrict financial institutions’ emergency access to central bank windows based on climate-related criteria would give them the incentive to reduce their financed emissions.

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in normal times, but that relies on the credibility of the commitment to maintain such restrictions when a crisis comes, and on forward-looking action by financial institutions to ensure that they will qualify. It thus seems unlikely that such restrictions on central bank lending would be an effective way of mobilizing change.

Central banks could also consider more direct targeting of lending toward green investments, through *funding-for-lending* and *targeted refinancing operations (TROs)*. Some central banks, notably the ECB, have made considerable use of targeted longer-term refinancing operations (TLTROs) for a variety of purposes. More generally, the central bank could offer financial institutions financing at preferential rates on condition that it be allocated to green activities. This is a more aggressive and potentially more sustained policy than green QE, as it need not be limited by the amount of QE purchases appropriate to achieve price stability objectives. If the central bank maintains a targeted volume of such refinancing, it can use other tools (such as sales of government bonds) to neutralize the effect on the overall stance of monetary policy.

While the use of such tools to promote green investment is comparatively recent, there is already some evidence, reviewed in Colesanti Senni and Monnin (2021), that TROs do influence bank credit allocation. It is more difficult, though, to gauge the overall impact of targeted refinancing—and as those authors note, “empirical evidence on the impact of TROs on the economy is scarce and often program specific.”. This impact depends, in particular, on the extent to which the shift in bank financing is offset by shifts in financing from other sources; and on how much of the investment financed through such facilities is additional to what would be undertaken in the absence of such support. Clearly, in the context of financial repression, central bank financing can have a strong influence on credit allocation, whereas in more developed financial systems typical of advanced economies, directed credit is more likely to result in a reshuffling of the provision of credit between the central bank and other channels—which could dilute its effect and also have the unintended consequence of creating a more segmented and potentially more fragile system. Indeed, the questionable effectiveness of selective credit allocation was an important reason most advanced economy central banks largely discontinued such practices several decades ago. While that experience clearly does not carry over directly to the kinds of targeted refinancing schemes that have been proposed as part of a proactive climate agenda, it does argue for a measure of caution regarding such policies.

In addition to the tools that could be used to pursue a proactive agenda, central banks would need *information* that is fit for purpose. While informational challenges are significant in assessing climate-related risks, much more detailed information would be required for efficient allocative decisions on how to achieve climate objectives. The transition will not just be a matter of promoting certain technologies or shutting down certain sectors but will require reducing the carbon footprint of almost every activity in the economy. To guide such a transition, available measures of scope I, II or III emissions or taxonomies of green versus other categories of activities or entities, are surely too crude to be a reliable guide to the allocation of funds in the economy. That would require assessing potentially numerous alternative ways of reducing emissions in every activity across the entire economy; the available information sets provide no guidance on alternative ways of reducing emissions, nor are they likely to in the foreseeable future. In effect, the central bank would need the

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kind of detailed microeconomic data that would be required by a central planner. While central banks could take instructions on these points from environmental regulators, it would surely be more effective for these agencies to regulate activities directly. This does not rule out that it could be helpful for the central bank to use its operations to promote activities or investments that evidently contribute to the appropriate transition or address market failure. It does suggest that the central bank should be modest about what it can achieve and clear and limited in its objectives.

More generally, this informational challenge is one of the main arguments for carbon pricing as a key element in supporting the transition. Carbon pricing aligns the incentives of the firms and households undertaking various economic activities with the economy-wide goal of reducing carbon emissions, and thus harnesses the specialized information those firms and households bring to bear on their own self-interested decisions. Arguably, a key proactive role for central banks and other financial regulators is to address any informational or other distortions that might otherwise prevent the incentives provided by carbon pricing from feeding through to asset prices and corporate decision making. ²⁸ For example, disclosure requirements could play a key role here—although financial regulators are generally better placed than the central bank to establish such requirements.

Central bank governance is another important consideration in determining the appropriate role of monetary policy in supporting the transition. Good governance requires that central bankers, like other decision makers who are appointed rather than elected, be assigned objectives that are clear, the use of appropriate tools to achieve those objectives, and a framework in which they can be held accountable. ²⁹ How could such a framework be established if central banks are to play a proactive role for the transition to a lower-carbon economy? Such a transition will involve complex structural changes which by their nature inevitably create winners and losers, including across industries, regions, income groups, and generations. The choice of transition path—precisely what economic activities are to change, and how, to reduce economy-wide carbon emissions—has important implications for how the gains and losses are distributed.

In this context, there are in principle two alternative ways a central bank could pursue a proactive policy. Central bankers could make decisions independently on the use of their tools, guided by a broadly worded mandate to promote the transition and deploying their own information, analysis, and judgment. In that case, they would be explicitly responsible for the wide-ranging and detailed distributional decisions referred to, with at least the potential that its judgments and policies diverge from those of the government. It seems unlikely that that wide-ranging an exercise of power by an unelected central bank would be accepted by the elected authorities or by the broader public. Alternatively, the central bank could direct financing for the transition in line with decisions by the government of the day. If this is accepted, though, it could become tempting for the government to direct central bank financing to a range of other priorities, blurring fiscal transparency and the central bank's clarity of purpose and ultimately undermining the central bank's ability to achieve its price stability objectives. Moreover, where decisions on how to make the climate transition are politically charged, central banks need to be careful not to be closely identified with the

²⁸ Of course, to avoid undermining the transition, governments also need to resist the temptation to subsidize carbon-intensive activities through tax expenditures. See for instance Laan and Steenblik (2023).

²⁹ Tucker (2018) provides a thoughtful discussion of such considerations in a wider set of contexts.
government of the day. That argues for any proactive agenda to be modest, beyond aligning its policies with priorities that are widely supported across the political spectrum.

To sum up: there is some scope for central banks proactively to support the transition to a lower-carbon economy through their monetary policy operations, beyond the dictates of comprehensive risk management. But that scope is limited and dependent on circumstances. In particular, central banks undertaking QE though sustained large-scale purchases of private-sector assets could tilt the composition of those purchases towards issuers with lower emissions and/or viable transition plans. Under those circumstances, the central bank’s large footprint in the market is likely to give such a tilt a significant impact. Similarly, collateral policy could play a role at the margin in supporting the transition, via the relative cost of financing for targeted activities and entities. There is much less scope for such proactivity related to asset purchases and lender of last resort facilities in crisis situations, where other objectives are paramount. Moreover, in the current higher-inflation environment where many central banks’ balance sheets are shrinking, using those operations to support the transition has less traction. Finally, both the information available, and the need for clear governance, argue for any proactive central bank role to be limited, clearly defined, and aligned with broad public objectives.

CONCLUSIONS

In conclusion, central banks have a duty to carry out their core mandates in the face of climate change, and there is much work to be done to enhance their ability to do so. This protective agenda is an important part of central banks’ risk management. Climate-related shocks are likely to become both more frequent and more severe—including extreme climatic events and rapid transition-related structural changes. While the nature, magnitude and timing of these events is highly uncertain, central banks need to be better prepared to cope with such shocks when they occur. There are important lessons to be learned from the experience of the COVID-19 pandemic—in which central banks did many things right, but also made some notable mistakes. More broadly, there is scope to reexamine the merits of robust policy: aiming for perfection in normal times can set the stage for disaster in the face of extreme events.

Central banks also have a duty, based on their core mandates, to incorporate a well-informed view of climate-related risks into their market operations. They need to assess what climate-related risks are material over the relevant time horizon and factor them into their operations, as they would any other risk. Central banks, like any other investor, have an interest in enhancing databases and analytical capabilities. And they should actively collaborate with other investors to provide a common basis of knowledge on which to work. Of course, there will always be limits to that knowledge, especially given the nonlinear interactions at work—but as in any sphere of human action there is a need to act on the basis of the best information and analysis available.

In contrast, there is much less scope for central banks to pursue a proactive agenda—to do something significant to promote the transition to a lower-carbon economy as a secondary objective while still adhering to core mandates for price stability. While central banks have tools that may have some impact on climate objectives, the scope to use those tools for such
purposes without undermining the achievement of core mandates is likely quite limited in most cases. Adding climate to central banks’ mandate as a secondary objective is thus of questionable benefit, and risks creating misperceptions of mission creep, even in cases where the actions the central bank is taking are those needed to fulfill its core mandate.

Obviously, central banks whose mandates require that they contribute to environmental objectives must do whatever they usefully can, however limited the benefits are likely to be. But in considering establishing such mandates—or stretching elastic language such as “promoting overall prosperity” to encompass environmental considerations—caution is needed, weighing probably small potential benefits against the risk of creating confusion with regard to central banks’ core mandates. The latter risk is particularly great at the present time when higher inflation has put many central banks under a harsh spotlight. In this context, it is understandable that central banks are especially cautious about offering to pursue objectives beyond their core mandate.

Finally, both the scope and the need for action by the central bank depends on what other public sector entities, especially the government, are doing. Consistent and predictable carbon pricing, climate regulation and disclosure provide a framework and incentives for private companies, financial institutions, and markets to take account of climate-related risks. In this context, climate-related risks become a more routine part of central bank risk management. In cases where the government is not committed to such policies, it would be tempting for central banks to try to fill the gap, but almost certainly a weaker public mandate for them to do so. More generally, though, central bank policies need to be framed in a highly imperfect world of shifting public policy priorities.

Above all, this points to a need for clarity. Central banks that do not have an explicit climate objective should make it clear to the public how their actions that take account of climate change are related to their core price stability mandates and to the protection of their balance sheets. Central banks that do have such an objective should clarify how much of what they are doing is related to that objective as distinct from risk management. As in other aspects of central bank activities, they need to specify the targets for which they are accountable and how they plan to achieve them, with due recognition of the limitations.
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