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Financial Regulation, Climate Change, and the Transition to a Low-Carbon Economy

A Survey of the Issues

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Financial Regulation, Climate Change, and the Transition to a Low-Carbon Economy: A Survey of the Issues

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ABSTRACT: There are demands on central banks and financial regulators to take on new responsibilities for supporting the transition to a low-carbon economy. Regulators can indeed facilitate the reorientation of financial flows necessary for the transition. But their powers should not be overestimated. Their diagnostic and policy toolkits are still in their infancy. They cannot (and should not) expand their mandate unilaterally. Taking on these new responsibilities can also have potential pitfalls and unintended consequences. Ultimately, financial regulators cannot deliver a low-carbon economy by themselves and should not risk being caught again in the role of 'the only game in town.'

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WORKING PAPERS

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A Survey of the Issues

Prepared by Dimitri G. Demekas and Pierpaolo Grippa [1]

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ABI	Association of British Insurers
ACPR	Autorité de contrôle prudentiel et de résolution (French Prudential Supervision and Resolution Authority)
APRA	Australian Prudential Regulation Authority
BCBS	Basle Committee on Banking Supervision
BES	Biennial Exploratory Scenario
BPF	Brown Penalizing Factor
CAT	Climate Action Tracker
CDI	California Department of Insurance
CDP	formerly the Carbon Disclosure Project
CDSB	Climate Disclosure Standards Board
CET1	Core Equity Tier 1
CFTC	U.S. Commodity Futures Trading Commission
COP26	26th United Nations Climate Change Conference of the Parties
CSRC	China Securities Regulatory Commission
DICE	Dynamic Integrated Climate-Economy model
DWS	Die Wertpapier Spezialisten
EBA	European Banking Authority
ECB	European Central Bank
ESRB	European Systemic Risk Board
ESG	Environmental, Social, and Governance
ETF	Exchange Traded Fund
EU	European Union
FoSDA	Future of Sustainable Data Alliance
FSB	Financial Stability Board
GAAP	Generally Accepted Financial Accounting Principles
GHG	Greenhouse Gas
GRI	Global Reporting Initiative
GWF	Green Weighting Factor
IAIS	International Association of Insurance Supervisors
ICAAP	Internal Capital Adequacy Assessment Process
IFRS	International Financial Reporting Standards
IIF	Institute of International Finance
IIRC	International Integrated Reporting Council

IMF	International Monetary Fund
IOSCO	International Organization of Securities Commissions
IPCC	Intergovernmental Panel on Climate Change
IPSF	International Platform on Sustainable Finance
ISSB	International Sustainability Standards Board
MSCI	Morgan Stanley Capital International
NDRC	National Development and Reform Commission
NFRD	Non-Financial Reporting Directive
NGFS	Network for Greening the Financial System
OECD	Organisation for Economic Co-operation and Development
OMFIF	Official Monetary and Financial Institutions Forum
ORSA	Own Risk and Solvency Assessment
PBOC	People's Bank of China
PD	Probability of Default
PESP	Private Equity Stakeholder Project
PRA	Prudential Regulation Authority, Bank of England
RWA	Risk-Weighted Asset
R&D	Research and Development
SASB	Sustainability Accounting Standards Board
SEC	U.S. Securities and Exchange Commission
SIFI	Systemically Important Financial Institution
SFN	Sustainable Finance Network
SME	Small- and Medium-size Enterprises
SOAS	School of Oriental and African Studies, Oxford University
SUSEP	Superintendência de Seguros Privados (Brazilian Insurance Supervisory Authority)
TCFD	Task Force on Climate-Related Financial Disclosures
UN	United Nations
UNEPFI	United Nations Environment Programme Finance Initiative
UNFCCC	United Nations Framework Convention on Climate Change
WWF	World Wildlife Fund

Executive Summary

The financial system faces challenges from the effects of climate change, while it is also expected to play a role in the transition to a low-carbon economy. Financial regulators trying to adapt their mission to these new exigencies find themselves having to walk a tightrope: on one hand, they should use all available means to accommodate the necessary reorientation of financial flows for the transition; on the other, they should be mindful of the limitations of their toolkit and of their mandates, as well as of the pitfalls and potential unintended consequences of their actions.

The first task is to analyze the risks that climate change and climate mitigation policies pose for financial firms and for the stability of the system as a whole, and explore how financial policy and regulation could be used to mitigate them. But estimating climate-related risks is challenging due to their long-term nature and radical uncertainty about the possible climate pathways. While the exploratory scenario-based assessments increasingly used by central banks and supervisory agencies can help shed light on these risks, they still have serious limitations as tools for accurate risk measurement and fine-tuning of policy. They can nevertheless be helpful in raising awareness of these risks in the industry and spurring improvements in risk management in financial firms.

As regards the role of policy and regulation, most of the initiatives to-date have been aimed at encouraging the incorporation and correct pricing of climate-related risks in private credit or investment decisions. Some critics find this risk-focused approach insufficient and argue that central banks and regulators should use their policy tools directly to promote decarbonization in the economy. However, apart from the debatable theoretical underpinnings of this proposal, the evidence suggests that regulatory tools on their own are unlikely to be effective in this regard. Engaging central banks and regulatory agencies to promote specific climate transition goals would also require expanding or amending their current mandates, as well as strengthening their political oversight and accountability, since these goals are essentially political. In addition, it would create difficult operational tradeoffs and could have unintended consequences in financial markets. On this basis, the net benefits of a more ‘promotional’ role for central banks and regulators to address the causes of climate change are doubtful.

Closing data gaps and strengthening disclosure are key for better risk management, as well as for improving the transparency, governance, and credibility of the various ‘green’ and ESG standards in the market today. While the need for shared and meaningful taxonomies is incontrovertible—and increasingly recognized by the industry—designing them to be dynamic and forward-looking and avoiding the pitfalls of old-fashioned industrial policies is a challenge.

Ultimately, the biggest risk for financial policy and regulation is lack of policy coordination. If central banks and financial regulators move ahead on their own—especially if they actively promote decarbonization in the economy—but governments fail to follow their own Paris Agreement commitments with effective climate mitigation policies, thus preventing the change in relative prices required to sustain the transition, financial firms could end up incurring losses and asset managers and pension funds could be seen as compromising their fiduciary duties. And central banks and financial regulators could end up being the target of the resulting backlash.

Introduction

There is increasing public awareness of the challenge posed by anthropogenic climate change and a strong political commitment to address it. At the 2015 Paris Agreement, now signed by 196 countries, world leaders called for holding the increase in global average temperature to below 2ºC above pre-industrial levels and for pursuing efforts to limit it to 1.5ºC. However, a recent report by the Intergovernmental Panel on Climate Change (IPCC 2021) warned that, on current trends, global warming is expected to exceed the 1.5ºC mark during the 21st century under most scenarios. The commitments made by the countries participating in the 26th United Nations Climate Change Conference of the Parties (COP26), held in Glasgow in November 2021 (UNFCCC 2021), are consistent with a median 2.4ºC temperature rise above pre-industrial levels by 2100, compared to a pre-Glasgow median rise of 2.7ºC (CAT 2021).

From an economic perspective, climate change is a negative externality of the production and consumption of carbon-intensive goods, while climate mitigation is a public good. The market would therefore not reflect the social price of carbon while, at the same time, the private return of investments in decarbonization would be lower than their social return, resulting in suboptimal provision of climate mitigation actions (Hourcade 2018). An extensive literature has explored the factors behind the market and government failures that prevent an optimal response to the climate challenge. These include the lack of historical precedent, extreme uncertainty, non-linearities, and tipping points of climate pathways (Stern 2008); the conceptual difficulties associated with fat-tailed distributions and catastrophic outcomes (Dasgupta 2008; Weitzman 2014); the endogeneity of technical change (Acemoglu *et al*. 2012); time inconsistency or the 'tragedy of the horizon' (Carney 2015); and collective action and free rider problems (for a review of the literature, see Krogstrup & Oman 2019).

Broad-based and sustained policy action centered around carbon pricing is necessary to address these failures and stimulate the massive economic transformation needed to tackle the climate challenge. The theoretical 'first-best' policy is to get carbon prices right through carbon taxes (or emissions trading systems with equivalent effect) and to encourage R&D and investment in climate mitigation through subsidies (Stern *et al*. 2006; Parry *et al*. 2014; IMF 2019a and 2019b). These fiscal policies are central and indispensable components of any effective climate mitigation strategy. But the magnitude and complexity of the challenge, as well as political economy considerations, argue in favor of a broader policy effort.

This paper reviews the debate on the role of financial policies in the transition to a low-carbon economy. It focuses on both (micro-)prudential regulation and supervision and macroprudential policies aimed at safeguarding the stability and orderly functioning of the financial system as a whole. The paper covers three topics:

- It offers a critical review of ongoing initiatives and proposals to assess climate-related risks to the financial system and incorporate relevant considerations into financial policies. Despite the progress, the paper argues that data gaps are still significant, and the diagnostic and policy toolkits are not yet sufficiently developed to allow clear visibility of the risks and precise targeting of policies. For policymakers, measuring and taking steps to mitigate climate-related risks is—still—like trying to see through a glass, darkly.

- Some of these initiatives and proposals stretch to the limit the legal frameworks currently governing central banks and financial regulators, and there is a lively debate whether or not these frameworks are still fit for purpose in the face of the climate challenge. The paper provides an overview of the arguments, as the outcome of this debate could have profound repercussions on the political economy, design, and operation of financial policies, as well as on the mandate and functions of central banks and financial regulators.

- Finally, regardless of whether the legal frameworks for financial policies change or stay the same, the paper argues that entering this new territory creates risks and may have unintended consequences. These are rarely discussed, perhaps for fear of being perceived as insufficiently concerned about climate change. But understanding these risks and guarding against the pitfalls is crucial if financial policies are to be effective in supporting the transition to a low-carbon economy.

Through a Glass, Darkly: Managing Climate-Related Risks to the Financial System

Pressure to adapt financial policies and regulatory frameworks to incorporate climate-based considerations came from multiple directions, first and foremost from growing awareness in the financial industry itself. By the turn of the millennium, it was clear, especially among insurers, that the rising frequency and severity of extreme weather events, combined with societal changes (population growth, demographic shifts, geographic concentration of wealth), was already affecting their risk profile (UNEPFI 2002; Dlugolecki & Loster 2003; ABI 2004; Allianz Group & WWF 2006; Lloyd's of London 2006). This was underpinned by the first IPCC report that focused on the economic and financial impact of climate change (IPCC 2001) and the work of Easterling *et al*. (2000), Tol (2002), and others.

Pressure also came from market developments. During the last two decades or so, there has been a gradual increase in investor and shareholder interest in environmental, social, and governance (ESG) issues. After the global financial crisis, this shift in investor focus accelerated at an "unprecedented" pace, according to the Chair of the U.S. SEC (Lee 2021). Its influence is increasingly felt in boardrooms, investment committees, and shareholder meetings. No less important was a shift in tactics: while the majority of proposals by ESG advocates until the early 2000s sought companies to adopt social or environmental goals or to take specific action with respect to a business activity, the tone began to change in the middle of the decade, with an increasing number of proposals seeking disclosure, risk assessment, and oversight of particular issues (Papadopoulos 2019). This changed the conversation from an argument about ethics to an economic discussion about how environmental and social risks can impact the long-term value of a company, an investment project, or a portfolio.

These shifts in investor focus and tactics have had two notable effects.

- They have increased awareness and discussion of climate-related risks for financial and non-financial companies.

- They have spurred the rapid growth of ESG-labeled funds and 'green' bonds issued to raise finance for 'green' assets and climate mitigation projects[1] and, relatedly, a proliferation of ESG or 'green' scores and standards. This, in turn, laid bare the scarcity of relevant data and the difficulties of measurement, and fueled concerns about mis-labeling and 'greenwashing' and calls for better governance of these standards.

Finally, political leaders demanded action. Following the Paris Agreement, which explicitly called for making finance flows consistent with a pathway towards low GHG emissions and climate-resilient development, the G20 Finance Ministers and Central Bank Governors tasked the Financial Stability Board (FSB) in 2015 to "convene public- and private-sector participants to review how the financial sector can take account of climate-related issues."[2] The Climate Pact agreed by COP26 in Glasgow in November 2021 reconfirmed and expanded this expectation on the financial sector by calling upon "multilateral development banks, other financial institutions and the private sector to enhance finance mobilization in order to deliver the scale of resources needed to achieve climate plans" (UNFCCC 2021).

Regulators reacted with a lag to market developments and shifting political priorities, but since the middle of the 2010s, a work program has gradually emerged in three areas. First, there are efforts to measure the magnitude and identify the transmission channels of climate-related risks for the financial system. Second, this leads to the question of what the appropriate response should be, both for macroprudential policy that aims to ensure the stability of the system as a whole and for microprudential supervision that focuses on the safety and soundness of individual financial institutions. Finally, there is a drive to close data and knowledge gaps, improve the dissemination of relevant information, and promote common standards for climate disclosures across institutions, markets, and jurisdictions. These three areas are discussed in turn below.

Assessing climate-related risks to the financial system

The interactions between climate and economic systems have been studied for decades but the focus on the impact of climate-related factors on the financial system is more recent. Integrated Assessment Models (IAMs), such as William Nordhaus's DICE model (Nordhaus 1992; 1994), had been widely used to analyze the potential economic costs of climate change, as well as the costs and benefits of climate mitigation actions. But it was not until the previously mentioned pioneering study by the Finance Initiative of the UN Environment Program (UNEPFI 2002) that research started focusing specifically on the impact on financial systems—initially on insurance, but also on other sectors.

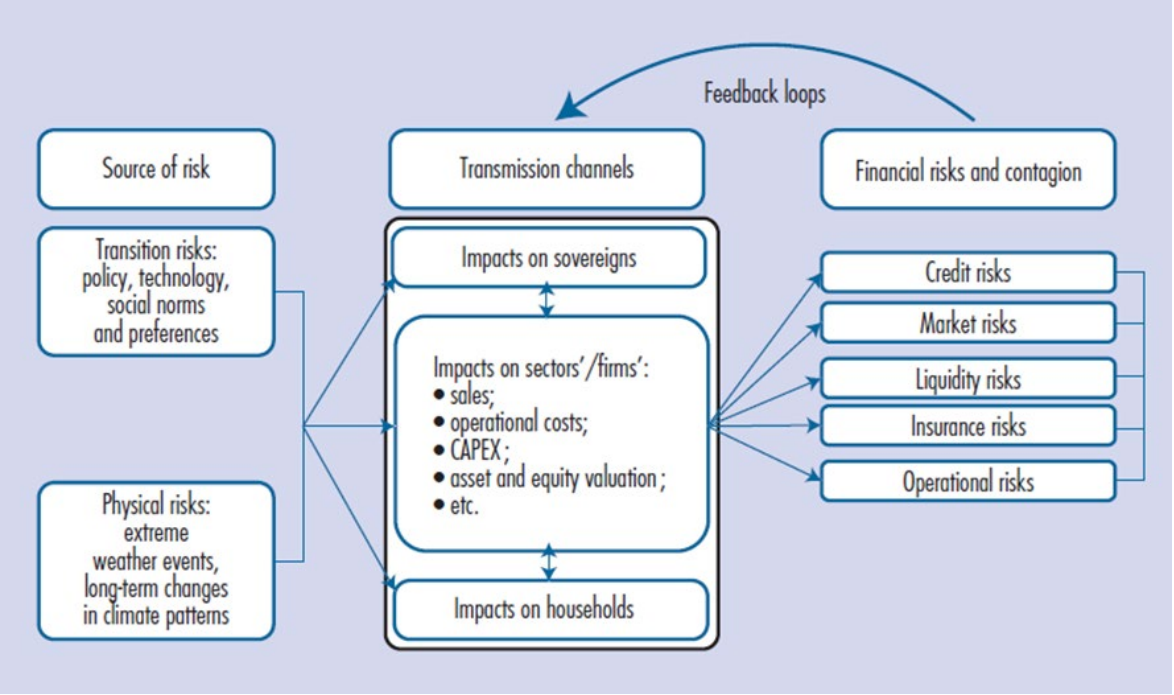
By the middle of the 2010s, a small number of central banks and regulatory agencies, mainly in Europe, had started studying climate-related risks. In a landmark speech in 2015, Mark Carney, then Governor of the Bank of England, outlined the conceptual framework that is still used to classify the impact of climate-related factors on financial systems (Carney 2015). This impact can manifest itself through two different

[1] In 2019, assets under management of the 75 largest ESG funds in Bloomberg's annual survey of the largest ESG funds with a five-year track record surpassed US$100 billion, while cumulative issuance of 'green' bonds topped US$750 billion (Farmer & Thompson 2020; Almeida 2020). The much broader—and much more loosely defined—category of 'sustainable investments' which, in addition to 'green' bonds, includes estimates of the impact of norms-based screening of investment decisions, integration of ESG factors in asset allocation, and sustainability-themed investing, had reached US$30 trillion in 2018 (GSIA 2019).

[2] G20 Finance Ministers and Central Bank Governors' Communiqué, Washington DC, April 17, 2015.

channels: (i) the physical repercussions of climate change on the economy and financial system from the effects of rising sea levels, changing agricultural production patterns, or the increasing severity and frequency of extreme weather events, usually referred to as *physical risk*;[3] and (ii) the economic effects of policies to mitigate climate change, notably increases in carbon pricing, on asset prices and financial markets, usually referred to as *transition risk* (Figure 1). Carney's speech was followed by similar interventions by other central bankers (Villeroy de Galhau 2015; Signorini 2017; Lane 2017). The Bank of England's Prudential Regulation Authority (PRA) was the first regulatory agency to publish a detailed analysis of climate-related risks for the insurance sector (PRA 2015) and attempt to incorporate these risks into stress tests for insurers (PRA 2017). Similar early initiatives were undertaken by the Swedish, Dutch, and French regulators (Finansinspektionen 2016; DNB 2017; Banque de France 2018a; ACPR 2019) and, outside Europe, by the Brazilian insurance supervisor (SUSEP 2016) and the California Department of Insurance[4] (CDI 2018) (see the summary in IAIS 2018).

Figure 1. Climate-Related Risks and Transmission Channels



Source: Bolton et al. (2020b).

These initiatives were bolstered by the creation of the Network for Greening the Financial System (NGFS). The NGFS was established in December 2017 by eight central banks and financial regulatory agencies as a 'coalition of the willing,' whose purpose is to "contribute to the development of climate- and environment-related risk management in the financial sector and mobilize mainstream finance to support the transition toward a sustainable economy." The NGFS, which by now has 100 members and 16 observer

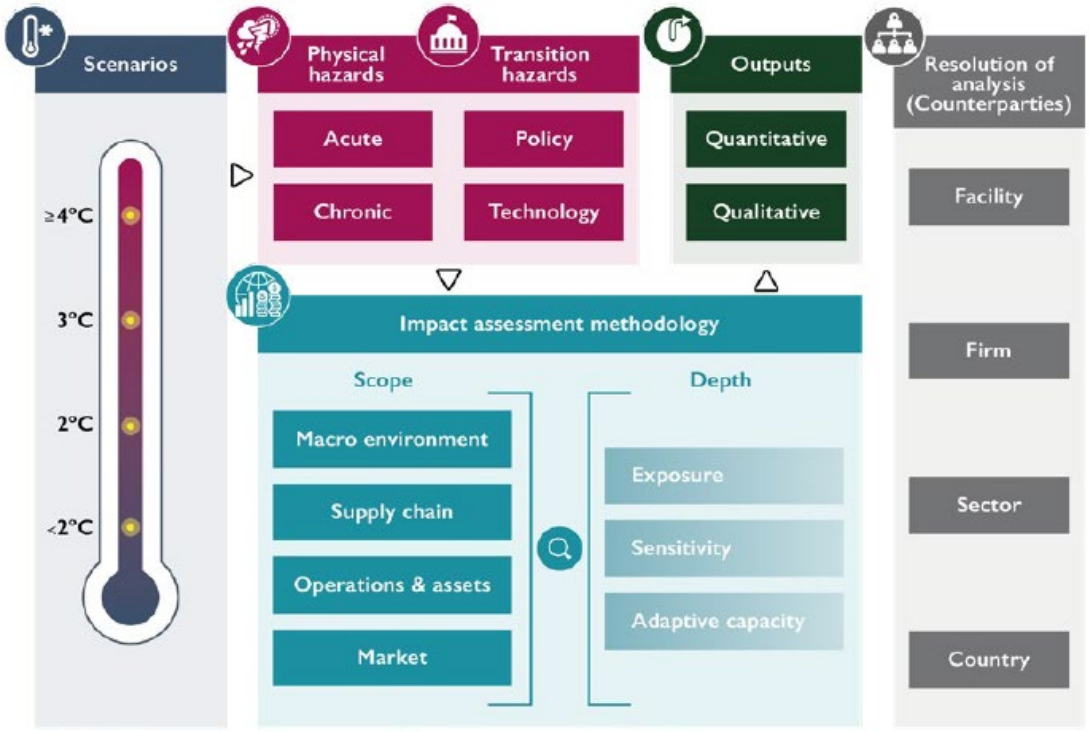
[3] *Liability* or *litigation risk* is sometimes identified as a separate climate-related risk. Since in most cases this arises as a result of climate change, it is included in *physical risk* for the purposes of this paper.

[4] Insurance supervision in the USA is the responsibility of individual states.

organizations, has so far given priority to the first of these two goals, issuing six recommendations for central banks and financial supervisors (NGFS 2018; 2019). Most of these recommendations focus on improving data collection and internationally consistent disclosure of climate- and environment-related risks and integrating these risks into financial stability monitoring and microprudential supervision. In its Glasgow Declaration on the occasion of COP26, NGFS re-c0nfirmed these priorities (NGFS 2021e).

Climate-related risks for the financial sector are unique and systemic and their modeling poses some fundamental challenges. Their long time horizon; radical (Knightian) uncertainty about the possible climate pathways and their probability distribution (in the sense described in Kay & King 2020); and their unprecedented and potentially catastrophic consequences mean that well-established risk management tools in the financial industry, such as Value-at-Risk models and stress tests, cannot be used off-the-shelf to measure these risks. Exploratory scenario-based impact assessments have to be used instead (Figure 2). Although these are methodologically different, they are often also referred to as 'stress tests'—and in the rest of this paper, these two terms are used interchangeably.[5] In addition, if climate-related risks materialize, they would affect the economy and the financial system as a whole and may be amplified by pro-cyclical behavior of market participants; self-reinforcing reductions in bank lending and insurance provision; the bank-sovereign

Figure 2. Analytical Elements of Scenario-Based Impact Assessments



Source: UNEPFI (2019).

nexus; feedback loops with the real economy; and network and cross-border effects (BCBS 2021a; FSB 2020a;

[5] The methodological differences between 'traditional' stress tests and scenario-based assessments in relation to climate-related risks have been analyzed extensively in the literature. For an in-depth discussion, see Chenet *et al*. (2019) and Thomä & Chenet (2016).

Battiston *et al*. 2017). This means that climate-related risks are best assessed using system-wide (macroprudential) approaches. Finally, the data required to perform climate-based stress tests are not always available or sufficiently granular. For a discussion of the various methodological and other challenges facing climate-related scenario-based assessments, see BCBS (2021b); Covas (2020); Gruenewald (2020); Dépoues *et al*. (2019); Campiglio *et al*. (2018).

Against this background, a number of central banks and regulatory agencies have endeavored to develop novel system-wide scenario-based approaches to capture climate-related risks (or have indicated their intention to do so).

- The Dutch central bank was the first to conduct a scenario-based assessment focusing on transition risk for Dutch banks, insurers, and pension funds (Vermeulen *et al*. 2018).

- The Banque de France and ACPR launched in 2020 a pilot exercise for banks and insurance companies that volunteered to participate (Allen *et al*. 2020) and published the results in April 2021 (ACPR 2021).

- The Bank of England was the first to announce a comprehensive approach to incorporate *both* physical *and* transition risks into its regular biennial exploratory stress test scenario (BES) in 2021, covering the largest UK-based banks and insurers, with the aim to test climate-driven risks across the system (Breeden 2019; Bank of England 2019; 2020a).

- The European Systemic Risk Board published a report that provided estimates of the potential impact of transition risks for EU banks and insurers under different climate mitigation policy scenarios (ESRB 2020), followed by a joint report with the ECB that measured climate risks for the European financial system and also performed long-term forward-looking climate risk assessments for banks, insurers, and investment funds (ECB and ESRB 2021).

- The European Central Bank conducted in 2021 a top-down eurozone economy-wide climate stress test that assessed the resilience of banks and non-financial corporates to physical and transition risks over a 30-year time horizon (Alogoskoufis *et al.* 2021) and plans to undertake a bottom-up supervisory stress test focusing on climate-related risks in 2022.

- The European Banking Authority (EBA) published in 2021 the results of a pilot exercise that collected granular data from 29 volunteer banks from 10 EU countries on exposures to large corporates and sought to identify their sensitivity to climate-related shocks (EBA 2021a).

- A number of other central banks and supervisory agencies have announced plans to incorporate climate-related risks into their financial stability assessment, including the European Banking Authority (EBA 2019), the Bank of Japan,[6] the Australian Prudential Regulatory Authority (APRA 2020), and the Monetary Authority of Singapore (Menon 2020), while the U.S. Federal Reserve has indicated that it is "evaluating and investing" in ways to incorporate climate risk in its assessment of financial institutions

[6] Taking account of the works by the Network of Central Banks and Supervisors for Greening the Financial System (NGFS) and other authorities, the Bank, in collaboration with the Financial Services Agency, is working on pilot exercises of scenario analysis targeting large financial institutions by using common scenarios; see Bank of Japan (2021).

(Board of Governors 2020).[7] The NGFS has prepared guidelines for climate-related scenarios to help central banks and supervisors (NGFS 2020c).

- Finally, though not a regulatory agency, the International Monetary Fund has started including climate-related risks in its Financial Sector Assessment Programs (IMF 2021a; Grippa & Mann 2020).

The experience thus far has highlighted the limitations of these analytical approaches as guides for policy.

- The scenarios need to incorporate drastic simplifying assumptions in order to overcome the fundamental challenges in modeling climate-related risk discussed earlier, notably the data gaps, inherent complexity, and long time horizon (which, as in the Bank of England's BES and the ECB's top-down stress test, stretches into decades). This increases model risk: seemingly minor technical decisions about functional forms and parameter values can dominate the results. In situations like this, it has been argued that "economists should be less confident […] and adopt a more modest tone that befits less robust policy advice" (Weitzman 2014).

- The time horizon raises issues of prioritization since, over the long term, climate is just one of many uncertainties facing the economy and the financial system, from geopolitical upheavals to technological disruption to pandemics. Additional arguments are therefore needed to justify policymakers' and supervisors' focus on this particular one (Stiroh 2020).

- Current scenario-based analyses tend to treat the mitigation pathways as exogenous (typically derived by IAMs that do not model the financial sector), thus missing the feedback loop between the financial system and those pathways (Battiston *et al*. 2021).

- In the exercises that have been completed so far, the estimates of the financial impact of climate scenarios in terms of losses, regulatory capital, solvency ratios, etc. span—unsurprisingly—a very wide range, from minor to severe. One such exercise concluded, for example, that "between 3.8 percent to 29.9 percent of the available Common Equity Tier 1 (CET1) capital of the banking system is wiped out in first-round losses following the implementation of a sizeable carbon tax of €100, depending on the geographical scope of application and abruptness of the policy" (Reinders *et al*. 2020). The ECB exercise concluded that even in the most severe ("hot house") climate scenario, the increase in probabilities of default (PDs) for banks' portfolios would range from 5 to 30 percent over the 30-year test horizon (Alogoskoufis *et al.* 2021). Such a wide range of results over such a long time frame does not provide a firm basis for policy action today.

- Even if financial institutions' potential long-term losses from climate-related risk were conclusively shown to be high, this would not necessarily imply risks to financial stability nor, by itself, suffice as an argument for pre-emptive supervisory action today, since the mission of supervisors is not to prevent losses for the financial institutions they supervise (Cochrane 2021).

[7] For a detailed list of concluded, ongoing, and planned scenario-based exercises by a group of NGFS members, see NGFS (2021d).

These limitations mean that regulators can analyze this important class of risks only 'through a glass, darkly,' and help explain why they have so far proceeded cautiously in incorporating climate-related risks into the supervisory process, as discussed in the next section.

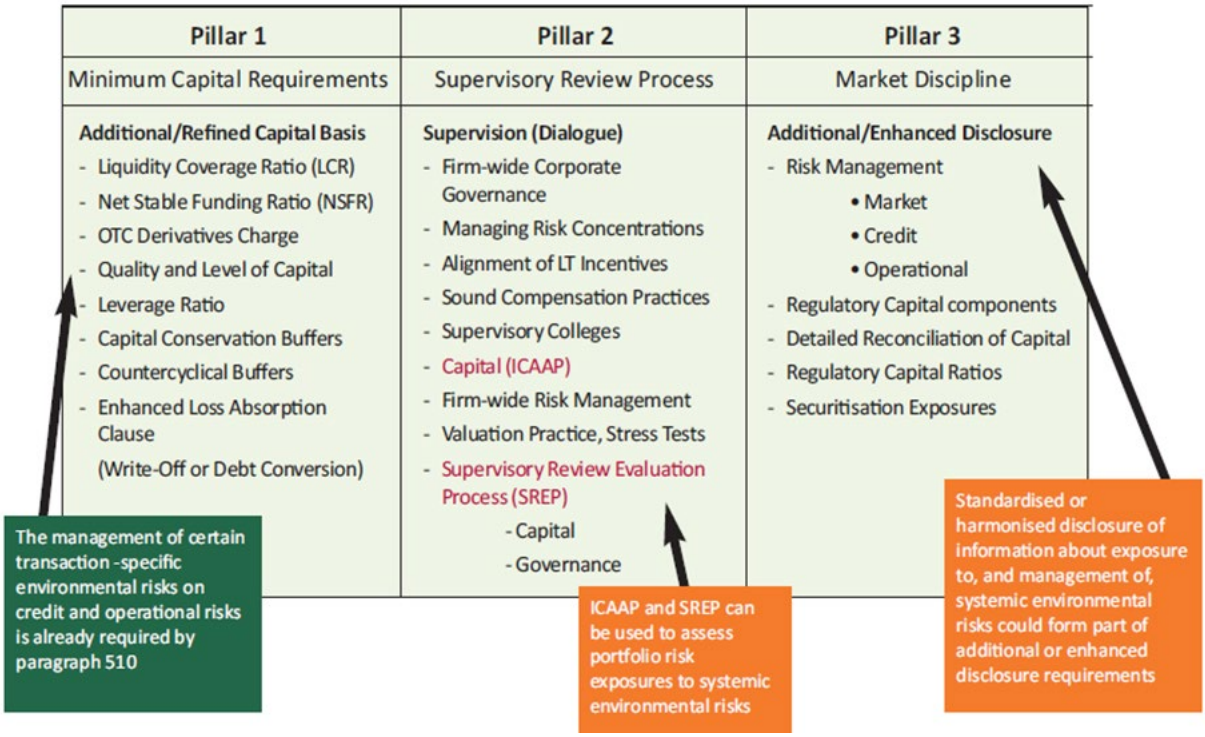
Nevertheless, there is a more modest but still important role that these risk assessment exercises can—at a minimum—play. This is succinctly summarized in the Bank of England's description of the goal of the BES. This exercise will "focus on sizing risks, rather than testing firms' capital adequacy or setting capital requirements [and] will allow the Bank to examine how major financial firms expect to adjust their business models, and what the collective impact of these responses on the wider economy might be" (Bank of England 2019). By translating, however imperfectly, the long-term and highly uncertain climate-related risks into quantitative, tangible losses and by illustrating the channels of transmission and contagion, these exercises raise awareness of these risks in the industry; provide incentives for improving risk management in individual financial firms; and help supervisors strengthen their own supervisory frameworks.

Incorporating climate-related risks in macro- and microprudential policy

Researchers have outlined a number of ways in which macroprudential policy and microprudential supervision tools, notably the capital framework, could in theory be used to mitigate climate-related risks in the financial system. The cross-sectional dimension of macroprudential policy could incorporate climate-related risks though exposure or concentration limits to 'brown' sectors of the economy and/or sovereigns with elevated environmental risk, as well as by considering climate-based factors in the designation of systemically important financial institutions (SIFIs) (Gruenewald 2020; Schoenmaker & van Tilburg 2016; ESRB 2016). Incorporating climate-related risks into the time (counter-cyclical) dimension of macroprudential policy is conceptually more difficult. But at least one researcher (Gruenewald 2020) has put forward the notion of a (single, very long-term) 'carbon cycle,' with the global economy permanently stuck in its upswing, characterized by excessive credit growth to GHG-intensive sectors, as a justification for imposing climate-related systemic risk buffers. As regards microprudential supervision, there have been many proposals for 'greening' all three Pillars of the Basel III capital framework (see, for example, Bolton *et al*. 2020a; Berenguer *et al*. 2020; Nieto 2019). Figure 3 provides a high-level summary of these proposals.

The idea of incorporating environmental impacts into the calculation of risk-weighted assets (RWA) has gained some popularity. This could be done by adjusting risk weights through a Green Supporting Factor (GSF) and a Brown Penalizing Factor (BPF). The latter would require banks to hold more capital for loans to 'brown' sectors, thus discouraging them from lending to those sectors, while the former would lower capital requirements in order to encourage lending to 'green' sectors. EU policymakers, in particular, have seriously considered this step (Dombrovskis 2017; EU HLEG 2018), as the capital framework for EU banks already includes similar 'SME supporting' and 'infrastructure supporting' factors.

Figure 3. Proposed Adaptations of Basel III to Incorporate Climate-Related Risk



Source: CISL & UNEPFI (2014).

However, there is no consensus on how—or indeed whether—to introduce these factors in RWA in practice.

- Some have argued that the GSF and BPF are complementary and should be used in tandem, perhaps combined into a Green Weighting Factor (GWF) (Berenguer *et al*. 2020).[8] Others have pointed out that since the empirical evidence that 'green' assets are less risky is, at best, mixed[9] and not robust enough to justify lower risk weights, the GSF would result in an unwarranted weakening of banks' total capital base (and could also fuel a 'green' bubble).[10] Instead, the BPF should be used alone, since "the [climate] transition risks *will at some point* materialize" (Villeroy de Galhau 2018; see also Boot & Schoenmaker 2018; Ford 2018). In either case, regulators would need non-distortionary criteria to distinguish 'green' from 'brown' assets—but this turns out to be an extraordinarily difficult task, as the experience of trying to develop 'green taxonomies' demonstrates (more on this below).
- Still others, at a more fundamental level, have argued that risk weights should reflect *present and quantifiable* economic risks and have questioned the wisdom of using the regulatory capital framework,

[8] In 2019, Natixis became the first financial services company to introduce voluntarily a GWF to manage the climate impact of its balance sheet ("Natixis rolls out its Green Weighting Factor," Press Release, September 23, 2019).

[9] See, for example, Giglio *et al*. (2021) and Campiglio *et al*. (2019). Overall, there is limited evidence that broader market prices incorporate risk premia commensurate with the scale and nature of climate-related risks across different sectors (see IMF (2020a)).

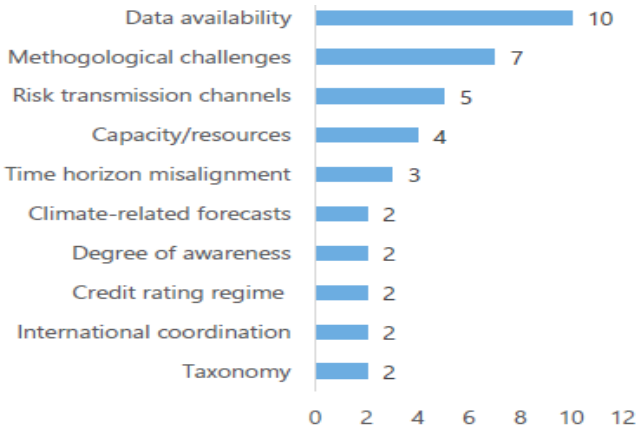
[10] In addition, risk reductions that may appear linked to the 'green' nature of an exposure, could in fact be the result of other factors, such as the benefit they might enjoy from tax advantages or government subsidies.

which is supposed to protect financial stability, to finance the transition to low-carbon economy (IIF 2021; Samtani 2021; Manninen & Tiililä 2020; Carney 2015).

- In this context, it is worth recalling that it took regulators decades to agree on a shared standard of risk-based prudential requirements, and *ad hoc* departures from this standard—such as the EU's 'SME supporting factor'—are already contentious (BCBS 2014). While some elements of the prudential framework could be adjusted to differentiate between 'green' and 'brown' exposures when this is supported by concrete, risk-based considerations—such as, for example, exposures secured by assets in high-carbon-intensive sectors at risk of becoming 'stranded' in the face of a sharp increase in carbon prices—the international regulatory community may be reluctant to countenance introducing generic, non risk-based factors for differentiating risk weights (Alexander & Fischer 2018; NGFS 2020a, esp. Box 26). Further divergence of individual jurisdictions from the global standard, on the other hand, risks increasing fragmentation and disincentivizing supervisory cooperation.

Against this background, regulators are proceeding cautiously. Surveys by the FSB and the Basel Committee of central banks and financial supervisory authorities in two (largely overlapping) groups of 26 and 27 jurisdictions,[11] respectively, have shown that the integration of climate-related risks into the supervisory process is at an early stage compared to other types of financial risk (FSB 2020b; BCBS 2020). While no respondents to these surveys reported specific barriers from a legal or enforcement perspective that prevent them from considering climate-related financial risks, most respondents identified major operational and practical challenges. The three most often-quoted challenges were data availability; the lack of a robust methodological framework for assessing and measuring climate-related financial risks, reflecting the discussion in the previous section; and difficulties in mapping the transmission channels for climate-related risks (Figure 4; see also OMFIF 2020a). Despite these limitations, central banks and financial supervisors have underscored their intention to continue working toward improving the supervision of climate-related risks (NGFS 2021e).

Figure 4. Key Challenges in Incorporating Climate-Related Risks in the Supervisory Process (responses by jurisdictions)



Source: BCBS (2020).

[11] Respondents to the FSB survey also included a number of international organizations.

Most financial supervisors have acted to build awareness of climate issues among the firms they supervise. They are doing this through publicly signaling their concern, undertaking surveys, organizing conferences, or convening industry fora. One such example is the Climate Financial Risk Forum, formed in 2019 in the UK, co-chaired by the Prudential Regulation Authority and the Financial Conduct Authority.

A number of supervisors have taken a step further and have issued—or indicated that they are preparing—supervisory guidance on how financial institutions should monitor and manage climate-related risks. Supervisory guidance is issued in the form of guidelines, action plans, and supervisory statements. These are not always legally binding, but often principle-based guidelines or interpretations of existing rules. The guidance that has been issued—or is in process of being developed—usually takes one or more of the following forms: (i) outlining supervisory plans on deliverables and activities related to climate-related risks; (ii) encouraging financial institutions to strengthen governance, risk management, and the disclosure of climate-related exposures; and (iii) providing guidance on how to properly integrate climate-related financial risks within risk management (BCBS 2020; see also the case studies in NGFS 2020a).

Such efforts are relatively more advanced in the insurance industry, where the liability risk of climate change-related weather events (physical risk) is most pressing. A comprehensive Issues Paper published by the International Association of Insurance Supervisors (IAIS) discussed climate-related risks for the sector, identified gaps in current supervisory practice, and put forward "preliminary insights from practice and initial conclusions relating to the supervision of climate change risks to the insurance sector" (IAIS 2018). National insurance supervisors have started taking this agenda forward. The Bank of England's PRA, for example, expects insurers to include in their Own Risk and Solvency Assessment (ORSA) "all material exposures relating to financial risks from climate change, and an assessment of how firms have determined the material exposure(s) in the context of their business" (PRA 2019). The European Commission has recently launched a 'sustainable finance package' that includes regulatory measures on sustainability risks and factors to be taken into account by insurance and reinsurance companies, as well as other non-bank financial institutions (European Commission 2021).

Work is also ongoing in banking, where a number of supervisors, notably the ECB and the Bank of England, have set out supervisory expectations for banks to understand and analyze climate-related risks, incorporate them into their risk appetite framework and overall business strategy, report data that reflect their exposures to environmental and climate-related risks, and take these risks into account in all relevant stages of the credit-granting process, as well as in their operational risk management framework (PRA 2019; ECB 2020). The European Banking Authority (EBA) has also published an Action Plan outlining its "high-level policy direction and expectations," in which "institutions are encouraged to consider taking steps (strategy and risk management, disclosure, and scenario analysis), before the EU legal framework is formally updated and the EBA regulatory mandates delivered" (EBA 2019). This is a clear case of banks being guided to take steps voluntarily in anticipation of future regulatory action.[12]

In contrast, efforts in securities supervision are relatively less advanced at this stage. In its latest report covering 145 European issuers, ESMA concluded that only a few sectors and companies incorporate climate-related elements in their corporate reporting and proposed that the European Commission consider the adoption of a single set of international standards for ESG disclosures (ESMA 2020). Along similar lines, the U.S. Commodity Futures Trading Commission (CFTC), noting that material climate risks must be disclosed

[12] Another example is the EBA initiative on implementing standards for prudential disclosures on ESG risks (EBA 2021b).

under existing U.S. law, called for financial regulators to clarify the definition of materiality for disclosing medium- and long-term climate risks; support the availability of consistent, comparable, and reliable data to advance the effective measurement and management of climate risk; and, on this basis, require banks and non-bank financial firms to address climate-related financial risks through the existing risk management frameworks (CFTC 2020).

From a more general perspective, incorporating climate-related risks into micro- and macro-prudential policy not only poses analytical and practical challenges but also requires a shift in the supervisory approach. Short-termism does not only afflict financial institutions' boardrooms. Financial policymakers and regulators also face the challenge of reconciling the long-term effects of climate change with the short-to-medium-term horizon that their risk assessment and supervisory actions have so far focused on. This challenge is not only analytical and practical but also a matter of mindset.

Closing information gaps, improving disclosure, promoting standards

As the preceding discussion has made clear, the lack of relevant and sufficiently granular data is a major impediment to both measuring climate-related risks and taking policy action. Recognizing this, international organizations and regulatory networks have launched a number of initiatives aimed at closing data gaps and improving disclosure.

- The FSB launched the private sector-led Task Force on Climate-related Financial Disclosures (TCFD) to develop "voluntary, consistent climate-related financial disclosures that would be useful to investors, lenders, and insurance underwriters in understanding material risks." Its report (TCFD 2017) includes four recommendations on the collection, analysis, reporting, and governance of climate-related data and risk metrics for financial and non-financial organizations.

- IOSCO established a Sustainable Finance Network (SFN) and announced its intention to work toward "robust sustainability reporting standards, interconnected with financial reporting standards" that would "lay the foundations for mandatory corporate reporting on sustainability internationally" (IOSCO 2019).

- Five global organizations—CDP (formerly the Carbon Disclosure Project), the Climate Disclosure Standards Board (CDSB), the Global Reporting Initiative (GRI), the International Integrated Reporting Council (IIRC), and the Sustainability Accounting Standards Board (SASB)—published in 2020 a vision document for a comprehensive corporate reporting system that would include both financial accounting and sustainability disclosures and complement generally accepted financial accounting principles (GAAP), as well as a prototype of a climate-related financial disclosure standard.[13]
- A broad partnership including the World Economic Forum, the Institute for International Finance (IIF), the Official Monetary and Financial Institutions Forum (OMFIF), the Climate Bonds Initiative, a number of academic institutions, and others launched in January 2020 the Future of Sustainable Data Alliance (FoSDA), whose mission is to "identify and accelerate the reliable, actionable ESG data and related

[13] "Five global organisations, whose frameworks, standards, and platforms guide the majority of sustainability and integrated reporting, announce a shared vision of what is needed for progress towards comprehensive corporate reporting – and the intent to work together to achieve it," Press Release, September 11, 2020.

technology needed for improved investor decision" toward sustainable development. FoSDA published its initial recommendations in December 2020.[14]

- The NGFS recently issued a 'Progress Report on Bridging Data Gaps' (NGFS 2021c), which proposes a strategy centered on three building blocks: (i) rapid convergence towards a common and consistent set of global disclosure standards; (ii) efforts towards a minimally accepted global taxonomy; and (iii) development and transparent use of well-defined and decision-useful metrics, certification labels and methodological standards.

- The European Commission published in 2017 supplementary non-binding guidelines for climate-related reporting to its Non-Financial Reporting Directive (NFRD) (Directive 2014/95/EU) that applies to large companies (over 500 employees) domiciled in the EU. Moreover, in February 2020, the Commission launched a public consultation for the thorough revision of the NFRD. The proposed revision would embed in regulation the criterion of *double materiality*, i.e., the notion that corporate disclosures should provide information necessary for understanding not only the impact of environmental and climate issues on their own finances and risk profile but also the impact of their activities on the environment and society (European Commission 2020).

In view of these overlapping global initiatives, the IFRS Foundation announced at COP26 the formation of an International Sustainability Standards Board (ISSB).[15] The ISSB is meant to build on the work of existing investor-focused reporting initiatives—including the CDSB, the TCFD, the Value Reporting Foundation's Integrated Reporting Framework and SASB Standards, and the World Economic Forum's Stakeholder Capitalism Metrics—to become the global standard-setter for sustainability disclosures for financial markets. The ISSB is expected to launch a public consultation on a set of proposed standards in 2022, following which it will finalize and endorse them. As the G20 have welcomed this initiative, the ISSB looks likely to yield eventually a broadly accepted disclosure standard.

In parallel, the explosion in investor and shareholder interest in ESG issues and, relatedly, the growth in 'green' bonds has spurred the development of a bewildering array of standards and taxonomies for 'green' or 'sustainable' financial products in the private sector. Most of them have been developed by industry associations, environmental advocates, or 'ESG ratings' advisers and are voluntary. IOSCO has identified more than 45 such initiatives (Figure 5).

Most of these initiatives have major shortcomings in the areas of transparency, coherence, governance, and accountability. Many financial products are labeled by their owners or managers as 'ESG,' 'green,' or 'sustainable' without a clear link to how the product is contributing to environmental and/or social objectives. For the majority of these initiatives, there is no provision for an independent external evaluation of implementation and compliance. In particular, there are no provisions for certifying that self-reporting has been prepared in accordance with particular standards and represents an objective view of the related ESG elements, risks, or transactions (IOSCO 2020). As a result, different providers often come up with different

[14] "ESG Data holes and empty talent pools: FoSDA publishes key initial recommendations," Press Release, December 10, 2020.
[15] "IFRS Foundation announces International Sustainability Standards Board, consolidation with CDSB and VRF, and publication of prototype disclosure requirements," Press Release, November 3, 2021.

Figure 5. ESG-Related Initiatives for Companies, Investors, Issuers, and Asset Managers

	Categories	No. of initiatives
1	Disclosure and reporting principles and frameworks used by companies and issuers	12
2	Principles and frameworks applicable to asset managers	4
3	Green bond principles and taxonomies	7
4	Coalitions and alliances related to ESG	17
5	Other initiatives	8

Source: IOSCO (2020).

ratings for the same companies.[16] The confusion is heightened by the fact that the vast majority of the frameworks are high-level, voluntary in nature, and non-binding. Although there may be some good reasons for this—including notably that not everyone has the resources and capacity to comply with mandatory disclosure requirements (OMFIF 2020b)—the lack of consistency and rigor in defining and applying 'green' criteria risks undermining the credibility of these classifications (NGFS 2021a; OECD 2020a; Belaisch 2019). Emerging evidence of extensive 'greenwashing' (Amenc *et al.* 2021) and the probes launched in the summer of 2021 by U.S. and German regulators into Germany's DWS for mis-labeling 'green' financial products underscore these concerns.[17]

Securities regulators may not have the authority to step into this breach. All 34 national securities regulators responding to a recent IOSCO survey shared the goal of supporting sustainable investment by facilitating greater transparency and disclosure. However, only 13 indicated that they have the legal mandate to promote or incentivize 'green' or sustainable investment through statutory measures (IOSCO 2020).

As a result, only a handful of regulators have so far introduced—or are considering—statutory frameworks for classifying and mandating sustainable or 'green' investment and related disclosures.

- The EU introduced in 2019 a Framework to Facilitate Sustainable Investment—the so-called 'Taxonomy Regulation.'[18] The Taxonomy Regulation establishes an EU-wide classification system intended to provide businesses and investors with a common language to identify what economic activities can be considered environmentally sustainable. While the bulk of the Regulation applies to asset managers making available financial products that are marketed as 'environmentally sustainable' or promote other environmental characteristics, the Regulation also states that financial market participants who do not consider criteria for environmentally sustainable investments should provide a statement to this end. This effectively means that *all* asset managers—including non-EU asset managers offering financial products in the EU—are in scope.

- The Chinese authorities issued in 2019 a "Guiding Catalogue for the Green Industry" to help promote sustainable development through clarifying the definition of 'green industry' and harmonizing standards

[16] "Navigating the thicket of ESG metrics," Financial Times, October 24, 2021.
[17] "DWS probes spark fears of greenwashing claims across industry," Financial Times, August 31, 2021.
[18] The text of the Regulation can be accessed at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32020R0852.

for sustainability. By promoting specific sectors and technologies, such as renewables, cleaner production methods, waste management, and sustainable infrastructure, the Catalogue has been characterized as a "mini industrial plan" (Paulson Institute 2019). In addition, in June 2020, the People's Bank of China (PBoC), the China Securities & Regulatory Commission (CSRC), and the National Development & Reform Commission (NDRC) released a draft "Green Bond Endorsed Project Catalogue" to update PBoC's 2015 green bond guidelines and harmonize them with the "Guiding Catalogue."

The Climate Bonds Initiative has prepared a useful comparison of the EU and Chinese standards (Climate Bonds Initiative 2019; on the EU taxonomy, see also ESG Global Advisers 2021 and Farmer & Thompson 2020). In addition, Canada, South Africa, and Malaysia are reportedly considering similar initiatives (Martindale 2020; Government of Canada 2019). More recently, the International Platform on Sustainable Finance (IPSF) – founded in 2019 by the EU, China, and other six countries and now counting 18 members – has published a report comparing the EU and China's green taxonomies, with the intent of "[improving] the comparability and future interoperability of taxonomies around the world" (IPSF 2021).

Notwithstanding the broad agreement on the need for shared and meaningful taxonomies that facilitate transparency and consistent disclosure, mandatory taxonomies have serious pitfalls (discussed by, among others, Hentov 2021; Ogus 2021; OECD 2020b; and Caldecott 2019).

- First, they are backward-looking: they reward currently established 'green' assets and activities and penalize 'brown' ones. As such, they may not provide adequate incentives for investment and technological innovation in 'brown' activities today that could help make these more environmentally sustainable in the future. For example, climate investment funds—which represent a subset of the 'sustainable funds' category—tend to hold portfolios with slightly higher carbon intensity levels than conventional funds, as these are the ones with the highest decarbonization potential if supported by credible decarbonization plans (IMF 2021b). This type of funds could be penalized under a rigid, static green taxonomy.

- Second, they tend to be static and binary (green/brown), which could make them obsolete as technology advances. Instead, the distinction should ideally be dynamic, by establishing a target path over time that an activity must follow to satisfy the taxonomy's criteria (for example, a declining GHG emissions pathway for power generation—the approach taken by the EU). However, translating reliably and transparently these dynamic pathways for specific activities to dynamic targets for individual corporations, which often operate many different activities, is a major conceptual and practical challenge.

- Third, these taxonomies can be applied to public equities and funds but not to direct investments into privately held assets through venture capital and private equity. These continue to invest in oil, gas, and coal (PESP 2021). As a result, despite the regulators' best intentions, mandatory disclosure requirements and, more broadly, regulatory actions to promote 'green' investments may simply push heavy GHG emitters to shift their financing sources to private equity, diminishing their effectiveness.

- Finally, like old-fashioned industrial policies, mandatory taxonomies could be swayed by industry lobbying or be used to promote political agendas (on the latter, see, for example, Kyriakopoulou *et al*. 2021).

Brave New World: Should Financial Policy and Regulation Promote Low-Carbon Transition?

All these initiatives share an underlying preoccupation: they seek to safeguard the conventional goals of financial policy and regulation in the face of a new reality. The new reality is climate change and the concomitant imperative to transition towards a low-carbon economy, which will involve a massive economic transformation. This new reality portends major change and disruption for the financial system. To be sure, this change is not only a source of risk but also of opportunity, as Carney (2020a; 2020b) and others have argued. Either way, however, it changes the environment in which financial policy and regulation operates. And for the last five years or so, policymakers and regulators have been trying to 'see through a glass, darkly' and identify what changes they need to make in their data requirements, analytical models, policy toolkit, and global standards in order to continue doing their job in this new environment: ensuring financial stability, the safety and soundness of financial institutions, market integrity, investor protection, or whatever other goals they are mandated to pursue.

Recently, a growing chorus of voices has been questioning this focus. From this perspective, the financial policymakers' insistence on their 'conventional' mandates is seen as at best narrow-minded and at worst an abrogation of responsibility. Critics have pointed out that in the face of climate change, which arguably represents an urgent threat to humanity—let alone the economy and the financial system—continuing to focus on financial stability is akin to re-arranging tables on the deck of the Titanic while doing little to "make finance flows consistent with a pathway towards low GHG emissions and climate-resilient development" as laid out in the Paris Agreement (Schoenmaker & van Tilburg 2016; Mazzucato *et al.* 2020).

According to this view, financial policymakers and regulators have a duty to play a more active, 'promotional' role in the transition to a low-carbon economy. The actions discussed in the previous section—measuring and raising awareness of climate-related risk, enhancing transparency and disclosure of relevant information to the market, and using prudential regulations to improve the pricing of risk in credit decisions—are helpful but insufficient. In addition to those, central banks and financial regulators should (i) lead by example, by taking steps to make their own operations 'greener' and more environmentally sustainable; and (ii) use all tools at their disposal to influence private investment and credit allocation decisions so as to promote decarbonization in the financial system and the economy as a whole. This would involve, for example, directing credit allocation to 'green' investments through differentiated capital requirements or rediscount facilities; setting ceilings to (or banning outright) lending to 'brown' activities; and requiring all supervised entities to submit decarbonization plans and holding them accountable for their implementation (Robins *et al*. 2021; Finance Watch 2020; Volz 2017; Schoenmaker & van Tilburg 2016).

A separate but parallel debate is taking place about monetary policy and central bank operations. This debate, and the burgeoning related literature (for an overview, see NGFS 2020b, 2020d, 2021b and the references therein) lie outside the scope of this paper. The themes, however, are similar. Many—including among central bankers—have acknowledged that climate change and climate mitigation policies could have an impact on price stability, thus making these factors relevant for monetary policy (Lagarde 2021; NGFS 2021b; Andersson *et al*. 2020; Coeuré 2018; McKibbin *et al*. 2017). As with financial stability, some have suggested that central banks should not 'just' adjust monetary policy tools to ensure continued achievement of price stability in the face of climate-related effects but should go further and actively use those tools—such as asset

purchases, collateral policies, and refinancing operations—to promote decarbonization (Senni 2021; Oustry *et al*. 2021; van t'Klooster & van Tilburg 2020; Chenet *et al*. 2019). While this debate lies outside the scope of this paper, it is closely related: if it is agreed that central banks should use monetary policy tools to promote low-carbon transition, this strengthens the argument that they should do the same with financial stability policy and regulation.

The first proposal—leading by example—is uncontroversial and a number of central banks have embraced it. The Banca d' Italia has been publishing since 2010 annual "Environment Reports" monitoring its ecological footprint through a series of environmental indicators, such as energy and resource consumption, waste production, etc. (Banca d' Italia 2020). The Banque de France published a "Responsible Investment Charter" in 2018, followed by annual "Responsible Investment Reports" (Banque de France 2018b; 2021), and recently updated its "responsible investment" policy with plans for reducing the carbon footprint of its operations.[19] The Sveriges Riksbank published a sustainability strategy (Sveriges Riksbank 2020). The Bank of England started publishing a climate-related financial disclosure report in line with the recommendations of the TCFD (Bank of England 2020b), while the Dutch central bank started including this information in its Annual Report (DNB 2021).

In contrast, the proposal for central banks and regulators to use their financial policy tools actively to promote decarbonization in the economy is more controversial. It goes against the long-standing principle of market neutrality for central bank operations; it may be inconsistent with the current legal mandates of central banks and financial regulators; and it raises issues of policy coherence, effectiveness, and coordination.

- **Recent developments have undermined the market neutrality argument and advocates of the 'promotional' role for central banks and regulators—and even some central bankers—now dismiss it**. Market neutrality is the notion that central bank policy interventions aimed at financial (or price) stability should avoid discriminating between different financial instruments or asset classes. It is based on the belief that provided with adequate information and a level playing field, the market will achieve allocative efficiency without a need for distortionary interventions by central banks or regulators. This belief, however, is undermined by the evident market failures affecting carbon pricing, GHG emissions, and climate mitigation investments, and even some central bankers have questioned it.[20] More broadly, market neutrality as a guiding principle of central bank operations has been fatally weakened by the unconventional monetary operations central banks have launched in the aftermath of the global financial crisis. Given the undisputed distributional effects of these operations (Bank of England 2012), the notion of market neutrality may be no more than a "myth behind which to hide" (van t'Klooster & Fontan 2020).

- **Advocates also argue that such a 'promotional' role is consistent with the existing mandates of many central banks and financial regulators**. After examining the charters of 133 central banks, Dikau & Volz (2019) show that, while only a few have a mandate that explicitly includes the promotion of sustainable growth, almost half are tasked to support their governments' national policy objectives, often as a subordinate goal conditioned on not interfering with their primary goal (typically price stability and financial stability). Since many governments have adopted climate mitigation or

[19] "Responsible investment policy: reinforcing exclusions with regard to fossil fuels," Press Release, January 18, 2021, Banque de France.

[20] "Lagarde says ECB needs to question market neutrality on climate," Bloomberg, October 14, 2020. See also Sleijpen (2021), Knot (2021), Villeroy de Galhau (2021), ESRB (2020).

sustainability targets and since, as discussed in the previous section, climate change and climate mitigation policies are likely to have an impact on financial stability, the authors argue that central banks and financial regulatory authorities in many jurisdictions do not need additional or modified mandates to play a 'promotional' role in the economic transition to a low-carbon economy.

- **Moreover, in cases where a 'promotional' role is not permitted by the existing mandates, these mandates can be updated**. Historically, central bank and regulatory agency mandates and policy frameworks have evolved considerably, and often in response to crises. For example, the experience of the global financial crisis prompted an expansion of the mandates of central banks and financial regulators to cover systemic stability. Whether this update took the form of a revised legal and institutional framework or a re-interpretation of the existing one is immaterial. Likewise, the argument goes, in the face of a climate emergency, mandates of central banks and financial regulators should be updated, if necessary, to enable them—and indeed compel them—to contribute to the transition to a low-carbon economy.

- **In practice, however, using regulatory tools to promote climate transition would complicate the conduct of policy while, based on the available evidence, it is unlikely to be effective**. At a minimum, it would need to address the 'Tinbergen' constraint of correspondence between objectives and tools: if the same tools are used to pursue different objectives, policy inconsistencies will inevitably arise. For example, as illustrated in Berenguer *et al*. (2020), such an inconsistency could arise if a 'Green Supporting Factor' were used to adjust RWAs. A 'promotional' objective for the prudential regulator would dictate that RWAs for 'green' activities be adjusted downwards; but if a certain activity presents a certain level of risk from the Basel III perspective, its climate-adjusted RWA should not be lower than the unadjusted one. In situations like this, regulators would be forced to make uneasy choices between their standard and 'promotional' roles. In addition, regulatory measures are unlikely to achieve the massive shift in credit and investment flows required for decarbonization. The evidence shows that the EU's 'SME supporting factor,' which was supposed to promote SME lending in a similar fashion, has had no material influence on lending prices or volumes to SMEs (EBA 2016). This is corroborated by recent model estimates that show that even a massive 'Green Supporting Factor' (effectively halving the capital requirement for 'green' projects) would have a negligible impact on overall credit growth and a very low impact on financing for the targeted transition projects (Chamberlin & Evain 2021). Lastly, it has been shown that the anticipation by the market of such 'promotional' interventions by regulators may create risky imbalances in the balance sheets of financial intermediaries (Diluiso *et al*. 2020).

In conclusion, the merits of the proposal to task financial policymakers and regulators with promoting the transition to a low-carbon economy are doubtful. Advocates of a 'promotional' role for central banks and financial regulators sometimes like to present their case as a struggle against old-fashioned 'traditionalists,' in which "the only barrier is orthodox thinking" (Schoenmaker & Jourdan 2020). But this oversimplification overlooks a much more complex reality. The fundamental problem is not legal: agency legal mandates are often flexible enough and, if necessary, can indeed be re-interpreted or updated. This, of course, is not something that central bankers or regulators can (or should) do by themselves: it has to be done through the political process and be accompanied by appropriate political oversight and accountability arrangements for the central banks and other agencies that would be given these expanded responsibilities. The fundamental problem rather is that in practice, 'green'-promoting regulatory action would raise major governance and

operational challenges for regulators while, based on the available evidence, it is likely to have a limited real-world impact.

Not surprisingly, central banks and financial regulators seem so far reluctant to adopt a more active 'promotional' role. Their role in supporting the energy transition has to be consistent with their established objectives. They continue to approach the financial consequences of climate change through the lens of risk management for the financial sector (Elderson 2021). The Bank of England has concluded that regulatory tools—and the capital framework, in particular—should be used to address the consequences of climate change for the financial sector in terms of increased risk, not its causes (PRA 2021). Ultimately, central banks and regulators see their role as a "complement, a catalyst, and an amplifier, not a substitute for wider policy action."[21]

To Boldly Go? Risks and Unintended Consequences

In adapting their policies to the new challenges created by the effects of climate change and the transition to a low-carbon economy, central banks and financial regulators need to weigh carefully the potential pitfalls. These fall broadly into two groups: (i) unintended consequences their policies may have on markets and the financial system, and (ii) risks that these policies may fail to achieve their stated objectives owing to poor design or lack of coordination with other policymakers. In both cases, there could be negative repercussions on the central bankers' and regulators' reputation for competence and independence and, ultimately, on their credibility. And if this were to happen, it would undermine their ability to achieve not just their climate-related but *all* their policy goals.

One potential unintended consequence of regulatory action to favor 'green' or penalize 'brown' assets or activities is inadvertently exacerbating financial market volatility. This potential exists regardless of whether the intention of the regulator is to mitigate climate-related risks for the financial sector or to promote decarbonization in the economy. Although market volatility *per se* is not a concern for financial policy and regulation, it can trigger financial instability and have broader repercussions.

- **There is already some evidence of a certain price exuberance in the 'green' energy sector, although this may to some extent reflect normal market dynamics**.[22] The MSCI Global Alternative Energy Index has reached a market cap of about 15 percent of the global energy sector, up from 6.4 percent in 2010. Alternative energy equity ETFs have shown a similar growth.[23] These dynamics are, at least to some extent, an inherent aspect of market adjustment to new information. As awareness of climate-related risks grows but—due to data gaps, cognitive lags, or other reasons—these risks are only slowly being priced in, stocks of 'green' companies (or companies with higher ESG

[21] As pointed out by Sarah Breeden, Executive Director for Financial Stability Strategy and Risk and Member of the Financial Policy Committee of the Bank of England at a webinar organized by the LSE Grantham Research Institute on Climate Change and the Environment and the SOAS Centre for Sustainable Finance on March 19, 2021, to launch the report 'Net Zero Central Banking: A New Phase in Greening the Financial System' (Robins *et al*. 2021).

[22] "'Green bubble' warnings grow as money pours into renewables," Financial Times, February 19, 2021.

[23] Data from MSCI Global Alternative Energy Index, MSCI World Energy Index, and ETF Database.

scores) should initially have a return advantage over 'brown' stocks (with lower ESG scores). As ESG investing becomes more widely adopted and these risks are gradually priced in, 'brown' stocks would decline relative to 'green' until, other things being equal, they have a higher expected return that compensates for their higher environmental risk. Hence, it is to be expected that during an initial period, 'green' stocks would outperform 'brown' stocks creating a 'green' bubble, but once a new equilibrium has been reached where ESG risks are fully integrated into the analysis of most investors, 'brown' stocks should have higher returns. The evidence suggests that the market is currently in this initial period (Bolton & Kacperczyk 2020; Klement 2020; Goergen 2020).

- **In addition, since many of the 'green' companies—in sectors such as renewables or energy storage—tend to be more capital- and technology-intensive, their stock prices are more sensitive to increases in interest rates**. For a gas-fired power plant, for example, a large part of the total operating cost over its lifetime is the cost of fuel, while for a solar or wind power plant almost all costs are fixed and borne upfront, at the time of construction and installation. Such 'long duration' stocks, whose valuations are based on high expected earnings in the future (like those of technology companies) are, at least in theory, more sensitive than other stocks (e.g., cyclicals) to changes in the cost of finance. Therefore, a transition to a higher interest rate environment could induce temporary volatility in the prices of these stocks.

- **Finally, a new commodity cycle appears to be forming, with potentially broader economic ramifications**. At present, the technological transformation required for the transition to a low-carbon economy is dependent on the supply of a small group of minerals, such as graphite, lithium, nickel, and cobalt, used in energy storage; palladium for hydrogen fuel cells; and molybdenum for wind turbines. Because clean energy technologies are much more material-intensive than fossil fuel-based electricity generation, the World Bank has estimated that in a scenario that would keep the global temperature rise below 2ºC from pre-industrial levels, as called for by the Paris Agreement, demand for 17 specific minerals would quadruple by 2050 (World Bank 2020). And these estimates do not include the demand from the additional infrastructure needed to support the deployment of these technologies, such as new transmission lines or the chassis of newly built electric vehicles. Prices of these minerals have already started reflecting these trends, which some see as the start of a new commodity super-cycle.[24] Last but not least, although most of these minerals are abundant in nature, supply chain dependencies can choke their provision. The batteries used in electric vehicles, for example, require a number of critical minerals for which substitutes are limited or non-existent and supplies are geographically concentrated (Elkind *et al*. 2020). Volatility in such a context could have ramifications that extend well beyond the financial system.

Looking beyond financial markets, as the spike in energy prices in the second half of 2021 demonstrates, the road towards a low-carbon economy is going to be bumpy. The scale of the economic transformation required to achieve the Paris Agreement goals is unprecedented. Given the delicate balance that has to be struck through the long process of replacing fossil fuel resources with sustainable ones, market volatility is to be expected.

In such a complex environment, central banks and financial regulators have to tread a fine line. While they should not necessarily aim at dampening market volatility or preventing overstretched valuations in the

[24] "Goldman proclaims the dawn of a new commodity super-cycle," Reuters, January 5, 2021.

'green' sector (which are arguably natural at this stage), measures that unintentionally amplify volatility can be destabilizing: this could be the case, for example, if central banks' asset purchases are tilted toward 'green' securities while their supply is still limited. Moreover, as the discussion of a potential commodity super-cycle highlights, they could have repercussions that extend well beyond the financial system. Last but not least, excessive volatility of 'green' asset prices could temporarily dampen investment flows into the sector and delay urgently needed progress toward decarbonization.

Another set of challenges that central banks and financial regulators face in this new environment relates to their own governance. Prior to the global financial crisis, central banks were by and large focused on price stability: as one of the leading central bankers of the day put it, their "ambition was to be boring" (King 2000). The crisis and the Great Recession that followed prompted countries to overhaul their central banking and regulatory frameworks. Although the new arrangements varied across countries, in almost all cases central banks were given substantial additional responsibilities, notably for financial stability. Because these did not fit well within the governance model that had been established for monetary policy, they created frictions—and, in some cases, a political backlash against central bank power—and prompted a search for new governance and accountability arrangements (Tucker 2018; Balls *et al*. 2018; Bean 2017). The new expectations that are now being placed on central banks and regulators as a result of climate-based considerations, especially if they include playing an active role in decarbonization, fit even less well within existing governance arrangements. Like financial stability (Demekas 2019), climate mitigation is not a task that can—or should—be delegated to technocratic agencies, like the central bank or a regulator, as it does not meet the conditions for such delegation (Alesina & Tabellini 2007; 2008). A collective effort of such magnitude and far-reaching economic and distributional repercussions should be mediated by the political process.

Given this history, central banks and regulators taking on—or being tasked with—supporting the transition to a low-carbon economy may face renewed criticism for 'mission creep' and unchecked power. For some academic advocates of a 'promotional' role in climate mitigation, such 'mission creep' cannot happen fast enough (Robins *et al*. 2021; Mazzucato *et al*. 2020). But for real-life central bankers and regulators, it is a risk: it could divert attention and resources from the pursuit of their core mandates; it would raise difficult technical tradeoffs in the targeting of their tools, as discussed in the previous section; and it would create a pressing need for stronger governance and greater accountability for achieving the new objectives (for which there are no accepted criteria), as well as the specter of greater political and public scrutiny of their activities.[25]

Failures of broader policy coordination also create risks for the financial system that would reflect back on central banks and financial regulators. Financial policy and regulation cannot deliver the transition to a low-carbon economy by itself. Broader policy efforts and investments will be needed for the real economies to meet climate and environmental objectives, and most of these are in the hands of governments, notably carbon pricing and other policies that are necessary to deliver the governments' own Paris Agreement commitments, as well as help channel capital flows towards sustainable activities and net-zero emissions technologies (IMF 2020b; Group of Thirty 2020). If central banks and regulators move ahead on their own—especially if they try to actively promote decarbonization in the financial system and the economy as a whole—but, despite their stated intention, governments fail to follow, these efforts will not only prove fruitless but could have negative repercussions. Financial firms could end up incurring losses if they move—in anticipation of or prompted by

[25] "The downsides of central bank mission creep," The Wall Street Journal, June 18, 2019; "Central banks need to stop mission creep," Financial Times, August 27, 2021.

regulators—towards 'green finance' but governments fail to follow through with changes in carbon pricing. This could happen for a variety of reasons, including lack of legislative support or weakening of political resolve in the face of popular protests. Such an outcome would prevent the change in relative prices needed to sustain the transition (Pisany-Ferry 2021) and would deprive the market of the "critical signal for re-directing private investment and innovation to clean technologies, and to incentivize energy efficiency" (Georgieva 2021). Asset managers and pension funds could be seen as compromising their fiduciary responsibilities as these are currently defined—a risk that is acknowledged even by advocates of a more active role for financial policy and regulation (Vaccaro & Barmes 2021). And the inevitable backlash would be directed toward central banks and financial regulators (King & Katz 2021).

Concluding Observations

The reality of climate change and the increasing political support for measures to move towards a low-carbon economy mean that financial policy and regulation have to grapple with new challenges. The required large-scale, long-term economic transformation generates new risks—as well as opportunities—for financial firms and for the stability and orderly functioning of the financial system as a whole. Central bankers and financial regulators need to understand the implications for the financial system and for the firms they supervise, as well as assess and, if possible, take action to mitigate these new risks. Given the current state of development of their diagnostic and policy tools, however, none of these tasks are easy. In addition, at least in some jurisdictions, they are increasingly pushed to play a more active role, alongside other policymakers, in encouraging the economic transition to a low-carbon economy. And because central bankers and regulators are not immune to the political environment in which they operate, some of them seem to be ready to take on these additional responsibilities.

Engaging central banks and regulatory agencies to achieve specific climate transition goals may not be consistent with their current legal mandates, governance arrangements, or with the risk-focused approach they have been taking so far. To be sure, the mandates can be re-interpreted or expanded, if necessary. But this has to happen through the political process, not by the central bankers themselves, in order to avoid criticism of 'mission creep.' Governance arrangements would have to be amended and political oversight and accountability of central banks and regulators strengthened considerably if they are given a new goal that is essentially political and has far-reaching social, distributional, and inter-generational implications. Moreover, the evidence suggests that their tools are unlikely to be effective in bringing about the massive reorientation in financial flows required for the transition. Last but not least, pursuing this new goal alongside their existing goals using the same tools will create difficult operational tradeoffs and risk compromising their ability to achieve any of their goals.

As with any other policy, there is also the risk of unintended consequences for the financial system and the broader economy. Instead of safeguarding market integrity and stability, central banks and financial regulators may find themselves inadvertently fueling market volatility, overstretched asset valuations, or even a commodity super-cycle—which appear to be already underway. To be sure, an economic transformation of such a magnitude can be expected to generate large-scale re-pricing of financial assets, and market volatility *per se* should not be a concern for policy. But excessive volatility or, at the limit, the bursting of a 'green' bubble

could be destabilizing. And given the complexities of the economics of climate transition, this could have repercussions beyond the financial system.

These challenges are significant but neither unprecedented nor insuperable. The scope of financial policy and regulation has always been adapting to new exigencies, most recently after the global financial crisis. In the process, mandates had to be re-defined, accountability strengthened, institutions reformed, technical problems tackled, and risks taken. Given the importance and urgency of the challenge of climate change, the same has to happen today in order to enable financial policy and regulation to play its role in the transition to a low-carbon economy. At the same time, these challenges are real and cannot be wished away. Recognizing and debating them should not be seen as an excuse for inaction but as a necessary step to developing appropriate solutions.

Central banks and financial regulators find themselves having to walk a tightrope. As in the aftermath of the global financial crisis, there is pressure on central bankers and regulators to step into the breach and take on the new challenge of the times. Indeed, some of them appear eager to do so. While they certainly have a key supporting role to play in the transition to a low-carbon economy, they cannot deliver this goal by themselves. They should not overestimate their abilities or their toolkit, overstep their mandate, or disregard the possible unintended consequences of their actions. More importantly, they should always act in concert with government climate policies, especially on carbon pricing. Their reputation and, ultimately, their effectiveness in achieving not just their climate-related but *all* their goals could be compromised if they find themselves (again) in the role of ‘the only game in town.’

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