Journal of Financial Regulation, 2022, **8**, 203–229
https://doi.org/10.1093/jfr/fjac010
Advance access publication date 24 August 2022
Article

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

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ABSTRACT

As with the global financial crisis, there are once again demands on central banks and financial regulators to take on new responsibilities, this time for supporting the transition to a low-carbon economy. Regulators can indeed facilitate the reorientation of financial flows necessary for the transition. But they may find themselves walking a tightrope, having to balance exaggerated expectations against limited capabilities and political economy constraints. Their diagnostic and policy toolkits are still in their infancy. Expanding their legal mandates to take on these new, essentially political, responsibilities should be done through the political process and be accompanied by strengthened governance and accountability arrangements. Taking on these new responsibilities can also have potential pitfalls and unintended consequences on financial markets. Ultimately, central banks and 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'.

KEYWORDS: financial stability, financial regulation, climate change, climate mitigation policy, low-carbon economy, energy transition

I. A NEW CHALLENGE FOR FINANCIAL REGULATORS

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 agreed the aim of holding the increase in global average temperature to below 2°C above pre-industrial levels and pursuing efforts to limit it to 1.5°C. However, a recent

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The views expressed in this article are those of the authors and do not necessarily represent the views of the Bank of England or of the IMF, its Executive Board, or IMF management.

report by the Intergovernmental Panel on Climate Change (IPCC) warned that, without more ambitious policies beyond those in place by the end of 2020, median global warming is expected to reach 3.2°C above pre-industrial era by the end of the 21st century.[1] The commitments for reduction of greenhouse gas (GHG) emissions made by the countries participating in the 26th United Nations Climate Change Conference of the Parties (COP26), held in Glasgow in November 2021, are consistent with a median 2.4°C temperature rise above pre-industrial levels by 2100.[2]

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. 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;[3] the conceptual difficulties associated with fat-tailed distributions and catastrophic outcomes;[4] the endogeneity of technical change;[5] time inconsistency or the 'tragedy of the horizon';[6] and collective action and free rider problems.[7]

The theoretical 'first-best' policy to address these failures and stimulate the massive economic transformation needed to tackle the climate challenge 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.[8] These fiscal policies are indispensable for any effective climate mitigation strategy. But the magnitude and complexity of the challenge, as well as political economy considerations, argue in favour of a broader policy effort, and there are calls for central banks and financial regulators to 'play their part'.

This article reviews the potential role of financial regulation and policies in the transition to a low-carbon economy. It focuses on both microprudential regulation and supervision and macroprudential policies aimed at safeguarding the stability and orderly functioning of the financial system as a whole. In order to keep the discussion relevant for a range of different jurisdictions, the article takes a broad view of financial regulation, encompassing all rules and policies applying to the financial sector regardless of who is the rule-maker (legislature, supervisor, or other regulatory agency). Specifically:

- The article reviews ongoing efforts to assess climate-related risks to the financial system and incorporate relevant considerations into financial regulation. Despite the progress, it argues that data gaps are still significant, and the diagnostic and policy toolkits are not yet

1 Intergovernmental Panel on Climate Change (IPCC), 'Climate Change 2022: Mitigation of Climate Change—Summary for Policymakers' (WMO–UNEP) <https://www.ipcc.ch/report/ar6/wg3>.

2 Climate Action Tracker, 'The CAT Thermometer' (2021) <https://climateactiontracker.org/global/cat-thermometer>.

3 Nicholas Stern, 'The Economics of Climate Change' (2008) 98(2) American Economic Review 1.

4 Partha Dasgupta, 'Discounting Climate Change' (2008) 37 Journal of Risk and Uncertainty 141; Martin Weitzman, 'Fat-Tailed Uncertainty in the Economics of Catastrophic Climate Change' (2011) 5 Review of Environmental Economics and Policy 275.

5 Daron Acemoglu and others, 'The Environment and Directed Technical Change' (2012) 102 American Economic Review 131.

6 Mark Carney, 'Breaking the Tragedy of the Horizon—Climate Change and Financial Stability' (Speech by the Governor of the Bank of England at Lloyd's of London, 29 September 2015) <https://www.bankofengland.co.uk/speech/2015/breaking-the-tragedy-of-the-horizon-climate-change-and-financial-stability>.

7 For a review of the literature, see Signe Krogstrup and William Oman, 'Macroeconomic and Financial Policies for Climate Change Mitigation: A Review of the Literature' IMF Working Paper WP/19/185 <https://www.imf.org/-/media/Files/Publications/WP/2019/wpiea2019185-print-pdf.ashx>.

8 Nicholas Stern and others, *The Economics of Climate Change: The Stern Review* (Cambridge University Press 2006); Ian Parry and others, *Getting Energy Prices Right: From Principle to Practice* (International Monetary Fund 2014); International Monetary Fund, 'Fiscal Monitor: How to Mitigate Climate Change' (October 2019).

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.

- Proposals to assign central banks and financial regulatory agencies explicit environmental goals in order to promote decarbonization in the financial system and the economy as a whole would stretch to the limit their current mandates and legal frameworks. While these can of course be expanded, the article argues that 'green'-promoting regulatory action would raise major governance and operational challenges for regulators while, on the basis of the available evidence, it is unlikely to have a significant real-world impact.
- Finally, regardless of whether the legal frameworks for financial policies change or stay the same, the article 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 is crucial if financial policies are to be effective in supporting the transition to a low-carbon economy.

II. THROUGH A GLASS, DARKLY: MEASURING AND MANAGING CLIMATE-RELATED RISK TO THE FINANCIAL SYSTEM

Pressure to adapt financial policies and regulatory frameworks to incorporate climate-based considerations has come from multiple directions—first and foremost from 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.[9] This was underpinned by the first IPCC report that focused on the economic and financial impact of climate change.[10]

Pressure also came from shareholders and the market. 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.[11] 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 that companies should 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

[9] United Nations Environment Programme Finance Initiatives (UNEPFI), 'Climate Change and the Financial Services Industry' (2002) <http://www.unepfi.org/fileadmin/documents/cc_fin_serv_ind_module1_2002.pdf>; Andrew F Dlugolecki and Thomas Loster, 'Climate Change and the Financial Services Sector: An Appreciation of the UNEPFI Study' (2003) 28(3) The Geneva Papers on Risk and Insurance; Association of British Insurers, 'A Changing Climate for Insurance' (June 2004) <https://engweb.swan.ac.uk/~hewstonr/A%20Changing%20Climate%20for%20Insurance%20-%20ABI.pdf>; Allianz Group and World Wildlife Fund, 'Climate Change and Insurance: An Agenda for Action in the United States' (October 2006) <http://www.climateneeds.umd.edu/pdf/AllianzWWFreport.pdf>; 360 Risk Project, Lloyd's of London, 'Climate Change: Adapt or Bust' (2006) <https://biotech.law.lsu.edu/climate/docs/FINAL360climatechangereport.pdf>.

[10] Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2001: Impacts, Adaptation, and Vulnerability—Contribution of Working Group II to the Third Assessment Report of the IPCC* (Cambridge University Press 2001) <https://www.ipcc.ch/report/ar3/wg2>. See also the work of David R Easterling and others, 'Climate Extremes: Observations, Modelling and Impacts' (2000) 289 Science 2068, and Richard SJ Tol, 'Estimates of the Damage Costs of Climate Change, Part II: Dynamic Estimates' (2002) 21 Environmental and Resource Economics 135.

[11] Allison H Lee, 'A Climate for Change: Meeting Investor Demand for Climate and ESG Information at the SEC' (Speech by the Acting SEC Chair Allison Herren Lee, 15 March 2021) <https://www.sec.gov/news/speech/lee-climate-change#_ftn1>.

disclosure, risk assessment, and oversight of particular issues.[12] 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-labelled funds and 'green' bonds issued to raise finance for 'green' assets and climate mitigation projects and, relatedly, a proliferation of ESG or 'green' scores and standards.[13] This, in turn, laid bare the scarcity of relevant data and the difficulties of measurement, and fuelled concerns about mis-labelling and 'greenwashing' and calls for better governance of these standards.

Last but not least, political leaders demanded action. Following the Paris Agreement, which explicitly called for making finance flows consistent with a pathway towards low greenhouse gas (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'.[14] 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'.[15]

Regulators reacted with a lag to market developments and shifting political priorities, but since the middle of the 2010s, a work programme 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 has led 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. Third, 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.

1. 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

[12] Kosmas Papadopoulos, 'The Long View: US Proxy Voting Trends on E&S Issues from 2000 to 2018' (Harvard Law School Forum on Corporate Governance 2019) <https://corpgov.law.harvard.edu/2019/01/31/the-long-view-us-proxy-voting-trends-on-es-issues-from-2000-to-2018>.

[13] In 2020, 'green' bond issuance reached a record of US$270 billion, continuing on a rising trend for nine consecutive years (Climate Bonds Initiative (24 January 2021) <https://www.climatebonds.net/2021/01/record-2695bn-green-issuance-2020-late-surge-sees-pandemic-year-pip-2019-total-3bn>). 'Sustainable investments', a broader category that includes all investments that integrate ESG factors in asset selection and management, is estimated to have reached US$35.3 trillion in five major markets, more than one-third of global assets under management (Global Sustainable Investment Alliance (GSIA), 'Global Sustainable Investment Report 2020' (2021) <http://www.gsi-alliance.org/wp-content/uploads/2021/08/GSIR-20201.pdf>.

[14] 'G20 Finance Ministers and Central Bank Governors' Communiqué' (17 April 2015) <http://www.g20.utoronto.ca/2015/150417-finance.html>.

[15] United Nations Framework Convention on Climate Change (UNFCCC), 'Glasgow Climate Pact' (2021) <https://unfccc.int/sites/default/files/resource/cma2021_L16_adv.pdf>.

Assessment Models (IAMs), such as William Nordhaus's DICE model,[16] had been widely used to analyse 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 Programme[17] 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.[18] This impact can manifest itself through two different channels: (i) the physical repercussions of climate change on the economy and financial system, for example from rising sea levels, changing agricultural production patterns, or the increasing severity and frequency of extreme weather events—usually referred to as physical risk;[19] and (ii) the economic effects of policies to mitigate climate change, notably increases in carbon pricing, on asset prices and financial markets—referred to as transition risk (Figure 1). Carney's speech was followed by similar interventions by other central bankers.[20] The Bank of England's Prudential Regulation Authority (PRA) was the first regulator to publish a detailed analysis of climate-related risks for the insurance sector and attempt to incorporate these into stress tests for insurers.[21] Similar early initiatives were undertaken by the Swedish, Dutch, and French regulators and, outside Europe, by the Brazilian insurance supervisor and the California Department of Insurance (in the USA, insurance supervision is the responsibility of individual states).[22]

Source: Patrick Bolton and others, '"Green Swans": Central Banks in the Age of Climate-Related Risks' [2020] Banque de France Bulletin 229/8 (2020) 1 <https://particuliers.banque-france.fr/sites/default/files/medias/documents/820154_bdf229-8_green_swans_vfinale.pdf>.

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 organizations, has so far given

[16] William D Nordhaus, 'The DICE Model: Background and Structure of a Dynamic Integrated Climate-Economy Model of the Economics of Global Warming' Cowles Foundation Discussion Paper No 1009 (Yale University 1992) <https://ideas.repec.org/p/cwl/cwldpp/1009.html#download>; and *Managing the Global Commons: The Economics of Climate Change* (MIT University Press 1994).

[17] UNEPFI (n 9).

[18] Carney (n 6).

[19] 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 article.

[20] François Villeroy de Galhau, 'Climate Change—The Financial Sector and Pathways to 2°C' (Speech by the Governor of the Bank of France at the COP21, Paris, 30 November 2015) <https://www.bis.org/review/r151229f.pdf>; Luigi F Signorini, 'The Financial System, Environment and Climate: A Regulator's Perspective' (Welcome Address by the Deputy Governor of the Bank of Italy, Conference on the National Dialogue on Sustainable Finance, 6 February 2017) <https://www.bancaditalia.it/pubblicazioni/interventi-direttorio/int-dir-2017/en_Signorini_06.02.2017.pdf?language_id=1>; Timothy Lane, 'Thermometer Rising—Climate Change and Canada's Economic Future' (Remarks by the Deputy Governor of the Bank of Canada at the Finance and Sustainability Initiative, Montréal, 2 March 2017) <https://www.bis.org/review/r170405b.pdf>.

[21] Prudential Regulation Authority (PRA), 'The Impact of Climate Change on the UK Insurance Sector' (September 2015) <https://www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/publication/impact-of-climate-change-on-the-uk-insurance-sector.pdf>; and 'General Insurance Stress Test 2017 Feedback, Letter to CEOs of Participating Firms' (December 2017) <https://www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/letter/2017/general-insurance-stress-test-2017-feedback.pdf?la=en&hash=EA1B998F8E753DA71232A490FEEB27E7101C18C3>.

[22] See the summary in International Association of Insurance Supervisors (IAIS), 'Issues Paper on Climate Change Risks in the Insurance Sector' (July 2018) <https://www.iaisweb.org/uploads/2022/01/180727-SIF-IAIS-Issues-Paper-on-Climate-Changes-Risk.pdf>.

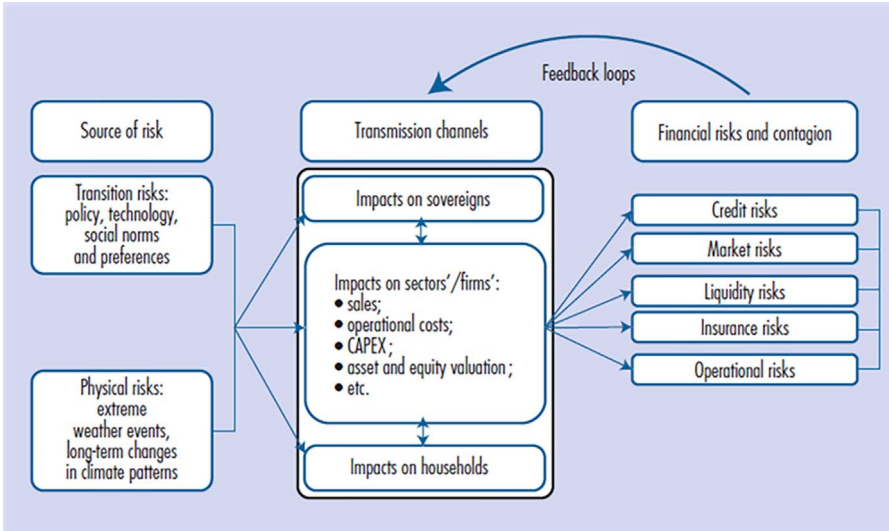

Figure 1. Climate-Related Risks and Transmission Channels

priority to the first of these two goals, issuing six recommendations for central banks and financial supervisors.[23] Most of these recommendations focus on improving data collection and internationally consistent disclosure of climate- and environment-related risks, and on integrating these risks into financial stability monitoring and microprudential supervision. In its Glasgow Declaration on the occasion of COP26, NGFS reconfirmed this priority.[24]

Climate-related risks for the financial sector are unique and systemic and their modelling poses fundamental challenges. Their long time horizon; radical (Knightian) uncertainty about the possible climate pathways and their probability distribution; 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 readily be used to measure these risks: exploratory scenario-based impact assessments must be used instead (Figure 2). Although these are methodologically different,[25] they are often also referred to as 'stress tests'—and in the rest of this article, these two terms are used interchangeably. 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 behaviour of market participants; self-reinforcing reductions in bank lending and insurance provision; the bank-sovereign nexus;

[23] Network for Greening the Financial System (NGFS), 'First Progress Report' (October 2018) <https://www.ngfs.net/en/first-progress-report>; and 'First Comprehensive Report: A Call for Action—Climate Change as a Source of Financial Risk' (April 2019) <https://www.ngfs.net/sites/default/files/medias/documents/ngfs_first_comprehensive_report_-_17042019_0.pdf>.

[24] NGFS, 'Glasgow Declaration: Committed to Action' (3 November 2021) <https://www.ngfs.net/sites/default/files/medias/documents/ngfsglasgowdeclaration.pdf>.

[25] The methodological differences between 'traditional' stress tests and scenario-based assessments in relation to climate-related risks have been analysed extensively in the literature. For an in-depth discussion, see Jakob Thomä and Hugues Chenet, 'Transition Risks and Market Failure: A Theoretical Discourse on Why Financial Models and Economic Agents May Misprice Risk Related to the Transition to a Low-Carbon Economy' (2017) 7 Journal of Sustainable Finance and Investment 82; and Hugues Chenet, Josh Ryan-Collins and Frank van Lerven, 'Climate-related Financial Policy in a World of Radical Uncertainty: Towards a Precautionary Approach' UCL Institute for Innovation and Public Purpose Working Paper IIPP WP 2019-13 <https://www.ucl.ac.uk/bartlett/public-purpose/wp2019-13>.

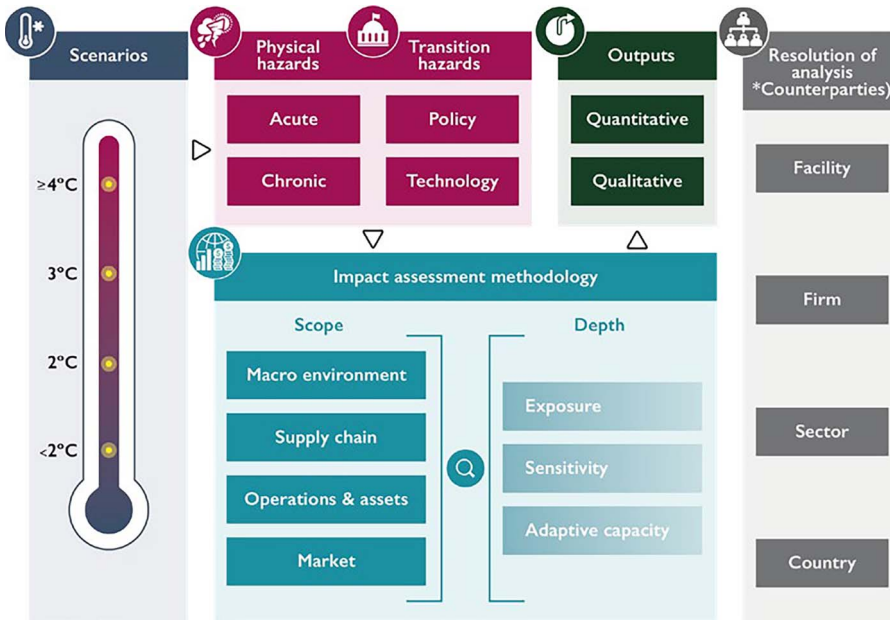

Figure 2. Analytical Elements of Scenario-Based Impact Assessments

feedback loops with the real economy; and network and cross-border effects.[26] 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.[27]

Source: UNEPFI, *Changing Course* (UNEPFI 2019) <https://www.unepfi.org/publications/investment-publications/changing-course-a-comprehensive-investor-guide-to-scenario-based-methods-for-climate-risk-assessment-in-response-to-the-tcfd>

A number of central banks and regulatory agencies have endeavoured to develop novel system-wide scenario-based approaches to capture climate-related risks.

- The Dutch central bank was the first to conduct a scenario-based assessment focusing on transition risk for Dutch banks, insurers, and pension funds.[28]
- The Bank of England was the first to announce in 2019 a comprehensive approach to incorporate *both* physical *and* transition risks into its regular biennial exploratory stress test

[26] Basel Committee on Banking Supervision (BCBS), 'Climate-related Risk Drivers and Their Transmission Channels' (April 2021) <https://www.bis.org/bcbs/publ/d517.pdf>; Financial Stability Board (FSB), 'The Implications of Climate Change for Financial Stability' (November 2020) <https://www.fsb.org/wp-content/uploads/P231120.pdf>.

[27] For a discussion of the various methodological and other challenges facing climate-related scenario-based assessments, see BCBS, 'Climate-related Financial Risks—Measurement Methodologies' (April 2021) <https://www.bis.org/bcbs/publ/d518.pdf>; Francisco Covas, 'Challenges in Stress Testing and Climate Change' (Bank Policy Institute, October 2020) <https://bpi.com/challenges-in-stress-testing-and-climate-change>; Seraina N Gruenewald, 'Climate Change as a Systemic Risk: Are Macroprudential Authorities Up to the Task?' European Banking Institute, EBI Working Paper No 62 (2020) <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3580222>; Vivian Dépoues and others, 'Pour une Autre Approche du Risque Climatique en Finance. Tenir Pleinement Compte des Incertitudes' International Atomic Energy Agency INIS-FR-20-0310 (2019) <https://inis.iaea.org/search/search.aspx?orig_q=reportnumber:%22INIS-FR--20-0310%22>; and Emanuele Campiglio and others, 'Climate Change Challenges for Central Banks and Financial Regulators' (2018) 8 Nature Climate Change 462.

[28] Robert Vermeulen and others, 'An Energy Transition Risk Stress Test for the Financial System of the Netherlands' De Nederlandsche Bank, Occasional Studies 16-7 (2018) <https://www.dnb.nl/media/pdnpdalc/201810_nr-_7_-2018-_an_energy_transition_risk_stress_test_for_the_financial_system_of_the_netherlands.pdf>.

scenario (BES) in 2021, covering the largest UK-based banks and insurers.[29] The results were published in May 2022.[30]

- The Banque de France and the French Prudential Supervision and Resolution Authority (ACPR) launched in 2020 a pilot exercise for banks and insurance companies that volunteered to participate and published the results in April 2021.[31]
- The European Systemic Risk Board (ESRB) published estimates of the potential impact of transition risks for EU banks and insurers under different climate mitigation policy scenarios,[32] followed by a joint report with the European Central Bank (ECB) that measured climate risks for the European financial system and performed long-term forward-looking climate risk assessments for banks, insurers, and investment funds.[33]
- The ECB 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[34] and, more recently, a bottom-up supervisory stress test focusing on climate-related risks.[35]
- 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.[36]
- A number of other central banks and supervisory agencies have announced plans to incorporate climate-related risks into their financial stability assessment, including the Bank of Japan, the Australian Prudential Regulatory Authority (APRA), and the Monetary Authority of Singapore,[37] while the US Federal Reserve has indicated that it is 'evaluating and investing' in ways to incorporate climate risk in its assessment of financial institutions.[38] The NGFS has prepared guidelines for climate-related scenarios to help central banks and supervisors.[39]

[29] Bank of England, 'The 2021 Biennial Exploratory Scenario on the Financial Risks from Climate Change' Discussion Paper (2019) <https://www.bankofengland.co.uk/paper/2019/biennial-exploratory-scenario-climate-change-discussion-paper>.

[30] Bank of England, 'Results of the 2021 Climate Biennial Exploratory Scenario (CBES)' (May 2022) <https://www.bankofengland.co.uk/stress-testing/2022/results-of-the-2021-climate-biennial-exploratory-scenario>.

[31] Autorité de Contrôle Prudentiel et de Resolution (ACPR), 'The Main Results of the 2020 Climate Pilot Exercise' Analyses et Synthèses No 122-2021 <https://acpr.banque-france.fr/en/analysis-and-synthesis-no-122-main-results-2020-climate-pilot-exercise>.

[32] European Systemic Risk Board (ESRB), 'Positively Green: Measuring Climate Change Risks to Financial Stability' (June 2020) <https://www.esrb.europa.eu//pub/pdf/reports/esrb.report200608_on_Positively_green_-_Measuring_climate_change_risks_to_financial_stability~d903a83690.en.pdf>.

[33] European Central Bank (ECB) and ESRB, 'Climate-related Risk and Financial Stability' (July 2021) <https://www.ecb.europa.eu/pub/pdf/other/ecb.climateriskfinancialstability202107~87822fae81.en.pdf>.

[34] Spyros Alogoskoufis and others, 'ECB Economy-wide Stress Test' European Central Bank, Occasional Paper No 281 (September 2021) <https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op281~05a7735b1c.en.pdf>.

[35] ECB, '2022 Climate Risk Stress Test' (July 2022) <https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.climate_stress_test_report.20220708~2e3cc0999f.en.pdf?d27896f699f13878870f2d26775db6ec>.

[36] European Banking Authority (EBA), 'Mapping Climate Risk: Main Findings From the EU-wide Pilot Exercise' EBA Report 2021/11 <https://www.eba.europa.eu/sites/default/documents/files/document_library/Publications/Reports/2021/1001589/Mapping%20Climate%20Risk%20-%20Main%20findings%20from%20the%20EU-wide%20pilot%20exercise%20on%20climate%20risk.pdf >.

[37] For a detailed list of concluded, ongoing, and planned scenario-based exercises by a group of NGFS members, see NGFS, 'Scenarios in Action. A progress report on global supervisory and central bank climate scenario exercises' (October 2021) <https://www.ngfs.net/sites/default/files/medias/documents/scenarios-in-action-a-progress-report-on-global-supervisory-and-central-bank-climate-scenario-exercises.pdf>.

[38] Board of Governors of the Federal Reserve System, *Financial Stability Report* (Board of Governors of the Federal Reserve System 2020) <https://www.federalreserve.gov/publications/files/financial-stability-report-20201109.pdf>.

[39] NGFS, 'NGFS Climate Scenarios for Central Banks and Supervisors' (2020) <https://www.ngfs.net/en/publications/ngfs-climate-scenarios>.

- Finally, though not a regulatory agency, the International Monetary Fund (IMF) has started including climate-related risks in its Financial Sector Assessment Programs.[40]

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 challenges in modelling climate-related risk, 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, 'economists should be less confident . . . and adopt a more modest tone that befits less robust policy advice'.[41]
- 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.[42]
- 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.[43]
- In the exercises that have been completed so far, the estimates of the impact of climate scenarios in terms of losses, regulatory capital, solvency ratios, etc span a very wide range from negligible 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'.[44] The 2021 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 per cent over the 30-year test horizon.[45] Such a wide range of results 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.[46]

[40] International Monetary Fund (IMF), *Philippines—Financial System Stability Assessment* (International Monetary Fund 2021) <https://www.imf.org/en/Publications/CR/Issues/2021/04/08/Philippines-Financial-System-Stability-Assessment-Press-Release-and-Statement-by-the-50347>; Pierpaolo Grippa and Samuel Mann, 'Climate-Related Stress Testing: Transition Risks in Norway' IMF Working Paper 20/232 <https://www.imf.org/-/media/Files/Publications/WP/2020/English/wpiea2020232-print-pdf.ashx>; and IMF, *United Kingdom—Financial Sector Assessment Program—Systemic Stress, and Climate-Related Financial Risks: Implications for Balance Sheet Resilience* (International Monetary Fund 2022) <https://www.imf.org/en/Publications/CR/Issues/2022/04/07/United-Kingdom-Financial-Sector-Assessment-Program-Systemic-Stress-and-Climate-Related-516264>.

[41] Weitzman (n 4).

[42] Kevin Stiroh, 'Climate Change and Risk Management in Bank Supervision' (Remarks at the conference on Risks, Opportunities, and Investment in the Era of Climate Change, Harvard Business School, 4 March 2020) <https://www.bis.org/review/r200309b.pdf>.

[43] Stefano Battiston and others, 'Accounting for Finance is Key for Climate Mitigation Pathways' (2021) 372 Science 918.

[44] Henk Jan Reinders, Dirk Schoenmaker and Mathis Van Dijk, 'A Finance Approach to Climate Stress Testing' (Centre for Economic Policy Research 2020) <https://cepr.org/active/publications/discussion_papers/dp.php?dpno=14609>.

[45] Alogoskoufis and others (n 34).

[46] John Cochrane, 'Testimony to the US Senate Committee on Banking, Housing, and Urban Affairs on Financial Regulation and Climate Change' (2021) <https://johnhcochrane.blogspot.com/2021/03/testimony-on-financial-regulation-and.html>.

These limitations mean that regulators can analyse 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 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'.[47] By translating, however imperfectly, the long-term and highly uncertain climate-related risks into quantitative 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.

2. 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).[48] Incorporating climate-related risks into the time (counter-cyclical) dimension of macroprudential policy is conceptually more difficult. But at least one researcher 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.[49] As regards microprudential supervision, there have been many proposals for 'greening' all three Pillars of the Basel III capital framework.[50] Figure 3 provides a high-level summary of these proposals.

Source: Cambridge Institute for Leadership Development and UNEPFI, 'Stability and Sustainability in Banking Reform: Are Environmental Risks Missing in Basel III?' (2014) 21 <www.unepfi.org/fileadmin/documents/StabilitySustainability.pdf>.

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 lend-

47 Bank of England (n 29).

48 Gruenewald (n 27); Dirk Schoenmaker and Rens van Tilburg, 'What Role for Financial Supervisors in Addressing Environmental Risks?' (2016) 58 Comparative Economic Studies; ESRB, *Too Late, Too Sudden: Transition to a Low-carbon Economy and Systemic Risk* Report of the Advisory Scientific Committee No 6 (European Systemic Risk Board 2016) <https://www.esrb.europa.eu//pub/pdf/reports/esrb.report200608_on_Positively_green_-_Measuring_climate_change_risks_to_financial_stability~d903a83690.en.pdf>.

49 Gruenewald (n 27).

50 See, eg, Patrick Bolton and others, 'The Green Swan: Central Banking in the Age of Climate Change' (Bank for International Settlements 2020) <https://www.bis.org/publ/othp31.htm>; Maria Berenguer, Michel Cardona and Julie Evain, 'Integrating Climate-Related Risks into Banks' Capital Requirements' (Institute for Climate Economics 2020) <https://wwfint.awsassets.panda.org/downloads/integratingclimate_etudeva.pdf>; and Maria J Nieto, 'Banks, Climate Risk and Financial Stability' (2019) 27 Journal of Financial Regulation and Compliance 243.

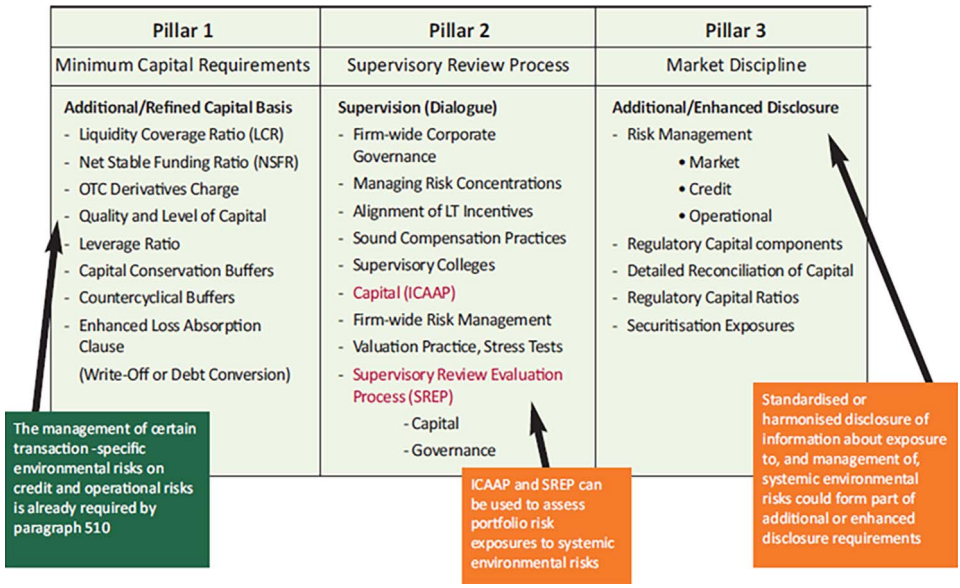

Figure 3. Proposed Adaptations of Basel III to Incorporate Climate-Related Risk

ing to 'green' sectors. EU policymakers, in particular, have seriously considered this step, as the capital framework for EU banks already includes similar 'SME supporting' and 'infrastructure supporting' factors.[51]

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).[52] Others have pointed out that since there is no robust empirical evidence that 'green' assets are less risky and can justify lower risk weights,[53] the GSF would result in an unwarranted weakening of banks' total capital base (and could also fuel a 'green' bubble). Instead, the BPF should be used alone, since 'the [climate] transition risks *will at some point* materialise'.[54] In either

[51] Valdis Dombrovskis, 'Greening Finance for Sustainable Business' (Speech by the Vice President of the European Commission, 12 December 2017) <https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_17_5235>; EU High Level Expert Group, 'Financing a Sustainable European Economy' Final Report 2018 by the EU High Level Expert Group on Sustainable Finance <https://ec.europa.eu/info/sites/info/files/180131-sustainable-finance-final-report_en.pdf>. It should be noted that in the EU context, introducing a GSF/BPF—as with the 'SME supporting' factor—would be a matter for the European Parliament and EU Council.

[52] Berenguer and others (n 50).

[53] See Stefano Giglio, Bryan T Kelly and Johannes Stroebel, 'Climate Finance' National Bureau of Economic Research (NBER) Working Paper 28226 (2020) <http://www.nber.org/papers/w28226> and Campiglio and others (n 27). 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, 'Physical Risk and Equity Prices', *Global Financial Stability Report April 2020* ((International Monetary Fund 2020) <https://www.imf.org/-/media/Files/Publications/GFSR/2020/April/English/ch5.ashx>. In addition, risk reductions that may appear linked to the 'green' nature of an exposure could be the result of other factors, such as government subsidies or tax advantages.

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 evidence-based and quantifiable economic risks and have questioned the wisdom of using the regulatory capital framework, which is supposed to protect financial stability, to finance the transition to low-carbon economy.[55]
- 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.[56] 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.[57] 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, 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.[58] While no respondents to these surveys reported specific barriers from a legal or enforcement perspective that prevent them from considering climate-related risks, most 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).

[54] François Villeroy de Galhau, 'Green Finance—A New Frontier for the 21st Century' (Speech by the Governor of the Bank of France at the International Climate Risk Conference for Supervisors, Amsterdam, 6 April 2018) <https://www.bis.org/review/r180419b.htm> (emphasis added); see also Arnoud Boot and Dirk Schoenmaker, 'Climate Change Adds to Risk for Banks, but EU Lending Proposals Will Do More Harm than Good' *Bruegel* (2018) <https://www.bruegel.org/2018/01/climate-change-adds-to-risk-for-banks-but-eu-lending-proposals-will-do-more-harm-than-good>; Greg Ford, 'A Green Supporting Factor Would Weaken Banks and Do Little for the Environment' *Finance Watch* (2108) <https://www.finance-watch.org/a-green-supporting-factor-would-weaken-banks-and-do-little-for-the-environment>.

[55] Institute of International Finance, 'Prudential Pathways: Industry Perspectives on Supervisory and Regulatory Approaches to Climate-related and Environmental Risks' (January 2021) <https://www.iif.com/Portals/0/Files/content/Regulatory/01_21_2021_prudential_pathways.pdf>; Manesh Samtani, 'Climate Risk and Regulation: A Race to the Top' (Interview with Bill Coen, Chair of the IFRS Advisory Council and former BCBS Secretary General, Regulation Asia, 2021) <https://www.regulationasia.com/climate-risk-regulation-a-race-to-the-top>; Otso Manninen and Nea Tiililä, 'Could the Green Supporting Factor Help Mitigate Climate Change?' Bank of Finland Bulletin (13 July 2020) <https://www.bofbulletin.fi/en/2020/articles/could-the-green-supporting-factor-help-mitigate-climate-change>.

[56] BCBS, *Regulatory Consistency Assessment Programme (RCAP)—Assessment of Basel III regulations—European Union* (Bank for International Settlements 2014) <https://www.bis.org/bcbs/publ/d300.htm>.

[57] Kern Alexander and Paul Fisher, 'Banking Regulation and Sustainability'(2018) <https://ssrn.com/abstract=3299351>; NGFS, 'Guide for Supervisors: Integrating Climate-related and Environmental Risks into Prudential Supervision' NGFS Technical Document (May 2020) 57, Box 26 <https://www.ngfs.net/sites/default/files/medias/documents/ngfs_guide_for_supervisors.pdf>.

[58] Financial Stability Board (FSB), 'Stocktake of Financial Authorities' Experience in Including Physical and Transition Climate Risks as Part of Their Financial Stability Monitoring' (July 2020) <https://www.fsb.org/wp-content/uploads/P220720.pdf>; BCBS, *Climate-related Financial Risks: A Survey on Current Initiatives* (Bank for International Settlements 2020) <https://www.bis.org/bcbs/publ/d502.pdf>.

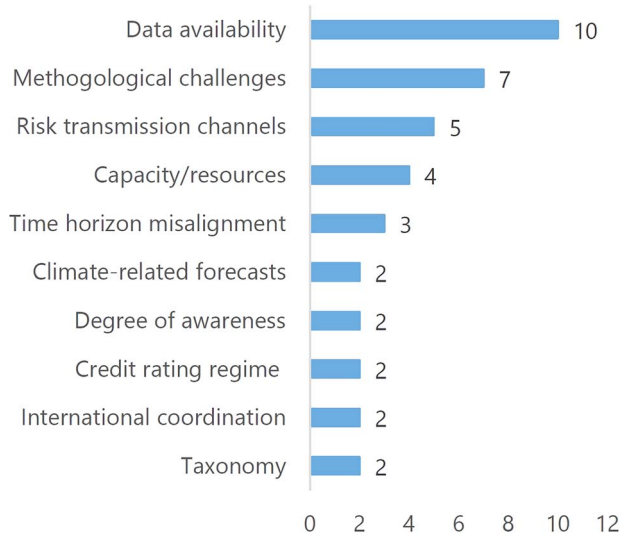

Figure 4. Key Challenges in Incorporating Climate-Related Risks in the Supervisory Process (responses by jurisdictions)

Source: Basel Committee on Banking Supervision, *Climate-related Financial Risks: A Survey on Current Initiatives* (Bank for International Settlements 2020) 4 <https://www.bis.org/bcbs/publ/d502.pdf>.

Nevertheless, most financial supervisors have acted to build awareness of climate issues among the firms they supervise through publicly signalling 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 PRA and the Financial Conduct Authority (FCA).

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 not always legally binding but is often principle-based guidelines or interpretations of existing rules. The type of 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 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.[59] Some regulators have also introduced standards for the incorporation of ESG risks in banks' financial disclosures under the third Pillar of the Basel framework.[60]

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

[59] BCBS (n 58); see also the case studies in NGFS, 'Guide for Supervisors: Integrating Climate-related and Environmental Risks into Prudential Supervision' NGFS Technical Document (May 2020) <https://www.ngfs.net/sites/default/files/medias/documents/ngfs_guide_for_supervisors.pdf>.

[60] See, eg, EBA, 'Final draft implementing technical standards on prudential disclosures on ESG risks in accordance with Article 449a CRR' (24 January 2022).

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'.[61] 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'.[62] The European Commission launched a 'sustainable finance package' that includes regulatory measures on sustainability risks and factors to be considered by insurance and reinsurance companies and other non-bank financial institutions; as well as a 'comprehensive review package' of Solvency II rules that would introduce sustainability risks into insurance prudential regulation. The latter is currently under consideration by EU legislators.[63]

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 analyse climate-related risks; incorporate these risks 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.[64] The 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'.[65] This is a clear case of banks being guided to take steps voluntarily in anticipation of future regulatory action.

Regulatory and supervisory action in this area requires striking a fine balance between opposite risks: at one end of the spectrum ('deferential transition'), supervisors could simply push banks to develop better internal capacities to manage climate-related risk, while limiting their own role to enforcement of the rules—at the risk, though, of limited effectiveness; at the other end ('guided transition'), regulatory authorities could actively specify what types of investments are compatible with the climate mitigation objectives—but at the risk of getting drawn into a more political role, as discussed in more detail below, without the necessary democratic legitimization to do so.[66]

Efforts in securities supervision are relatively less advanced at this stage. In a report covering 145 European issuers, the European Securities and Markets Authority (ESMA) concluded that

[61] IAIS, 'Issues Paper on Climate Change Risks in the Insurance Sector' (2018) <https://www.iaisweb.org/uploads/2022/01/180727-SIF-IAIS-Issues-Paper-on-Climate-Changes-Risk.pdf>.

[62] PRA, 'Enhancing Banks' and Insurers' Approaches to Managing the Financial Risks from Climate Change' PRA Supervisory Statement SS3/19 <https://www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/supervisory-statement/2019/ss319>.

[63] European Commission, 'Sustainable Finance Package' (2021) <https://ec.europa.eu/info/publications/210421-sustainable-finance-communication_en>; and European Commission, 'Communication from the Commission to the European Parliament and the Council on the review of the EU prudential framework for insurers and reinsurers in the context of the EU's post pandemic recovery' COM/2021/580 Final <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0580>.

[64] PRA (n 62); ECB, 'Guide on Climate-Related and Environmental Risks: Supervisory Expectations Relating to Risk Management and Disclosure' (November 2020) <https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.202011finalguideonclimate-relatedandenvironmentalrisks~58213f6564.en.pdf>.

[65] EBA, 'Action Plan on Sustainable Finance' (6 December 2019) <https://www.eba.europa.eu/sites/default/documents/files/document_library/EBA%20Action%20plan%20on%20sustainable%20finance.pdf>.

[66] Agnieszka Smoleńska and Jens van 't Klooster, 'A Risky Bet: Climate Change and the EU's Microprudential Framework for Banks' (2022) 8 Journal of Financial Regulation 51.

only a few sectors and companies incorporate climate-related elements in their corporate reporting and proposed that the European Commission support the creation of a single set of international standards for ESG disclosures.[67] Along similar lines, the US Commodity Futures Trading Commission (CFTC), noting that material climate risks must be disclosed under existing US 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.[68]

From a more general perspective, incorporating climate-related risks into micro- and macro-prudential policy 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.

3. CLOSING INFORMATION GAPS, IMPROVING DISCLOSURE, PROMOTING STANDARDS

The preceding discussion has made clear that 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 includes four recommendations on the collection, analysis, reporting, and governance of climate-related data and risk metrics.[69]
- The International Association of Securities Commissions (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'.[70]
- 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

[67] European Securities and Markets Authority (ESMA), 'Enforcement and Regulatory Activities of European Enforcers in 2019' Report 32-63-846 (2 April 2020) <https://www.esma.europa.eu/sites/default/files/library/esma32-63-846_2019_activity_report.pdf>.

[68] Commodity Futures Trading Commission (CFTC), *Managing Climate Risk in the U.S. Financial System* (Commodity Futures Trading Commission 2020).

[69] Task Force on Climate-related Financial Disclosures (TCFD), 'Recommendations of the Task Force on Climate-related Financial Disclosures' (June 2017) <https://www.fsb-tcfd.org/publications/final-recommendations-report>.

[70] International Organization of Securities Commissions (IOSCO), 'Statement on Disclosure of ESG Matters by Issuers' IOSCO Statement (18 January 2019) <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD619.pdf>.

disclosures and complement generally accepted financial accounting principles (GAAP), as well as a prototype of a climate-related financial disclosure standard.[71]

- The NGFS issued a 'Progress Report on Bridging Data Gaps' that proposes a strategy centred 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.[72]
- The European Commission published in 2017 non-binding guidelines for climate-related reporting supplementing its Non-Financial Reporting Directive (NFRD) (Directive 2014/95/EU) that applies to large companies (over 500 employees) domiciled in the EU. After a public consultation, a proposal for revisions to NFRD is under consideration by EU legislature. The proposed revisions would extend the scope of reporting to all large companies and all companies listed on regulated markets and they would embed in regulation the criterion of *double materiality*, ie 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.[73]

In view of these overlapping global initiatives, the International Financial Reporting Standards (IFRS) Foundation announced at COP26 the formation of an International Sustainability Standards Board (ISSB).[74] 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. In March 2022, the ISSB launched a public consultation on a set of proposed standards (on general sustainability-related disclosure requirements and climate-related disclosure requirements), following which it will finalize and endorse them.[75] 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 the growth in 'green' bonds have 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 (Table 1).

Most of these initiatives have major shortcomings in the areas of transparency, coherence, governance, and accountability. Many financial products are labelled by their issuers or managers as 'ESG', 'green', or 'sustainable' without a clear link to how the product is contributing to

[71] '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 (11 September 2020) <https://bit.ly/35qx8KH>.

[72] NGFS, 'Progress Report on Bridging Data Gaps' NGFS Technical Document (26 May 2021) <https://www.ngfs.net/en/progress-report-bridging-data-gaps>.

[73] European Union, 'Proposal for a Directive of the European Parliament and of the Council amending Directive 2013/34/EU, Directive 2004/109/EC, Directive 2006/43/EC and Regulation (EU) No 537/2014, as regards corporate sustainability reporting' COM/2021/189 final (2021) <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021PC0189>.

[74] 'IFRS Foundation announces International Sustainability Standards Board, consolidation with CDSB and VRF, and publication of prototype disclosure requirements' Press Release (3 November 2021) <https://www.ifrs.org/news-and-events/news/2021/11/ifrs-foundation-announces-issb-consolidation-with-cdsb-vrf-publication-of-prototypes>.

[75] See <https://www.ifrs.org/news-and-events/news/2022/03/issb-delivers-proposals-that-create-comprehensive-global-baseline-of-sustainability-disclosures>.

Table 1. ESG-Related Initiatives for Companies, Investors, Issuers, and Asset Managers.

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

Source: IOSCO, *Sustainable Finance and the Role of Securities Regulators and IOSCO—Final Report* IOSCO Report FR/04/2020 (2020) 9 <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD652.pdf>.

environmental objectives. Most of these classification schemes make no provision for an independent external evaluation of compliance or for a process for certifying that self-reporting has been prepared in accordance with any particular standards. As a result, different providers often come up with different ratings for the same companies.[76] The lack of consistency and rigor in defining and applying 'green' criteria risks undermining the credibility of these classifications.[77] Emerging evidence of extensive 'greenwashing'[78] and the probes launched in the summer of 2021 by US and German regulators into Germany's DWS for mis-labelling 'green' financial products underscore these concerns.[79]

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.[80]

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

- The EU introduced in 2020 a Framework to Facilitate Sustainable Investment—the so-called 'Taxonomy Regulation' (Regulation (EU) 2020/852). This Regulation, which followed and amended the Sustainability-Related Disclosures Regulation (Regulation (EU) 2019/2088), 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

[76] Sarah Murray, 'Navigating the thicket of ESG metrics' *Financial Times* (24 October 2021).

[77] NGFS, 'Sustainable Finance Market Dynamics' NGFS Technical Document (31 March 2021) <https://www.ngfs.net/en/report-sustainable-finance-market-dynamics>; Organization for Economic Co-operation and Development (OECD), 'ESG Investing: Practices, Progress and Challenges' (OECD 2020) <http://www.oecd.org/finance/ESG-Investing-Practices-Progress-Challenges.pdf>.

[78] Noël Amenc, Felix Goltz and Victor Liu, 'Doing Good or Feeling Good? Detecting Greenwashing in Climate Investing' (EDHEC Business School 2021) <https://www.edhec.edu/sites/www.edhec-portail.pprod.net/files/210921-1_doing_good_or_feeling_good.pdf>.

[79] Attracta Mooney and Chris Flood, 'DWS Probes Spark Fears of Greenwashing Claims Across Industry' *Financial Times* (31 August 2021).

[80] IOSCO (n 70).

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 for sustainability. In addition, in June 2020, the People's Bank of China (PBoC), the China Securities and Regulatory Commission (CSRC), and the National Development and 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 and the International Platform on Sustainable Finance (IPSF)—founded in 2019 by the EU, China, and other six countries and now counting 18 members—have published comparisons of the EU and Chinese standards.[81] Canada, South Africa, and Malaysia are reportedly considering similar initiatives.[82]

Notwithstanding the broad agreement on the need for shared and meaningful taxonomies that facilitate transparency and consistent disclosure, mandatory taxonomies have serious pitfalls.[83]

- 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.[84] This type of funds would be penalized under a green taxonomy.
- Second, they tend to be binary (green/brown), thus failing to adequately reflect the more nuanced reality of the transition to a low-carbon economy. This has been brought into full evidence by the intense controversy that surrounded the decision by the European

[81] Climate Bonds Initiative, 'Comparing China's Green Bond Endorsed Project Catalogue and the Green Industry Guiding Catalogue with the EU Sustainable Finance Taxonomy' (September 2019) <https://www.climatebonds.net/files/reports/comparing_chinas_green_definitions_with_the_eu_sustainable_finance_taxonomy_part_1_en_final.pdf>; International Platform on Sustainable Finance, 'Common Ground Taxonomy—Climate Change Mitigation' (IPSF Taxonomy Working Group Co-chaired by the EU and China 2021) <https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/211104-ipsf-common-ground-taxonomy-instruction-report-2021_en.pdf>.

[82] Government of Canada, 'Final Report of the Expert Panel on Sustainable Finance' (2019) <https://www.canada.ca/en/environment-climate-change/services/climate-change/expert-panel-sustainable-finance.html>; Will Martindale, 'Taxonomies a revolutionary shift in ESG' *Top 1000 Funds* (18 September 2020) <https://www.top1000funds.com/2020/09/taxonomies-a-revolutionary-shift-in-esg>.

[83] Discussed in, among others, Organisation for Economic Co-Operation and Development, 'Developing Sustainable Finance Definitions and Taxonomies, Green Finance and Investment' (2020) <https://doi.org/10.1787/134a2dbe-en>; Simon Ogus, 'ESG Criteria Are Distorting Markets and Portfolio Decisions' *OMFIF Commentary* (16 March 2021) <https://www.omfif.org/2021/03/esg-criteria-are-distorting-markets-and-portfolio-decisions>; Elliot Hentov, 'Biden Impact on ESG Investing Will Go Deeper than Climate' *OMFIF Commentary* (3 March 2021) <https://www.omfif.org/2021/03/biden-impact-on-esg-investing-will-go-deeper-than-climate>; and Ben Caldecott, '"Encourages laziness and disincentives ambition": Ben Caldecott shares his thoughts on the EU's green taxonomy' *Responsible Investor* (14 June 2019) <https://www.responsible-investor.com/articles/encourages-laziness-and-disincentives-ambition-ben-caldecott-shares-his-tho>.

[84] IMF, 'Investment Funds: Fostering the Transition to a Green Economy' *Global Financial Stability Report October 2021* (International Monetary Fund 2021) <https://www.imf.org/-/media/Files/Publications/GFSR/2021/October/English/ch3.ashx>.

Parliament to include nuclear energy and gas in the EU Taxonomy. Nuclear energy is a low-carbon technology and its revamping is considered by some to be a crucial ingredient of any realistic decarbonization strategy,[85] while others see it as fundamentally incompatible with the principle of 'do no significant harm' (to environmental objectives other than climate change mitigation) that lies at the foundation of the taxonomy.[86] Natural gas is seen by some as a 'bridge fuel' between coal (which is almost twice as carbon-intensive) and renewables,[87] but by others as a way to perpetuate the economy's carbon addiction.[88] A binary framework, such as the EU Taxonomy, fails to reconcile these opposite views, while amplifying the influence of mutually incompatible ideological stances in what should be an essentially pragmatic decision.

- Third, they tend to be static, 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.[89] However, translating reliably and transparently these dynamic pathways for specific activities to targets for individual corporations, which often operate many different activities, is a major conceptual and practical challenge.
- Fourth, these taxonomies can be applied to publicly traded 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.[90] 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, which they resemble, mandatory taxonomies could be swayed by industry lobbying or be used to promote political agendas.[91]

Nonetheless, in the absence of 'first-best' policies for climate change mitigation (notably carbon taxes), it has been argued that a disclosure-based regulatory strategy could make a positive contribution.[92]

III. BRAVE NEW WORLD: SHOULD FINANCIAL POLICY AND REGULATION PROMOTE LOW-CARBON TRANSITION?

All the initiatives discussed thus far share an underlying preoccupation: they seek to safeguard the established goals of financial policy and regulation in the face of a new reality: climate change

[85] International Energy Agency (IEA), 'Nuclear Power and Secure Energy Transitions' (June 2022) <https://www.iea.org/reports/nuclear-power-and-secure-energy-transitions?utm_content=bufferf8ae1&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer>.

[86] See Mehreen Khan, 'Scientists Lambast EU over Gas and Nuclear's "Green" Energy Label' *Financial Times* (21 January 2022).

[87] IEA, 'The Role of Gas in Today's Energy Transitions' (July 2019) <https://www.iea.org/reports/the-role-of-gas-in-todays-energy-transitions>.

[88] Greg Muttitt, 'Gas Is Not a Bridge Fuel, It's a Wall. So Why Are Governments Still Financing It?' (International Institute for Sustainable Development, 10 June 2021).

[89] The EU taxonomy tries to address this issue by setting thresholds for 'contributing to environmental objectives' that are to be updated by the European Commission in line with technological advances.

[90] Private Equity Stakeholder Project, 'Private Equity Propels the Climate Crisis' (October 2021) <https://pestakeholder.org/wp-content/uploads/2021/10/PESP_SpecialReport_ClimateCrisis_Oct2021_Final.pdf>.

[91] On the latter, see, eg, Danae Kyriakopoulou, David Marsh and Mark Sobel, 'Biden's Climate Challenges: China, Data, Turf Wars' *OMFIF Commentary* (21 April 2021) <https://www.omfif.org/2021/04/bidens-climate-challenges-china-data-turf-wars>.

[92] Sebastian Steuer and Tobias H Tröger, 'The Role of Disclosure in Green Finance' (2022) 8 Journal of Financial Regulation 1.

and the concomitant imperative to transition towards a low-carbon economy. 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. Critics have pointed out that in the face of climate change, which arguably represents an urgent threat to humanity, 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.

According to this view, central bankers and financial 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 regulators should (i) lead by example, taking steps to make their own operations 'greener'; and (ii) use all tools at their disposal to influence private investment and credit allocation decisions so as to promote decarbonization in the economy. This would involve, inter alia, directing credit 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.[93]

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;[94] the Banque de France published a 'Responsible Investment Charter' in 2018, followed by annual 'Responsible Investment Reports';[95] the Sveriges Riksbank published a sustainability strategy;[96] the Bank of England started publishing a climate-related financial disclosure report in line with the recommendations of the TCFD;[97] and the Dutch central bank started including this information in its Annual Report.[98]

[93] See, eg, Schoenmaker and van Tilburg (n 48); Ulrich Volz, 'On the Role of Central Banks in Enhancing Green Finance' UNEP Inquiry Working Paper 7/01 <https://unepinquiry.org/wp-content/uploads/2017/02/On_the_Role_of_Central_Banks_in_Enhancing_Green_Finance.pdf>; Finance Watch, 'Report—Breaking the Climate-Finance Doom Loop' (June 2020) <https://www.finance-watch.org/wp-content/uploads/2020/06/Breaking-the-climate-finance-doom-loop_Finance-Watch-report.pdf>; Mariana Mazzucato, Josh Ryan-Collins and Asker Voldsgaard, 'Central Bank's Green Mission' *Project Syndicate* (8 December 2020) <https://www.project-syndicate.org/commentary/central-banking-green-transition-climate-change-by-mariana-mazzucato-et-al-2020-12>; Nick Robins, Simon Dikau and Ulrich Volz, 'Net-Zero Central Banking: A New Phase in Greening the Financial System' (Grantham Research Institute, LSE, and Centre for Sustainable Finance, SOAS, University of London 2021) <https://www.lse.ac.uk/granthaminstitute/publication/net-zero-central-banking-a-new-phase-in-greening-the-financial-system>.

[94] Banca d'Italia, 'Rapporto Ambientale 2020' (2020) <https://www.bancaditalia.it/pubblicazioni/rapporto-ambientale/2020-rapporto-ambientale/index.html>.

[95] Banque de France, 'Charte d'Investissement Responsable de la Banque de France' (2018) <https://www.banque-france.fr/sites/default/files/media/2018/03/29/818080_-charte-invest_en_2018_03_28_12h12m41.pdf>; Banque de France, 'Rapport d'Investissement Responsable' (2021) <https://www.banque-france.fr/sites/default/files/medias/documents/rapport_investissement_responsable_2020.pdf>.

[96] Sveriges Riksbank, 'Sustainability Strategy for the Riksbank' (2020) <https://www.riksbank.se/globalassets/media/riksbanken/hallbarhetsstrategi/engelska/sustainability-strategy-for-the-riksbank.pdf>.

[97] Bank of England, 'The Bank of England's Climate-related Financial Disclosure 2020' (2020) <https://www.bankofengland.co.uk/-/media/boe/files/annual-report/2020/climate-related-financial-disclosure-report-2019-20.pdf?hash=5DA959C54540287A2E90C823807E089055E6721B&la=en>.

[98] De Nederlandsche Bank, 'Annual Report 2020' (2021) <https://www.dnb.nl/media/odydkcui/jaarverslag2020.pdf>.

In contrast, the proposal to use regulatory tools actively to promote decarbonization in the economy is more controversial. 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. However:

- Advocates of a 'promotional' role for central banks and financial regulators have argued that in many cases, it is indeed consistent with their existing mandates. While only a few have an explicit mandate to promote sustainable growth, many are tasked to support their governments' policy objectives, often as a subordinate goal conditioned on not interfering with their primary goals.[99] Since many governments have adopted climate mitigation targets, advocates argue that central banks and regulatory authorities in many jurisdictions do not need additional or modified mandates to play a 'promotional' role in the transition to a low-carbon economy.
- Moreover, in cases where a 'promotional' role is not permitted by the existing mandates, these can be updated. Historically, central bank and regulatory agency mandates have evolved considerably, and often in response to crises: for example, the global financial crisis prompted an expansion of these mandates to cover systemic stability. Whether this took the form of a revised legal 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 expanded to enable them—indeed compel them—to contribute to the transition to a low-carbon economy.[100]

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, if a 'Green Supporting Factor' were used to adjust RWAs).[101] 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.[102] 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

[99] Simon Dikau and Ulrich Volz, 'Central Bank Mandates, Sustainability Objectives and the Promotion of Green Finance' (2021) 184 Ecological Economics 107022, examined the charters of 133 central banks and showed that about half are directly or indirectly mandated to support their national governments' national policy objectives.

[100] The EU, for example, has extended the mandates of its supervisory agencies to include sustainability by obliging them to consider environmental, social, and governance factors (ESG) in the course of their duties. See Nathan De Arriba-Sellier, 'Turning Gold into Green: Green Finance in the Mandate of European Financial Supervision' (2021) 58 Common Market Law Review 1097.

[101] As illustrated in Berenguer and others (n 50).

[102] EBA, 'EBA Report on SMEs and SME Supporting Factor' EBA Report 2016/04 <https://www.eba.europa.eu/sites/default/documents/files/documents/10180/1359456/602d5c61-b501-4df9-8c89-71e32ab1bf84/EBA-Op-2016-04%20%20Report%20on%20SMEs%20and%20SME%20supporting%20factor.pdf>.

projects.[103] In addition, a sudden and sizeable differentiation of capital requirements between 'green' and 'brown' projects could increase financial stability risks.[104] 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.[105]

In conclusion, the merits of the proposal to task financial regulation 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'.[106] 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 and 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 it is unlikely to have a real-world impact.

Not surprisingly, central banks and financial regulators seem so far reluctant to adopt a more active 'promotional' role. They continue to approach the consequences of climate change primarily through the lens of risk management for the financial sector.[107] As the Bank of England has concluded, regulatory tools—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.[108]

IV. 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

[103] Benjamin Chamberlin and Julie Evain, 'Indexing Capital Requirements on Climate: What Impacts Can Be Expected' (Institute for Climate Economics (I4CE) 2021) <https://www.i4ce.org/en/publication/indexing-capital-requirements-on-climate-what-impacts-can-be-expected>.

[104] Yiannis Dafermos and Maria Nikolaidi, 'How Can Green Differentiated Capital Requirements Affect Climate Risks? A Dynamic Macrofinancial Analysis' (2021) 54 Journal of Financial Stability 100871.

[105] Francesca Diluiso and others, 'Climate Actions and Stranded Assets: The Role of Financial Regulation and Monetary Policy' CESifo Working Paper No 8486 (Center for Economic Studies and Ifo Institute 2020) <https://www.econstor.eu/handle/10419/223558>.

[106] Dirk Schoenmaker and Stanislas Jourdan, 'Foreword' in Jens van 't Klooster and Rens van Tilburg, 'Targeting a Sustainable Recovery with Green TLTROs' (Positive Money Europe 2020) <http://www.positivemoney.eu/wp-content/uploads/2020/09/Green-TLTROs.pdf>.

[107] See, eg, Frank Elderson, 'Integrating the Climate and Environmental Challenge into the Missions of Central Banks and Supervisors' (Speech by Frank Elderson, Member of the Executive Board of the ECB at the 8th Conference on the Banking Union, Goethe University, 23 September 2021) <https://www.ecb.europa.eu/press/key/date/2021/html/ecb.sp210923~0c7bd9c596.en.html>. Other central bankers and regulators have also cautioned against adopting a 'promotional' role, for example, Jens Weidmann, 'Climate Change and Central Banks' (Address by the President of the Deutsche Bundesbank and Chairman of the Board of Directors of the Bank for International Settlements at the Deutsche Bundesbank's second financial market conference, Frankfurt am Main, 29 October 2019) <https://www.bis.org/review/r191029a.htm>; and Peter Laca, 'Central Banks Can't Fix Climate Change, Czech Policy Maker Says' *Bloomberg* (18 February 2021).

[108] PRA, 'Climate-related Financial Risk Management and the Role of Capital Requirements—PRA Climate Adaptation Report 2021' (28 October 2021) <https://www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/publication/2021/october/climate-change-adaptation-report-2021.pdf?la=en&hash=FF4A0C618471462E10BC704D4AA58727EC8F8720>.

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 favour '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.[109] The MSCI Global Alternative Energy Index has reached a market cap of about 15 per cent of the global energy sector, up from 6.4 per cent in 2010. Alternative energy equity exchange-traded funds (ETFs) have shown a similar growth.[110] 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 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 they have a higher expected return that compensates for their higher environmental risk. 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.[111]
- 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, but 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 to changes in the cost of finance. Therefore, a transition to a higher interest rate environment could aggravate volatility in the prices of these stocks, at least temporarily.
- Moreover, 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 depends on the supply of a small group of minerals, such as graphite, lithium, and nickel, used in energy storage; palladium for hydrogen fuel cells; and

[109] Billy Nauman, '"Green Bubble" Warnings Grow as Money Pours into Renewables' *Financial Times* (19 February 2021).

[110] Data from MSCI Global Alternative Energy Index <https://www.msci.com/documents/10199/40bd4fec-eaf0-4a1b-bfc3-8ed5c154fe3c>, MSCI World Energy Index <https://www.msci.com/documents/10199/de6dfd90-3fcd-42f0-aaf9-4b3565462b5a>, and ETF Database <https://etfdb.com/etfdb-category/alternative-energy-equities/#etfs__returns%26sort_nam e%3Dassets_under_management%26sort_order%3Ddesc%26page%3D1>.

[111] Patrick Bolton and Marcin T Kacperczyk, 'Do Investors Care about Carbon Risk?' European Corporate Governance Institute (ECGI) Finance Working Paper 711/2020 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3398441>; Joachim Klement, 'Are We Seeing a Green Bubble Forming?' *The Evidence Based Investor* (3 February 2020) <https://www.evidenceinvestor.com/are-we-seeing-a-green-bubble-forming>; Maximilian Goergen and others, *Carbon Risk* (2020) <https://ssrn.com/abstract=2930897>.

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 2°C from pre-industrial levels, as called for by the Paris Agreement, demand for 17 specific minerals would quadruple by 2050.[112] 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.[113] 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.[114] Volatility in such a context could have ramifications that extend well beyond the financial system.

- Finally, 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 maintained throughout the long process of replacing fossil fuel resources with sustainable ones, volatility in energy markets is likely to remain high.

In such a complex environment, central banks and financial regulators have to tread a fine line. While they should not necessarily aim at dampening volatility in financial, commodity, or energy markets or preventing overstretched valuations in the 'green' sector, measures that unintentionally amplify this volatility (for example, if central banks' asset purchases are tilted toward 'green' securities while their supply is still limited) can be destabilizing and ultimately counterproductive: excessive volatility of 'green' asset prices could temporarily dampen investment flows into the sector and delay urgently needed progress toward decarbonization. Moreover, as the discussion of commodity and energy markets highlights, such measures could have repercussions that extend well beyond the financial system.

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'.[115] The crisis and the Great Recession that followed prompted an overhaul of central banking and regulatory frameworks. 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—

[112] World Bank, 'Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition' (2020) <https://pubdocs.worldbank.org/en/961711588875536384/Minerals-for-Climate-Action-The-Mineral-Intensity-of-the-Clean-Energy-Transition.pdf>.

[113] Andy Home, 'Goldman Proclaims the Dawn of a New Commodity Super-Cycle' *Reuters* (5 January 2021).

[114] Ethan N Elkind, Patrick RP Heller and Ted Lamm, 'Sustainable Drive Sustainable Supply: Priorities to Improve the Electric Vehicle Battery Supply Chain' (Berkeley Law, July 2020) <https://www.law.berkeley.edu/research/clee/research/climate/transportation/building-a-sustainable-electric-vehicle-battery-supply-chain>.

[115] Mervyn King, 'Balancing the Economic See-Saw' (Speech by the Deputy Governor of the Bank of England, 14 April 2000) <https://www.bankofengland.co.uk/-/media/boe/files/speech/2000/balancing-the-economic-see-saw>.

and prompted a search for new governance and accountability arrangements.[116] 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,[117] climate mitigation is not a task that can—or should—be delegated to technocratic agencies, like a central bank or a regulator, as it does not meet the conditions for such delegation.[118] A collective effort of such magnitude and far-reaching economic and distributional repercussions should be mediated by the political process.

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.[119] But for real-life central bankers and regulators, it is a major risk: it would divert attention and resources from the pursuit of their core mandates; it would raise difficult technical trade offs in the targeting of their tools, as illustrated in the previous section; and it would create a pressing need for greater accountability for achieving the new objectives, as well as the spectre of greater political and public scrutiny of their activities.[120]

Failures of broader policy coordination also create risks for the financial system that could reflect back on central bankers and financial regulators. Financial policy and regulation cannot deliver the transition to a low-carbon economy by itself: broader policy efforts and investments are needed 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.[121] If central banks and regulators move ahead on their own but, despite their stated intentions, 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 regulators—towards 'green' finance but governments fail to follow through with changes in carbon pricing. Such an outcome would prevent the change in relative prices needed to sustain the transition[122] and would deprive the market of the 'critical signal for re-directing private investment and innovation to clean technologies, and to incentivize energy efficiency'.[123] 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

[116] Paul Tucker, *Unelected Power* (Princeton University Press 2018); Ed Balls, James Howat and Anna Stansbury, 'Central Bank Independence Revisited: After the Financial Crisis, What Should a Model Central Bank Look Like?' Mossavar-Rahmani Center for Business & Government Working Paper, Harvard Kennedy School (2018) <https://www.hks.harvard.edu/sites/default/files/centers/mrcbg/files/67_central.bank.v.2.pdf>; Charles Bean, 'Central Banking After the Great Recession' (2018) 38 Economic Affairs 2.

[117] Dimitri G Demekas, 'Building an Effective Financial Stability Policy Framework: Lessons from the Post-Crisis Decade' (London School of Economics and Political Science 2019) <http://eprints.lse.ac.uk/100483/3/Building_an_effective_financial_stability_policy_framework.pdf>.

[118] Alberto Alesina and Guido Tabellini, 'Bureaucrats or Politicians? Part I: A Single Policy Task' (2007) 97 American Economic Review 169; and 'Bureaucrats or Politicians? Part II: Multiple Policy Tasks' (2008) 92 Journal of Public Economics 426.

[119] Robins and others (n 93); Mazzucato and others (n 93).

[120] James Mackintosh, 'The Downsides of Central Bank Mission Creep' *Wall Street Journal* (18 June 2019); Merryn Somerset Webb, 'Central Banks Need to Stop the Mission Creep' *Financial Times* (27 August 2021).

[121] IMF, 'World Economic Outlook October 2020: A Long and Difficult Ascent' (2020) <https://www.imf.org/-/media/Files/Publications/WEO/2020/October/English/text.ashx>; Group of Thirty, 'Mainstreaming the Transition to a Net-Zero Economy' (2020) <https://group30.org/images/uploads/publications/G30_Mainstreaming_the_Transition_to_a_Net-Zero_Economy.pdf>.

[122] Jean Pisany-Ferry, 'Central Banking's Brave New World' *Project Syndicate* (23 February 2021) <https://www.project-syndicate.org/commentary/central-banking-brave-new-world-inequality-climate-change-by-jean-pisani-ferry-2021-02>.

[123] Kristalina Georgieva, 'Remarks by IMF Managing Director on Global Policies and Climate Change' (International Conference on Climate, Venice, 11 July 2021) <https://www.imf.org/en/News/Articles/2021/07/11/sp071121-md-on-global-policies-and-climate-change>.

regulation.[124] And the inevitable backlash would be directed toward central banks and financial regulators.[125]

V. CONCLUDING OBSERVATIONS

The reality of climate change and the increasing political support for moving 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. Central bankers and financial regulators need to understand the implications 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 is easy. In addition, at least in some jurisdictions, they are increasingly pushed to play a more active role promoting the 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 may be willing 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, these 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 will create difficult operational trade offs 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 fuelling market volatility, overstretched asset valuations, or even a commodity super-cycle—which appears 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 well beyond the financial system.

These challenges are neither unprecedented nor insuperable, but they are significant. 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. 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

[124] James Vaccaro and David Barmes, 'Financial Stability in a Planetary Emergency: The Role of Banking Regulators in a Burning World' (Climate Safe Lending Network 2021) <https://www.climatesafelending.org/s/6-Financial-Stability-Planetary-Emergency.pdf>.

[125] Mervyn King and Dan Katz, 'Central Banks Are Risking Their Independence' *Bloomberg Opinion* (23 August 2021) <https://www.bloomberg.com/opinion/articles/2021-08-23/central-banks-are-risking-their-independence-mervyn-king-dan-katz>.

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, they face political pressure to step into the breach and take on the new challenge of the times. 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'.