



TACKLING CLIMATE CHANGE

The role of banking
regulation and
supervision

3 FOREWORDS

6 EXECUTIVE SUMMARY

Getting ready for green regulation

Financial institutions, investors and other market participants must prepare for radical changes in the regulatory and investment landscape.

8 CHAPTER ONE

A threat to stability

Most central banks acknowledge that climate change is a major threat to financial stability. However, opinions vary on whether they should take action, and some are struggling to reconcile their climate ambitions with their mandates.

12 STATE OF PROGRESS

14 CHAPTER TWO

Tools for better regulation

Central banks are investigating the application of market-fixing and market-shaping initiatives to bolster sustainable investments. Setting out some uniform 'green' taxonomies is considered a crucial yet challenging initial step in the right direction.

19 FOCUS ON GREEN FINANCE

22 FOCUS ON MONETARY POLICY

24 CHAPTER THREE

Facing the future

Policy-makers are investing more time and resources into the field of climate-risk supervision, but remain hamstrung by scant and often poor-quality data. Problems arise at all stages, from the country level down to individual company disclosures.

28 CASE STUDIES: REGULATORY APPROACHES TO CLIMATE RISKS

34 APPENDIX

Preparing for radical change



Rudi Lang
Mazars

THE battle against climate change is all-pervasive and all-encompassing. A campaign once viewed as narrowly esoteric has, within a few short years, broadened and intensified into an all-out global crusade linking the strata of politics, business and public affairs. Funding corporations and governments that both contribute to and can mitigate climate change, banks and financial institutions are caught in the maelstrom. Furthermore, governments have thrust central banks and other regulatory bodies into the centre of the struggle. These agencies policing world finance, alongside the entities they supervise and regulate across banking and capital markets, face a fresh increase in public and political pressures, already growing inexorably since the 2007-08 crisis. But all these financial actors can also gain from opportunities profiting those that demonstrate sufficient agility to master the new rules of the climate change landscape.

Against this many-sided background, OMFIF and Mazars are proud to have come together to produce a global report that seeks to answer two basic questions. What policy adjustments are being undertaken in different jurisdictions around the world to assess and control climate risks? How are these actions likely to develop in future? And, in view of the momentum of events, our report may help banks and other financial institutions to best react to present and future shifts in the regulatory environment.

Our report shows that monitoring and mitigating climate risk, harmonising policy approaches and plugging the all-too-obvious gaps in data provision and international coordination have become priority tasks for global finance. All players – regulators and regulated alike – must prepare for radical change. If sufficient numbers meet the challenge head on, then there is good reason to hope that the institutions concerned, and the wider world, will enjoy a prosperous and stable future.

Rudi Lang is Partner and Head of Global Financial Institutions at Mazars.

Finance at the forefront



Danae Kyriakopoulou
OMFIF

ENVIRONMENTAL catastrophes, many of which can be attributed at least partly to climate change, are growing in frequency, severity and cost. With these rise the likelihood of massive economic and social disruption. Tipping points in loss of biodiversity and ice mass are in sight. The Intergovernmental Panel on Climate Change estimates global economic impairment of \$54tn by 2100 if temperatures rise on average by 1.5 degrees Celsius – with still worse outcomes if the earth heats up more.

Politicians and public opinion around the globe are increasingly aware of the scale of efforts needed to halt the trend. Central banks and regulatory authorities must ensure that physical damage, falling confidence and the cost of adjusting to a low-emissions growth model do not wreck the global economy. The worldwide financial services industry is at the forefront of the debate.

As a forum for private-public sector interactions, OMFIF is pleased to partner with Mazars in producing this report. We see this both as helping define regulatory best practice and also as preparatory reading for financial institutions getting ready for changing regulatory and supervisory regimes. We examine central banks' and regulators' different approaches to climate-related risks, including in assessing and stress-testing financial institutions. Through individual case studies, the report illustrates the variety of regulatory and supervisory approaches. We investigate, too, how central banks can integrate climate considerations in their monetary policy frameworks – and how they can promote green finance policies through regulatory innovations.

We are grateful to 33 central banks and regulatory authorities across six regions, representing 77% of global GDP, which participated in an OMFIF survey backing this report. We would like to thank the many officials, experts and industry participants who aided our research. Our aim is to produce a concrete and constructive guide to a shifting regulatory landscape. We hope the results fulfil these expectations.

Danae Kyriakopoulou is Chief Economist and Director of Research at OMFIF.

The time to act is now



Sarah Breeden
Bank of England

IN November 2020, the UK and Italy will host the United Nations climate change conference in Glasgow. It is an outstanding opportunity to accelerate global efforts to address climate change and to put it at the heart of every financial decision. Such an acceleration is essential if we are to avoid potentially catastrophic costs to the economy and significant risk to the financial system.

In 2019 we witnessed a marked uptick in the focus on climate issues, in the UK as well as abroad, and in both the public and private sectors. The UK parliament declared a 'climate emergency', and the UK became the first G7 country to commit to net-zero greenhouse-gas emissions by 2050. At the Bank of England, we set expectations for banks and insurers for their management of climate risks and launched plans to stress test firms' resilience to a variety of climate scenarios.

Actions like this are needed now. Climate change represents the tragedy of the horizon: by the time it is clear that changes to the climate are creating risks and costs that we want to reduce, it may already be too late to act.

Leading the charge in this area, and others, is the Network for Greening the Financial System – an enormously successful vehicle for developing capability and sharing best practice among central banks and supervisory authorities in addressing the financial risks from climate change. We share common challenges, whether stemming from lack of data or the inadequacies of conventional financial and macroeconomic models to assess these risks. This report underlines the importance of international collaboration in overcoming those obstacles and achieving our mutual goals. The window for an early and orderly transition is finite and closing. It's for all of us to act now.

Sarah Breeden is the Executive Director of UK Deposit Takers Supervision at the Prudential Regulation Authority (part of the Bank of England) and Chair of the Network for Greening the Financial System's Macropprudential workstream.

Increased awareness as risks arise



Ma Jun
People's Bank of China

IT is increasingly clear that climate-related physical and transition risks pose major challenges to financial stability. As a result, these risks should be scrutinised and managed by financial regulators and institutions. Studies have shown that physical destruction caused by sea level rise and more intense natural disasters may cause financial losses of tens of trillions of dollars. As carbon prices increase and demand for fossil-fuel energy falls, the valuations of oil companies and coal-fired power generation assets could fall by 40%-70%, while the ratio of non-performing loans to these industries may surge to double digits.

Several central banks and financial supervisors have carried out internal studies on the implications of climate risks for financial stability. More members of the Network for Greening the Financial System are initiating similar research projects. The NGFS's supervision workstream is compiling research models and methodologies on environmental risk analysis for financial institutions, with the findings set to be published in April 2020.

I expect many regulators, starting with a few core NGFS members, will make efforts to enhance awareness among financial institutions of environmental and climate risks. They will encourage banks, asset managers and insurance companies to conduct environmental risk analyses. They will help develop research capacities and databases, and provide guidance on key assumptions for scenario analyses and stress tests and on disclosure of financial information.

This report provides a useful update to the discussion on the role of regulators in analysing climate risks and regulating institutions' activities to mitigate financial risks. It will help raise awareness of this critical issue and solicit more contributions from the financial sector on appropriate supervisory approaches.

Ma Jun is a Member of the Monetary Policy Committee of the People's Bank of China and Chair of the Network for Greening the Financial System's Supervision workstream. He is former Co-Chair of the G20 Green/Sustainable Finance Study Group.

Sustainable investment needs broad focus



Sabine Mauderer
Deutsche Bundesbank

CLIMATE change is one of the greatest challenges to humankind and affects all economic agents, with consequences for our daily lives – all over the world. It is a global problem that calls for global answers. That is the spirit of the Network for Greening the Financial System.

Climate change as a source of financial risk is becoming more prominent as the frequency and severity of catastrophic events are growing. Central banks must take responsibility in their role as financial supervisors and guardians of financial stability. We must examine the effects of climate change and climate policy for our own operations, including monetary policy.

Recently, the NGFS issued 'a sustainable and responsible investment guide for central banks' portfolio management'. This guide outlines possible ways to include sustainable and responsible investment principles in the different portfolios that central banks manage. The results of our survey are encouraging. Many NGFS members already incorporate socially responsible investing in their portfolio management, while others are reviewing their operations. Most of the survey respondents favour a broad environmental, social and governance approach over a narrower, climate-specific focus. Among the top drivers of SRI integration are the need for protection against sustainability risk and an enhanced risk-return profile.

However, central banks face specific challenges. We must act without prejudice to our mandate and avoid conflicts of interest. Thus, not all portfolio types lend themselves to SRI to the same degree. While the adoption of SRI is relatively straightforward for central banks' own portfolios, the manoeuvring room for integrating SRI principles into monetary policy portfolios seems limited.

Publications such as this report and the NGFS portfolio management guide are crucial to keep up the momentum and lower barriers for others to follow suit. Central banks must act and find their role in protecting our climate.

Sabine Mauderer is a Member of the Executive Board of the Deutsche Bundesbank and Chair of the Network for Greening the Financial System's workstream on scaling up green finance.

Getting ready for green regulation

Across the world, financial institutions and investors should expect ever-tougher regulatory action on climate change. Most central banks from advanced and emerging economies now identify climate change as a major threat to financial stability; even two years ago, hardly any made that claim. So far, few central banks have decided significant climate action. That number is expected to grow markedly.

The agenda has shifted from whether central banks should act on the climate crisis to what measures they should take and in what sequence. The report reveals a mosaic of practices to monitor and control climate risks, from microprudential tools and stress tests to macroprudential and monetary policy. Central banks are increasingly facilitating green finance by developing new regulatory regimes such as in green investment taxonomies. They are building sustainable investment practices into their own asset management.

To facilitate meaningful change, policy-makers must have access to better climate-risk data. They must overcome fragmentation of different regulatory frameworks. Collective action involving all parts of global finance is key to enhancing resilience and ensuring prosperity.

Main report findings:

Wide awareness of threat – disagreement over responsibilities

- Most central banks and regulators (70% of respondents) see climate change as a major threat to financial stability. Respondents highlight the potential of climate risks to translate to systemic financial instability through sudden changes to asset valuations, or damage and disruption to economic infrastructure.
- Respondents' views vary on responsibilities for responding to risks. A majority of 55% say they are monitoring risks, with a further 27% saying that they are actively responding to them. Overall, 12% say that, while they see climate change as a major risk, action should come from other policy institutions. These divergences partly reflect differences in mandates. Capability of response differs across advanced and emerging economies, in some cases making action subject to criticism that central banks are exceeding their powers.
- Initiatives such as the Network for Greening the Financial System have gathered momentum over the past two years. Within the network members are at different stages in understanding risks and developing supervisory practices.

Complementary approaches on taxonomy – but fragmentation a problem

- Several jurisdictions are developing complementary regulatory infrastructures such as green investment classifications (taxonomies) to facilitate more consistent and targeted green finance policies and investment. However, the limited scope and uniformity of sustainable taxonomies hold back their full utility – more harmonisation is required.
- Fragmentation of climate-risk frameworks is deemed a key challenge, with 31% of respondents concerned about the comparability and consistency of supervisory frameworks.
- While some central banks are responding to this call and investing resources to develop the necessary in-house expertise and information, the challenges are considerable and require efforts from all sides of the financial industry.

More climate stress-testing – sizable minority support for green monetary policy

- Only a minority (15%) of respondents include climate-related considerations in their routine stress tests of financial institutions. Nearly four-fifths (79%) report that they intend to do so in the future.
- Many institutions (39%) are largely wary of using more interventionist 'market-shaping' microprudential tools for climate purposes, in part because of the risks of unintended consequences in distorting current prudential rules. Only 13% of respondents supported the need for 'green-supporting' or 'brown-penalising' factors to incentivise banks to increase credit for green investments and reduce lending to unsustainable ones.
- Nearly half of respondents (42%) see a role for monetary policy to support the climate agenda. Most of those disagreeing with this approach say central banks' monetary responsibilities should play only an ancillary role in addressing climate change. Socially responsible investment and environmental, social and governance criteria are starting to make headway in central banks' own investment management.

Major concern over data gaps – and different approaches to plug them

- Almost all respondents highlight as major problems the lack of appropriate analytical tools, methodologies and data, where significant gaps exist. Data availability and quality are the key concern for 84% of respondents. This includes firm-level data needed to help guide green investments and sector data on carbon emissions. This is an area where ratings agencies can play an important role.
- In terms of addressing data gaps, most participants (55%) do not require institutions under their regulatory perimeter to disclose their climate-related risks. 34% say they are considering this in the future. By contrast, around half of respondents (48%) favour voluntary engagement with financial institutions.

A threat to stability

Most central banks acknowledge that climate change is a major threat to financial stability. However, opinions vary on whether they should take action, and some are struggling to reconcile their climate ambitions with their mandates.

From wildfires in California and Australia to floods in India and Indonesia, climate-related threats are topping the list of global worries mobilising activists, governments and public opinion. There is increasing recognition that such risks are not only a threat to the environment and ecosystems, but also jeopardise the world's economy and financial system.

Physical damage and economic disruption

Climatic phenomena pose substantial physical risks to the financial sector, including damages to property and infrastructure and disruption to trade and economic activity. A 2019 World Bank study on resilient infrastructure estimates that infrastructure in key transport and power generation sectors incurs average annual losses of \$30bn from such hazards. These economic losses can take the form of direct damages to production facilities or logistics infrastructure. There can also be losses due to reduced availability of and changes in the price of raw materials. Insurance company MunichRE estimates that there were around 850 natural catastrophes in 2018, incurring a total cost of \$160bn.

Costs from disasters are usually immediate and visible, enabling direct measurement. But gradual changes in temperature can also have economic effects. Variations in precipitation and temperatures can affect water availability (affecting agriculture) or the popularity of tourist destinations (such as ski or seaside resorts), thus impacting businesses and industries operating in these areas. These effects can trickle through the financial sector, becoming systemic. For the banking sector, these may be felt directly through the

Physical, liability and transition risks

PHYSICAL RISKS are transmitted to the financial sector largely through the tangible, disruptive impact of climate events such as natural disasters, rising sea levels, volatile weather patterns and natural resource shortages. Physical damage to infrastructure and real estate assets, for example, can have implications for systemically important financial institutions, and by extension regulators, especially if corporate balance sheets or portfolios are comprised of assets whose book value could be diminished significantly through such occurrences.

LIABILITY RISKS relate to the financial costs and losses that could emerge from parties claiming compensation from financial institutions due to damages stemming from natural hazards linked to climate change.

TRANSITION RISKS may arise when the value of financial institutions' assets falls abruptly due to adjustments made to facilitate the transition to a low-carbon economy. Paradigm shifts in policies, public attitudes, and technologies which render financial assets reliant on fossil-fuel supply and make generation resources obsolete may affect the future credit health and risk exposure of corporate and financial institutions.

exposure of mortgage books to flood risk. Globally active banks and investors face increased credit risk in their portfolios through the deterioration of corporate and sovereign issuers' creditworthiness as they become more vulnerable to climate risk. This can affect corporate and sovereign bond yields, as well as the stock value of firms. Such costs are becoming more visible. The United Nations Office for Disaster Risk Reduction notes that the total economic cost of climate-related disasters has risen by nearly 150% in the last 20 years.

The insurance sector is particularly exposed, as parties that have suffered losses from the effects of climate change seek compensation from those they hold responsible. Climate change is exacerbating the frequency and intensity of natural hazards. As such, historical trends in insurance costs and past weather patterns may no longer be sufficient to predict the emergence of new liability costs. Weather-related insurance losses increased almost five-fold to an average of \$50bn per annum in the 2010s, from a yearly average of around \$10bn in the 1980s.

With large insurance institutions and fossil-fuel companies comprising major segments of the financial system, climate change is likely to expose them to significant liability claims. This is already happening in several jurisdictions. For instance, in January 2018, the City of New York filed a multi-billion-dollar lawsuit against five large oil companies for damages and claims on climate-adaptation costs to infrastructure, due to the firms' contributions to global warming. Meanwhile, the global insurance protection gap remains sizeable. The uncertainty associated with climate scenario analysis complicates the task of modelling implications for insurers' liabilities. Households and businesses will be affected too, as they could face more expensive or more curtailed insurance policies.

Financial innovation is beginning to address the challenge. Catastrophe bonds are insurance-linked securities, sharing risks with capital markets for the direct or reinsurance costs for potential natural disaster damages. These bonds are designed to cover specific categories of natural hazards and have relatively low maturities of around three to five years. In disaster-prone developing regions, sovereign disaster risk insurance pools shared between countries with different risk profiles are fast emerging as a cost-effective climate-risk management tool. Pooling helps to lower members' insurance premiums through diversification and transfers a portion of excess risks to the private sector. This can be especially important to small economies that are highly vulnerable to natural disasters and which individually may lack the technical expertise or the financial scale to hedge their climate risks through insurance-linked securities.

Stranded assets and a climate 'Minsky moment'

As the financial sector becomes increasingly exposed to the physical and liability risks posed by climate change, it faces additional transition costs from the need to comply with governments' commitments to address these effects. The 2015 Paris climate agreement includes a commitment to limit the increase in global average temperatures to below two degrees Celsius compared with pre-industrial levels. Signatories have also pledged to cut carbon emissions by 45% from 2010 levels by 2030, to reach net zero by 2050. The European Union, as well as

'In the long run, climate change poses a major risk to the stability of the financial system and the sustainability of investment returns. In coming years, a wide range of asset classes are expected to expose financial institutions to climate-related risks, negatively affecting the sustainability of portfolios' returns, as well as their credit risk profile.'

Developed economy central bank, Europe

more than a dozen governments around the world, has begun legislating to achieve carbon neutrality by 2050. The EU has also committed to a 40% reduction in emissions by 2030 compared with 1990 levels. Achieving these targets, requiring significant changes in behaviour by households and businesses and industries, will bring changes in asset prices.

This implies a clear trade-off between physical and transition risks. Getting the balance right will be crucial. The more sudden and disorderly the transition, the greater the costs and risks to financial stability. Reflecting the idea originally advanced by economist Hyman Minsky on financial instability caused by rapid collapses in bullish asset markets, transition risks may arise through sudden adjustments to a low-carbon emissions mode of economic production. For example, investor portfolios containing assets derived from fossil fuel supplies may be overvalued over a long-term horizon as the impending low-carbon transition to meet United Nations goals render assets unusable or 'stranded'. Potential losses are estimated at \$1tn-\$4tn when considering fossil fuels alone and up to \$20tn when including a wider range of sectors. These can represent a material share of global financial assets and can cause financial instability through the economic repercussions of declining asset prices.

The role of central banks

As regulators and supervisors of the financial system, and as institutions with a broad range of instruments at their disposal, central banks have begun exploring how they can align their approaches with climate commitments. This refers primarily to their supervisory functions – and to a lesser extent also their monetary policy and other operations – to ensure the transition does not jeopardise financial stability, as well as to address physical and liability risks to financial stability.

Traditionally, the long-term effects of climate change have been perceived as outside the remit of central banks and supervisors. Instead the focus has been on largely short- to medium-term policy goals such as price stability through inflation targeting,

maintaining financial stability with macro- and microprudential regulation, and reserves management. In a speech at Lloyd's of London in 2015, Bank of England Governor and then-chair of the Financial Stability Board Mark Carney dubbed climate change as the 'tragedy of the horizon', stating that 'once it becomes a defining issue for financial stability, it may already be too late.'

But 70% of respondents to our 2019 Central Banks and Climate Change Survey now acknowledge that climate change is a major risk to financial stability. While most central banks within that group highlight that this is a long-term risk, they still recognised it as a matter of concern. According to a respondent from a Latin American central bank, 'Raising awareness [on climate change] and capacity-building intersect with leadership, in which central banks could play an important role as institutions that foster transparency and long-termism.'

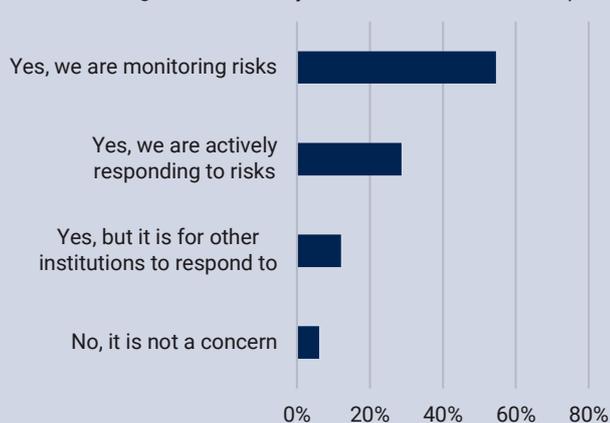
As shown in Figure 1, 55% of respondents said they are monitoring risks, with a further 27% actively responding to them. Overall, 12% view climate risks as a concern to which other institutions should respond. Only 6% did not view climate change as a concern. These mixed opinions reflect the distinction between interpreting climate change mitigation as a distinct end goal, as opposed to one policy consideration among others.

Several respondents are at very early stages of monitoring and addressing risks. They stated that they have set up internal networks and working groups to deal with sustainability-related issues, and are developing frameworks for risk analysis and monitoring. According to a respondent from a European central bank, 'Analytical work, including the development of stress testing, is still ongoing to assess climate change's impacts on financial stability.' Another respondent from a Latin American central bank said, 'While there has been no explicit change to the regulatory framework in order to integrate climate change risks, the bank is working to enhance statistical information to develop a framework to measure the impact of climate and environmental risks on the financial system.'

Within the minority of respondents who do not view climate

Figure 1: Central banks take on climate change

'Is climate change a concern for your institution?', share of responses



Source: OMFIF Central Banks and Climate Change Survey 2019

'Climate change may pose a risk to the financial system in the long term. Only a sudden transition (political or technological) to a more sustainable and low-carbon economy could be a major risk to financial stability.'

Emerging market central bank, Europe

change as a major risk to financial stability, the reasons for doing so are mixed. Some cite a lack of adequate information. One central bank from Latin America notes, 'Although we recognise the importance of social and environmental risks to individual institutions and to the whole financial system, we are still assessing the extent to which climate change is a major risk to financial stability and how best to deal with it.' Others are more sceptical, recognising that climate change can have impacts on financial institutions but rejecting the notion that these can become a major risk to financial stability. A respondent from a central bank in Asia Pacific said, 'We do not view climate change as a major risk to financial stability' but recognised that 'climate and environmental risks are a source of financial risk and we expect our regulated financial institutions to closely monitor and assess these risks.'

A central bank from Europe notes that 'from a financial stability perspective, climate-related risks might have a systemic impact. However, these risks are not well understood yet and from our very preliminary results we do not judge climate change as a major risk for financial stability, at least at this stage.'

Still, even the most staunchly conservative among our respondents acknowledge the tangible impacts that climate change can exert upon a range of macroeconomic issues, including future output growth, capital formation, productivity and the long-run level of the real interest rate.

One Asia Pacific central bank states that 'the effects of climate change and any policy designed to mitigate climate change are most likely to affect the supply-side of the economy and manifest as large changes in relative prices. In a flexible inflation targeting framework, understanding these effects improves the ability of monetary policy to achieve low and stable inflation, while taking into account other policy considerations, such as full employment and financial stability'. This respondent added that 'climate change factors may become new variables influencing the monetary and financial sectors, but authorities must develop relevant tools to be able to associate it with monetary and financial stability policy.'

Overall, analysis of responses across different questions shows a growing understanding and willingness to develop expertise in how climate change can fit into central banks' supervision practices. A respondent from a supervisory authority in the Middle East says, 'We are building capacity and understanding of risks in this field, and are planning to include climate change risk assessment in our risk assessment cycle.' An

African central bank says it is 'preparing a regulation dedicated to the management of environmental risks which will establish principles and guidelines in terms of governance, assessment and monitoring, disclosure of environmental risks, as well as training and capacity building.'

Making mandates fit for purpose

Central banks' and supervisors' increased interest in climate change has not come without criticism. As organisations possessing significant institutional independence from other branches of government, most central banks can pursue crucial monetary policy and financial stability objectives relatively insulated from short-term political influence. Intervention for long-term sustainability issues is regarded by some with a degree of reticence, and as a 'second-best' option in lieu of other government measures such as fiscal policy and taxation. This has at times created difficulties for central banks looking to marshal the momentum to advance their climate agenda, adding to the considerable scrutiny (mixed with criticism) they have faced for pursuing unorthodox monetary policy in the wake of the 2008 financial crisis.

Additionally, the operational scope to support the climate agenda varies widely across central banks, with sustainability far from being a universally explicit mission statement. Some monetary and prudential authorities have relatively narrow interpretations of their mandate to address climate issues. For instance, in 2015, BoE Governor Carney's call for central bankers to engage in a policy area outside their traditional charter was met with accusations of 'mission creep' (the gradual expansion of a mandate beyond its scope). Others possess relatively wider policy remit to support green finance measures and climate policy. Many central banks, including those of China, Brazil and Bangladesh, often have broader developmental objectives that can be interpreted flexibly. In these jurisdictions, targeted policies such as green credit allocation instruments and explicit green micro- and macroprudential policies have been employed as part of economy-wide sustainable development objectives.

Reflecting these divergences, there continues to be much debate on the role of central banks in directly influencing climate policy and mitigating its associated risks. In some cases, pursuing climate change policy more directly may require altering central bank charters or interpreting existing ones more broadly. This could open central banks to potential criticism for overstepping their prerogatives.

International coordination and divergence

Central banks' mandates and functions may vary, but international coordination and unconventional action are key to tackling climate change, a risk that affects all countries. There is a need for collaborative research to develop analytical tools to factor in climate risks. A framework to share best practices and experiences on environmental and risk management in the financial sector is also required.

In December 2017 during the One Planet Summit and at the initiative of the Banque de France, eight institutions from four continents set up the Central Banks and Supervisors Network for Greening the Financial System. Self-described as a 'coalition of the willing', in just two years the NGFS has grown nine-fold to

Figure 2: NGFS members as of 12 December 2019

Africa	German Federal Financial Supervisory Authority	Bank of Thailand
Bank Al-Maghrib	Magyar Nemzeti Bank	Hong Kong Monetary Authority
Banque Centrale de Tunisie	Central Bank of Ireland	Japan Financial Supervisory Authority
South African Reserve Bank	Central Bank of Malta	Monetary Authority of Singapore
	Central Bank of the Russian Federation	People's Bank of China
	Commission de Surveillance du Secteur Financier (Luxembourg)	Reserve Bank of Australia
	Danmarks Nationalbank	Reserve Bank of New Zealand
	De Nederlandsche Bank	
	Deutsche Bundesbank	North America
	European Banking Authority	Bank of Canada
	European Central Bank	Department of Financial Services of the State of New York
	European Insurance and Occupational Pensions Authority	
	Swedish Financial Supervisory Authority	Observers
	Norwegian Financial Supervisory Authority	Bank for International Settlements
	Guernsey Financial Services Commission	Basel Committee on Banking Supervision
	National Bank of Belgium	European Bank for Reconstruction and Development
	National Bank of Slovakia	European Investment Bank
	Norges Bank	Inter-American Development Bank
	Oesterreichische Nationalbank	International Association of Insurance Supervisors
	Sveriges Riksbank	International Monetary Fund
	Swiss Financial Market Supervisory Authority	International Organisation of Securities Commissions
	Swiss National Bank	Nordic Investment Bank
		Organisation for Economic Co-operation and Development
	Asia Pacific	Sustainable Insurance Forum
	Bank Indonesia	World Bank and International Finance Corporation
	Bank Negara Malaysia	
	Bank of Japan	
	Bank of Korea	
Latin America		
Banco Central de Costa Rica		
Banco de la República (Colombia)		
Banco de México		
Comisión Nacional Bancaria y de Valores (Mexico)		
Comisión para el Mercado Financiero (Chile)		
Superintendencia Financiera De Colombia		
Europe		
Banca d'Italia		
Banco de España		
Banco de Portugal		
Bank of England		
Bank of Finland		
Bank of Greece		
Banque centrale du Luxembourg		
Banque de France / Autorité de Contrôle Prudentiel et de Résolution		

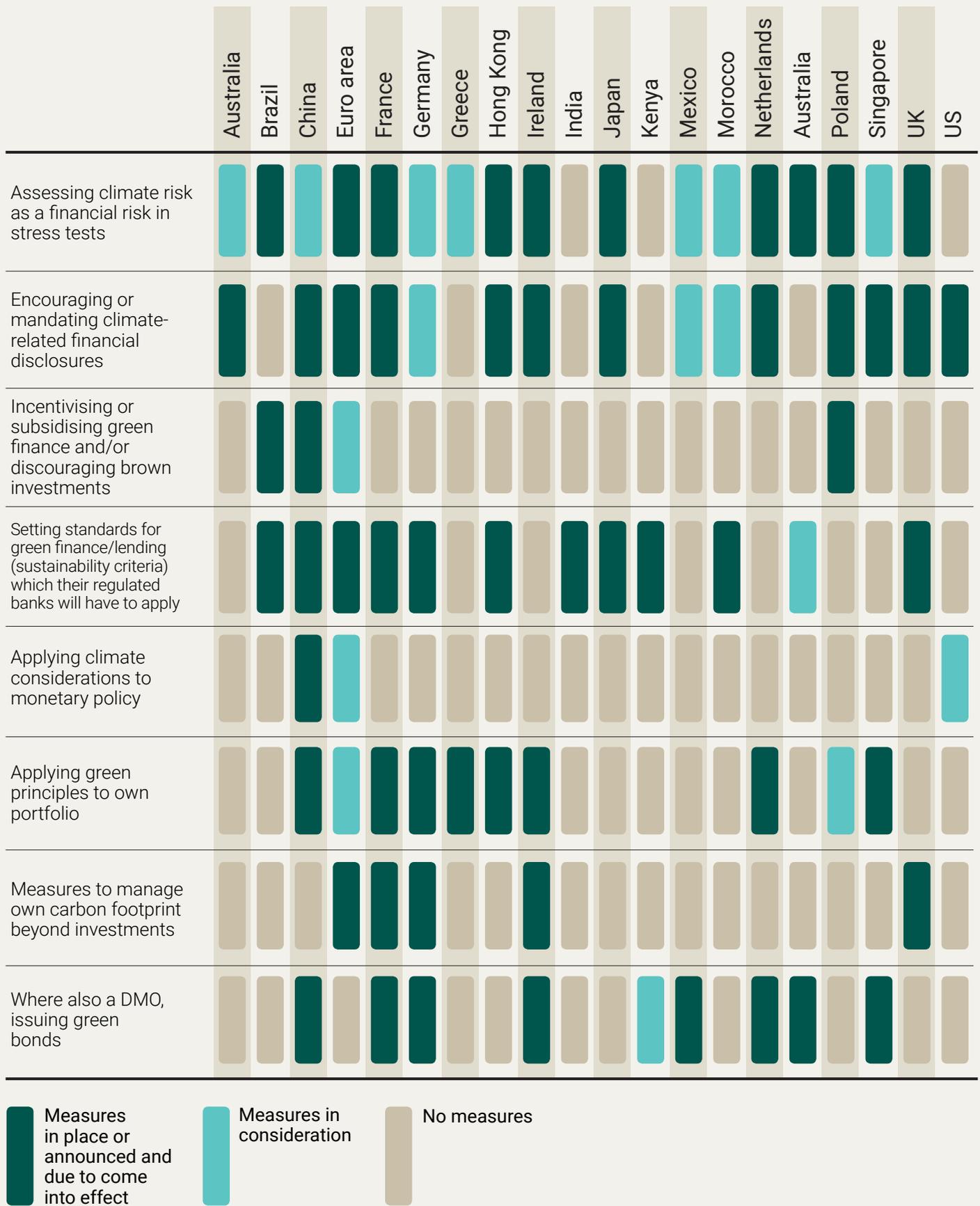
54 members and 12 observers as of December 2019 (see Figure 2). These include central banks and regulators from Africa, Asia Pacific, Europe, Latin America and North America.

The NGFS features three dedicated workstreams. The first focuses on microprudential supervision, climate disclosures and the risk differential between 'green' and 'brown' assets, and is headed by Ma Jun, adviser at the People's Bank of China. The second is led by Sarah Breeden, executive director for UK deposit takers supervision at the Bank of England, and focuses on macrofinancial research on how climate change affects systemic macroeconomic stability. The third workstream is dedicated to the role of central banks in scaling up green finance, and is chaired by Sabine Mauderer, a member of the executive board of the Deutsche Bundesbank. Among the central banks participating in our research, 82% are NGFS members, with a further 6% considering joining. Members of the network are united in their belief that climate change is a risk to financial stability and that central banks 'have to lead by example', in the words of NGFS Chair and De Nederlandsche Bank Executive Board Member Frank Elderson. But their ability and willingness to address the issue vary widely.

In choosing which instruments to deploy, central banks and regulators know that their decisions will have repercussions spreading well beyond the financial sphere. ❖

Regulatory progress on climate risks

Central banks and regulatory authorities are increasingly integrating climate risks into their activities. This table highlights which areas of operation this is affecting, and in which jurisdictions, based on public information. Many are moving ahead with stress tests, disclosures and standards for green finance, but macroprudential measures and monetary policy applications are less popular. These are explored in greater detail in the case studies on pages 28-33.



Tools for better regulation

Central banks are investigating the application of market-fixing and market-shaping initiatives to bolster sustainable investments. Setting out some uniform 'green' taxonomies is considered to be a crucial yet challenging initial step in the right direction.

The ethos guiding climate change action among central banks and regulators is split between policy tools exhibiting a passive, 'market-fixing' approach and those reflecting a more activist, 'market-shaping' one. Many potential tools are available. They include supportive functions such as developing stress-tests, and more proactive policies like green quantitative easing.

The goal of market-fixing approaches is to incentivise financial market participants to internalise the inherent mispricing of assets. While these will generally be guided by government policy (such as the decision to set a carbon tax), central banks can play a more hands-off, supporting role in facilitating the better functioning of financial markets. The complementary market-shaping approach is one where central banks proactively promote green finance and reduce unsustainable economic activities.

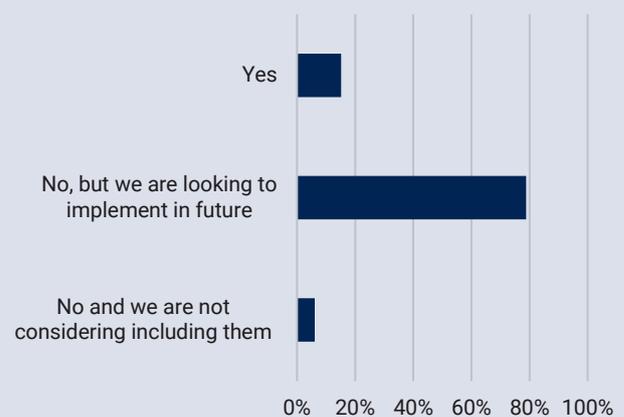
Collaboration for climate risk supervision

Most of our survey participants are members of the Network for Greening the Financial System, which fosters an environment for collaborative research and capacity building. Several respondents highlight that they would require accurate assessments of the risks from climate change before they could craft long-term responses. Nearly all respondents highlight data gaps and heterogeneity as major risks in climate risk supervision, with one saying that effective supervision of climate risk is still 'complicated by limited data availability and the lack of data standardisation'.

Conventional stress tests are the most common risk assessment framework used by central bank regulators and other supervisors to gauge the resilience of financial institutions' capital adequacy levels and macrofinancial stability to possible crisis scenarios. But there is a growing consensus that the conventional macroeconomic models

Figure 3: Central banks determined to implement climate stress tests but process still at early stage

'Do you include climate-related risks and/or climate-risk scenario analysis in stress testing?', share of responses



Source: OMFIF Central Banks and Climate Change Survey 2019

used to do so – such as dynamic stochastic general equilibrium and integrated assessment models – are inadequate for assessing the complex, non-linear dynamics of climate change and environmental policies. Integrating climate risk scenario analyses into their standard stress tests requires drawing from alternative techniques, such as stock-flow consistent and agent-based modelling. This was echoed by a central European regulator sharing that ‘analytical work, including the development of stress testing, is still ongoing to assess climate change’s impacts on financial stability.’

As shown in Figure 3, only a minority of central banks and regulators surveyed are conducting climate-related scenario analyses in their routine stress tests. Many central banks, even members of the NGFS, are grappling with the novelty of employing climate-related analytical tools. This was especially challenging for some central banks, such as those from relatively small jurisdictions, that face constraints in terms of in-house expertise and resources. Encouragingly, while most central banks surveyed do not include climate considerations in stress tests, 79% of respondents report they are looking to do so.

Some are already in the early stages of implementing such considerations, or reported to be waiting for more conclusive research to inform their decisions. One central bank from Europe commented that while climate risks could be addressed through a ‘dedicated stress test-like exercise with a less frequent and longer-term focus’, the necessary tools and methodologies were ‘still admittedly at an early stage’. The Bank of England has committed to running climate stress tests on institutions in 2021. In November and December 2019, the Banque de France and European Banking Authority announced they will run climate stress tests on banks from 2020.

Several survey participants highlighted the importance of international collaboration through forums such as the NGFS, United Nations Environment Programme, G20 Study Group on Sustainable Finance and the International Finance Corporation’s Sustainable Banking Network as effective guidance for ‘building capacity and understanding of risks in the field’ on green macroprudential policy tools.

Voluntary v. mandatory climate disclosures

A key question is the pressure regulators can exert on financial institutions to begin measuring and addressing climate-related risks. It is widely acknowledged in regulatory circles that climate risks are not accurately reflected in asset valuations within financial markets. This creates a market failure, as companies and investors are subject to asymmetric information on the potential risk exposures of stranded assets. This can be countered by appropriately valuing economic activities on financial markets, for which disclosures are necessary. These seek to rectify the paucity of reliable financial information on climate change and insufficient investor awareness on the degree of exposure towards risks.

Climate-related disclosures can be an important aspect of market-fixing microprudential regulations. Often it is not within the mandate of central banks and supervisors to make such disclosures compulsory. Instead, they could signal their

‘Many [banks] have taken a proactive approach and make public disclosures of their stance on climate change at the head office/parent level.’

Regulatory authority from the Middle East

position through recommendations to the market regulator or government.

Since its formation by the G20 Financial Stability Board in 2015, the Task Force on Climate-related Financial Disclosures (TCFD) has become the leading voluntary standard. The number of backers grew almost ninefold to 898 in 2019 from 102 in June 2017 (see Figure 4). While disclosure is just a first step, the implicit expectation is that releasing climate risk data properly would enable financial markets to allocate capital more efficiently to green and sustainable investments.

Generally, central banks and regulators surveyed do not require institutions within their regulatory perimeter to

Figure 4: Investment community moves on disclosures

Number of TCFD supporters, selected dates



Source: Financial Stability Board, OMFIF analysis

disclose their climate-related risks, although one-third are considering doing so (see Figure 5). Only 6% of respondents said they operate mandatory disclosure frameworks.

The reasons for not requiring mandatory reporting or directly encouraging climate risk disclosures were mixed. Some central banks have separated responsibilities from prudential functions that are managed by other agencies. Others were still in the midst of developing a formalised policy on climate disclosures. Many European central banks are monitoring advances made at the European Union level concerning legislation governing disclosures, such as the Capital Requirements Directive V. One central bank noted that ‘even before the EU legal framework is formally updated, we are assessing what role climate-related disclosures can play in our supervisory framework.’

One nuance that emerged in survey responses was a distinction between rules- and principles-based approaches to climate disclosure regulation. Article 173 of the French Energy Transition Law is an example of the former. It legally mandates that major institutional investors and asset managers report climate risks for prudential supervision in regular stress tests.

However, most central banks surveyed favoured voluntary engagement with financial institutions. While the TCFD recommendations were often acknowledged as a useful framework to draw upon, they were not necessarily seen as standards to which institutions should rigidly adhere. Given the relative novelty of climate risk assessments, many respondents stressed the importance of soliciting input from commercial banks and insurers to develop contextually appropriate climate disclosure frameworks. One EU-based NGFS member shared that it is ‘asking institutions under their supervision to map out their vulnerability to climate risk’. The Bank of England offers a prominent example of a principles-based approach, with the recent supervisory statement

‘Prudential rules could favour “green” investments and loans... The EBA is already assessing the possibility of introducing a more risk-sensitive capital treatment of green assets, as a “green-supporting factor”.’

Valdis Dombrovskis, Vice-President, European Commission

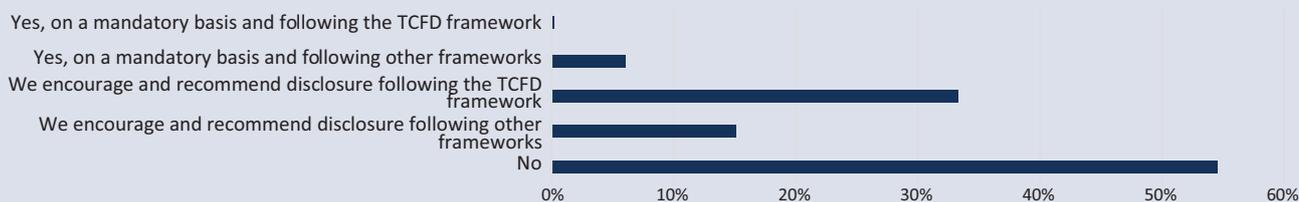
from the Prudential Regulation Authority outlining regulatory expectations for climate change to the UK financial industry.

Enhancing risk management frameworks

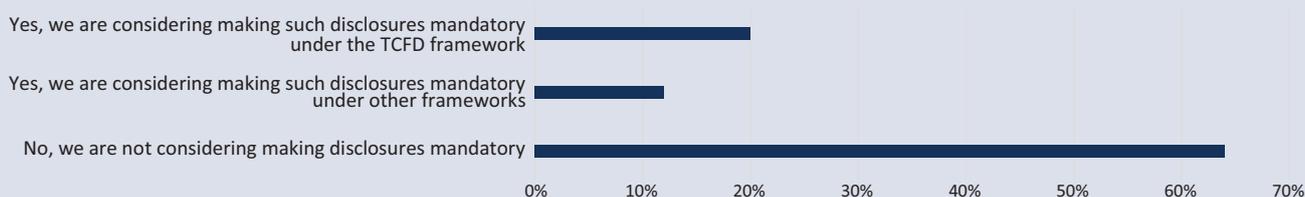
Another market-fixing approach within the existing scope of central bank mandates is influencing the governance and risk management processes of commercial banks and institutional investors. While climate disclosure frameworks in many jurisdictions are still being researched or under negotiation, supervisory authorities are emphasising climate change as a source of material risk that the private sector should account for independently. Several central banks, such as that of Brazil, have already developed environmental and social risk management and governance standards for regulated institutions. The UK government and regulators have shown strong leadership in this area. Its Department for Work and Pensions has introduced rules requiring pension fund trustees to outline their approach to engagement with and voting of their shares in investee companies, as well as how they take account of environmental, social, governance and climate change considerations in their investment decision-making.

Figure 5: Weak appetite for mandatory disclosures

(a) ‘In your capacity as banking regulator, do you monitor and evaluate the approaches commercial banks take to account for climate-related risks, and if so, how?’, share of responses



(b) ‘If you do not require disclosure of climate-related risks by institutions within your regulatory perimeter, are you considering making such requirements mandatory?’, share of responses



Source: OMFIF Central Banks and Climate Change Survey 2019

The Bank of England's Prudential Regulation Authority has issued a supervisory statement that sets out expectations for banks, insurers and building societies to embed in their governance arrangements the consideration of climate-related risks. This includes ensuring that firms have 'clear roles and responsibilities for the board and its relevant sub-committees in managing the financial risks from climate change'. Furthermore, the UK's Financial Conduct Authority intends to introduce rules requiring independent governance committees to oversee and report on firms' environmental, social, governance and stewardship policies.

Although climate risks intersect with environmental and social risk management, they possess distinct characteristics reflecting their long-term horizons, multidimensional nature and the uncertainty involved. Risk management frameworks, as well as the overarching strategies governing them, must be equally dynamic to accommodate this unpredictability.

This approach was popular among respondents to our survey, with 41% saying they are looking into ways to evaluate the approaches commercial banks take to account for climate-related risks (see Figure 6). Among these, most do so in connection with their governance and risk management frameworks, suggesting they recognise climate change as a long-term and unpredictable phenomenon. This includes scrutiny of both the standards of internal bank management and strategic outlook, alongside support for integrated risk management, as mutually reinforcing actions. And while 59% of central banks surveyed do not conduct supervision of climate-related risk management, most of these said they intend to assess commercial bank actions in this area. One Latin American regulator said the 'involvement of senior management in financial firms is crucial, as well as the gradual regulatory involvement in focusing this attention by providing information, incentivising action, and increasing awareness to ensure that climate-related risks are understood and discussed at board level and considered in risk-management.' In the UK since October 2019, the Prudential Regulation Authority has updated the Senior Managers and Certification Regime to require that responsibility for climate-change risk must be allocated explicitly to a senior manager function holder.

'Market shaping' macroprudential tools

Complementing 'market fixing', 'market shaping' approaches envision central banks' role as one in which they proactively foster and practise green investment and finance while disincentivising unsustainable economic activities. Such an activist approach uses prudential and monetary tools to stimulate demand for green assets and can take one of two forms. The first concerns adjusting prudential regulations such as the Basel III capital requirements to increase banks' green investments and reduce unsustainable ones. The second employs monetary policy tools such as green quantitative easing, climate-aligned criteria in central bank collateral frameworks and portfolio management, and green credit allocation and quotas.

Central banks participating in our survey were generally less enthusiastic about the prospect of market-shaping actions.

Green-supporting factors and brown-penalising factors

A GREEN-SUPPORTING FACTOR lowers capital requirements for financial institutions conducting more green investments by assigning lower risk weights to sustainable assets. This would incentivise banks to increase the volume of credit to green investments.

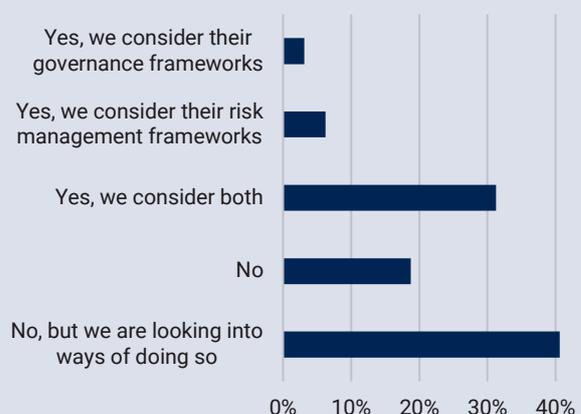
A BROWN-PENALISING FACTOR assigns higher risk weights to carbon-intensive assets, requiring banks to increase capital requirements to cover the increased risks and thereby disincentivising credit allocation to unsustainable investments.

Many expressed concerns about these more direct methods of climate risk supervision that use unconventional prudential and monetary tools. Such interventions could create market distortions, and might involve policy trade-offs with central banks' other goals.

One notable suggestion for amending prudential supervision in favour of this objective is to add a 'green-supporting factor' or 'brown-penalising factor' to banking regulations. At the European Commission's 'Implementing Basel III: Challenges and impact' event in November 2019, Commission Vice-President Valdis Dombrovskis said the European Banking Authority is considering offering banks regulatory relief for green investments in the form of a 'green-supporting factor' in the next revision of Basel capital requirements. These Basel III prudential regulations were introduced after the 2008 financial crisis to improve

Figure 6: Only minority of central banks monitor commercial banks' climate-risk approaches

'In your capacity as banking regulator, do you monitor and evaluate the approaches commercial banks take to account for climate-related risks?', share of responses



Source: OMFIF Central Banks and Climate Change Survey 2019

the banking system’s resilience through enhanced capital and liquidity standards designed to improve their regulation, supervision and risk management capacities. The framework comprises three pillars: minimum capital requirements that are mandatory for all firms; supervisory reviews enabling regulators to prescribe additional capital for firms on a case-by-case basis; and market discipline related to disclosure requirements.

While the aforementioned market-fixing approaches go some way towards addressing gaps in pillars two and three, climate-related risks derived from holding green or carbon-intensive assets are not explicitly factored in under the current framework. Reflecting this, one Asia Pacific regulator said they ‘follow closely the Basel III pillar three disclosure requirements which do not presently cover climate-related disclosures.’ In the UK, the PRA’s supervisory statement from April 2019 noted existing requirements to disclose information on material risks within their pillar three disclosures and on principal risks and uncertainties in their strategic report. It set out expectations of firms to consider whether further disclosures are necessary to enhance transparency on their approach to managing the financial risks from climate change.

Proposals for altering prudential regulations to integrate green-supporting and brown-penalising factors have encountered controversy. From the regulatory standpoint, central banks and supervisors are reluctant to implement prudential measures. This reluctance stems partly from a lack of data to evaluate the links between ‘greenness’ and credit risk.

Among respondents to our survey, 39% say they do not support the use of microprudential tools to address climate change (see Figure 7). One African central bank noted that it ‘would like to support the use of microprudential tools to address climate change but all the unintended consequences need to be explored’. Another regulator qualified the need to ‘evaluate (and quantify) whether current prudential rules mean that capital requirements adequately reflect the financial risks resulting from climate change that institutions are exposed

‘We are undertaking an in-depth survey... This will allow financial authorities to have a precise diagnosis of the readiness and capacity of financial institutions to address climate- and/or environment-related risks.’

Central bank from Latin America

to, or if changes to the framework are necessary and justified.’ Nonetheless, the scope for reforms was, in the same regulator’s view, conditional on not ‘distorting or jeopardising the credibility and suitability of prudential rules’.

Others’ scepticism was rooted in the potential policy trade-offs involved in incentivising credit allocation into and away from specific sectors. One European central bank said ‘prudential rules, which are designed to protect financial stability, must not be changed for other needs... prudential regulation as such should not be adjusted to target non-prudential goals, such as allocations of capital towards sustainable investments.’ Overall, green-supporting and brown-penalising factors were particularly unpopular among respondents asked to declare support for various microprudential tools to address climate change, each chosen by 13% of our sample.

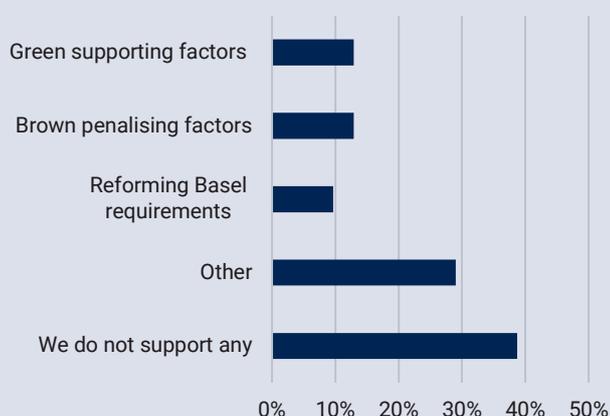
Just under one-third of respondents said that neither of the options offered accurately reflected their position. While they did not wish to state that they supported the use of green-supporting factors, brown-penalising factors or a reform of Basel requirements more broadly, neither did they directly oppose such measures. Many commented on the need for more information to assess these measures’ potential policy effectiveness and the trade-offs involved. One Latin American central bank admitted that ‘we believe we need to understand better the implications of microprudential tools to address climate change’ while a Middle Eastern regulatory agency said ‘we have not yet come to a conclusion about this’.

The politicised nature of climate intervention can make central banks reluctant to implement prudential reforms. A European central bank said that ‘from a financial stability perspective, prudential tools should be risk adequate and should not be designed to support political goals.’ It echoed others’ concerns about premature action and a lack of information, stating that ‘a thorough assessment of the financial risks, which could substantiate the application of prudential tools with regards to climate change, is not available yet.’

Market participants and other commentators have expressed frustration with what they call an ‘overly cautious’ approach by regulators to warn that ‘green does not mean risk-free’ and that the use of green-supporting factors is therefore unwarranted. Some argue instead that, by the time a thorough assessment of the impacts of microprudential measures can be possible, it may be too late urgency to resolve the climate emergency. ❖

Figure 7: Mixed attitudes on microprudential tools

‘Do you support the use of any of the following microprudential tools to address climate change?’, share of responses



Source: OMFIF Central Banks and Climate Change Survey 2019

FOCUS ON:

Green finance

Tasked with safeguarding financial and price stability, central banks have focused on the risks that climate change poses to the portfolios of institutions they supervise. But climate change is also creating opportunities for the investment community, and for central banks themselves in their capacity as portfolio and reserves managers.

A shared vocabulary for 'greenness'

A first step in developing an understanding of the links between 'greenness', 'brownness' and credit quality is to define what 'greenness' and 'brownness' mean. Some jurisdictions and regulators are developing green and brown 'taxonomies' to clarify which assets and economic activities are considered environmentally friendly and which are unsustainable.

One European central bank respondent said 'the lack of harmonised definitions is an important deterrent for establishing, in a comparable manner, which activities and sectors should be considered aligned with the goals of environmental sustainability, and therefore to assess institutions' exposure to climate risk.' Many respondents concurred with this statement, indicating that existing sector- and asset-level data were too scant to give worthwhile guidance on the implementation of green microprudential policies.

Several jurisdictions are crafting taxonomies to scale up green finance innovation and harmonise regulation, and more intend to do so. Among survey respondents, 39% said green taxonomies are being developed in their jurisdiction, with a further 3% saying that both green and brown taxonomies are being drafted (see page 20). Only 27% say there are no taxonomies being developed and nor are there plans to do so.

One jurisdiction that is relatively advanced in developing a taxonomy is China, which issued its Green Industry Guidance Catalogue in March 2019. Several Chinese ministries and regulatory agencies, including the People's Bank of China, collaborated on its development. The catalogue sets uniform standards nationwide for policy-makers to determine which industries and projects are eligible for green bond financing. It sets environmental objectives, such as pollution prevention and energy efficiency, but does not explicitly make climate change mitigation a core objective.

The EU is another jurisdiction at a relatively advanced stage of developing a green taxonomy related to the European Commission's sustainable finance action plan. The taxonomy, which sets out a list of economic activities aligned with six environmental objectives, will complement parallel efforts to scale up and harmonise green capital markets through an 'EU

Green Bond Standard'. The taxonomy is scheduled to come into effect by December 2022, but obstacles remain. For example, the precise composition of economic activities is still subject to lively debate among member states. A further challenge is the original design of the taxonomy; it was not initially developed for banks and is likely to require updates before implementation.

There is less encouraging news on the other side of the green-brown taxonomy divide. As indicated in our survey, few resources are being committed to the development of brown taxonomies. This could limit the policy and investor utility of taxonomic frameworks. While green assets and activities are environmentally beneficial, those not classified as green are not automatically unsustainable in nature. They could be marginally sustainable, neutral, or polluting (brown).

The EU taxonomy sets out a list of economic activities aligned with six environmental objectives:

- Climate change mitigation
- **Climate change adaptation**
- Sustainable use and protection of water and marine resources
- **Transition to a circular economy, waste prevention and recycling**
- Pollution prevention and control
- **Protection of healthy ecosystems**





To progress, these climate-risk frameworks would require studying a risk differential between green and brown assets. Reflecting this taxonomic gap, one European central bank responding to our survey says ‘it is too early to use such tools in this manner without the presence of clear definitions of green/brown and a clear risk differential’. Another burden is keeping the taxonomy up to date with technological

innovation. As noted by European Commission Director-General for Financial Stability Olivier Guersent, ‘The only thing you know about an environmental taxonomy is that the day you adopt it, it is outdated.’

The role of rating agencies

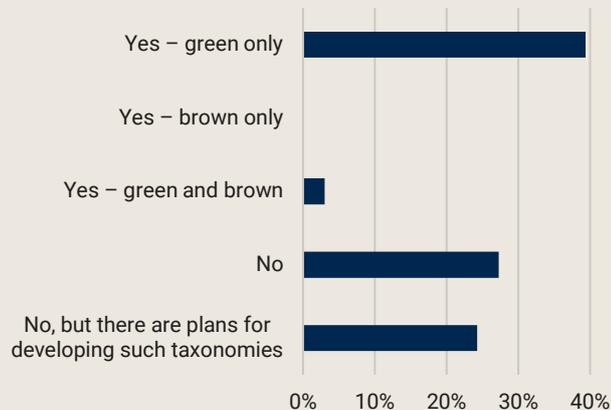
Rating agencies can play an important role in supporting the practical implementation of climate risk supervision. The collateral frameworks that central banks use determine the terms of eligibility of assets offered by commercial banks in exchange of central bank-issued money. To support climate agendas, policy-makers could modify these to accept sustainable assets that, under current frameworks, would be classified as higher-risk.

Some respondents see opportunities for central banks in this policy area. One European central bank says ‘collateral policy needs to take account of climate risk’ while ‘monetary policy is aimed at price stability’. The PBoC is a notable example of a monetary authority directly using its collateral framework for green finance. Since June 2018, China’s central bank has accepted green bonds rated double-A and above as valid collateral within its medium-term lending facility.

The alternative would be for external credit rating agencies to alter their risk ratings on collateralised assets to account for climate factors. Rating agencies have already taken steps in that direction. Lending further support towards the development of more holistic methodologies would not only benefit central banks’ collateral frameworks, but could help the wider financial sector internalise climate risks in their decision-making.

Figure 8: Growing appetite for taxonomies

‘Are there green and brown taxonomies being developed in your jurisdiction?’, share of responses



Source: OMFIF Central Banks and Climate Change Survey 2019

‘The process of developing a taxonomy can be lengthy and involves multiple stakeholders and, crucially, economic rationale and transition considerations. However, it is clearly unhelpful for each jurisdiction to develop its own taxonomy, given the problem to be addressed is a global one.’

Regulatory authority from the Middle East

Guiding green credit lines

The creation of taxonomies could enable central banks to develop green credit allocation policies to mandate or encourage commercial banks to lend directly to environmentally beneficial sectors. One such policy could be credit floors for minimum lending requirements to sustainable sectors, or, conversely, credit ceilings that limit loans to carbon-intensive industries. Central banks in several developing economies have introduced green credit quotas. In 2015 the Reserve Bank of India included renewable energy and social infrastructure projects as targeted categories in its ‘priority sector lending’ programme. Up to 40% of commercial credit from institutions that the RBI regulates is directed to PSL areas.

While green credit quotas set predefined loan targets to preferred sectors, this diminishes the control commercial banks have over risk management and loan origination. There are alternative ways to influence credit allocation while keeping the choice of assuming default risks within the private sector. Cases in point include subsidised loans, preferential refinancing lines and differential reserve requirements. These green finance incentives enable commercial banks to decide how much credit they extend and to which projects. Examples of green loan subsidies include the Bank of Japan’s loan support programme, which offers low-interest, long-term credit to banks that back sustainable projects. Other central banks have engaged in similar activities. The Banque du Liban lowers commercial banks’ reserve requirements by 100%-150% of the value of loans certified to assist energy savings. In 2018, the PBoC

became the first central bank to accept green bonds and loans as eligible collateral from commercial banks.

Greenwashing

The increasing momentum of investor interest in sustainable finance, alongside the parallel surge of green capital market initiatives, poses other distinct challenges for central banks and regulators. One such hazard is the risk of greenwashing. Dubious cases of green bond certification or the misuse of their proceeds to non-stipulated ends could greatly diminish investor confidence in the credibility of the asset class. ❖

Greenwashing: Cases in which financial assets and economic activities are misleadingly labelled as green or sustainable

FROM a policy-making standpoint, central banks must strike a judicious balance between robust regulatory standards and flexibility for context and timelines. According to one Asia Pacific central bank responding to our survey, ‘the lack of a set of international comparable standards for green finance’ inhibits efforts to ‘scale up green finance and avoid greenwashing for cross-border green capital flows’.

On the other hand, an overly rigid or onerous regulatory regime that is insensitive to different economic contexts and industries could prove equally unproductive. One concern raised in connection with the EU taxonomy, for instance, is that overly restrictive interpretations of ‘greenness’ could discourage short-term capital flows needed for low-carbon transition investments. There is a continuing debate about whether the taxonomy’s proposed classifications give an unfair advantage to those countries that do not rely so heavily on fossil fuels. Commenting in September 2019 on the EU taxonomy, Bank of England Governor Mark Carney said a more nuanced, ‘richer’ approach is required. However, as jurisdictions pursue different taxonomic systems, regulators are wary of being hampered by incompatible protocols and diverging standards. A Middle Eastern supervisory authority cautioned that ‘the process can be lengthy and involves multiple stakeholders and, crucially, economic rationale and transition considerations. However, it is clearly unhelpful for each jurisdiction to develop its own taxonomy, given the problem to be addressed is a global one.’

FOCUS ON:

Climate risks and monetary policy

Central banks' and regulators' growing interest in the climate agenda has precipitated calls from civil society and the financial community for policy-makers to integrate climate considerations into their monetary operations. The evidence from the OMFIF survey is that this pressure is starting to take effect. Nearly half the central banks and regulators polled see a role for monetary policy in supporting the climate agenda.

There are strong reasons why this should be the case. According to Banque de France Governor François Villeroy de Galhau, 'If you look at the economic effect of climate change, it's probably in the long run a stagflationary shock with higher prices and lower economic output. This is one of the most difficult shocks we central bankers have to deal with.' The effects of physical and transition risks on price stability can work through several channels. Weather anomalies and natural hazards could diminish macroeconomic productive capacity by damaging infrastructure, supply chains and ecosystems. Gradual changes in the climate can make short-term weather patterns more erratic, with grave repercussions for macroeconomic output and prices.

Transition risks can affect the supply-side conditions relevant for monetary policy. The need to prevent temperature increases and the cost of the transition towards a lower-

'Climate change risk would be better addressed through government policies and regulatory means.'

Regulatory authority from the Middle East

carbon economy may entail reducing short-term economic growth. Price-based climate policies such as carbon taxes could create supply-side shocks as firms adjust by temporarily lowering production to accommodate regulatory restrictions. Climate risks can also have demand-side effects through their impact on household wealth and private consumption, investment and trade. Such potential declines in aggregate demand for goods and services, as well as changes in investment preferences, could exacerbate associated supply-side shocks.

Institutions are investigating the links between climate risks and price stability. The ECB has explored the German economy's vulnerability to specific physical risk channels such as bottlenecks on the Rhine, an important shipping route for industrial inputs and commodities, caused by summer droughts. The Bank of Canada has explored the effect of climate change on the forestry, agricultural and mining sectors.

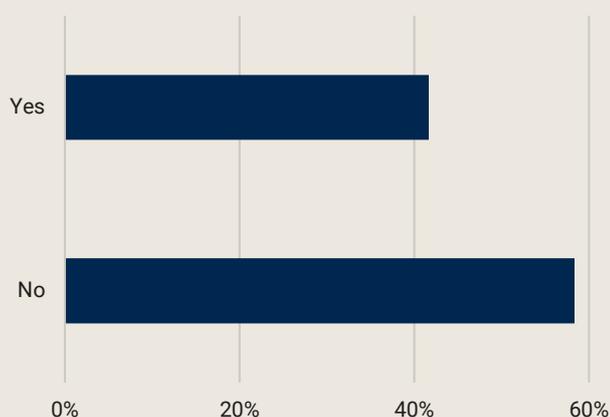
This gradual integration of climate considerations into monetary policy frameworks has not generally translated into central banks using monetary policy to directly address climate change.

A sizeable minority (42%) see a role for integrating climate considerations into their monetary operations (see Figure 9). The prevailing rationale among those who oppose this view is that central banks' monetary responsibilities should play only an ancillary role. One Asia Pacific central bank says it did 'not see monetary policy as a particularly effective tool for directly contributing to the transition to a low-carbon economy as compared with carbon taxes, emissions permit markets, and regulatory action.' Nonetheless, the central bank qualified that it expects that 'monetary policy will need to consider risks from the physical effects of climate change as well as from the broader policy response to climate change'.

Other central banks considered monetary policy to be a second-best substitute for managing climate transitions. One European central bank said its 'view is that monetary policy is less suited to putting the economy on a path with structural change towards a low-carbon economy. Other tools, mainly

Figure 9: Central banking community divided on role of monetary policy

'Does your institution see a role for monetary policy to support the climate agenda?', share of responses



Source: OMFIF Central Banks and Climate Change Survey 2019

global fiscal policy tools, are substantially more suitable.’

Another Asia Pacific respondent says climate mitigation objectives are ‘not an aim of monetary policy in and of itself’ but accepted that ‘monetary policy is concerned about the impact of climate change to the extent that it affects the outlook for inflation and growth’.

Beyond conventional monetary operations, climate risks could be integrated into central banks’ unconventional policy practices, such as quantitative easing, as well as into their reserves management frameworks. Many central bank balance sheets hold a considerable volume of carbon-intensive assets, precipitating calls for the recalibration of QE programmes to support sustainable objectives. This could have the added effect of stimulating private-sector sustainable investments by lowering the interest rates on green bonds.

However, most central banks are hesitant to commit to green QE programmes. Traditionally central bank asset purchase programmes have adhered to the principle of ‘market neutrality’ and avoided directing credit to specific industries and companies. Moreover, the relative immaturity of the green bond market poses practical constraints. The Bank for International Settlements notes that, while the credit ratings of green bonds have improved noticeably, the accessibility and liquidity of the secondary green bond market remain limited in comparison to conventional securities.

Central banks’ activities in this area have remained fairly conservative overall, but changes to the principle of market neutrality may be impending. ECB President Christine Lagarde has been vocal about restructuring the central bank’s asset purchase programme to account for climate criteria. However, these changes would depend on pushing through broader regulatory reforms. Lagarde has noted that climate

integration would be contingent on ‘objective criteria’, such as the forthcoming EU taxonomy, that would enable the ECB to ‘assess whether and how it can apply green financial instruments to its APP’.

Decarbonising central bank operations

Despite the uncertainty surrounding green QE and targeted credit, some central banks are going green through other means, such as introducing more explicit sustainability criteria into their portfolio management and internal operations. An NGFS report from October 2019 outlined how central banks could potentially adopt a layered approach to integrating sustainability into their different portfolio mandates. While some central bank asset portfolios have clear short- to mid-term policy goals requiring stability and low risk levels, others may have more leeway to accommodate a broader scope for sustainability. In mid-2019, Hungary’s central bank announced its intent to establish a specialised portfolio for green bonds to help stimulate the development of the green finance market. In western Europe, De Nederlandsche Bank and the Banque de France have outlined responsible investment charters guiding asset selection criteria for portfolios for which they are fully responsible. France’s central bank was the first to formally adopt a responsible investment charter, and DNB was the first central bank to sign the United Nations Principles for Responsible Investment. Though still in the early stages, the integration of socially responsible investing and ESG considerations is gaining traction in central banks. In 2019 the Banca d’Italia began introducing sustainability criteria for its equity investments, and in November the Sveriges Riksbank divested itself from several Canadian and Australian local bonds owing to concerns about their states’ climate impact. ❖



‘We do not consider monetary policy as a particularly effective tool for directly contributing to the transition to a low-carbon economy as compared to carbon taxes, emissions permit markets, and regulatory action.’

Central bank from Asia Pacific

Facing the future

Policy-makers are investing more time and resources into the field of climate-risk supervision, but remain hamstrung by scant and often poor-quality data. Problems arise at all stages, from the country level down to individual company disclosures.

Many challenges are complicating central banks' endeavours to integrate climate risks into their supervisory frameworks.

The top concern for respondents to our survey was data availability and quality, with 84% identifying the lack of decision-useful data for assessing climate risks as the biggest challenge to moving ahead with the supervision of such risks (see Figure 10). This aligns with the recommendations issued in April 2019 by the Network for Greening the Financial System in its first comprehensive report, which highlighted climate data gaps as a major obstacle for central banks. While some policy-makers are responding by investing a great many resources to develop in-house expertise and information, the challenges are considerable and require a multi-stakeholder effort. Central bank initiatives to design feasible supervisory frameworks must account for these data and methodological limitations. Regulators and firms must take steps to bridge these gaps and prepare for a time when, as a result of advances in data collection, they will have sufficient statistics to back implementation.

Impact of data limitations on risk policy

Data gaps can hamper considerably the feasibility of analysing the impact of physical and transition risks. A particular challenge for central banks and supervisors, and for those looking to support their agenda through data provision, is assembling historical and forward-looking data series. Many financial institutions and non-financial firms only recently began assessing and disclosing their climate-related risks. While country-level climate data are occasionally available, measuring financial exposures to climate change requires detailed information at the sector and company levels. Undertaking borrower-specific analysis requires asset-level data combined with information on climate effects for particular industries and businesses at specific locations.

Bottom-up portfolio-specific scenario analyses, reliant on firm-level data, are essential to direct green investments strategically. Sectoral data on carbon emissions obscure variation in production processes and technologies, as well as any time-dependent changes in individual firms' environmental impact. The lack of nuance in top-down data has important implications for policy-makers and investors. Investment in sectors otherwise considered carbon-intensive could be intended to introduce cleaner technologies. Responding to our survey, one Asia Pacific central bank identified the 'lack of detailed emissions data across emissions scopes, comparable geolocation data between assets, infrastructure, business operations and ecological risk zones' as the biggest data challenges.

A European central bank added that 'one of the main challenges to further progress [in climate-risk supervision] is the availability of enough detailed information regarding exposures of banks to sectors and companies'. Some granular climate-risk data at the asset level are available from proprietary platforms such as the 2° Investing Initiative, Four Twenty Seven and Carbon Delta. However, actionable climate-risk data are often acquired and processed at great

expense. A central bank from Asia Pacific lamented the lack of necessary resources to integrate the limited volumes of available climate-risk data into supervisory activities – a problem especially for smaller jurisdictions.

Green finance considerations for supervision

Central banks’ supervisory approaches concerning climate risk focus predominantly on the exposure of financial institutions to these factors. Several private financial institutions are seeking to balance negative exposure to brown assets with investments spurring climate mitigation and adaptation such as renewable infrastructure and energy.

Central banks and supervisors mostly acknowledge that effective climate disclosures and risk management require a synthesis of both market-led innovation and regulatory guidance. However, 87% of respondents said they generally do not take firms’ green finance activities into account when assessing their exposure to climate risk.

That being said, many central banks demonstrated that they are conscious of the need to operate within a broader framework of concerted action. One African central bank said ‘supervising climate risks can have a wide impact extending beyond just the supervised entities. A collaborative effort is therefore required that brings together all stakeholders and role-players in order to take appropriate and coordinated action.’ Although there was consensus that it is too early to

‘The biggest challenge is the lack of rules/requirements specifying the role of each market participant.’

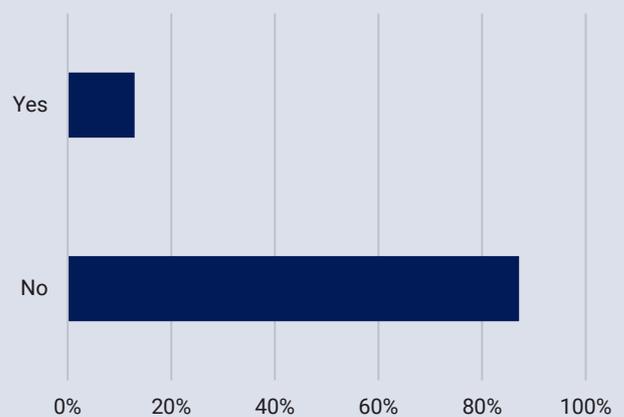
Central bank from Europe

employ microprudential tools, some central banks identified other means to bolster green finance. One Asia Pacific central bank said that ‘while we do not take into account these factors in assessing a financial institution’s environmental or climate-related risks on its balance sheet, we do monitor such developments as part of our holistic supervisory assessment of the firm pertaining to its business strategies.’

Regulatory and supervisory regimes that support green finance have often involved collaboration between central banks and commercial banking associations. In 2017 the Central Bank of Kenya worked with the Kenya Bankers

Figure 10: Supervision focus on negative risk

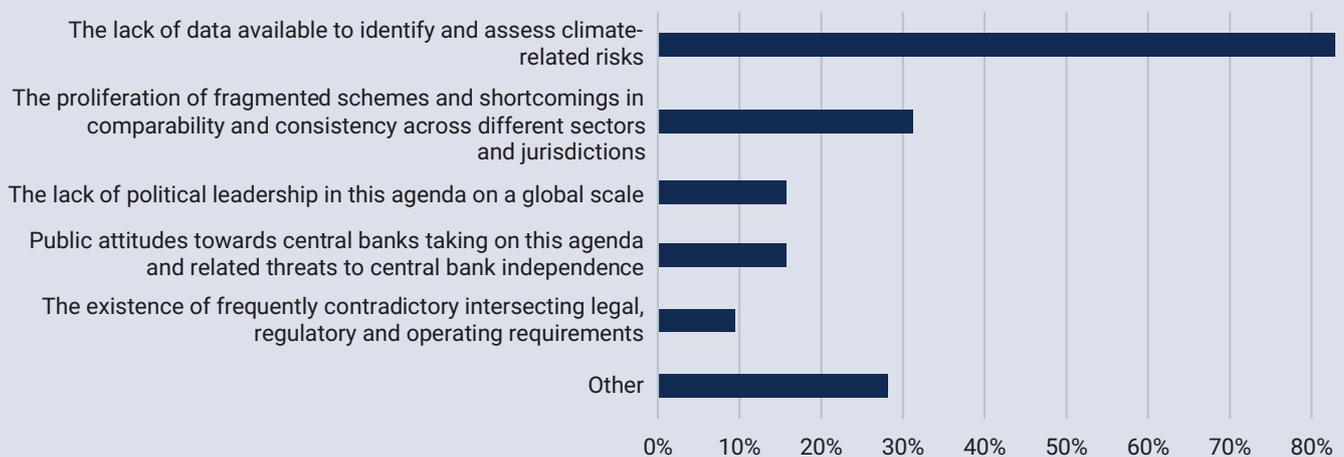
‘When assessing firms’ exposure to climate risk, do you evaluate and take into account their approaches to leverage green finance opportunities and innovate in product development?’, share of responses



Source: OMFIF Central Banks and Climate Change Survey 2019

Figure 11: Central banks determined to implement climate stress tests but process still at early stage

‘What do you see as the biggest challenges in the supervision of climate risk?’, share of responses



Source: OMFIF Central Banks and Climate Change Survey 2019

‘Unequivocal signals given by political and financial authorities are key. In addition, tools such as environmental scenario analysis are very relevant and the financial system needs to innovate and develop new methodologies. Involvement of senior management in financial firms is crucial.’

Central bank from Latin America

Association, Capital Markets Authority and national treasury to develop the country’s green bonds programme. The Banco Central do Brasil’s Resolution 4327 on social and environmental responsibility for financial institutions builds on voluntary green protocols originated by Brazil’s banking federation. Other regulators employ subsidies to incentivise private-sector green finance. In 2019 the Monetary Authority of Singapore introduced a sustainable bond grants scheme, expanding on its 2017 green bond grants scheme. The programme helps sustainable bond issuers defray the costs of external review and ratings.

However, great uncertainty remains. Aside from their own regulatory initiatives, most of the central banks surveyed do not formally evaluate private-sector green finance as part of their supervisory mandate (see Figure 10). The rationale for not including private-sector green financial innovation in a supervisory capacity relates to the perceived constraints of central bank mandates. In some jurisdictions, regulatory and supervisory activities such as consumer protection are divided between central banks and other authorities. Where possible in this report we have surveyed various types of institutions to ensure a comprehensive assessment of the supervisory landscape. Their comments point to a need for

concerted action on green finance between regulators on the global as well as national level. Overall, several respondents said they are developing means or would seek to include such considerations – albeit with the qualification that it is ‘unlikely to be a key area of focus’, according to one respondent.

Fragmentation and consistency

Among survey respondents, the second-most frequently cited challenge to proper climate-risk supervision after data shortcomings was the fragmentation of climate-risk schemes, cited by one-third of institutions. Some highlighted the complications to supervision arising from the lack of ‘comparability and consistency’ of disclosure frameworks, as in the case of company-level disclosures.

In addition to the recommendations of the Task Force on Climate-related Financial Disclosures, popular reporting standards include those of the Sustainability Accountability Standards Board and Global Reporting Initiative, which use differing metrics for climate performance. The SASB uses a relatively narrow framework ranging between two and 10 sustainability metrics per industry, while the GRI’s can exceed 80. Moreover, the voluntary nature of many disclosure requirements means that even company-level disclosures within a common reporting standard may not be consistent.

The problems posed by fragmentation are far-reaching. According to one African central bank, ‘Supervising climate risk can have a much wider impact than only on supervised entities, and a collaborative effort is therefore required that brings together all stakeholders and role-players in order to take appropriate and coordinated action.’ The NGFS itself acknowledged in its April 2019 ‘Call for Action’ that there is a trade-off between ‘the fragmentation of regional or national approaches, diversity of jurisdictions’ collective preference and differing stages of development’ on the one hand, and ‘harmonisation in order to avoid level-playing field problems and to facilitate global assessment of risk profiles’ on the other. ❖



CASE STUDIES:

Regulatory approaches to climate risks

This section highlights the initiatives across climate risk supervision through micro- and macroprudential regulation and other measures across 20 jurisdictions, as well as other activities in support of green finance.



Australia

RESERVE BANK OF AUSTRALIA, APRA AND ASIC

The Reserve Bank of Australia joined the NGFS in July 2018. The RBA has identified climate change as a systemic risk to the Australian economy, with its October 2019 Financial Stability Review describing in detail the potential implications of climate change on price and financial stability. The RBA monitors climate risks as part of its monetary policy and financial stability mandates, and works closely on climate risk regulation with the Australia Prudential Regulation Authority, Australian Securities and Investments Commission and Treasury as part of the country's Council of Financial Regulators. The council has established a working group to better understand the financial implications of climate change and co-ordinate interagency policies.

APRA and ASIC have strongly encouraged the financial institutions and listed firms under their remit to disclose climate-risk information aligned with TCFD recommendations. APRA has said financial institutions should treat climate risks as a mainstream risk factor. A recent APRA survey of institutions' climate-risk management practices noted that while many were making progress to implement measures, there was substantial room for improvement. A 2018 ASIC study on climate risk disclosures concluded that although large listed firms recognised the importance of climate data, they were often too heterogeneous and limited to be of meaningful use. APRA is now considering how to assess bank and insurer exposures to physical and transition risk scenarios.

Brazil

BANCO CENTRAL DO BRASIL

The Banco Central do Brasil is at the frontier of employing environmentally-aligned prudential regulation policies, being the first regulator to engage commercial banks in this area. Since 2011 the BCB's Resolution 3,988 has required banks to conduct

environmental and social stress-testing and integrate these risks in line with Basel II capital adequacy requirements. Annual stress tests necessitate banks to consider their exposure to a variety of risks, including environmental and social ones, and to demonstrate adequate capital to cover them.

In 2014 the BCB published thorough guidelines on social and environmental responsibility applying to its authorised financial institutions, building on voluntary protocols from the banking sector. This established the expected areas of environmental and social risk that banks' governance frameworks should address. Notably, banks are required to gather data on financial losses due to environmental damages stretching back five years.

Apart from green macroprudential regulation, the BCB has intervened in specific credit markets through environmental regulation. Since 2008, the central bank has made access to subsidised rural credit in the Amazon rainforest conditional on compliance with environmental and social regulations. This is estimated to have restricted around Br12.9bn (\$700m) in loans to harmful economic activities between 2009-11.

China

PEOPLE'S BANK OF CHINA

The People's Bank of China is a founding member of the NGFS and chairs its first workstream on supervision of financial institutions. The central bank employs macroprudential and monetary policy tools to promote green financial development. Alongside other supervisory entities such as the China Banking and Insurance Regulatory Commission, the PBoC adheres to China's Green Credit Policy, first outlined in 2007, and the Guidelines on Establishing the Green Financial System released in 2016.

These plans require banks to shift loans away from unsustainable, high-pollution or high-emission industries to environmentally-friendly options. The measures the PBoC employs to support these goals can be divided broadly into the following areas: standardising taxonomies for green financial products; requiring mandatory disclosure for environmental risks; restricting loans to non-compliant polluting firms; and incentivising commercial bank

lending to green projects.

In December 2015 the PBoC issued its Green Bond Guidelines, as well as the China Green Bond Endorsed Project Catalogue. These set out the official criteria for projects that qualify as 'green', the management procedure for bond proceeds, and the reporting requirements for periodic disclosures.

As the regulator overseeing the interbank bond market and issuance by financial institutions, the PBoC's guidelines cover around 93% of outstanding bonds in China. In December 2017 the PBoC and China Securities Regulatory Commission released the Provisional Green Bond Assessment and Verification Guidelines.

These aim to prevent greenwashing by setting standards for qualified entities rating and verifying green bond compliance. The PBoC's shared database with the ministry of ecology and environment and with banks facilitates macroprudential policies by assessing environmental credit risks for loan approvals and reviews. The database helps restrict credit availability for firms that violate environmental compliance standards.

The PBoC incorporates green performance metrics into macroprudential assessment systems guiding commercial banks to extend lines of credit to green projects.

Since 2018, it has broadened the types of collateral it accepts for medium-term lending, becoming the first central bank to accept commercial banks' green bonds, loans and asset-backed securities with a rating of double-A and above as eligible collateral.

Euro area

EUROPEAN CENTRAL BANK

The European Central Bank is an NGFS member and wields immense influence as the central bank shaping the monetary policy of its member states. There is much debate on the role the ECB could and should play to complement the European Union-wide sustainable finance agenda. Its new president, Christine Lagarde, has described climate change as 'mission critical' for the ECB. One of the most significant suggestions includes the ECB adopting 'green quantitative easing' within its €2.5tn asset purchase programme.

In November 2018 it was noted that, due to the APP, the ECB held a significant portion of both public and private sector green bonds, with estimates of around 24% and 20% of the eligible investment universe respectively. The market neutrality principle that guides asset purchases has resulted in the ECB's APP balance sheet reflecting the industry makeup of carbon-intensive economic activities.

The ECB is beginning to implement sustainability principles, including divestments, proxy voting and hiring external specialists listed by the United Nations Principles for Responsible Investment to manage several of its non-monetary portfolios, such as its pension portfolio. It is reviewing implementing such criteria in its paid-up capital and general reserve funds.

In November 2019, European Commission Vice-President Valdis Dombrovskis announced that banks could get regulatory relief for green investments under the next revisions to the Basel capital requirements. A month later, the European Banking Authority published its 'action plan on sustainable finance', which sets a

timeline to deliver on its environmental, social and governance mandates by focusing on key metrics and disclosure to support banks' green strategies, and exploring evidence needed to adjust risk weights.

Onlookers expect climate change will become a greater area of focus for the ECB under its new president Christine Lagarde, who plans to include the agenda in the bank's strategic review. On asset purchases, the finalising of the EU-level sustainability taxonomy could enable the ECB to play a more active role in directing corporate purchases towards green bonds.

France

BANQUE DE FRANCE AND AUTORITÉ DE CONTRÔLE PRUDENTIEL ET DE RÉOLUTION

The Banque de France is a founding member and houses the secretariat of the NGFS. The Banque participates in the G20 Green Finance Study Group, which aims to harmonise and deepen green bond markets. The central bank also supports green finance research through partnerships with universities, research centres and think tanks. Since 2018 it has offered an annual 'Young Researcher Prize for Green Finance' to fund studies on climate risks to the financial sector.

National legislation such as Article 173 of 2016's Energy Transition Law has brought climate-risks to the fore for the Banque and Autorité de contrôle prudentiel et de resolution, its prudential agency. Article 173 mandates that climate risks be integrated into prudential supervision 'in the context of regular stress tests'. The main principle underpinning the Banque's climate agenda is raising awareness and enhancing ownership of these risks in the banking sector. The central bank will be implementing stress tests for climate risks from 2020.

A 2017 Banque de France-ACPR report concluded that transition risks were particularly relevant to financial stability, but also stated that the timeframe for their materialisation was beyond the conventional length used to supervise commercial banks. A follow-up survey in 2018 took stock of the progress made by major French banks and insurers to account for various climate risks. This highlighted significant progress in preparing for transition risks, modest progress in assessing physical risks, and a low level of sophistication in analysing liability risks. Like DNB, the Banque applies ESG considerations to fund portfolios, and in March 2018 became the first central bank to adopt a responsible investment charter.

This is aligned with key international ESG standards including the UN Sustainable Development Goals, the UN Global Compact and 2015 Paris climate agreement.

In October 2019 the ACPR created the Climate and Sustainable Finance Commission, tasked with assessing the climate and sustainable finance commitments of financial sector entities through defining methods for measuring, communicating, comparing and monitoring such commitments over the long term.

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 **Germany**
**BUNDESBANK AND BAFIN**

The Bundesbank is a founding member of the NGFS and chairs the network's third workstream on scaling up green finance. This focuses on how central banks can more proactively support the transition to a sustainable economy. The Bundesbank works closely with BaFin, Germany's financial regulatory authority, to monitor the capacity for individual financial institutions to undertake climate risk disclosures.

Qualitative information on the risk management capabilities of German small and medium-sized banks regarding climate risk was collected as part of a 2019 stress test. It was concluded that climate risk management remains at an early stage – only around 33% of participating banks said they would cover climate risk at least to some extent in their risk management framework. In the same month, BaFin launched a consultation on its expectations and recommendations to supervised entities for dealing with sustainability risks.

The Bundesbank is integrating green finance into its own business areas. Six of the 16 portfolios it manages on behalf of federal states use sustainability criteria in their investments. Three states – Hesse, Baden-Wuerttemberg and North Rhine-Westphalia – are in a working group with the Bundesbank to develop bespoke sustainability and ESG indices. Moreover, the Bundesbank is considering expanding its own investments to include more sustainability criteria, especially in its non-monetary portfolios.

 **Greece**
**BANK OF GREECE**

The Bank of Greece was one of the first central banks to devote considerable resources towards climate and environmental economics research, reflecting the country's high sensitivity to negative climate change effects. As early as 2009 the interdisciplinary Climate Change Impact Study Committee was set up within the Bank to raise awareness and integrate climate risks into policy-making. Notably, a 2011 committee report concluded that under a worst-case 'business as usual' scenario, climate impacts could cause Greece's GDP to fall by 2% annually by 2050, worsening to 6% by 2100. Cumulative economic costs over this timeframe were estimated at €701bn.

The committee worked closely with other government branches, including the ministry of environment and energy, to develop Greece's 2015 National Climate Adaptation Strategy. In January 2019 the Bank of Greece joined the NGFS and in March subscribed to the United Nations Environment Programme Finance Initiative's Principles for Responsible Banking, encouraging the banks it supervises to follow its example. Governor Yannis Stournaras has been one of the most vocal central bankers on climate change, delivering numerous related speeches during his tenure.

 **Hong Kong**
**HONG KONG MONETARY AUTHORITY**

At its Green Finance Forum in May 2019, the Hong Kong Monetary Authority set out a three-pronged approach to promote green and sustainable finance. One strategy is the promotion of green and sustainable banking practices undertaken in three phases. The first phase, already underway, is developing a common framework and methodology for authorised financial institutions under its remit to undertake 'green baseline assessments'. This framework will be informed by industry consultation and international best practices, drawing on the HKMA's participation in the NGFS. The HKMA intends to complete this stage by 2020 followed by a comprehensive green assessment exercise. Subsequent phases will enact measurable targets for the banking industry's promotion of green finance and methods to track and evaluate their progress in this area.

The HKMA has launched a Centre for Green Finance under the auspices of its Infrastructure Financing and Facilitation Office to conduct capacity building and experience sharing for sustainable practices in the banking and finance industry. The authority has also committed to extending responsible investment principles in the management of its Exchange Fund. These principles prioritise ESG investments if the long-term return is comparable to other investments on a risk-adjusted basis.

 **India**
RESERVE BANK OF INDIA

Since 1949, the Reserve Bank of India has employed a Priority Sector Lending programme, granting it the ability to direct up to 40% of commercial bank lending to specific economic sectors. Traditionally, focus sectors have been related to agriculture, education, infrastructure and micro, small and medium-sized enterprises. In 2015, the programme was amended to extend its reach to facilitate sustainable development by explicitly including social infrastructure and renewable energy projects as priority areas. This has stimulated credit flow for renewable energy projects, the lending for which expanded at a higher rate than overall credit growth between 2009-14.

The RBI is reviewing whether to include environmental risks as part of its monitoring of agricultural markets and their impact on financial and monetary stability. This may become a pressing need in the light of climate change's direct impact on agricultural activities and their importance to India's economy. Given agriculture's PSL status, commercial banks regulated by the RBI are obliged to provide support in the event of natural disasters affecting the sector.

The RBI's 'master direction on relief measures by banks in areas affected by natural calamities' outlines initiatives such as rescheduling existing loans and sanctioning fresh loans to aid recovery. A 2018 report from Action on Climate Today, an initiative working closely with governments in South Asia, concluded that the locally concentrated portfolios of many Indian banks would be exposed to high financial risks if the frequency and severity of natural hazards rise in tandem with climate change.

Ireland

CENTRAL BANK OF IRELAND

The Central Bank of Ireland is an NGFS member and acknowledges that climate change is a fundamental risk to financial stability. A letter from Philip Lane, the former governor and now chief economist of the European Central Bank, highlighted the strategic priority of tackling climate risks as part of the CBI's mandate to 'serve the public interest by safeguarding monetary and financial stability'. The CBI has focused on transition risks, with plans to integrate carbon-related systemic risk factors into its macroeconomic and financial stability assessments.

The CBI is researching how to adapt analytical models to incorporate the impact of acute and chronic climate change effects. On the prudential side, the central bank has already suggested it intends to increase its focus on the adequacy of financial institutions' emerging risk management and disclosures. Firms will be expected to use tools such as scenario analysis and stress testing to determine their vulnerabilities to climate risks and act appropriately to mitigate them.

Sustainability criteria are being applied to the CBI's portfolio management and internal operations. The central bank uses compliance with the UN Principles for Responsible Investment as a condition for allocating the mandate of its equities portfolio. The CBI is also developing ESG criteria for its fixed-income assets, with the central bank already holding green bonds in its investment portfolio and as part of the ECB's public sector purchase programme. The CBI's new headquarters were designed to be energy efficient, with the central bank pledging to halve its greenhouse gas emissions by 2030.

Japan

BANK OF JAPAN AND FINANCIAL SERVICES AGENCY

Japan is the world's largest supporter of the TCFD, with 172 companies assenting to its recommendations as of September 2019. The main supervisory bodies overseeing the financial sector are the Bank of Japan and Financial Services Agency.

Like other major central banks, the BoJ has employed unconventional policies such as quantitative easing to stimulate growth. However, an unusual aspect of the BoJ's QE programme is its heavy inclusion of equities through exchange traded funds. Views on the contributions of equity purchases to green goals are nonetheless unclear. Some have argued these are beneficial, enabling central bank purchases to support low-carbon projects funded primarily by equity and project loans. Others are more sceptical, as equity stocks may be more exposed to climate risks affecting asset values.

Since 2012 the BoJ has engaged in central bank financing supporting lines of credit to green activities. This is accomplished through a funding facility called the 'Loan Support Programme', providing preferential liquidity at low interest to financial institutions lending to socially and environmentally beneficial projects.

Both the Bank of Japan and Financial Services Agency are NGFS members. The FSA supports TCFD-aligned disclosures. In May 2019 it launched a TCFD consortium to promote information sharing and capacity building on climate risk disclosures. In October 2019 the agency announced a research partnership with 2° Investing Initiative, a London-based sustainability think tank, to assess the impact of climate risks on Japan's financial stability.

Kenya

CENTRAL BANK OF KENYA

Relating to its financial stability mandate supporting government objectives for growth and employment, the Central Bank of Kenya is a strong advocate of green and sustainable finance. While the CBK has not explicitly outlined guidelines on environmental risks linked with monetary policy, it has collaborated extensively with public and private sector institutions to promote Nairobi as an African centre for green capital markets. Developing green financial products alongside the private sector is intended to enable commercial banks to build the required capacity for effective and meaningful implementation. This will also give the CBK time to build the internal capacity for effective supervision to avoid greenwashing.

In 2015, the central bank partnered with the Kenya Bankers Association to create a set of sustainable finance guiding principles for the banking industry. Two years later, the CBK launched, in conjunction with the Bankers Association, Capital Markets Authority and Treasury, the Kenya Green Bonds Programme, which provides capacity building and technical assistance to facilitate green bond issuances. Kenya unveiled its regulatory framework for green bonds in February 2019, and issued its first green bond that October, raising around \$41m for climate-resilient student housing. The Treasury has signalled its intent to debut Kenya's first sovereign green bond. Additionally, since 2009 the central bank has issued long-term infrastructure bonds on the Treasury's behalf. Unlike conventional securities, these infrastructure bonds are tax-exempt to attract investors. The proceeds are used to finance sustainable projects that improve transport, energy and water infrastructure.

Mexico

BANCO DE MÉXICO AND CNBV

The Banco de México (Banxico) is a founding member of the NGFS and part of its steering committee. The National Banking and Securities Commission (CNBV), the primary regulator of Mexico's banking and securities industry, joined the network in September 2019. Presently no explicit component of Banxico's or the CNBV's regulatory frameworks requires them to incorporate climate risks into their risk management responsibilities. However, Banxico is working with multiple international partners to develop frameworks to measure the impact of climate and environmental risks on the financial system. In 2018, the central bank collaborated with German development agency GIZ, the Instituto Tecnológico Autónomo de México and Cambridge

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Institute for Sustainability Leadership to embed forward-looking environmental scenario analysis into its decision-making process. This project sought to increase financial institutions' resilience to environmental risks.

Banxico does not have an explicit responsible investment policy. However, it employs environmental, social and governance considerations within fixed-income assets in its portfolio. It does this, for instance, by buying bonds from supranational organisations that contribute to sustainable economic growth and development. In 2016, Banxico broadened its responsible investment universe to incorporate green bonds and included them as eligible assets for its foreign reserves portfolio. However, due to the lack of secondary market liquidity in green securities, as well as inconsistencies in sustainability standards and ratings, Banxico has not yet implemented a mandatory ESG threshold for its portfolio to follow.

Morocco

BANK AL-MAGHRIB AND MOROCCAN CAPITAL MARKET AUTHORITY

Since the 2016 UN climate change conference in Marrakech, Bank Al-Maghrib and the Moroccan Capital Markets Authority (AMMC), the country's main financial regulators, have committed to catalysing green finance capabilities alongside other agencies. This is guided by two policy roadmaps: the central bank's 'roadmap for aligning the Moroccan financial sector with sustainable development', and a multiparty 'roadmap for the alignment of the financial sector with climate change commitments'.

Bank Al-Maghrib (a member of the NGFS steering committee) and the AMMC (part of the International Finance Corporation's Sustainable Banking Network, alongside the central bank) are introducing green finance principles and capacity building programmes following these roadmaps. Bank Al-Maghrib is drafting regulations that will introduce disclosure and stress test requirements for financial institutions on environmental topics. The AMMC, likewise, has endeavoured to harmonise and deepen capital markets for green financial products. It first published green bond guidelines in 2016, which were updated in June 2018 to include social and sustainability bonds.

Netherlands

DE NEDERLANDSCHE BANK

De Nederlandsche Bank is one of the founding members of the NGFS, with Executive Director Frank Elderson serving as the network's chair. DNB has been at the forefront of addressing climate risks as part of central bank supervisory responsibilities. In 2011 it updated its mission statement to consider long-term factors by safeguarding 'financial stability' and contributing to 'sustainable prosperity'. DNB has developed analytical tools to understand better the climate-related risks facing the Netherlands, given the country's vulnerability to natural hazards such as rising sea levels.

In a 2017 report, DNB laid the foundations for incorporating

climate-related risk factors into its assessment frameworks and dialogue with institutions. The study focused on the Dutch financial sector's exposure to carbon intensive sectors. Building on this, in October 2018 DNB became the first central bank to undertake climate stress tests for banks, insurers and pension funds under its supervision. The stress tests considered the implications of energy transition risks to the Dutch financial sector over a five-year period and concluded that losses were 'sizeable but also manageable'. The bank has been more cautious of employing tools such as green-supporting factors and brown-penalising factors that would alter banks' capital requirements. With no conclusive evidence of clear risk differentials between green and conventional lending, DNB considers it premature to use microprudential policy directly for sustainable finance. In November 2019, DNB issued guidance to insurers for integrating climate risks in their 'own risk and solvency assessments'. Later that month it launched a consultation on the draft 'good practice guide' on integrating climate risk considerations into banks' risk management.

DNB has revamped the internal management of its reserve portfolio (nearly €19bn) to be more sustainable. DNB is notable for being the first central bank to sign up, in March 2019, to the UN PRI. It launched a new corporate social responsibility charter the same month, committing to integrate environmental, social and governance criteria into its reserves investment process, promoting green finance and transparently reporting on its responsible investment approach. With its responsible investment mandate, DNB hopes to inspire the Dutch financial sector and other central banks to undertake similar measures.

Poland

POLISH FINANCIAL SUPERVISION AUTHORITY

In 2016, Poland became the first sovereign to issue a green bond, with a term of five years and value of €750m. There have since been three more sovereign green bond issuances. In 2018, Poland issued a green bond worth €1bn with an eight-and-a-half-year term. In 2019, two green bonds were issued, the first at €1.5bn with a 10-year term and the second at €500m and a 30-year term.

The challenge of stranded assets and transition risks is of great relevance to Poland's regulatory entities, since coal is the country's primary energy source. A 2015 study assessing the exposure of the five largest Polish banks and pension funds to high-carbon sectors pegged their combined value at €5bn. The Polish Financial Supervision Authority (KNF) is the main regulatory authority responsible for monitoring the stability of the country's banking, capital markets, insurance and pensions sectors. The KNF already employs stress tests for the insurance sector in several scenarios such as flood and draught risks, as well as reinsurance coverage for coal-related risks. However, climate stress tests are not applied systematically, nor are they applied to the banking and capital sectors. A 2018 report by research institute WiseEuropa on transition risks in the Polish financial sector emphasised the need for sector-wide disclosures and stress tests to address high fossil-fuel exposures adequately.

 **Singapore**
MONETARY AUTHORITY OF SINGAPORE

The Monetary Authority of Singapore leads the country's green finance action plan and is a member of the NGFS steering committee. The central bank's green investments programme is intended to both strengthen its understanding of climate change-related risks and better position the MAS's own investment portfolio for long-term sustainable returns.

Designated insurers in Singapore are mandated to conduct assessments of risks associated with climate change and natural catastrophe in industry-wide stress tests.

As a member of the Asean Capital Markets Forum, the MAS helped develop the 'Asean green bond standards'. At home, the MAS initiates a green bond grants scheme, which defrays the cost of external review for qualified issuers. This was expanded to include social and sustainability bonds.

The central bank has set out plans to publish in 2020 a consultation paper detailing environmental risk management guidelines for the banking, insurance, and asset management sectors.

 **Sweden**
SVERIGES RIKSBANK AND THE FINANSINSPEKTIONEN

The Sveriges Riksbank and Financial Supervisory Authority (FI) are the main entities in Sweden responsible for financial stability and prudential regulation. Both are members of the NGFS. The FI is a founding member and part of the network's steering committee, and the Riksbank joined in December 2018. In 2016, the FI conducted a preliminary assessment of the financial risks that climate change poses to Sweden. Its report notes that while Sweden is generally less exposed to physical and transition risks, its financial system's exposure to Europe and the global economy may be channels for instability. Through its activities with international platforms like the NGFS, the FI is working to integrate sustainability in its supervision by developing appropriate tools to assess and quantify climate risks.

The Riksbank likewise sees climate change affecting Sweden in a systemic manner. Its first financial stability report of 2019 classified climate risks as global phenomena affecting Sweden through the international financial system. In addition, in January 2019 the Riksbank instituted a revised financial risk and investment policy. Under this, the Riksbank will be able to take into consideration sustainability aspects in the management of its foreign reserves.

 **UK**
BANK OF ENGLAND

The Bank of England is a founding member of the NGFS, with senior leadership being staunch proponents of the need for central bank involvement in tackling climate change. Mark Carney (governor of the Bank of England, 2013-20) first outlined the 'tragedy of the horizon' in 2015, and continues to be a prominent advocate for green finance and awareness on climate risks to the financial system. The BoE chairs the second NGFS workstream on

macrofinancial risks. This workstream is focused on developing appropriate analytical frameworks to measure climate risks to the macroeconomy. In 2015 the Prudential Regulation Authority – through which the BoE has a regulatory responsibility covering insurers – conducted a preliminary study on the impact of climate risks to the UK insurance sector. Subsequently, a 2017 report from the BoE highlighted the relevance of physical and transition risk channels to the Bank's supervisory objectives.

Based on these studies, the Bank has adopted several measures to support an orderly market transition within the financial sector to a carbon-neutral economy. In April 2019 it became the first central bank regulator to outline supervisory expectations for UK banks and insurers to embed the financial risks from climate change into their governance frameworks, risk management, scenario analysis and disclosures. The PRA also recommends these institutions to adopt the TCFD framework.

The PRA's 2019 insurance stress test, conducted in June, included for the first time an 'exploratory exercise', asking major insurers to consider how various climate scenarios would affect their liabilities and investments. While the Bank is yet to implement comprehensive stress tests for the banking sector and overall financial system, it has revealed plans to do so by 2021 through utilising its biennial exploratory scenario exercise to explore the financial risks posed by climate change.

Internally, the Bank has committed to reducing its carbon footprint by two-thirds by 2030.

 **US**
FEDERAL RESERVE

Unlike other major central banks, the Federal Reserve does not participate formally in official inter-central bank initiatives related to climate change such as the NGFS. The first US regulator to date to join the NGFS was the New York State Department of Financial Services, which became a member in September 2019.

The Fed's position on climate change has been largely ambiguous. In July 2019, Fed Chair Jerome Powell said that while the central bank employs 'cutting-edge research' on the economic impact of climate risks, climate change was perceived as more as a 'longer-run issue' unlikely to add value to day-to-day supervision. Some speculate that the Fed's reticence to be more vocal about this stems from climate change being a politically polarising topic in the US. Politicians are already scrutinising the Fed's prerogatives and decision-making, so taking a strong stance on climate change could generate further antagonism.

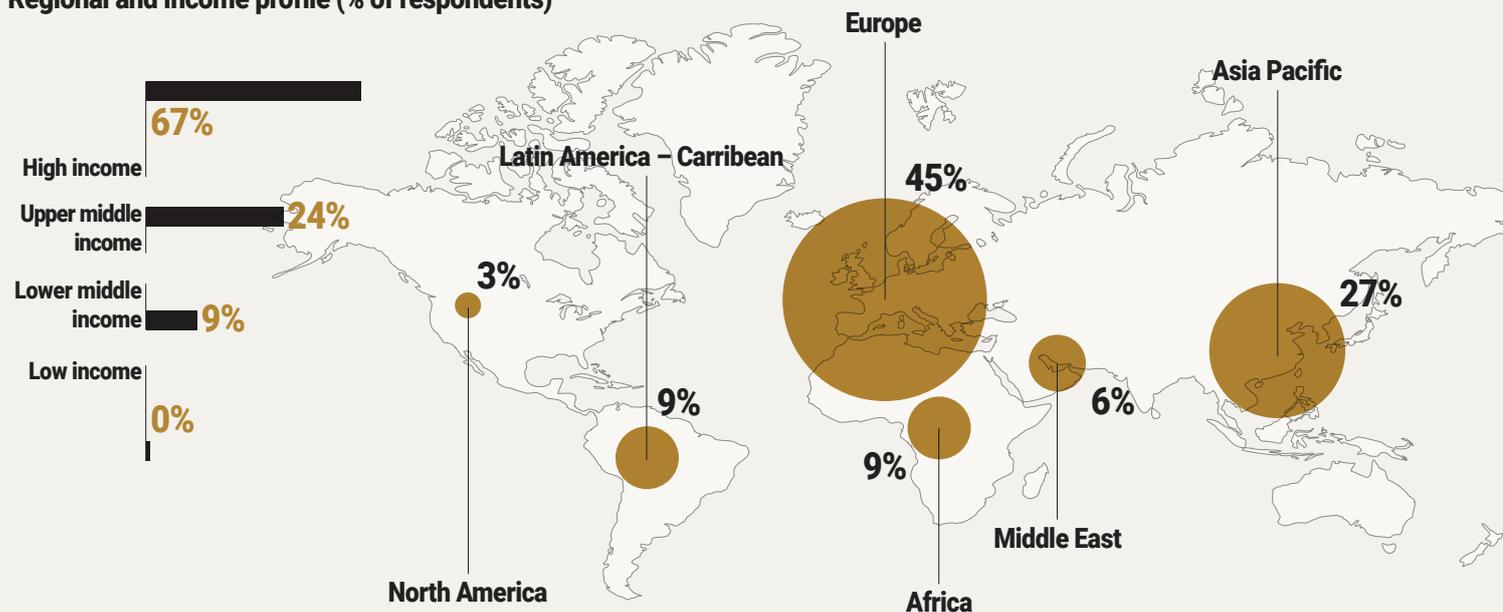
Despite these obstacles, there are signals the Fed is prioritising raising awareness about and research on climate risks to the financial system. In March 2019, the San Francisco Fed became the first regional branch to acknowledge that the effects of climate change are 'relevant considerations for the Federal Reserve in fulfilling its mandate for macroeconomic and financial stability'. Building on this, in November 2019 the San Francisco Fed organised the central bank's first conference on the economics of climate change. Lael Brainard, member of the board of governors, said at the conference that 'increasingly, it will be important for the Federal Reserve to take into account the effects of climate change and associated policies in setting monetary policy.' ❖

APPENDIX:

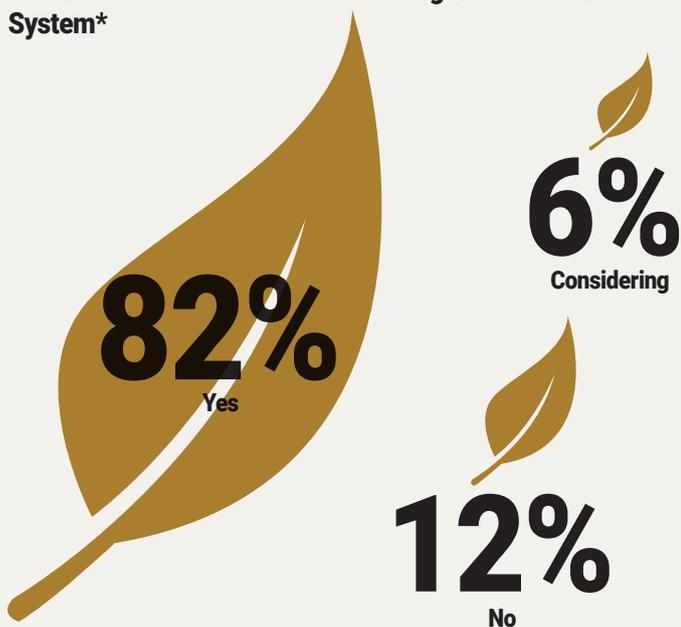
Profile of survey respondents

The report findings were informed by 33 central banks and supervisory authorities across six regions representing 77% of global GDP, which participated in an OMFIF survey conducted between August-December 2019.

Regional and income profile (% of respondents)

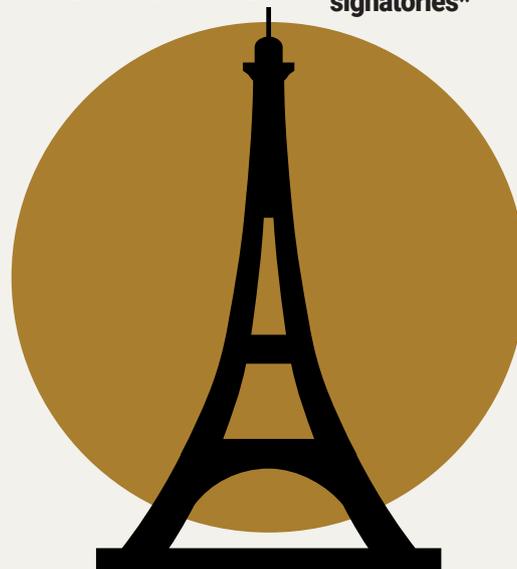


Members of the Network for Greening the Financial System*



*In some jurisdictions responses were submitted jointly by the central banks and supervisory authorities. We have listed these as 'NGFS members' where at least one of the institutions who participated from the jurisdiction is a member of the network.

100% Paris climate agreement signatories*



*Includes countries which are currently part of the Paris Climate Agreement despite stated intentions to withdraw in the future



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Company Number: 7032533. ISSN: 2398-4236



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