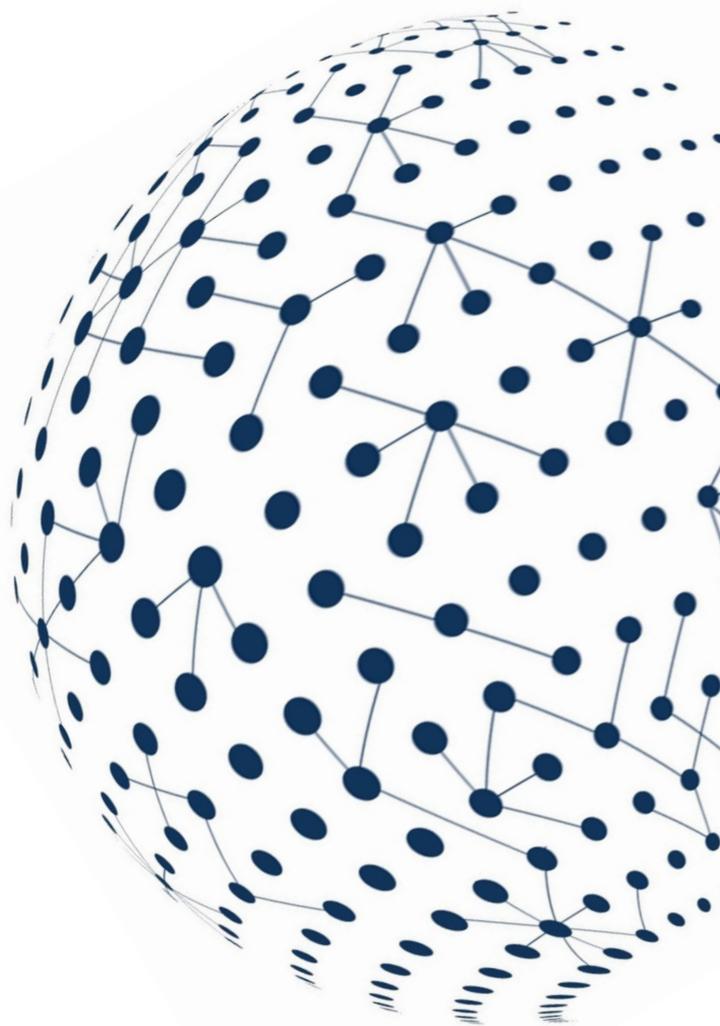


Supervisory and Regulatory Approaches to Climate-related Risks

Interim Report

29 April 2022



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Supervisory and Regulatory Approaches to Climate-related Risks

The Financial Stability Board (FSB) invites comments on the consultative report, Supervisory and Regulatory Approaches to Climate-related Risks.

Background

The objective of this report is to assist supervisory and regulatory authorities in developing their approaches to monitor, manage and mitigate risks arising from climate change and, in particular, to promote consistent approaches across sectors and jurisdictions. A more consistent global approach to addressing climate-related risks will help to better assess and mitigate financial vulnerabilities and to reduce the risk of harmful market fragmentation.

Supervisory and regulatory reporting and collection of climate-related data from financial institutions

1. Does the report highlight the most important climate-related data (qualitative and quantitative) for supervisors' and regulators' identification of exposures and understanding of the impacts of climate-related risks of financial institutions and across financial sectors? Please provide examples of climate-related data deemed most relevant and that should be prioritised.
2. Does the report draw attention to the appropriate areas to increase the reliability of climate-related data reported by financial institutions?
3. Does the report appropriately identify the elements of a common high-level definition of climate-related risks (physical, transition and liability risks)?
4. Do the proposed recommendations help accelerate the identification of authorities' climate-related information needs from financial institutions and work towards common regulatory reporting frameworks? Please elaborate on areas where the recommendations could be enhanced, if any.

Incorporating systemic risks into supervisory and regulatory approaches

5. Does the report identify relevant system-wide aspects that should be considered as part of supervisory and regulatory approaches to incorporate systemic risks arising from climate change? Please elaborate on other aspects that should be considered, if any.
6. Does the report accurately reflect the extent to which current supervisory and regulatory tools and policies address climate-related risks?
7. Do the proposed recommendations on incorporating systemic risks into supervisory and regulatory approaches, including the expanded use of climate scenario analysis and stress testing for macroprudential purposes, address the appropriate areas? Please elaborate if there are any other features or tools that should be considered.

Early considerations on other macroprudential tools and policies

8. Are there other areas of work, literature or research being conducted on macroprudential tools and policies on climate-related risks that should be considered in the report?

Additional considerations

9. Are there any other issues that should be considered in future work of the FSB on supervisory and regulatory approaches to climate-related risks?

Responses should be sent to fsb@fsb.org by 30 June 2022 with the title “Supervisory and Regulatory Approaches to Climate-related Risks”. Responses will be published on the FSB’s website unless respondents expressly request otherwise.

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Executive summary

Climate-related risks, including physical, transition and liability risks, may be transmitted across the financial system through various transmission channels and may be amplified by the financial system, including across borders and across sectors. A more consistent global approach to addressing climate-related risks will help to better assess and mitigate financial vulnerabilities and reduce the risk of harmful market fragmentation.

This report aims to assist supervisory and regulatory authorities in developing their approaches to monitor, manage and mitigate risks arising from climate change and to promote consistent approaches across sectors and jurisdictions. By focusing on cross-sectoral and system-wide aspects of climate-related financial risks, it complements the standard-setting bodies' ongoing work on approaches to addressing climate-related financial risks for their respective sectors. In addition, as climate change is likely to represent a systemic risk for the financial sector, potential macroprudential tools or approaches would complement microprudential instruments.

Supervisory and regulatory reporting and collection of climate-related data from financial institutions

The lack of sufficiently consistent, comparable, granular and reliable climate data reported by financial institutions is one main challenge for authorities in the development of supervisory and regulatory approaches to climate-related risks. Areas where data contribute to identifying exposures and understanding the impacts from climate-related risks include: sufficiently granular data on sectors or economic activities that are sensitive, vulnerable or exposed to physical, transition and liability risks; financial institutions' exposures to such sectors or economic activities; geographical location of financial institutions' exposures most prone to physical risk; and financial institutions' and their counterparties' reporting of carbon-related metrics, including Scope 1, 2, and 3 Greenhouse Gas (GHG) emissions.

Consistent and comparable climate-related firm disclosures, based on a global baseline climate reporting standard, provide a good starting or reference point for the future development of regular standardised regulatory reporting requirements. As relevant, authorities may require more granular and specific information for supervisory or regulatory purposes to support climate risk monitoring and analysis and to inform potential regulatory policy development.

As authorities continue to evaluate their information needs and move towards regular standardised regulatory reporting requirements, key policy considerations include: the expansion of regulatory returns to gather more granular and specific climate-related data on a regular basis; capacity building including upskilling staff and developing analytical tools; information system capabilities; and proportionality, taking into account the nature, size, and risk profile of a financial institution.

Recommendations

1. Supervisory and regulatory authorities should accelerate the identification of their information needs for supervisory and regulatory purposes to address climate-related risks and work towards identifying, defining, and collecting climate-related data and key metrics that can inform climate risk assessment and monitoring.

2. Supervisory oversight on financial institutions' governance, processes and controls on climate-related data reported, along with reviews by financial institutions' internal audit function, could strengthen the reliability of data. Establishing supervisory expectations addressing these areas would serve as an effective mechanism.

Where appropriate within jurisdictions' legal and regulatory frameworks, supervisory and regulatory authorities should consider the need for third-party verification to strengthen the reliability of climate-related data, such as on emerging key metrics, that will be relied on by authorities and financial market participants more broadly. (Third-party verifications could play an important role also in avoiding greenwashing risks.)

3. To promote further consistency across jurisdictions and sectors, authorities should consider using common definitions (such as those proposed by standard-setting bodies and international bodies) for: (i) physical risk, including both acute and chronic risks; (ii) transition risk, including technological developments, behaviour or social change, and policy changes; and (iii) liability risk, whether separate from or as a subset of physical and transition risk.
4. To the extent that more specific climate-related information is required for supervisory and regulatory objectives above and beyond public disclosures:
 - authorities should begin with asking financial institutions to report to supervisors qualitative information supplemented with increasingly available quantitative information (including, where full information is not available, use of proxies or estimates); and
 - as the availability and quality of data and measurement methodologies improve, authorities should move to higher reporting standards and/or mandatory reporting requirements.

In this way, strengthening the quality of data and improving its availability can possibly move forward together.

5. Global coordination and cooperation towards common regulatory reporting frameworks could be a catalyst in the identification of exposures and understanding of impacts of climate-related risks on financial institutions, financial sectors and to the broader financial system. Authorities and standard-setting bodies are encouraged to work towards common regulatory reporting requirements as part of future work.

System-wide perspective and the extent to which supervisory and regulatory tools and policies address climate-related risks

Supervisory and regulatory risk assessments and policies need to better incorporate understanding of the channels for how climate-related risks to financial institutions may be transferred across sectors or borders. Conceptually, a system-wide approach to climate-related risks would draw on elements of existing prudential frameworks: (1) supervisory review and evaluation processes; (2) use of risk analytical tools such as scenario analysis and stress testing exercises; (3) supervisory actions to address deficiencies in the risk management of climate-related risks; and (4) macroprudential tools and policies to address systemic risks.

Steps taken so far by authorities have focused on establishing supervisory expectations on financial institutions' risk management practices, setting out regulatory climate disclosure requirements, and increased use of climate scenario analysis and stress testing to inform a supervisory perspective on systemic risks.

Climate scenario analysis and stress tests have been the primary tool used to capturing transition risk and physical risk, with a lower proportion of jurisdictions capturing liability risk. The use of such tools is generally more common for the banking and insurance sectors and less common for the asset management and pension fund sectors. Credit and market risks are the financial risks most commonly addressed, and the proportion of jurisdictions that use tools covering credit risk in the banking sector is notably higher than other risk types in other sectors. Liability, liquidity, operational, reputational, and insurance (underwriting) risks are also covered but to a lesser extent. While the outcomes of the exercises have limitations on comparability of results, they have started to inform future steps authorities plan to take on regulatory actions and supervisory expectations.

Authorities are starting to expand their approaches by looking at risks in aggregate and factoring in system-wide aspects such as risk transfers between financial sectors, spillovers and feedback loops between the financial system and the real economy. Examples include the potential increase in insurance premia and insurance protection gap which could impact credit risk for banks; credit tightening and financial stress resulting from abrupt changes in global climate policy; potential fire-sale dynamics; and the potential for risk management actions by individual financial institutions to cumulate to create systemic risks. This work would in turn help inform policy approaches or supervisory expectations to avoid unintended consequences and a less effective transition.

When seeking to adopt a system-wide perspective, emerging practices include the use of top-down exercises combined with bottom-up elements involving financial institutions, dynamic balance sheet assumptions, and common scenarios. Some interactions are taking place between authorities across financial sectors, but approaches vary depending on their mandates.

Recommendations

1. In addition to microprudential measures at the firm level, authorities' approaches should account for the potential widespread impact of climate-related risks across the financial system.
2. Jurisdictions are encouraged to expand the use of climate scenario analysis and stress testing as a tool for macroprudential purposes. The design and scope of the analysis should ideally include the following features to inform a system-wide view: (i) both physical and transition risks; (ii) key financial sectors (e.g. banks, insurers, asset managers and pension funds); (iii) interdependencies between physical and transition risks, geographical and sectoral risks, as well as improved understanding of impacts on financial risks; and (iv) system-wide aspects of climate-related risks such as indirect exposures, risk transfers, spillovers and feedback loops.
3. When designing their climate scenario analysis and stress tests, authorities should adopt features that can best inform a system-wide view. A top-down approach, or a

combination of top-down and bottom-up approach (hybrid approach) could be used to capture cross-sectoral, system-wide aspects of climate-related risks. In addition, a dynamic balance sheet assumption could help capture second-round effects and potential feedback loops, while recognizing the inherent challenges on assumptions for financial institutions' future actions over a longer time horizon.

4. Future exercises should consider the range of financial risks beyond credit and market risk, to the extent they pose material risks, such as liquidity and insurance (underwriting) risk, which could be important to assessing the resilience of sectors across the financial system and address their interconnectedness.
5. As the FSB noted in its 2020 Report,¹ the NGFS should continue its work to refine and develop climate scenarios, which authorities should make use of in their climate scenario analysis, as appropriate, in order to align the data and methodologies used in such analysis.
6. Cooperation and coordination between authorities within a jurisdiction is encouraged. Authorities within each jurisdiction, aligned with their mandates, should cooperate and coordinate to better inform a system-wide view of climate-related risks. Such cooperation could, for example, include joint system-wide scenario analysis or stress test exercises on climate-related risks.
7. With respect to cross-border coordination and cooperation, as authorities develop their approaches, authorities should engage in active dialogue on home-host coordination through means such as institution-specific supervisory colleges, given the global nature of climate-related risks. In addition, standard-setting and international bodies provide an important platform for cooperation and coordination on cross-jurisdictional risks stemming from climate-related financial risks.

Early consideration of other potential macroprudential policies and tools

Microprudential tools alone may not sufficiently address the cross-sectoral, global and systemic dimensions of climate-related risks. It presents some of the early thinking among existing literature and work of standard-setting bodies and authorities on macroprudential policies and tools that could complement microprudential measures, and trade-off considerations. For example, in the European Union, the European Central Bank and the European Systemic Risk Board are examining the use of systemic risk buffers in response to unaddressed systemic climate risk while the Bank of England is undertaking further analysis to explore possible adjustments to capital adequacy requirements.

Authorities and standard-setting bodies are also encouraged to undertake research and analysis in the near to medium term on the appropriate enhancements to their regulatory and supervisory frameworks. This work would further support the link to financial stability mandates of authorities.

¹ FSB (2020) *The implications of climate change for financial stability*, November.

1. Introduction

The objective of this report is to assist supervisory and regulatory authorities (referred to as “authorities” throughout the report) in developing their approaches to monitor, manage and mitigate risks arising from climate change and to promote consistent approaches across sectors and jurisdictions. Climate-related risks, including physical, transition and liability risks, may be transmitted across the financial system through various transmission channels and may be amplified by the financial system, including across borders and across sectors. A more consistent global approach to addressing climate-related risks will help both to better assess and mitigate financial vulnerabilities and to reduce the risk of harmful market fragmentation.

This report has been developed as part of the FSB Roadmap for Addressing Climate-related Financial Risks published in 2021. As noted in the Roadmap, the FSB focuses on financial risks from climate change as well as actions by financial supervisory and regulatory authorities to promote financial resilience to the risks, while recognising the importance of mobilising the financing of sustainable investments and the financing of a transition to a low-carbon economy, which are covered by the G20’s broader roadmap for sustainable finance developed by the G20 Sustainable Finance Working Group.

By focusing on cross-sectoral and system-wide aspects of climate-related financial risks, this report complements the standard-setting bodies’ ongoing work on approaches to addressing climate-related financial risks for their respective sectors. In addition, as climate change is likely to represent a systemic risk for the financial sector, potential macroprudential tools or approaches would complement microprudential instruments.

In particular, the report focuses on three areas:

- supervisory and regulatory reporting and collection of climate-related data from financial institutions as foundational elements in the identification and monitoring of climate-related risks;
- system-wide supervisory and regulatory approaches to assessing climate-related risks, including the use of analytical tools such as climate scenario analysis and stress testing; and
- assessing the extent to which current policies and tools address climate-related risks, and early consideration of other potential macroprudential policies and tools to address systemic risks that may not be addressed fully by current measures, based on the work of standard-setting bodies and authorities.

These three areas taken together inform how the use of climate scenario analysis and stress tests can be expanded to incorporate systemic risks that arise from climate change and to better inform a macroprudential perspective of risks across financial sectors and jurisdictions.

The findings and analysis reflected in this report has been prepared in close coordination and cooperation with the standard-setting and international bodies, including the Basel Committee on Banking Supervision (BCBS), International Association of Insurance Supervisors (IAIS), the International Organisation of Securities Commissions (IOSCO) and the Network for Greening the Financial System (NGFS) based on work to date which continues to evolve. It is informed by

a comprehensive stocktake of completed or ongoing climate policy initiatives at the time of this report as well as a series of focus group sessions and surveys conducted² across FSB member authorities in 2021 on the areas covered in this report.

The report covers the following sections. Section 2 examines current supervisory and regulatory practices on reporting and collection of climate-related data from financial institutions, identifies relevant types of data and metrics that authorities may require and includes policy considerations and recommendations to assist authorities in their future work. Section 3 explores the system-wide perspective to addressing climate-related risks and identifies relevant elements to supervisory and regulatory frameworks considered within the scope of this report. Section 4 covers the use of analytical tools through case studies on authorities' approaches to addressing systemic risks and their challenges. Lastly, Section 5 assesses the extent to which current policies and tools address all or parts of climate-related risks and introduces considerations of potential complementary macroprudential policies and tools to address systemic risks that may not be addressed fully by current measures. Section 5 also sets out high-level guidance to support authorities in the expanded use of climate scenario analysis and stress tests to incorporate systemic risks that arise from climate change. Section 6 concludes.

2. Supervisory and regulatory reporting and collection of data from financial institutions

The lack of sufficiently consistent, comparable, granular and reliable climate data reported by financial institutions is one main challenge for supervisory and regulatory authorities in the development of supervisory and regulatory approaches to climate-related risks.³ This is consistent with the FSB and NGFS reports on availability of data and on bridging the data gaps.⁴

This section of the report:

- Examines current regulatory and supervisory practices on the reporting and collection of climate-related data from financial institutions (in Section 2.1).
- Identifies relevant types of data and metrics that authorities may require and provides examples of industry practices on climate-related metrics (in Section 2.1.4).
- Discusses the reliability of climate-related data (in Section 2.2).
- Identifies common elements for a high-level definition of climate-related risks (in Section 2.3).

² In 2021, the FSB Working Group on Climate Risks (WGCR) conducted a series of focus group sessions with selected FSB member authorities, NGFS and expert representatives from the industry and academia experienced in the area of climate-related financial risks. In 2021, the FSB WGCR also conducted two comprehensive surveys with selected FSB member authorities on system-wide aspects on climate-related risks and with the FSB WGCR members on macroprudential tools and policies.

³ Based on an FSB stocktake on supervisory and regulatory approaches to climate-related risks conducted in 2021.

⁴ FSB (2021) *The Availability of data with which to monitor and assess climate-related risks to financial stability*, July. NGFS (2021) *Progress report on bridging the data gaps*, May.

- Discusses key policy considerations to assist authorities in their future work, where appropriate, towards expanding regular standardised regulatory reporting requirements (in Section 2.4).

Against this backdrop, the section sets out high level guidance, in the form of recommendations, to assist authorities regarding reporting and collection of climate-related data from financial institutions.

2.1. Regulatory and supervisory practices

Authorities have collected climate-related data for various objectives. These include but are not limited to:

- Microprudential objectives (e.g. to assess firm-specific strategy and risks (such as viability of firms' business models, exposure quantification, impact of scenario analysis and stress testing, capital adequacy assessments)).
- Macroprudential objectives (e.g. to assess sector level or financial system level risks (such as monitoring of vulnerabilities and their implications to financial stability, sector or jurisdiction level scenario analysis and stress testing)).
- Macroeconomic objectives (e.g. to assess the impact on economic growth, productivity, inflation, structural implications or other macroeconomic aspects).

Authorities have gathered climate-related risks data from financial institutions through three main mechanisms: (i) ad-hoc surveys, targeted information requests and stocktakes; (ii) climate scenario analysis and stress tests; and (iii) specific regulatory reporting requirements. **Annex 1** provides several examples of authorities' approaches across these three sources.

2.1.1. *Ad-hoc surveys, targeted information requests and stocktakes*

The nature of ad-hoc surveys and similar information collection exercises reflects the focus of authorities on the understanding of financial institutions' climate-related risk exposures and risk management practices, and aims to inform development of supervisory climate risk management expectations.

For example, some authorities⁵ have used surveys to obtain qualitative information on the steps financial institutions are taking to meet supervisory expectations and/or how financial institutions are managing and mitigating their exposures to climate-related risks. Such sources have provided information to authorities across sectors and encouraged financial institutions to assess their governance and risk management practices. Some authorities⁶ have published or plan to publish the results of their surveys and their assessment, with a view to share good practices from financial institutions.

⁵ Brazil, Germany, Hong Kong, Singapore and UK

⁶ France, Germany, Hong Kong, Singapore and South Africa

In some cases, authorities⁷ have complemented their information requests with further supervisory dialogue with financial institutions. In addition to qualitative information, some surveys have aimed to size the exposures of financial institutions to climate-related risks by requiring quantitative information.

For its Global Insurance Market Report (GIMAR) special edition on climate change published in 2021,⁸ the IAIS collected ad-hoc quantitative and qualitative data as part of the IAIS' annual Global Monitoring Exercise (GME) from IAIS members covering 75% of the global insurance market to better understand insurers' asset-side exposures to, and supervisors' views on, climate-related risks. The lessons from this exercise were used to inform the GME which will now include climate-related data on an annual basis. As data elements become more stable it is expected that insurance supervisors will collect this information as part of their regulatory reporting exercises and provide for increased data consistency.

2.1.2. Climate scenario analysis and stress tests

The use of climate scenario analysis and stress test exercises have served as important information sources contributing to authorities' understanding of the potential impacts of physical and transition risks from climate change.

Some authorities have used supervisory templates for gathering data from financial institutions, which they plan to refine in future exercises. Scenario analysis and stress testing exercises have allowed authorities to gather insightful qualitative information on financial institutions' business strategies and management actions, such as mitigation policies, in response to different climate scenarios. This source has also been a means to gather quantitative information on financial institutions' exposures broken down by sector and geography, as well as data on credit risk (such as on loss given default (LGD), probability of default (PD) and expected credit loss (ECL) of borrowers and counterparties) and market risk. Particularly in cases where bottom-up exercises (i.e. carried out by financial institutions based on guidance from authorities) have been conducted, financial institutions have been required to use granular data from clients and counterparties based on their climate-related exposures. The above mentioned IAIS data collection was also used as input for scenario analysis as part of its GIMAR publication.

2.1.3. Specific regulatory reporting requirements

Some authorities are also planning to make use of publicly disclosed information, such as through specific Pillar 3 public reporting requirements for banks, to collect supervisory and regulatory information.

European Union (EU)

In the EU, the European Banking Authority (EBA) Implementing Technical Standards on climate change Pillar 3 reporting templates, published in January 2022, provide a practical example of

⁷ Canada, Hong Kong, Singapore and UK

⁸ IAIS (2021) *Global Insurance Market Report Special Topic Edition – The impact of climate change on the financial stability of the insurance sector*, November.

a comprehensive set of reporting requirements being introduced on climate-related information.⁹ The EBA Pillar 3 reporting templates are composed of qualitative disclosures on environment, social and governance risks (ESG) risks, governance and processes, and quantitative disclosures on climate-related transition and physical risks. There are five quantitative templates on institutions' banking book information:

- Credit quality of exposures by sector, emissions and residual maturity. It aims to show exposures towards non-financial corporates from sectors that contribute highly to climate change (e.g. fossil fuel companies excluded from sustainable climate benchmarks), and in carbon related sectors, and the quality of those exposures, including credit quality information on non-performing exposures, stage 2 exposures and related impairments and provisions. The EBA requires banks to disclose information on financed scope 3 emissions,¹⁰ if already available and specifies a transitional period for the disclosure of GHG financed emissions until June 2024, during which banks should at least disclose their plans and potential methodology to put in place these disclosures.
- Distribution of real estate loans and advances and of repossessed collaterals, based on the energy efficiency of the collateral (using a breakdown of the Energy Performance Certificate label of the collateral) together with the actual energy consumption.
- Banks' scope 3 emissions (GHG financed emissions, including Scope 1, 2 and 3 emissions of the counterparty), based on the counterparty's sector and on alignment metrics defined by the International Energy Agency (IEA) for different sectors. Banks are required to estimate the distance from the current value of the alignment metric to the 2030 projection according to the IEA's Net Zero Emissions by 2050 scenario.
- Banks' exposures to the top 20 carbon-intensive companies in the world, including the average maturity of the exposures.
- Exposures subject to physical risk. It includes loans and advances, debt securities and equity instruments not held-for-trading and not held-for-sale towards non-financial corporates, loans collateralised with immovable property and on repossessed real estate collaterals, exposed to chronic and acute climate-related hazards. The information is broken down by sector and geography.

There are also five templates on mitigation actions, providing information on assets and exposures that are supporting banks' counterparties in the transition to a carbon-neutral economy (e.g. building renovation loans that improve the energy efficiency of a building) and in the adaptation to climate change (e.g. loans to build barriers against flooding), including actions in line with the EU Taxonomy Regulation. In particular these templates include information on three types of key performance indicators (KPIs) and mitigating actions: a green asset ratio (GAR), a banking book taxonomy alignment ratio (BTAR) and information on other investments

⁹ Under article 449a of the European Regulation n. 2019/876 (Capital Requirements Regulation (CRR) 2) large institutions (including financial ones) with securities traded on a regulated market of any Member State should disclose prudential information on ESG risks, including physical risks and transition risks. The information under the EBA Pillar 3 reporting templates will be required on an annual basis for the first year, and semi-annually thereafter, starting from 31 December 2022.

¹⁰ The EBA notes that the disclosures are in line with the metrics and KPIs of the TCFD recommendations and supplemental guidance for banks, which also recommend the disclosure by banks of information on scope 3 emissions.

and exposures where the bank is financing activities that help their counterparties in the transition and adaptation process but that do not meet the strict criteria of the Taxonomy Regulation.¹¹

The European Central Bank (ECB) is currently working on the development of new metrics that measure climate risk in combination with financial risks in bank portfolios. Its main objective is to introduce metrics for prudential purposes that looks at climate risk with financial risks through an intuitive, simple metric, which factors the early stages of data collection and current constraints that financial institutions face. One metric to measure transition risks of loans would look at GHG emissions of borrowers in combination with loan loss provisions or PDs. The ECB's focus will be on simple metrics initially and move eventually move towards advanced metrics to allow for more complex analysis (e.g. climate VaR). Its work is planned to be published in a joint ECB and European Systemic Risk Board (ESRB) publication about exposure metrics for banks in July 2022 and in the upcoming ECB Financial Stability Review in May 2022.

Some other jurisdictions have also started developing regulatory reporting frameworks as further described below.

Brazil

In Brazil, Banco Central do Brasil (BCB) has developed regulatory reporting for Social, Environmental and Climate risks (DRSAC) to be in effect in 2023.¹² Large and medium-sized financial institutions will be required to send, on a semi-annually basis, qualitative and quantitative information related to the exposure of their loan book and securities to social, environmental and climate risks. The BCB will also require information on counterparties, such as economic sector, risk amplifiers and mitigators, geographical location of assets and net GHG emissions. This reporting aims to help the BCB in mapping exposures of the financial system to these risks, supporting the development of its micro and macroprudential actions.

France

In France, the Autorité de Contrôle Prudentiel et de Résolution (ACPR) has developed regular reporting to monitor the climate commitments of French financial institutions (banks, insurers, and asset management companies).¹³ As part of this, the ACPR collects both quantitative and qualitative information focused on how institutions are accounting for climate change, including metrics on the assets (loans, investments, derivatives, etc.) held by firms connected to fossil fuel extraction and production. It also asks for specific policies and commitments financial institutions are taking to reduce their carbon footprint, as well as what climate-related requirements financial institutions impose on firms they invest in or as counterparties. The collection of data is mainly

¹¹ A green asset ratio (GAR) that shows the level of alignment with the EU Taxonomy Regulation for the objectives of climate-change mitigation and climate-change adaptation of exposures towards large corporates and households, the latter focused on residential real estate and car loan portfolios. A banking book taxonomy alignment ratio (BTAR), a comprehensive KPI that shows the overall alignment of institutions' banking book with the EU Taxonomy Regulation for the objectives of climate-change mitigation and climate-change adaptation, including not only exposures towards large corporates, households but also exposures towards SMEs. For more information, refer to EBA (2022), *Final draft implementing technical standards on prudential disclosures on ESG risks in accordance with Article 449a CRR*.

¹² BCB (2021) *Report on Social, Environmental and Climate-related Risks and Opportunities*, September.

¹³ See ACPR and AMF (2021), *Second ACPR and AMF's joint report: Sectoral policies and fossil fuel exposure of French financial market participants*, November.

focused on transition risks, including the risks to the institution's assets given energy sector transition and the steps the institution is taking in its investments and equity portfolios to account for energy sector transition.

Switzerland

In Switzerland, regular reporting requirements in the area of climate-related financial risks were introduced for significant financial institutions¹ based on the TCFD recommendations. From 2022, the largest banks and insurance companies must describe their material climate-related financial risks and the way they are addressing them with regards to governance, risk management and strategy. In addition, they must also disclose relevant quantitative data, including a description of the methodology used. The information disclosed and the resulting transparency and increased comparability between financial institutions also allows for a general benchmarking and informs Swiss Financial Market Supervisory Authority's (FINMA) institution-specific and sector-wide risk assessments. In addition, the disclosed information represents a basis for further discussions and assessments in the supervisory process.

United Kingdom (UK)

In the UK, the Prudential Regulation Authority (PRA) is shifting towards actively supervising climate-related risks. In its Climate Change Adaptation Report published in 2021,¹⁴ it committed to considering what regular data supervisors could require from firms and if there is need to obtain this information via regulatory returns. Any proposed change to the scope of its regulatory returns would follow usual processes, including public consultation. This work will be in addition to the existing commitment by the PRA to review the utility of Pillar 3 disclosures for climate-related financial risks during the first half of 2022 as part of the UK joint government-regulator TCFD taskforce. In addition, the Financial Conduct Authority (FCA) plans to consult on ESG disclosures as part of its Investment Firm Prudential Regime in 2022 and envisages that it will include prudential considerations with respect to climate change and in particular the disclosure of material microprudential risks.¹⁵

2.1.4. Relevant data for supervision and regulation

While consideration for regular standardised regulatory reporting frameworks for collecting climate-related data from financial institutions are in the beginning phase, authorities' experiences with data collection highlight relevant areas which contribute to identification of exposures and understanding of the impacts from climate-related risks. At a high level, these areas include the following but not limited to:

¹⁴ See BoE (2021) *PRA Climate Change Adaptation Report*, October.

¹⁵ More broadly, the FCA, intends to undertake supervision of publicly disclosed climate-related information. Together with the UK's Financial Reporting Council, the FCA will undertake thematic work to assess how listed companies have complied with its TCFD disclosure requirements and intends to identify areas of concern and share examples of best practice. FCA (2021) *Primary Market Bulletin 36: TCFD aligned climate-related disclosure requirements*, November.

1. Identifying **sufficiently granular** data on **sectors or economic activities** that are sensitive, vulnerable or exposed to physical, transition and liability risks arising from climate change;¹⁶
2. Identifying **financial institutions' exposures** to such sectors or economic activities impacted by transition risk. This includes identifying exposures that are **direct** (e.g. Scope 1 GHG emissions, first order impacts) and **indirect** (e.g. Scope 2 and more importantly 3 GHG emissions, spillovers, second order effects and risk transfers, including on and off-balance sheet exposures) to minimise underestimating the current and potential financial risks;
3. Identifying **geographical location** of financial institutions' exposures¹⁷ to as high a level of granularity and completeness as possible to capture heterogeneity of risks within areas and identification of geographies most prone to physical risk drivers (both acute and chronic).¹⁸ Together, this information can enable a mapping assessment of material physical risks on financial institutions' exposures;
4. Strengthening the availability, quality and completeness of financial institutions' reporting (and their counterparties' reporting) of **carbon related metrics**, including reporting of **Scope 1** and **Scope 2 GHG emissions**, and progressively expanding to **Scope 3 GHG emissions**; increasing transparency on the measurement methodology used (e.g. GHG protocol), assumptions and the computation of the metric to enable comparability;
5. Assessing forward looking information on financial institutions' governance, business model and strategies and, where relevant, **transition plans**¹⁹ to determine most vulnerable financial institutions with material exposures to climate-related risks and concentration risks;
6. Strengthening the quality and completeness of **information on financial institutions' significant counterparties** (e.g. non-financial corporates which they lend to or invest in) including the counterparties' exposures to climate-related risks and forward-looking information such as those identified above; and
7. Identifying systemic risks to inform **a macroprudential perspective**, in addition to a microprudential perspective, to comprehensively consider the nature, scale and severity of climate-related risks to financial institutions individually and to the financial system collectively. Systemic risks arising from climate change can include second order effects and risk transfers or spillovers between financial sectors as well as feedback loops between the financial sector and real economy (further elaborated in Section 3 of the report).

¹⁶ Determination of sectors or economic activities are based on a credible, recognized and clear mapping system, whether that be based on a global classification system adjusted for jurisdiction's economic environment or based on a jurisdiction's own classification system.

¹⁷ Exposures include financial institutions assets, liabilities or business activities.

¹⁸ For example, data from climate models that map the future paths of climate change (how the location, magnitude, probability of physical risks may evolve in the future years) could serve as useful inputs for risk assessments.

¹⁹ Transition plans includes targets and metrics to achieving climate-related goals and risk mitigation measures and adaptation plans.

Recommendation 1

Supervisory and regulatory authorities should accelerate the identification of their information needs for supervisory and regulatory objectives to address climate-related risks and work towards identifying, defining, and collecting climate-related data and key metrics that can inform climate risk assessment and monitoring.

At a more granular level, Table 1 provides detailed examples of the information gathered by authorities to varying degrees through various information collection exercises. The examples are categorised by qualitative and quantitative information, as well as information on linkages between financial sectors and jurisdictions.

Table 1: Examples of information collected to varying degrees

Type	Examples
Qualitative	Governance Governance arrangements, including board oversight, management accountabilities, active risk committees and organisational set up
	Risk management Risk management processes established to identify, assess and manage climate risks. To what extent these processes are integrated into overall risk management, the challenges and actions to be taken Risk identification, *measurement, assessment – relevant risk categories (e.g. credit, market, liquidity, operational, insurance, reputation) and materiality Whether ESG ratings, credit ratings with climate factors (internally/externally) and external data are used to supplement internal data *Risk reduction measures that will affect the firm’s exposures *Details on methodologies of external vendors (lack of transparency and comparability across vendors)
Strategy	How climate-related financial risks are integrated into the business strategy, risk appetite and planning Financial institution’s decarbonisation pathway Measures to reduce reputational risks related to climate change Use of risk mitigants (e.g. insurance-linked instruments, diversification, securitisation) and adaption plans; consideration of climate risk in outsourcing arrangements Approach to scenario analysis to assess resilience - have internal scenario analyses been performed and how have they informed the financial institutions’ strategies or risk management Approach to capacity building and integration Public disclosures of climate-related risks and impacts

Type	Examples
	*Information from borrowers/counterparties - business strategies, transition plans, decarbonisation plans, including non-financial corporates
Quantitative	<p>Financial metrics</p> <p>Asset exposures (lending, trading, investments) by sector or economic activity to carbon sensitive sectors; concentrations</p> <p>*Geographical location of assets at a granular level</p> <p>Expenditures or capital investment towards climate related risks or opportunities</p> <p>*Financial risk exposures (e.g. credit risk (PD, LGD, ECL) and market risk (e.g. potential climate value-at-risk (CVaR))</p> <p>Average term of exposures</p> <p>*Useful quantitative results of scenario analyses and stress tests</p> <p>Risk mitigants used, such as financial instruments</p> <p>*Financial impact (direct and indirect) of climate risk on firms' balance sheets and income statements</p> <p>*Forward-looking metrics (e.g. Portfolio alignment, decarbonisation pathways, implied temperature rise, climate Value-at-Risk to assess tail risks)</p>
	<p>Carbon-related metrics</p> <p>Greenhouse gas emissions (GHGs) – Scope 1, Scope 2, *Scope 3 where applicable on a gross and net basis, on up and downstream value chain</p> <p>Internal carbon prices</p> <p>*Comparable and transparent ESG metrics/scores/ratings</p>
System-wide and cross-border information*	<p>Systemic risks including:</p> <ul style="list-style-type: none"> - second order effects, - risk transfers between sectors - feedback loops between the financial sector and the real economy (e.g. insurance protection gap) - Interplay between geographical and sectoral risks (e.g. mapping sectoral allocation of exposures to geographies) <p>Climate risk mitigation channels and use of financial instruments (e.g. counterparty's holdings of insurance-linked products, catastrophe bonds)</p> <p>Outcomes of scenario analysis on physical and transition risks, including their financial impact across sectors</p> <p>Cross-border information (e.g. via supervisory colleges), such as:</p> <ul style="list-style-type: none"> - geographic distribution of assets or loans in other jurisdictions

Type	Examples
	<ul style="list-style-type: none"> - results of scenario analysis in other jurisdictions and factors which may cause varying results - Exposures (asset, loans or by business activities) broken down by geography and sectors

**Examples of notable areas where there are significant data gaps and remaining information needs.*

Consistent with the findings in the FSB and NGFS reports on data availability and bridging the data gaps, there remains a need for more granular, consistent, comparable and reliable climate-related data.²⁰ This becomes particularly important as there grows increasing reliance on climate-related data prepared and reported by financial institutions, including use of this data for supervisory and regulatory objectives. This report complements the NGFS' progress report on bridging the data gaps which also provides guidance and recommendations, including a classification of climate-related data needs under use cases and categories of metrics and forms its repository framework for priority climate data and metrics.

As financial institutions (and their counterparties) further embed climate-related risk management practices and advance on measurement and disclosure of climate-related data and metrics, the availability of decision-useful climate-related data may improve over time.

On advances in industry practices, the work of the FSB's Task Force on Climate-Related Financial Disclosures (TCFD) published relevant guidance in October 2021 on disclosures and cross-industry metrics and portfolio alignment metrics.²¹ The TCFD highlights that users found most useful disclosure of climate-related information on the actual impact of climate-related issues on an organisation's businesses and strategy, financial impacts on capital expenditures and capital allocation and indication of the direction or ranges of potential financial implications under different climate-related scenarios. The TCFD also emphasises that disclosure of GHG emissions (Scope 1, 2 and 3) is crucial for users to understand an organisation's exposure to climate-related risks and opportunities, and is foundational information from which other climate-related information is estimated.²² The TCFD's guidance on cross-industry metrics cover GHG emissions, transition risks, physical risks, climate-related opportunities, capital deployment, internal carbon prices and remuneration.²³ The TCFD has also contributed to IFRS Foundation's work on a climate reporting standard (further discussed under Section 2.4).

As well, other regional industry practices have developed on metrics. For example, UK's Climate Financial Risk Forum (CFRF) was co-convened by the PRA and FCA and comprises a number of private-sector-led working groups with one focused on climate data and metrics²⁴. The CFRF guide identified that a wide range of climate-related metrics are currently in use by financial

²⁰ FSB (2021).
NGFS (2021) *Progress report on bridging the data gaps*, May.

²¹ TCFD (2021), *Guidance on Metrics, Targets and Transition Plans*, October.

²² The TCFD guidance recommends that all organisations disclose absolute Scope 1 and Scope 2 GHG emissions, independent of materiality assessment. Disclosure of Scope 3 GHG emissions is strongly encouraged and should consider where such emissions are significant portion of the organisations total GHG emissions.

²³ Refer to Table C1 page 16 – 17 for the cross-industry, climate-related metric categories and examples from the TCFD (2021).

²⁴ CFRF (2021), *Climate Financial Risk Forum Guide*, October.

institutions for differing purposes. As a first step towards identifying a common set of core metrics, metrics were organised into use cases: transition risk, physical risk, portfolio decarbonisation, mobilising transition finance and cross-cutting metric on engagement. The CFRF guide also set out recommendations for categories of metrics ranging from basic to advanced.

With respect to reliability of climate-related data, supervisory oversight of financial institutions governance, controls and processes on data as well as the potential need for third-party verification mechanisms are discussed in the next section.

2.2. Reliability of climate-related data

2.2.1. *Supervisory oversight of financial institutions' governance, processes and controls on data*

As climate-related data will increasingly serve as important informational inputs into supervisory reporting and risk assessments of financial institutions exposures to climate-related risks, financial institutions need strong governance, processes and controls around risk data aggregation and reporting (internally and externally) of climate-related data. Examples include any necessary adaptation of financial institutions' information systems to collect and aggregate relevant climate-related data, reliability of data sources, analytics used to assess exposure and impacts, and review and approval processes on reported information.

Supervisory oversight on financial institutions' governance, processes and controls on climate-related data reported, along with reviews by financial institutions' internal audit function, could strengthen the reliability of data. Supervisory expectations on these areas would serve as an effective mechanism. For the banking sector, the BCBS' consultative document on *Principles for the Effective Risk Management and Supervision of Climate-related Risks* issued in November 2021 addresses expectations for banks. In particular, the principles set expectations on banks' data aggregation capabilities and internal risk reporting practices as to allow the identification and reporting of climate-related risks and exposures. This includes the expectation that banks will report such information in a timely manner, engage with clients and counterparties to collect additional data, and develop qualitative and quantitative metrics as necessary. The BCBS intends to monitor implementation across its member jurisdictions to promote a common understanding of expectations, support the development of harmonised practices and facilitate implementation of the principles as soon as possible.

In 2021, the IAIS published an Application Paper that included several recommendations related to governance (including the role of control functions), noting that insurers need to integrate climate risk into their governance and enterprise risk management.²⁵ In early 2022, the IAIS concluded an analysis of its Insurance Core Principles (ICPs) and concluded that the ICPs are sufficiently broad to cover climate risks. In the coming years, it will make a limited number of changes to the explanatory guidance in the ICPs and develop supporting material.

²⁵ See IAIS (2021) *Application paper on the supervision of climate-related risks in the insurance sector*, May.

Data reporting and collection will likely be an iterative process, which is further discussed in Section 2.4. Complementary to supervisory expectations, financial institutions introducing their own data reporting expectations from borrowers, investees or counterparties would also address filling in data gaps.

2.2.2. *Third-party verification mechanisms*

Another mechanism to improve the reliability and credibility of climate-related data is the use of third-party verification mechanisms, including external assurance. These mechanisms would serve as effective, reinforcing tools for objective and independent assessments on climate-related data.

Recommendation 2

Supervisory oversight on financial institutions' governance, processes and controls on climate-related data reported, along with reviews by financial institutions' internal audit function, could strengthen the reliability of data. Establishing supervisory expectations addressing these areas would serve as an effective mechanism.

Where appropriate within jurisdictions legal and regulatory frameworks, supervisory and regulatory authorities should consider the need for third-party verification to strengthen the reliability of climate-related data, such as on emerging key metrics, that will be relied on by authorities and financial market participants more broadly. (Third-party verifications could play an important role also in avoiding greenwashing risks.)

2.3. High level definition of climate-related risks

Improvement of data from financial institutions would come from clear regulatory and supervisory guidance, including on common definitions of climate-related risks. A common clear definition of climate-related financial risks and coherent approaches to classifying those risks can be foundational to providing clarity to financial institutions, better facilitate measurement and collection of robust and comparable data across jurisdictions and financial sectors while mitigating the risk of regulatory arbitrage through fragmentation in approaches. With regulation on climate-related financial risks in the early development phase, there is an opportunity to promote common definitions and approaches that will also facilitate better cross-border comparison. There are important climate-related areas in which refined and common definitions or classifications, related to the measurement of climate risk exposures or to the definition of consistent and comparable risk metrics, are needed. Other initiatives such as broader taxonomies to facilitate the flow of capital to sustainable activities while avoiding greenwashing are outside the scope of this report, which focuses on financial risk.

Authorities, standard-setting bodies and the NGFS have published definitions related to climate-related risks. The following common elements have been identified in existing definitions, to promote further consistency across jurisdictions and sectors.

- **A physical risk definition that includes both acute and chronic risks:** Definitions of physical risks generally included a recognition of both acute and chronic risks. Acute risks are noted as more severe weather events, such as floods, hurricanes, and droughts. Chronic risks are often described by examples of sea-level rise, reduced

farmland productivity, and changes in precipitation patterns. One authority (Hong Kong Monetary Authority (HKMA)) cited that disruptions in global supply chains could be part of the physical risks that financial institutions account for.

- **A transition risk definition that includes technological developments, behaviour or social change, and policy changes:** Definitions of transition risk primarily refer to three types of risk drivers. One driver is technological developments that would make less environmentally friendly technology obsolete. Another driver is behaviour or social change, where consumers and investors demand more environmentally sustainable products and services. Lastly, legislation or governmental policy changes intended to shift to a lower-carbon economy, such as carbon taxes or pricing mechanisms, are another source of risk.
- **A definition of liability risk:** Liability risk associated with physical and transition risks, such as potential financial losses stemming directly or indirectly from legal claims, were also included in definitions. Liability risk can result from manifestations of physical and transition risks. Some national authorities have accounted for liability risk within their definitions of either physical or transition risks, while others have established separate definitions for liability risk as an additional risk. Others have accounted for liability risk more broadly as ESG factors. However, liability risk might materialise independently from transition risks and far in advance from the materialisation of both transition and physical risks. Litigation cases have been increasing over the past few years and tend to be costly for financial institutions.²⁶ Having a clear definition of liability risk, whether as a separate definition of risk or a subset of physical and transition risk, could increase the consistency in how such risk is identified and assessed. It could also enhance the governance of climate-related risks within financial institutions by encouraging the involvement of legal and compliance departments.

System-wide considerations for climate-related risk definitions

The interplay between physical, transition and liability risks across the financial system is not explicitly captured in existing definitions. Authorities that use definitions of climate-related risks may want to explicitly refer to how they interact with each other at a financial system-wide level. For example, the definition of transition risk could refer to how the increased frequency and severity of physical risk may create additional pressure on policymakers to take mitigating actions, resulting in increased probability that transition risk could manifest alongside physical risk. The definition of physical risk could also refer to how a delayed climate policy response associated with transition risk may aggravate physical risk.

Recommendation 3

To promote further consistency across jurisdictions and sectors in the definition of climate-related risks, authorities should consider using common definitions (such as those proposed by standard-setting bodies and international bodies) for: (i) physical risk definition including both acute and chronic risks; (ii) transition risk definition including technological developments,

²⁶ See [Climate Change Litigation Databases](#)

behaviour or social change, and policy changes; and (iii) liability risk definition, whether separate from or as a subset of physical and transition risk.

2.4. Expanding regular reporting requirements

Consistent and comparable climate-related firm disclosures, based on a global baseline climate reporting standard, provides a good starting or reference point for the future development of regular standardised regulatory reporting requirements. The International Sustainability Standards Board's (ISSB) global baseline climate disclosure reporting standard, built on the TCFD Recommendations, will be important for improving comparability and consistency of public disclosures on climate-related risks (and opportunities), including on common industry-wide metrics and industry-specific metrics.

Many authorities are focused on establishing climate-related disclosure requirements as a priority. While these disclosure requirements will provide valuable information, as relevant, authorities may require more granular and specific information for supervisory or regulatory purposes to support climate risk monitoring and analysis and to inform potential regulatory policy development. These could, for example, build on and complement public disclosures made by firms. In addition, supervisors and regulators may require a greater level of consistency in the information they collect across financial institutions, for comparability and aggregation at a financial sector or system level.

Data reporting and collection will likely be an iterative process. Gradual steps can assist authorities in integrating climate-related financial risk information needs into regular standardised regulatory reporting requirements, including through the use of existing reporting channels.

To the extent that more granular and specific climate-related information is required for supervisory and regulatory objectives, above and beyond public disclosures, authorities could begin with requiring financial institutions to report qualitative information supplemented with increasingly available quantitative information (including, where full information is not available, use of proxies and estimates). These requirements could supplement financial institutions' public disclosures with more granularity to meet supervisory and regulatory objectives. As the availability and quality of data and measurement methodologies improve, authorities should move to higher reporting standards and/or mandatory reporting requirements. These could introduce quantitative reporting requirements that are more specific concerning financial risks, financial impacts and forward-looking metrics as examples.

Recommendation 4

To the extent that more granular and specific climate-related information is required for supervisory and regulatory objectives, above and beyond public disclosures:

- **authorities should begin with asking financial institutions to report to supervisors qualitative information supplemented with increasingly available quantitative information (including, where full information is not available, use of proxies or estimates); and**

- as the availability and quality of data and measurement methodologies improve, authorities should move to higher reporting standards and/or mandatory reporting requirements.

In this way, strengthening the quality of data and improving its availability can possibly move forward together.

2.4.1. *Standardised Regulatory Reporting Requirements*

As authorities continue to evaluate their information needs beyond ad-hoc means and move towards regular standardised regulatory reporting requirements, key policy considerations include expansion of regulatory returns to gather more granular and specific climate-related data (such as for physical and transition risks) on a regular basis, capacity building, information technology capabilities and proportionality of requirements.

Expansion of regulatory returns

Authorities might consider using existing regulatory reporting returns and supplementing these with more granular requirements to capture specific climate-related data. Alternatively, authorities might consider developing entirely new reporting returns that are tailored to the level of granularity and breadth required.

Examples of supervisory and regulatory information as a starting point could for instance be drawn from the EBA's ESG Pillar 3 disclosure requirements for the banking sector (illustrated in Section 2.1.3). The types of information could encompass both qualitative and quantitative requirements. Qualitative requirements could include governance, business strategy and risk management practices. Quantitative requirements could include granular reporting of exposures to physical and transition risk. The following are examples:

- Exposures to physical risk could include loans, debt and securities instruments of non-financial corporates and real estate collateral for example exposed to chronic and acute physical risks. These exposures can be further broken down by granular sector or economic activities (particularly those vulnerable or sensitive to climate-related risks) and geography (particularly areas impacted by physical risk perils).
- Exposures to transition risk could include credit quality of exposures by sector, GHG emissions and residual maturity in the banking book. The breakdown by sector could be by exposures to non-financial corporates from sectors that are carbon emitters or carbon sensitive or vulnerable sectors. Disclosure of GHG emissions could include increasing requirements for disclosure of Scope 1, Scope 2 and progress towards Scope 3 emissions.
- Exposures to top carbon-intensive companies in the world and/or country by average maturity.
- Real estate loans and collateral, broken down by characteristics of the underlying property such as by energy efficiency and resilience or vulnerability of the property to physical risks.
- Assets with mitigation actions supporting transition activities of counterparties.

Authorities could also consider regulatory reporting returns to include reporting on forward-looking information, such as financial institutions' transition plans, the results from climate stress testing or scenario analysis and forward-looking metrics as they become more mainstream in their application.

Other key considerations

Other key considerations for authorities in the expansion of regulatory returns may include capacity building, information systems and proportionality. On capacity building, authorities might consider the need to upskill staff on understanding of climate-related risks and on the use and analysis of climate-related data. This includes developing analytical tools to gain insights on the data collected. On information systems, authorities might consider their information system capabilities, whether large amounts of granular qualitative and quantitative data can be collected, stored and reported, the sources and quality of the data, and establishing any boundaries on the data collected for regulatory and supervisory purposes. On proportionality, authorities might need to consider how to apply regulatory reporting requirements taking into account the nature, size, and risk profile of a financial institution.

Existing reporting platforms may be focused on single sectors. Authorities may want to consider the need for a system-wide view, including how to gather data across sectors, and aggregating the data and metrics, to monitor cross-sectoral risks (e.g. risk transfers) and systemic risks.

Lastly, the establishment of public data repositories at national, regional or global levels for various forms of climate-related data could be one means to increase the efficiency and quality of data collection and risk management by financial institutions.

2.4.2. Cross-border coordination and cooperation

Global coordination and cooperation towards common regulatory reporting frameworks could serve as a catalyst towards a global understanding of climate-related exposures and impact on financial institutions and on the financial system. Further consistency and comparability of climate related data, including metrics, reported to authorities could inform a common basis to facilitate dialogue between supervisors – bilaterally or multilaterally such as through participation in international fora or supervisory colleges – and with financial institutions operating across borders.

In this regard, the initiatives by standard-setting bodies and international organisations, such as the IAIS GME illustrate how global coordination on data reporting and collection can promote consistency and comparability of exercises on climate-related data.

Recommendation 5

Global coordination and cooperation towards common regulatory reporting frameworks could be a catalyst in the identification of exposures and understanding of impacts of climate-related risks on financial institutions, financial sectors and to the broader financial system. Authorities and standard-setting bodies are encouraged to work towards common regulatory reporting requirements as part of future work.

3. Aspects of system-wide regulatory and supervisory approach to climate-related risks

As supervisory and regulatory practices develop across financial sectors and jurisdictions, it is also important to ensure that approaches take account of the potential systemic nature of climate-related risks. This section explores (i) why a system-wide perspective is important, (ii) the key elements of system-wide supervisory and regulatory tools and policies, and (iii) authorities' approaches to date.

3.1. Why system-wide perspective?

Supervisory and regulatory risk assessments and policies need to better incorporate understanding of these channels for how climate-related risks to financial institutions may be transferred across sectors or borders. In its report on the implications of climate change for financial stability published in 2020,²⁷ the FSB identified that once crystallised, climate-related risks might be transmitted through, and amplified by, the financial system. The report explains how increased physical risks could result in increased market, credit and insurance (underwriting) risks to the financial system. It also describes how both physical and transition risks combined might have amplifying effects on financial stability.

These analyses would in turn help inform policy approaches or supervisory expectations to avoid unintended consequences and less effective transition. For instance, sudden and/or collective credit withdrawal from industry sectors deemed to be of higher climate-related risks could deprive firms that need to transition access to affordable finance; the provision of certain products could also be restricted before a sustainable replacement is available which can have wider consequences for the broader real economy.

While supervisors and regulators recognise the need to account for system-wide aspects, such as spillovers, risk transfers and feedback loops, in seeking to address climate-related financial risks, the development of policy approaches is at an early stage. Standard-setting bodies such as BCBS and IAIS have undertaken analysis of the gaps in international standards and have worked to support authorities domestically. Authorities are building their capacity to better understand climate-related risks to the macro-economy and financial system through exploration of tools such as climate scenario analyses and stress tests. To date, prudential policy measures have usually had a microprudential focus, e.g. establishing supervisory risk management expectations for financial institutions, requiring mandatory disclosure requirements and/or performing risk assessments of individual financial institutions.

However, authorities are starting to expand their approaches by looking at risks in aggregate and factoring in system-wide aspects such as risk transfers between financial sectors and feedback loops between the financial system and the real economy. The cumulation of the tools and policies applied across sectors of the financial system can ultimately contribute to a

²⁷ FSB (2020).

macroprudential, system-wide perspective to addressing risks,²⁸ complementing a microprudential perspective by accounting more broadly for indirect exposures.

3.1.1. *Spillovers and risk transfers across the financial system*

Authorities note the importance of accounting for spillovers and risk transfers between the different sectors of the financial system. In particular, they note the interlinkages between the banking and insurance sectors and the lack of information to help size the insurance protection gaps, such as the proportion of banks' exposures to climate-related risks (e.g. via household mortgage collateral) which are covered by the insurance sector.²⁹ The risk of previously insured assets becoming uninsurable, either because the premia become too expensive or because insurance cover is withdrawn, can affect other parts of the financial system that rely on insurance to mitigate this risk. There could also be risk transfer from banks to insurers, insurers to reinsurers and reinsurers to governments.

Other examples of spillovers and risk transfers include:

- the impact of sovereign risk for countries or of credit risk for local authorities severely impacted by climate events, including the possibility to trigger a negative feedback loop between sovereign and banking or insurance risks and raising the issue of the insurability of extreme climate events which can differ depending on national catastrophe regimes and their features;³⁰
- shifts in exposures if there are asset price differentials between banks and bond markets;
- fire sale or redemption risks for the insurance and asset management sectors in response to climate-related shocks, in the context of sharp asset price corrections for stranded-assets; and
- the scenario where a reduction in the mark-to-market value of climate-vulnerable, real estate-backed assets in the wake of a natural disaster leads to a margin call on pledged assets, or reduces the ability of certain parties to provide liquidity in key markets.

3.1.2. *Feedback loops with the real economy*

In addition, the materialisation of physical or transition risks and their effects on financial institutions and markets, could give rise to feedback loops within the financial system, or between the financial system and the real economy.³¹ Reductions in bank lending and in insurance

²⁸ In the context of climate-related risks and in the scope of this report, the FSB refers to tools for macroprudential purposes as any tools or policies by authorities aimed to address financial stability risks related to climate change at a sector or system-wide level. This may include (but is not limited to) tools that are also used for micro-prudential purposes (safety and soundness of individual institutions) as well as tools also used for other purposes by securities regulators.

²⁹ See p.23 of FSB (2020).

³⁰ For example, national catastrophe regimes, whether public regimes or relying on an arrangement between private and public sectors, usually bear uninsurable risk that are otherwise not insured by the private sector. This raises the issue of asymmetric exposures across jurisdictions and also potentially the long-term sustainability of such regimes in the context of climate change.

³¹ See p.20 of FSB (2020).

coverage in response to climate-related risks could adversely affect the supply of financial services to the real economy, which in turn could lower economic growth and feedback negatively to the financial system via an increase in financial losses. Examples of feedback loops with the real economy include:

- financial intermediaries that may step back in the short-term from the provision of funding to corporates that are large carbon-emitters may make it harder for corporates to obtain financing to support their transition to a less carbon-intensive business model and cause more stranded assets in specific sectors (e.g. in commodities). Furthermore, the use of collateral to mitigate risks may become less effective if the collateral is exposed to the same climate-related risks;
- fire-sale externalities that are triggered by market counterparties or reputational risks;
- the potential for indirect impacts such as the case where certain corporates are low carbon emitters but the use of their products along the value chain generates large carbon emissions. Consequently, the implementation of a carbon tax for these corporates could create a negative feedback loop through the impact of negative demand effects, increasing corporates' credit or counterparty risks; and
- climate-related risks may exhibit tipping points and non-linearities, which may amplify the feedback effects between the financial sector and the real economy.

3.2. Elements of system-wide supervisory and regulatory tools and policies

Established principle-based supervisory and regulatory frameworks encompass microprudential frameworks which focus on safeguarding the safety and soundness of financial institutions and macroprudential frameworks which focus on addressing systemic risks to protect and enhance resilience of the financial system.

Both microprudential and macroprudential frameworks as currently designed, address traditional risks to the financial system such as credit, market, liquidity, insurance underwriting risks, operational risks, etc. Microprudential approaches, in particular, and their calibration tend to rely on direct exposures, a shorter time horizon in the materialisation of risks, and are more backward looking using historical loss experiences, which poses challenges on capturing the unique features of climate-related risks. These unique features include, for example, its forward-looking nature, material uncertainties around the timing of climate-related events and magnitude of impact, heterogeneity of exposures and impact across sectors, non-linearities and potential tipping points, as well as second order and spillover effects.

While climate-related risks present unique features, they can be integrated into existing risk classification and risk management frameworks. Standard-setting bodies, including the BCBS and IAIS, are taking steps to evaluate whether the current frameworks sufficiently capture the unique risks posed by climate change. The IAIS is planning to make some updates to its ICPs and set out supporting information to ensure that insurers integrate climate-related risks in their risk management.

A system-wide approach to climate related risks would draw on the following elements of existing prudential frameworks (not an exhaustive list):

- Supervisory review and evaluation processes, including risk assessments, supervisory expectations of financial institutions' risk management practices (including how institutions incorporate potential systemic risks of climate change in their risk management), institutions' own assessments of capital adequacy and supervisory reviews of these assessments and when compared to supervisory expectations;
- The use of risk analytical tools such as scenario analysis and stress testing exercises (for both microprudential and macroprudential purposes) to incorporate material financial shocks to the financial system and their potential impact on financial institutions;
- Further supervisory actions including using more intense supervision and reviews, as well as deployment of supervisory capital add-ons to address deficiencies in the risk management of climate-related risks; and
- Macroprudential tools and policies, or tools and policies with a macroprudential dimension³², such as potential regulatory capital measures, concentration limits on exposures, or ways to account for indirect exposures to address systemic financial risks.

Authorities are at different stages in taking steps to address the unique features of climate-related risks using current prudential frameworks. In particular, as highlighted from the focus group sessions and surveys conducted, steps so far taken have focused on establishing supervisory expectations on financial institutions' risk management practices as it pertains to climate-related risks, setting out regulatory climate disclosure requirements, and increased use of analytical tools such as climate scenario analysis and stress testing to inform a supervisory perspective on systemic risks.

3.3. Steps taken on supervisory and regulatory tools and policies

This section highlights key findings through focus groups and surveys conducted and provides an overview of supervisory and regulatory approaches, including on some of the steps taken by authorities to address the system-wide aspects (discussed in Section 3.1) of climate-related risks.

3.3.1. *Supervisory risk management expectations of financial institutions*

Supervisory risk management expectations of financial institutions and establishing climate-related disclosures requirements aligned with the TCFD recommendations are the common microprudential measures taken across banking, insurance and asset management sectors.

³² This covers any tools or policies by authorities aimed to address financial stability risks related to climate change at a sector or system-wide level. This approach to coverage focuses on the purpose for which the tool is used and therefore may include (but is not limited to) tools that are also used for micro-prudential purposes (safety and soundness of individual institutions) as well as tools also used for other purposes aligned with their mandates.

Supervisory expectations for financial institutions have generally focused on how financial institutions should embed climate-related risks in their governance and risk management frameworks and conduct scenario analysis to inform their strategy and risk assessment, although they do not yet specifically or to a great extent cover how financial institutions should capture potential system-wide impacts of climate change in their risk assessments and management.

Standard-setting bodies and international bodies have developed expectations and guidance in their respective sectors. In 2021, the BCBS published a consultation on principles for the effective management and supervision of climate-related risks for the banking sector³³ and the NGFS updated its Guide for Supervisors covering both banks and insurers.³⁴ From an insurance sector perspective, the IAIS' Application Paper published in 2021,³⁵ set out an expectation by insurance supervisors that climate risk should be integrated into insurers' Enterprise Risk Management. Further supporting material that the IAIS will consult on in the coming years will provide further details on these expectations. In addition, IOSCO published expectations relating to asset managers' sustainability-related monitoring activities.³⁶

Domestically, authorities either have supervisory expectations and disclosure requirements in place or are making plans to put them in place.³⁷ As part of these measures, several authorities are also gathering information to assess how financial institutions are embedding supervisory expectations into risk management practices and raising awareness and capabilities across financial institutions.³⁸ The incorporation of climate-related risks into risk management practices across financial institutions is at an early stage. The European Central Bank (ECB) is currently conducting a thematic review to ensure that banks adequately incorporate climate-related and environmental risks into their risk strategies, governance and risk management frameworks and processes. The Japan Financial Services Agency (FSA) issued a draft supervisory guidance on climate-related risk management for public consultation and encourage financial institutions to actively support the transition of their clients, with a view to help maintain financial stability under transition to a low-carbon society.³⁹

In terms of supervisory expectations on financial institutions' own risk assessments, the Internal Capital Adequacy Assessment Process (ICAAP) for banks and Own Risk and Solvency Assessment (ORSA) for insurers could be existing supervisory tools which are being reinforced to include the consideration of climate-related risks among material financial risks.

³³ BCBS (2021), *Principles for the effective management and supervision of climate-related financial risks*, November.

³⁴ NGFS (2021), *Progress report on the Guide for Supervisors*

³⁵ IAIS (2021), *Application Paper on the Supervision of Climate-related Risks in the Insurance Sector*

³⁶ IOSCO (2021), *Recommendations on Sustainability-Related Practices, Policies, Procedures and Disclosure in Asset Management*, November.

³⁷ Supervisory expectations: Brazil, EU, France, Germany, Hong Kong, Japan, Singapore, Netherlands, Spain, Switzerland UK and United States (US). Disclosure requirements – Canada, Japan, South Africa, Switzerland, UK and US. Singapore (currently included in supervisory expectations with plans to mandate it).

³⁸ EU, Germany, Hong Kong, Singapore, Spain and Switzerland

³⁹ Japan FSA (2022) <https://www.fsa.go.jp/news/r3/qinkou/20220425/20220425.html>

Some jurisdictions⁴⁰ have included ESG within their supervisory guidance on risk management expectations. Similarly, some jurisdictions require mandatory disclosures not only for climate-related risks, but broader ESG risks.⁴¹

In terms of other tools, a few jurisdictions plan to develop climate risk indicators and risk dashboards to track both physical and transition risks,⁴² enhance the availability and accessibility to climate-related data⁴³ and integrate climate-related risks into financial stability monitoring.⁴⁴ One jurisdiction⁴⁵ conducted a climate sensitivity analysis exercise published in 2021, which assessed vulnerabilities with respect to transition risks for the banks, insurers and investment funds. Another jurisdiction⁴⁶ is working to incorporate consideration of climate-related financial risks into its existing supervisory frameworks, including setting up a cross-government committee to help implement the recommendations of a recent regulatory report on climate-related risks to financial stability. One jurisdiction⁴⁷ is conducting an enhanced bottom-up climate stress test exercise, collecting information on banks' internal stress test exercises, climate-related metrics (e.g. GHG emissions based) and quantitative information regarding climate-relevant loss projections covering a set of risk types and asset classes.

Regulatory and supervisory tools for asset managers and pension funds are limited to microprudential measures which focus predominately on securities regulators' climate-related disclosure requirements⁴⁸ and risk management expectations. For investment funds, one jurisdiction⁴⁹ for example, requires asset managers to take into account sustainability risks in their procedures and organisation, risk management, and internal processes, and issues stress-testing guidelines for open-ended investment funds. Another jurisdiction⁵⁰ requires disclosure of ESG risks in investment policies encourages financial institutions to achieve carbon neutrality goals through responsible investment. Like the banking and insurance sectors, the incorporation of climate-related risks into risk management practices across asset managers and pension funds is at an early stage.

Other tools and initiatives include increased supervision of pension funds on ESG risks, own risk assessments of ESG and climate-related risks in the EU and the issuance of regulatory principles on ESG standards,⁵¹ business continuity and disaster recovery and sustainable

⁴⁰ Brazil, Germany, EU, France

⁴¹ For example, in the EU, the Regulation (EU) 2019/2088 on sustainability-related disclosures in the financial services sector requires financial market participants to disclose how environmental and social impacts are taken account of in investment decision-making. Regulation (EU) 2013/575 also requires large listed banks to disclose information on ESG risks on a regular basis starting in June 2022. The UK Government released a [*Roadmap to Sustainable Investing*](#) in October 2021, setting out the ambition of whole-of-economy sustainability disclosure requirements.

⁴² Canada, EU, Italy and South Africa

⁴³ Brazil, Canada, EU and Germany

⁴⁴ Canada, EU, France, Germany, India and Singapore

⁴⁵ Germany; Bundesbank (2021) [*Sensitivity analysis of climate-related transition risks in the German financial sector*](#).

⁴⁶ US

⁴⁷ EU

⁴⁸ Canada, China, EU, Hong Kong, South Africa, UK, and US

⁴⁹ EU

⁵⁰ China

⁵¹ South Africa

conduct expectations for assessment of the extent to which climate aspects might affect investments for asset managers.⁵²

With the development of supervisory expectations for financial institutions at a sectoral level domestically and by standard-setting bodies, there will be an opportunity for authorities to share experiences on supervisory expectations across sectors. The FSB will consider as part of its future work the need to provide a cross-sectoral perspective on regulatory and supervisory approaches.

3.3.2. Use of scenario analysis and stress testing

Authorities are starting to engage with financial institutions on system-wide aspects via the use of analytical tools such as climate scenario analysis and stress testing. Most jurisdictions use, or plan to use, climate scenario analyses and stress tests as measures to develop a system-wide perspective on supervisory and regulatory policies for climate risk. The use of these analytical tools has facilitated the initial identification and assessment of risk exposures and potential impacts of physical and transition risks to financial institutions and the financial system. These tools offer flexibility through the use of different climate scenarios (including varying ambition and timing of global climate policy actions and the extent of technology development), coverage of geographies and economic activities and assets, inclusion of cross-sectoral and systemic risks, and varying assumptions and parameters for modelling risks. Furthermore, the forward-looking features of scenario analyses help work around the challenges with the lack of relevant historical data. Many jurisdictions have completed their first climate scenario analysis or stress test exercise or will do so in the near future.⁵³

The nature of climate risks may require substantial modifications to a traditional macroprudential stress test framework. Many jurisdictions, for example Canada, EU, France, Germany, Hong Kong, Japan, Saudi Arabia, Singapore and UK, have developed or are developing new climate scenario and stress test frameworks or are improving existing methodologies to incorporate second-round effects, and expand the scope of such exercises, such as including a larger group of financial institutions.

Stress tests and scenario analysis have been applied mainly for the banking and insurance sectors and only a few jurisdictions have put in place climate scenario analysis and stress tests frameworks for asset managers and pension funds.

The stage of development of climate stress tests for insurers appears to be more advanced in Europe with initiatives conducted by the European Insurance and Occupational Pensions Authority (EIOPA), but jurisdictions outside Europe are also working on such exercises at a fast pace. For asset managers and pension funds, only a few jurisdictions have put in place climate scenario analysis and stress test frameworks. In the EU, EIOPA has developed a methodological framework for including environmental aspects in the stress testing of pension funds that may be deployed for future stress tests. One jurisdiction⁵⁴ has developed an analytical climate

⁵² EU, Hong Kong, Singapore and UK

⁵³ More information is included in the NGFS *Scenarios in Action* report published in 2021.

⁵⁴ Germany

scenario simulation to investigate the effects of transition risks on portfolios of funds and another jurisdiction⁵⁵ has focused on setting expectations for large fund managers to assess the relevance and utility of climate scenario analyses under different climate pathways.

From an insurance sector perspective, the IAIS has agreed to a programme of work focused immediately on supporting insurance supervisors to address challenges with climate scenario analysis. Over the course of this year, the IAIS will organise a series of workshops with its members and stakeholders to gather practical intelligence on emerging best practices. It will share these lessons with supervisors and embed them in supervisory training to support the development of tangible scenario analysis skills.

The following section uses case studies to conduct a more detailed review of the approaches taken by selected authorities as well as emerging practices of using analytical tools for a system-wide perspective.

4. The use of analytical tools for a system-wide perspective

4.1. Case studies on selected jurisdictions' approaches to analyse system-wide aspects of climate-related risks

This section looks at practical examples of analyses performed by authorities that have started assessing climate-related risks from a system-wide perspective. Scenario analysis and stress testing have been the primary analytical tools authorities used to obtain a system-wide perspective on climate-related risks. Case studies carried out across selected member authorities in eight jurisdictions⁵⁶ that have conducted or are conducting assessments of climate-related risks, highlighted experiences of how authorities have been identifying and assessing the impact of climate change across the financial system.

The NGFS Scenarios in Action report published in 2021 is a comprehensive review of the progress being made by central banks and supervisors on climate scenario analysis.⁵⁷ This section complements the NGFS report by focusing on authorities' experiences on incorporating system-wide and cross-sector considerations.

Almost all authorities that are considering potential system-wide effects of climate change are in the initial stages of analysis. Some authorities have completed one-off analyses while others are planning for routine analysis. Other analyses are in the planning stages. This section aims to identify emerging practices by setting out useful examples of authorities' approaches to date.

⁵⁵ Hong Kong

⁵⁶ Case studies on the experiences of eight jurisdictions were gathered from: Canada (OSFI and Bank of Canada), EU (ECB), France (ACPR), Hong Kong (HKMA), Japan (FSA), Netherlands (DNB), Singapore (MAS) and United Kingdom (Bank of England).

⁵⁷ NGFS (2021) *Scenarios in Action*, October.

4.1.1. *Financial institutions in scope*

Climate change may affect financial institutions differently depending on the role they play in the financial system. Banks are dominant creditors for certain types of loans, while insurers specialise in absorbing risk. Asset managers provide ready liquidity and generally help to ensure that market prices reflect the fundamentals. While the scope of the analysis carried out by authorities will depend on their respective mandates, it is important that approaches to system-wide climate-related risks include all key sectors of the financial system. This may require initiatives to be coordinated across several authorities within each jurisdiction.

Most existing analyses performed focus on one sector (e.g. banking) or two sectors (e.g. banks and insurers). Out of the eight jurisdictions included in the scope of the case studies carried out, six covered both banking and insurance sectors and two focused on banks only. Only one authority (DNB) conducted a climate stress test spanning three financial sectors (e.g. banking, insurance and pension funds), although it did not focus on cross-sector interlinkages. The ECB's economy-wide stress test conducted in 2021 covered both banks and non-financial corporates.

4.1.2. *Geographic scope*

Authorities took different approaches to the geographic scope of their exercises. The Office of the Superintendent of Financial Institutions (OSFI) and Bank of Canada's approach focused on the US and Canada, whereas ACPR's approach was global, covering between 80% and 85% of total French financial institutions' exposures, with categories covering France, Europe excluding France, the US, and a Rest-of-the-World (or material exposures) group. The ECB focused on Europe, covering 80% of loan exposures present in the AnaCredit database, a dataset containing detailed information on individual bank loans in the euro area. The Japan FSA focused on a global portfolio for transition risk, and a domestic portfolio for physical risk. The Bank of England (BoE) looked at global risks, focusing particularly on areas where UK financial firms have the most exposures, with most detail provided for the UK.

Box 1 below provides an overview of climate risk analyses carried out to date by selected jurisdictions from the case studies.

Box 1: Analytical tools used by selected authorities for a system-wide perspective

Canada: OSFI and Bank of Canada conducted a joint pilot project on climate transition risk scenarios in 2021 and published its results in January 2022.⁵⁸ Among other objectives, the project was undertaken to better understand the risks to the financial system that would arise from a transition to a low-carbon economy. The project involved the collaboration of two banks, two life insurers and two property and casualty insurers. While limited system-wide aspects have been considered, it indicates a number of potential material risks to the financial system, and that a delayed climate action could produce fairly substantial macroeconomic costs. In its future work, the Bank of Canada will examine potential system-wide, cross-sectoral aspects for both transition and physical-related risks. Notably, the latter will involve looking at the real estate sector given the importance of this sector for the Canadian economy and the large exposure of Canadian financial institutions to this sector.

⁵⁸ Bank of Canada and OSFI (2022), *Using scenario analysis to assess climate transition risk*, November.

EU: The SSM within the ECB launched a supervisory climate risk stress test to be conducted in the first half of 2022.⁵⁹ It aims to identify vulnerabilities, best practices and challenges banks face when managing climate-related risks, and consists of three modules: (i) a questionnaire on banks' climate stress test capabilities, (ii) a peer benchmark analysis to assess the sustainability of banks' business models and their exposure to emission-intensive companies, and (iii) a bottom-up stress test. The exercise will leverage upon the results of the ECB economy-wide climate stress test published in 2021.⁶⁰ The latter assesses the resilience of non-financial corporates and euro area banks to climate-related risks under different assumptions of future climate policies. The ECB economy-wide stress test covered approximately 1,600 euro-area banks and 2.3 million non-financial corporates in the euro area, and used a novel set of climate-specific models to capture both direct and indirect transmission channels of climate risk drivers.

France: The ACPR conducted its first pilot exercise on banks and insurers in 2020, the results of which were published in May 2021.⁶¹ It covered both the banking and the insurance sectors, looking in particular at the interactions between the two sectors, and the scope for potential second round effects due to an increase in the insurance premia or of the insurance protection gap on the cost of risk for banks. The exercise reached its main objectives of raising the awareness of French institutions and catalysed reflections on taking climate change into account.

Hong Kong: The HKMA's current focus is to understand the resilience of the banking sector to climate-related risks and help build capacity to measure such risks. The HKMA conducted a preliminary analysis to understand how climate-related risks could be transmitted to banks, and also completed a pilot exercise on climate risk stress testing (CRST) in which banks were encouraged to consider cross-sector interactions and the broader impact on the whole economy.

Japan: Japan FSA and the Bank of Japan are currently conducting a joint pilot exercise of climate scenario analysis which covers both banking and non-life insurance sectors, launched in 2021. This exercise aims to inform the magnitude of the risks in the financial system as well as challenges to quantify the risks. The authorities intend to engage in supervisory dialogue with financial institutions to discuss how best to improve the climate scenario analysis to inform their management actions and business strategy.

Netherlands: The DNB conducted a climate stress exercise to assess the impacts from shocks related to an abrupt energy transition shock. The stress test calculates the effects on the economy within the different financial sectors, depending on technological changes and government policies. It shows the impact of changes in economic conditions and losses from asset exposures to different economic sectors, depending on their energy-intensity

Singapore: The Monetary Authority of Singapore (MAS) undertook a preliminary study in 2021 to estimate the climate transition risk exposure of Singapore's banking and insurance sectors. In 2022, it will incorporate a range of thematic climate scenarios, featuring both physical and transition risks, as part of its Industry-Wide Stress Test exercise for selected key banks and insurers.

UK: The BoE is currently undertaking the analysis of its climate biennial exploratory scenario (CBES) exercise, launched in June 2021. It includes both the UK's largest banks and insurers, and aims, among other objectives, to inform the BoE's view on the system-wide impacts of climate-related risks.⁶²

⁵⁹ See [ECB Banking Supervision launches 2022 climate risk stress test](#), 27 January 2022.

⁶⁰ ECB (2021), [ECB economy-wide climate stress test](#), September.

⁶¹ ACPR (2021), [Main results of the climate pilot exercise for 2020](#).

⁶² BoE (2020), [Key elements of the 2021 Biennial Exploratory Scenario: Financial risks from climate change](#).

4.1.3. System-wide aspects of climate-related risks identified by authorities

Authorities have considered a variety of transmission channels in their analysis, of which some are particularly relevant from a system-wide and cross-sectoral perspective. Examples of spillovers and risk transfers that authorities have started assessing include the following:

- A potential increase in both insurance premia and the insurance protection gap (i.e. a drop in insurance coverage) that could leave other sectors of the economy, notably corporates and households, more exposed to climate-related risk, which could in turn impact credit risk for banks.⁶³ For instance, there could be linkages between flood risk, property valuations, mortgage lending, and the provision of insurance.
- Credit tightening and financial stress resulting from abrupt changes in global climate policy which could jointly expose financial institutions, corporates, and households to climate-related transitional risks.
- Potential fire-sale dynamics due to many financial institutions divesting from certain sectors of the economy (e.g. via the creation of new indexes focusing on less-carbon-intensive firms), in turn affecting the financial system as a whole.
- Related to the above, the potential for management actions to create systemic risks (e.g. herd behaviour and cumulative effects leading to fire sales and stranded assets, or a reduction in lending and an increase in funding costs).

Examples of system-wide and cross-sectoral aspects captured by authorities are further detailed in Box 2.

Box 2: Examples of system-wide and cross-sectoral aspects captured by authorities

Canada: OSFI and the Bank of Canada note that financial sector interlinkages and common exposures that make financial institutions vulnerable to fire sales and synchronous price dislocations, while not included in their analysis, could lead to disorderly market adjustments and systemic risk. The Canadian authorities also highlighted that opacity in climate-related financial reporting could lead to tighter overall credit conditions and financial stress triggered by abrupt changes in global climate policy. Their analysis does not include these aspects and channels, but notes that the frictions (e.g., search and matching frictions in the labour market) and systemic financial risk channels may increase the economic short-run costs of the transition. An additional analysis carried out during their pilot project introduced a disorderly reaction in financial markets by using shocks to risk spreads, household wealth, and business and consumer confidence. Shocks were calibrated based on experience during previous stress events, including the 2008–09 economic and financial crisis and the 2014–15 oil price shock. Results show how market repricing could pull forward transition costs, making for an earlier and more volatile adjustment.

EU: The ECB accounted for potential mitigants and amplifiers from the insurance sector to the banking sector, in the form of future insurance coverage of firms' physical capital due to higher exposures to natural hazards and higher future insurance cost premia for firms located in vulnerable areas.

France: The ACPR's analysis placed emphasis on cross-sectoral shocks mostly driven by a possible increase in both the insurance premium and the insurance protection gap that would impact credit risk. Similar to the Canadian authorities, the ACPR explored how the broad-based credit tightening and

⁶³ The effects of reductions in insurance provision are described on p.23 of the FSB (2020).

financial stress resulting from abrupt changes in global climate policy could jointly expose financial institutions, corporates, and households to climate-related transitional risks. To account for these spillovers, the analysis allowed for institutions to alter their lending flows and portfolios, which in turn generated second-round effects that require the analysis to impose consistency checks. Second-round effects due to changes in insurance policies were also included. The pilot exercise quantified both direct and indirect impacts of climate-related risks. In terms of indirect impacts, the exercise gathered projections on insurance premia and insurance gaps across regions in France. It considered second-round effects by measuring banks' indirect exposure to physical risk, under the hypothesis of an increase in the insurance protection gap for certain assets due to the increase in the cost and frequency of extreme weather events. However, only two banks were able to project this impact on their credit risk.

Hong Kong: The HKMA's pilot CRST exercise mainly quantified direct impacts and, while banks were encouraged to consider cross-sector interactions and the broader impact on the whole economy, analyses were constrained by limited availability of data and capabilities of banks to develop new economic forecast models. The HKMA intends to further explore the possibility to assess such impacts in future exercises. Separately, the HKMA considers several transmission channels which are relevant for a system-wide, cross-sectoral view of climate-related risks and that may be explored in its future work. This includes the impact of more frequent natural disasters on the insurance sector and on the asset management sector due to lower asset prices, which in turn may pose risks to banks through their exposures to these sectors. The role of government policy in creating stranded assets could also affect banks if such assets have been used as collateral for loans. Another consideration is the impact of higher funding costs and increased credit risk for carbon-intensive firms if asset managers reallocate their portfolios towards less-carbon-intensive firms.

Japan: The FSA will have intensive dialogue with financial institutions regarding their management approach to climate-related risks as well as their strategy to support their clients' transition. The FSA strongly encourages financial institutions to actively engage with their clients to mitigate climate risks and contribute to the transition to a low-carbon economy. It is concerned that there could be significant cross-sectoral and system-wide implications, should financial institutions withdraw financing and investment from non-green carbon-intensive firms and assets as part of a transition risk management strategy.

UK: In addition to understanding whether risks concentrated at specific institutions could spill over to the broader financial system, the BoE's CBES is intended to gauge which management actions could create systemic risks (e.g., if many financial institutions indicate their divestment from certain sectors of the economy, leading to fire-sale dynamics), and it explores the link between flood risk, property valuations, mortgage lending, and the provision of insurance. These interactions between banks and insurers are primarily assessed via the qualitative section of the exercise. The BoE has launched a second round of the CBES to further understand how participants' business models may be expected to respond to climate-related financial risks (e.g., banks may be asked to reconsider their management actions on their mortgage exposures in light of diminishing insurance provision). The CBES also explores the implications of the planned withdrawal of the government backed flood risk reinsurer (Flood Re) and property valuations via the qualitative section of the exercise.

Limited work has been done so far to incorporate feedback loops with the real economy in supervisory and regulatory expectations and very few authorities have considered feedback loops in their analysis. Authorities' objectives focused on raising awareness and supporting capacity building of financial institutions on climate related risks, with some relying on bottom-up scenario analysis or stress testing approaches which posed challenges to factoring in feedback loops.

The Japan FSA takes into account the potential negative feedback effects with the real economy. In particular, it is concerned about financial institutions taking management actions to exclude non-green assets in the short run, which could have a serious impact on the real economy. Therefore, it will have intensive dialogue with institutions to encourage them to actively engage with their clients. The ECB plans to update its methodology for its climate stress test in 2022-2023 to allow banks to react to increased climate-related risk from corporates in the future and to change their portfolio compositions accordingly, which will then feed into the assessment of the financial risk of firms.

4.2. Emerging practices from the case studies

Significant uncertainty about future climate paths for both physical risk and transition risk, lack of analytical models, information needs and the novelty of work in this area has encouraged a wide variety of approaches among authorities. The following section describes the emerging practices from the case studies conducted across selected member authorities' system-wide analyses of climate-related risks, including **design choices and interaction with other authorities** across financial sectors within a jurisdiction.

4.2.1. *Bottom-up, top-down, or hybrid approaches*

One of the key practical challenges to be addressed is whether to rely on financial institutions to undertake the analysis based on guidance provided by the regulatory authority (a bottom-up approach), whether to undertake the analysis entirely at the level of the regulatory authority based on existing or commissioned datasets (a top-down approach), or whether to use a combination of the two approaches (a hybrid approach). The trade-offs in each approach are discussed below.

Top-down approaches are well suited for capturing a system-wide view as they allow for a unified analysis which facilitates the aggregation of results. Such approaches offer consistency in methodology and assumptions for calculating risk metrics, as well as consistency of data sources. However, they are limited by the often sparse data available to authorities. Authorities may not have adequate information to fully take into account the idiosyncratic and granular characteristics of financial institutions' portfolios when performing climate scenario analysis. Hence, there may be some loss of informational value and nuances when adopting top-down approaches.

Bottom-up approaches allow financial institutions to leverage own models, data and analytical techniques, as well as integrate their own assumptions and expert judgements. They are also useful to raise awareness and encourage financial institutions to build capabilities to develop their own tools and methodologies to better assess climate-related risks. However, bottom-up approaches lend themselves to significant disparities in the analytical tools, capacity, and expert judgment employed across financial institutions. This raises issues on whether the results are methodologically consistent and comparable across financial institutions, as well as whether aggregated results can yield coherent conclusions at the financial system level. Nevertheless, the cross sharing of good practices for climate scenario analysis across the financial industry could promote the adoption of best practices and greater convergence in the bottom-up approaches used.

A hybrid approach combining the benefits of both top-down and bottom-up approaches may be best suited to capture the cross-sectoral, system-wide aspects of climate-related risks for supervisory and regulatory purposes. A discussion of some of the approaches that authorities have taken are provided in Box 3 below.

Box 3: Practical examples of bottom-up, top-down and hybrid approaches

Canada: OSFI and Bank of Canada used a three-part hybrid approach in which top-down exercise-determined financial impacts were passed to banks to use propriety data to perform a bottom-up assessment according to a pre-specified exercise which was then aggregated across the financial sector by a final top-down exercise. In addition, there was a separate top-down analysis of equity exposure. The Canadian authorities intend to develop their capabilities in top-down climate scenario analysis to assess potential systemic risks.

EU: The ECB's economy-wide stress test is strictly top-down, relying on extensive data collection and rigorous models run by the authority. The ECB considers a top-down approach to be the most appropriate method to capture cross-sectoral and system-wide aspects of climate-related risks. In its 2021 exercise, it used data from single sources for firms' balance sheet information and for emissions data and physical risk, noting that it enabled uniformity in terms of data quality. The ECB also used its own risk modelling, avoiding the difficulty in aggregating results from different models and calibration methods. For instance, credit risk parameters were assessed in the same model with the same variables and data for all firms. Having one single model also did not require alignment with individual banks, which allowed more flexible adaptations and efficiency.

France: The ACPR uses a hybrid approach with the main assumptions provided by ACPR but a complete bottom-up assessment carried out by institutions. Its pilot was the first bottom-up exercise to be carried out by a supervisory authority. One of its objectives was to raise the awareness of participating institutions. It also forced institutions to develop sectoral approaches to both quantify their exposures and improve their risk modelling frameworks.

Hong Kong: The HKMA uses a bottom-up approach. However, both the HKMA and the Insurance Authority consider that the cross-sectoral, system-wide aspects are more easily addressed by some form of hybrid exercise, combining climate change scenarios and macroeconomic models. Financial institutions could then be asked to use their best efforts to undertake impact analysis or stress testing exercises. HKMA believes such flexibility is warranted given the challenge of data availability and the varying level of sophistication among financial institutions. A bottom-up approach could also have the virtue of capacity building. Lastly, HKMA recognizes that industry feedback in developing a system-wide analysis could be valuable given the complexity involved.

Japan: The FSA stands out in placing a greater priority on engagement with clients by financial institutions as a risk management tool. A bottom-up approach was adopted to allow financial institutions to use the results of scenario analysis for their active engagement with their clients. Provided the data gaps are addressed and common methodologies are established, the FSA expects to engage in intense dialogue with financial institutions on how their business strategy, including engagement strategy, can be improved based on the scenario analysis' results. In this context, the FSA believes that micro-level sensitivity analysis of the successful transformation of the client's business structure against continuation of the current business structure could also be a useful complement to scenario analysis to highlight impacts of clients' actions.

Netherlands: In 2018, DNB conducted a top-down transition risk climate stress test based on granular corporate loan, equity and bond holdings data. The objective was to assess financial stability risks by using a common methodology to assess transition risk vulnerabilities for banks, insurance companies and pension funds. Due to the macroprudential nature of the stress test a top-down approach was used. Furthermore, as DNB's transition risk stress test was the first one conducted, methodologies had to be pioneered and financial institutions had at that time limited internal modelling tools available. In 2021,

DNB conducted an additional top-down climate stress test to assess the financial stability risks of severe floods.

Singapore: MAS' 2022 thematic climate scenario analysis exercise will involve bottom-up assessments by participating financial institutions, with MAS specifying standardised assumptions and parameters under the different scenarios. The intent for this approach this year is to raise awareness among the industry players of the economic and financial implications of climate risks and encourage the collaborative development of relevant capabilities. A sharing of the learning points from the diversity of methodologies and approaches used would also accelerate such capacity building efforts. In preparation for this exercise, MAS also consulted selected financial institutions to better understand their analytical capabilities and the data requirements for the assessment of climate risks

UK: The BoE uses a bottom-up approach in its CBES exercise so that participating firms are encouraged to improve their capability to model climate-related financial impacts on their balance sheets. It also allows the generation of important data on firms' exposures and as such aids in the bridging of data gaps.

4.2.2. *Dynamic or static balance sheet approaches*

Another key design approach is whether to assume that financial firms will adjust to climate change by altering assets and liabilities, or to keep their balance sheet constant. From a system-wide perspective, a dynamic balance sheet assumption could better reflect reality and help to capture second-round effects and potential feedback loops, as it would take into account how financial institutions' management actions or mitigation strategies could result in changes to their balance sheets over the scenario horizon. However, assuming a dynamic balance sheet requires difficult judgments about how institutions are likely to behave over a long-time horizon. It could also underestimate the risks by assuming that they are mitigated through balance sheet changes. If the horizon of analysis is short enough, and transaction costs are sufficiently high, a static balance sheet assumption may be plausible, serve as a proxy for firms' current business models, and simplify the analysis considerably. It is also useful to help to capture how much financial institutions need to change their business models to mitigate climate-related risks.

Authorities that have started to assess system-wide aspects of climate-related risks have either used a dynamic balance sheet assumption or a static balance sheet assumption supplemented with additional qualitative information on planned management actions. The ACPR's approach kept balance sheets static for five years but allowed institutions to adjust thereafter. As part of its work, the ACPR compared the outcomes of the dynamic versus static balance sheet assumptions for banks. The outcomes highlighted that while dynamic balance sheet assumptions can mitigate the impact of scenarios on the cost of risks, this impact was rather limited as banks may reallocate their exposures to sectors with higher default risks. This caused a trade-off for banks between reducing exposures to certain sectors versus maintaining market share. Banks that chose to maintain their market shares realised that they may be exposed to climate-related risk, in particular transition risk, much longer than expected. Other authorities have relied or are relying on a static balance sheet assumption, due to the limitations mentioned above. While it relied on a static balance sheet in its 2021 stress test, the ECB intends to have a dynamic balance sheet assumption in its top-down 2022/2023 exercise in order to capture second-round effects and feedback loops with the real economy. Some authorities have asked or plan to ask authorities about their expected management actions to get an indication of system-wide implications. Both the BoE, Japan FSA / Bank of Japan and MAS have asked

financial institutions to report their expected management actions in a separate qualitative template to supplement their static balance sheet assumption.

4.2.3. Use of common scenarios

The use of common scenarios as a reference point across jurisdictions could generate more comparable results and reduce the proliferation of potentially inconsistent supervisory requests, in particular for financial institutions operating across borders. The scenarios put forward by the NGFS have provided common points of reference. The ACPR, BoE, ECB, HKMA, Japan FSA/ Bank of Japan, MAS, and Bank of Canada/OSFI all relied to some extent on NGFS scenarios for transition risk. Authorities have needed to tailor their scenario analysis and stress test exercises to account for their specific needs in terms of geographical scope, sector/counterparty granularity, and to generate the relevant macroeconomic, sectoral, and financial variables or risk factors. Authorities make a number of scenario design choices, such as the use of dynamic or static balance sheet assumptions or additional transmission channels that create variability across scenarios, which may lead to methodological differences and difficulty to compare results or clearly inform a global picture of climate-related financial risks to the financial system.

4.2.4. Cooperation across authorities within a jurisdiction

Cross-sectoral supervisory and regulatory interactions on climate-related risks are currently limited. There is a need for stronger cooperation and coordination between regulators and supervisors across financial sectors of the financial system. Where authorities adopt a cross-sectoral perspective, the current supervisory focus appears to be mainly on the banking and insurance sectors, and less so on other financial sectors, although some authorities also include the asset management industry and pension funds. Some interactions are taking place between authorities across sectors, but approaches vary depending on the mandates of each authority.

For exercises covering some combination of banks, insurers and asset managers, multiple supervisory authorities or departments within one authority have needed to cooperate and coordinate. OSFI and Bank of Canada jointly carried out their climate pilot exercise, using OSFI's financial industry supervisory knowledge and Bank of Canada's economic modelling and risk assessment capacity, and intend to collaborate further to explore the systemic risks arising from climate change. The Japan FSA likewise collaborated with the Bank of Japan, and ACPR with Banque de France and the Caisse Centrale de Réassurance, a public entity in charge of managing the national catastrophe regime. The BoE's CBES is a collaborative exercise involving multiple departments across the organisation; it also cooperated with a number of governmental bodies, including the UK Office for National Statistics, Flood Re (a joint reinsurance scheme between the UK Government and insurers) and the UK Department for Environment, Food and Rural Affairs, as well as the Organisation for Economic Co-operation and Development (OECD). More broadly, some authorities have put in place inter-agency committees for cooperation and coordination within a jurisdiction on climate-related issues. Coordinated stress tests are also an important feature of the EU Commission's strategy,⁶⁴ where the mandated actions include a one-

⁶⁴ European Commission (2021) *Strategy for Financing the Transition to a Sustainable Economy*

off cross-sector EU-level climate change stress testing exercise coordinated across the supervisory authorities and the ECB.

4.3. Challenges and lessons learned

While recognising the progress made in climate scenario analysis and stress tests, including the NGFS global climate scenarios, authorities and financial institutions are at the early stages of the design and use of methodologies.

There is the need to further develop scientifically based methodologies, analytical tools and capacity as the financial sector gains deeper understanding of climate related risks, their impact and experience with the measurement methodologies. The improvements to climate scenario analysis and stress test methodologies are necessary to specifically identify and incorporate the systemic risks posed by climate change. The transmission channels of risk and their impact are not yet fully understood or incorporated into climate scenario analysis and stress testing exercises during the exploratory phases.

With the continuing challenges associated with data availability and methodologies, authorities highlight the difficulty in developing tools and policies to specifically capture systemic risks. Analytical challenges are also attributed to the uncertainty in the speed, timing, and impact of potential disruptive and irreversible effects of climate change. For instance, an increase in carbon pricing could have potential wider effects than just on emission-intensive industries, due to indirect contagion channels, stemming for instance from the demand side, or from second-round effects. Greater frequency and severity of climate hazards could have potential wider effects than being limited to the geographical location of the climate hazards, due to the disruption of global supply chains, rising costs and prices, and indirect contagion to downstream players. Further, acute physical risks are not yet fully captured in common global climate scenarios, such as those published by the NGFS.⁶⁵

Some early lessons learned identified from authorities' experiences include:

- In their pilot exercise, the Bank of Canada and OSFI identified financial sector interlinkages and common exposures which could have potential macroeconomic implications. In future work, they will conduct further analysis of such systemic risk channels related to the transition to a low-carbon economy. Canadian authorities also noted that a core goal of their pilot exercise was to build up the capacity of authorities and financial institutions for conducting climate scenario analysis, which is a natural prerequisite for system-wide assessments. They aim to enhance their understanding and assessment of climate change impacts on system-wide market and credit risks to improve how they assess system-wide vulnerabilities in the future.
- The ACPR identified the need to develop a methodology to take into account the transmission of physical risk from the insurance sector to the banking sector, so that banks can accurately project their probability of default based on the insurance gap. In addition, the ACPR noted the need for insurers to improve their models and data sources

⁶⁵ NGFS (2021), NGFS (2020).

for a better recognition of physical risk in their corporate portfolio. Another critical issue is the identification of sectors or firms exposed to transition risk when focusing on financial risks. In many exercises, sensitive sectors are identified by their direct GHG emissions (e.g. Scope 1 GHG emissions). However, transition risk may also affect downstream users (e.g. Scope 3 GHG emissions), with potential additional negative feedback loops stemming from demand side effects. Accounting for these indirect effects may sharply increase the financial stress on the emitting sectors.

- The HKMA noted that second-round effects could be important and that banks should have a more comprehensive assessment of the climate-related risks affecting other parts of the financial industry (e.g. investment funds and insurers), such as the availability and adequacy of insurance coverage on their physical assets or collateral received from their borrowers and counterparties.

Other lessons learned include the need for coordinating work on consistent classification for financial risk assessment to enhance comparability across financial institutions and across jurisdictions, and aggregation of comparable results for system-wide assessment. The HKMA noted this would also reduce the regulatory burden for cross-border financial institutions in their assessment of climate-related risk across jurisdictions. Lastly, the BoE noted the need for supervisory teams across sectors to collaborate closely to ensure the exercise could produce meaningful results both at individual firm and at aggregate level to form a system-wide view. The BoE also stressed the need to anticipate difficulties in piecing together a cohesive exercise for firms with dissimilar business models.

5. Extent to which regulatory and supervisory tools and policies address climate-related risks

This section of the report begins with a summary of the key findings on the extent to which tools and policies used or planned to be used by jurisdictions account for specificities of climate-related risks. These specificities include capturing how, and to what extent, the tools and policies address systemic risks, capture both physical and transition risks and their translation to financial risks, and the heterogeneity and concentrations of climate-related risks. Based on these key findings and building on the important system-wide considerations discussed in Section 4, this section proposes high-level guidance, in the form of recommendations, to support authorities on how the use of climate scenario analysis and stress tests can be expanded to incorporate systemic risks that arise from climate change and better inform a macroprudential view of cross-sectoral and cross-jurisdictional risks to the financial system. Lastly, this section also introduces an early consideration of other potential macroprudential policies and tools to address systemic risks that may not be addressed fully by current measures, based on the work of standard-setting bodies and authorities.

5.1. Current use of tools and policies

5.1.1. Coverage of climate-related risks

Climate scenario analysis and stress tests have been the primary tool used to address the coverage of climate-related risks. The use of such tools primarily captures transition risk and physical risk, with a lower proportion of jurisdictions capturing liability risk. Across sectors, the level of coverage for transition risk is slightly higher than for physical risk.

Use of such tools is generally more common for the banking and insurance sectors and less common for the asset management and pension fund sectors. When further broken down by sectors:

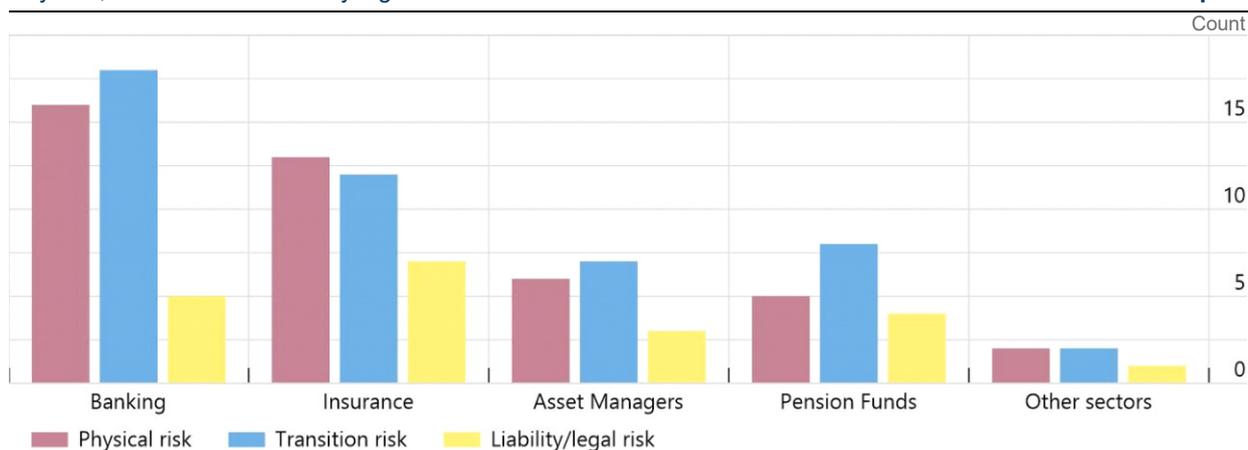
- *Insurance sector:* the level of coverage of transition risk and of physical risk are roughly equal and there is lower coverage for liability risk.
- *Banking sector:* the level of coverage of transition risk is slightly higher than for physical risk and there is lower coverage for liability risk.
- *Asset management and pensions sector:* there is overall less coverage. Based on the limited information, it appears there is slightly higher coverage for transition risk than physical risk and less coverage for liability risk.

Graph 1 below shows the distribution of transition, physical and liability risk coverage across the financial sectors.

The scope of jurisdictions' current, enhanced or new tools or policies that address climate-related financial risks for macroprudential purposes by sector and the types of climate risks captured

Physical, Transition and Liability/legal risks

Graph 1



Source: FSB Survey of participating FSB member jurisdictions and organisations

In future exercises, authorities may need to consider both physical risks and transition risks together, in light of their interdependencies. There may be important interdependencies between physical and transition risks posed by climate change under the various climate scenarios. For example, a delayed climate policy response increases physical risk. The materialisation of

extreme climate-related events may in turn result in an unanticipated rapid change in climate policy and therefore increases transition risk.⁶⁶

5.1.2. Transmission of climate-related risks to financial risks

Climate-related risks can transmit through a range of financial risks for the financial sector. Current literature suggests that the impact of climate-related risks can be captured within traditional financial risk categories, such as credit, market, liquidity, operational and insurance (underwriting) risks that are broadly part of existing prudential frameworks.⁶⁷ In addition, there are important systemic aspects such as externalities, second-round effects and spillover of risks that could be amplified by the financial system, further increasing (or decreasing) the magnitude of financial risks.

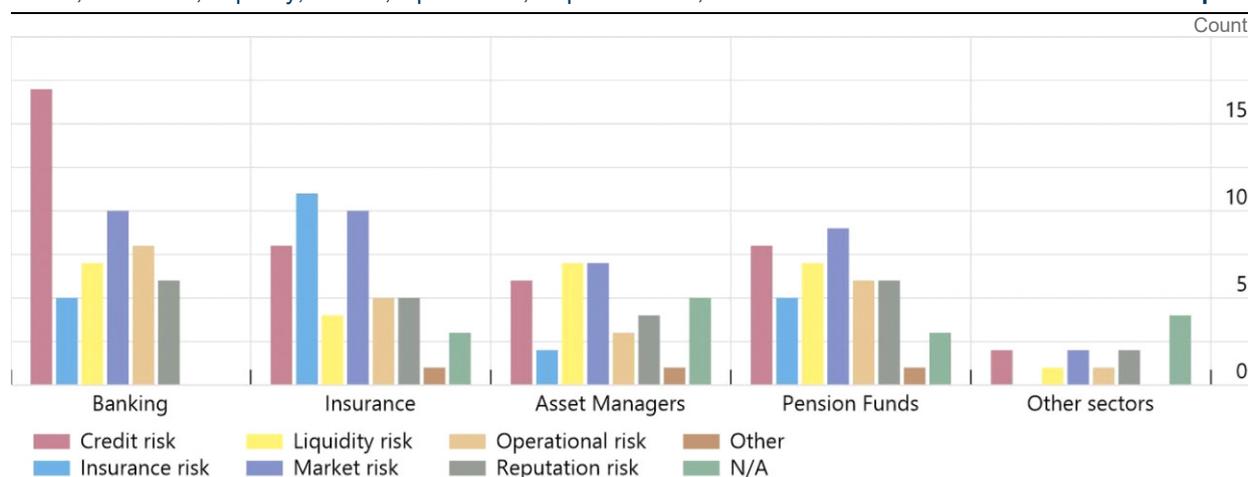
Credit and market risks are the financial risks most commonly covered by jurisdictions' use of tools. The proportion of jurisdictions that use tools covering credit risk in the banking sector is notably higher than other risk types in other sectors. Liability, liquidity, operational, reputational, and insurance (underwriting) risk are also covered but to a lesser extent.

Graph 2 below shows the distribution of financial risk channels across financial sectors.

The scope of jurisdictions' current, enhanced or new tools or policies that address climate-related financial risks for macroprudential purposes,⁶⁸ in terms of the types of climate risks captured and risk channels

Credit, Insurance, Liquidity, Market, Operational, Reputation risk, Other

Graph 2



Source: FSB Survey of participating FSB member jurisdictions and organisations

While jurisdictions are in the early stages of assessing the impact of climate-related risks on credit and market risk, the consideration of other financial risks and the interaction between financial risks is limited. The approaches were exploratory in nature, such as looking at certain

⁶⁶ FSB (2020).

⁶⁷ For example: BCBS (2021) and IAIS (2020).

⁶⁸ In the context of climate-related risks and in the scope of this report, the FSB refers to tools for macroprudential purposes as any tools or policies by authorities aimed to address financial stability risks related to climate change at a sector or system-wide level. This may include (but is not limited to) tools that are also used for micro-prudential purposes (safety and soundness of individual institutions) as well as tools also used for other purposes by securities regulators

financial sectors or a subset of financial institutions and focusing on a subset of financial risks. As one example of an authority's approach on analysing the interactions between financial risks, the climate stress test of the ECB estimated the impact of physical and transition risks on firms' market risk and also considered the impact that credit risk also had on market risk. The sensitivity of market risk (excess bond premia) to changes in credit risk (probabilities of default) of corporate bond issuers was estimated, which consequently allowed to account for the impact of increased credit risk due to climate change when assessing market risk channels of climate risk.

Future exercises conducted by authorities could consider a broader range of material financial risks beyond credit and market risk, such as liquidity risk and insurance (underwriting) risk, and their interactions.

5.1.3. Heterogeneity and concentrations of climate-related risks

The extent to which the heterogeneity and concentrations of climate-related risks can be captured depends on the granularity of information available and collected in jurisdictions. Jurisdictions are beginning to capture heterogeneities and concentrations of climate-related financial risks.

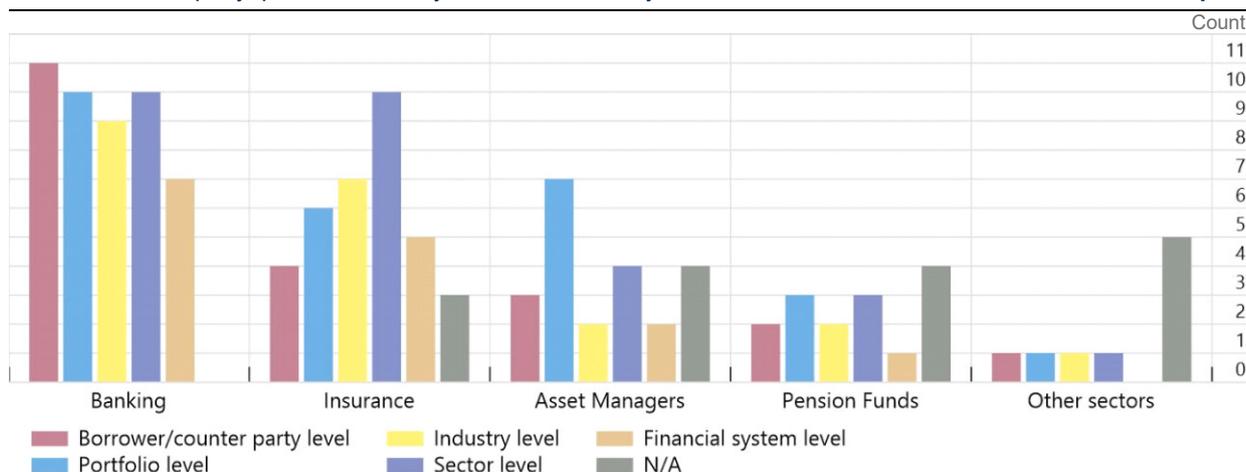
Generally, the level of granularity of climate-related financial information collected by jurisdictions varies by sector, with the widest range of granularity (i.e. borrower/firm/counterparty, portfolio, industry, sector and financial system levels) generally covered for banks. Information collected by banking supervisors was broadly across borrower/counterparty level, portfolio level, industry level, and sectoral level. Information collected for the insurance sector also covered the range of granularity. Information collected by insurance supervisors tended to be focused on the sectoral level and on the portfolio level for the asset management sector. A few jurisdictions reported information collected in the pension funds sector, with a range of granularity. In addition, insurers typically have more granular physical location data than banks, which is important for understanding physical risk.

Graph 3 below shows the distribution of granularity across the financial sectors from jurisdictions responses to the survey.

Level of granularity captured across financial sectors

Borrower/counterparty, portfolio, industry, sector, financial system level

Graph 3



Several jurisdictions⁶⁹ have captured heterogeneities and concentrations across different sectors and/or regions through granular borrower, firm or counterparty level data. For example, on physical risk, the ECB uses firm-level emissions and facility locations against different natural hazards for its economy-wide climate stress test conducted in 2021. The ECB identifies heterogeneities and concentration of both physical and transition risks in banks portfolios by examining data across a sample of 2.3 million European firms and information available on banks' loan and bond holdings to these European firms sampled. As an additional example of physical risk and its concentrations, the US requires property insurers to submit modelled hurricane risk to state insurance regulators. State insurance regulators use these submissions as a catastrophic risk indicator and calculate catastrophic risk charges for hurricane risk.

There are differences in the level of granularity for assessing physical risks across jurisdictions. For example, Banca d'Italia classifies bank loans' exposure to physical risk at the provincial level, using an indicator that measures expected losses and the hazard from extreme weather events. The BoE in its climate stress tests required banks and insurers to assess the physical risk of their real estate exposures at the postcode level based on high-resolution physical risk data. The Banque de France/ACPR required counterparty information at household or firm level and geographical level (municipality for insurers, district for banks) for exposures. In the HKMA's stress test, banks evaluated the impact of physical risk in their property-related lending, having regard to the locations of the properties. The exposure analysis of BCB maps banks' loan exposures to Brazilian municipalities' vulnerability to extreme droughts and rainfall.

In terms of transition risk, several jurisdictions⁷⁰ rely on the identification of heterogeneities and concentrations at various levels of granularity, at the sector, portfolio or loan level. Banca d'Italia uses climate risk exposure analysis and measures the carbon intensity of bank loans by sector of economic activity. In addition, it uses a micro-founded approach and estimates the impact of different levels of carbon taxes on firms' energy expenditures and financial vulnerability using firm-level balance sheet data and then estimates the effect on banks' default rates at the *sector*

⁶⁹ Brazil, EU, France, Hong Kong, Netherlands, Spain, UK and US

⁷⁰ Australia, Brazil, France, Hong Kong, Japan, Singapore, Spain, Switzerland and UK

level. Banco Central do Brazil also uses exposure analysis and maps banks' *loan exposures* to emission-intensive sectors to identify sectors most vulnerable to transition risk. The top-down climate stress test of Banco de España groups individual banks' loan exposures by economic sector and size of the counterparty, allowing for heterogeneities in their responses to transition risk.

In addition, some jurisdictions capture heterogeneity and concentrations through the design of their climate scenarios and stress tests to incorporate more stress factors. For instance, the BoE and Banco de España, in the design of their climate stress tests assigned vulnerable sectors a larger negative shock than less vulnerable sectors.

5.1.4. *Mandates*

Forming a macroprudential perspective on risks to the financial system, as a complement to microprudential measures at the firm level, is crucial to fully account for climate-related risks and their transmission channels that could have a wide-spread impact across financial sectors.

While most authorities consider climate-related risks within their mandates (explicit or implicit) which includes financial stability, the focus has largely been on the banking sector and/or the insurance sector. Assessing risks within a sector in isolation makes it challenging to account for potentially material cross sectoral risks, such as risk transfers or spillovers as well as systemic risks such as second round effects.

5.1.5. *Use of outcomes from analytical tools*

Scenario analysis and stress testing exercises have been key supervisory analytical tools used to raise awareness and build up capabilities of financial institutions to identify and assess climate-related risks. Stress-tests based on scenarios allow supervisors to incorporate a long-term view (e.g. 30 or 50 years) with forward looking elements with multiple climate pathways. It is also used to accommodate or work with existing challenges on the availability of data and the uncertainties of climate change. While the outcomes have limitations on their comparability of results between each other due to differences in design approaches and model assumptions, the outcomes have started to directionally inform future steps authorities plan to take on regulatory actions and supervisory expectations.

Several jurisdictions⁷¹ indicate outcomes from the exercises will start to inform, among other activities to be carried out, their regulatory policy responses and supervisory actions. This includes shaping supervisory prudential guidance on embedding climate-related risks into risk management and business planning practices of financial institutions. One jurisdiction⁷² makes recommendations based on the outcomes of the stress test results to the supervisory authority on the specific financial institution. Another jurisdiction⁷³ indicates that results will inform future supervisory actions, and could inform the consideration of any add-on supervisory Pillar 2 capital or other future work on enhancements to its regulatory framework on capital.

⁷¹ Canada, China, EU, Hong Kong and UK

⁷² EU

⁷³ UK

Other jurisdictions⁷⁴ reported that their outcomes may inform future actions, including supervisory strategy, policy, and priorities, however at this stage the results will largely be used to inform ongoing engagement with financial institutions and better understand climate related risks and vulnerabilities. These include understanding materiality of impacts on financial institutions and the financial system.

There are some jurisdictions⁷⁵ that do not yet use climate scenario analysis and stress test exercises and/or their results to inform regulatory policy responses and supervisory actions, though some of these jurisdictions⁷⁶ are currently undertaking exploratory work on scenario analysis.

5.2. High-level guidance on the expanded use of analytical tools

The stocktake of supervisory and regulatory tools in the previous section provides a good starting point to begin considering whether microprudential tools alone are sufficient or whether there is a need to consider macroprudential measures to address the systemic risks posed by climate change. Expanding the use of scenario analysis and stress tests can be a tool for both microprudential and macroprudential purposes.

While the scope of tools that authorities will use will depend on their mandate, the following sets out high-level guidance, in the form of recommendations, to support authorities in their consideration of future approaches on climate scenario and stress test exercises to incorporate systemic risks that arise from climate change, that can better inform a macroprudential perspective of cross-sectoral and cross-jurisdictional risks to the financial system. Note, complementary to this, the FSB's future joint report with the NGFS to synthesise the outcomes of climate scenario analysis by jurisdictions to consider the implications of possible climate scenarios for the financial system may provide further guidance in this area.

Recommendations for incorporating systemic risks into supervisory and regulatory approaches

- 1. In addition to microprudential measures at the firm level, authorities' approaches should account for the potential widespread impact of climate-related risks across the financial system.**
- 2. Jurisdictions are encouraged to expand the use of climate scenario analysis and stress testing as a tool for macroprudential purposes. The design and scope of the analysis should ideally include the following features to inform a system-wide view:**
 - (i) Both physical and transition risks**
 - (ii) Key financial sectors (e.g. banks, insurers, asset managers & pension funds)**
 - (iii) Interdependencies between physical and transition risks, geographical and sectoral risks, as well as improved understanding of impacts on financial risks**
 - (iv) System-wide aspects of climate-related risks such as indirect exposures, risk transfers, spillovers and feedback loops.**

⁷⁴ Australia, Brazil, Canada, Germany, Netherlands, Singapore and Switzerland

⁷⁵ Italy, Saudi Arabia, South Africa and US

⁷⁶ E.g. US

- 3. When designing their climate scenario analysis and stress tests, authorities should adopt features that can best inform a system-wide view. A top-down approach, or a combination of top-down and bottom-up approach (hybrid approach) could be used to capture cross-sectoral, system-wide aspects of climate-related risks. In addition, a dynamic balance sheet assumption could help capture second-round effects and potential feedback loops, while recognizing the inherent challenges on assumptions for financial institutions' future actions over a longer time horizon.**
- 4. Future exercises should consider the range of financial risks beyond credit and market risk, to the extent they pose material risks, such as liquidity and insurance (underwriting) risk, which could be important to assessing the resilience of sectors across the financial system and address their interconnectedness.**
- 5. Cooperation and coordination between authorities within a jurisdiction is encouraged. Authorities within each jurisdiction, aligned with their mandates, should cooperate and coordinate to better inform a system-wide view of climate-related risks. Such cooperation could, for example, include joint system-wide scenario analysis or stress test exercises on climate-related risks.**
- 6. With respect to cross-border coordination and cooperation, as authorities develop their approaches, authorities should engage in active dialogue on home-host coordination through means such as institution-specific supervisory colleges, given the global nature of climate-related risks. In addition, standard-setting and international bodies provide an important platform for cooperation and coordination on cross jurisdictional risks stemming from climate-related risks.**
- 7. As the FSB noted in its 2020 Report, the NGFS should continue its work to refine and develop climate scenarios, which authorities should make use of in their climate scenario analysis, as appropriate, in order to align the data and methodologies used in such analysis.**

5.3. Potential macroprudential tools and policies

This report acknowledges the nascent work in the area of macroprudential measures to address climate related risks. However, it calls attention to the risk that deployment of microprudential tools alone, as typically focused on direct exposures, may not sufficiently address the cross-sectoral and systemic dimensions of climate-related risks, including any potential for the financial system to amplify its effects. The resiliency of the financial institutions and the financial system may be tested as physical, transition and liability risks manifest from climate change and global policy actions to support the transition to a low-carbon economy.

As the use of climate scenario analysis, stress tests and other supervisory and regulatory measures advance and expand to incorporate systemic risks arising from climate change, this section provides an early exploration of what potential macroprudential tools and policies, or microprudential tools and policies with a macroprudential dimension, could be considered in the future to deal with systemic risks that may not be fully addressed by current measures, based on the work of standard-setting bodies and authorities. Potential macroprudential tools and policies, or tools and policies with a macroprudential dimension, could be complementary to address the systemic characteristics of climate-related risks that remain, including sources of tail risk, uncertainty around the timing of climate-related events and magnitude of impact, heterogeneity of exposures and impact across sectors, cross-sectoral spillover of risks or risk transfers and second-order effects.

Under current prudential frameworks, there might be scope to use principle-based supervisory expectations and capital requirements to address particular aspects of climate-related financial risks. For example, supervisory expectations would push financial institutions to evaluate their capital available to protect against material financial risks including climate-related financial risks, and that these assessments would be reflected in the financial institutions' own risk assessments such as ICAAP for banks and ORSA for insurers.⁷⁷ However, the global and uncertain nature of climate change may not be fully addressed through existing measures. The BoE identified in its Climate Adaptation Report, published in 2021, regime gaps related to the current macroprudential regime, such as the fact that tools currently only deal partly with risks that increase over time, and that the insurance framework does not include system-wide buffers.⁷⁸

This section of the report presents some of the early thinking among existing literature and work of standards setting bodies and authorities on macroprudential policies and tools, trade-off considerations.

Relevant work of standard-setting bodies and authorities

It is important to acknowledge that standard-setting bodies, including the BCBS for the banking sector and the IAIS for the insurance sector, and authorities are undertaking significant policy work, including a comprehensive gap analysis of the regulatory frameworks in the context of climate-related risks.

In early 2022 the IAIS concluded an analysis of its ICPs to assess whether there were any gaps related to climate-related risks. It has concluded that the ICPs are sufficiently broad to cover climate risks. It will make a limited number of changes to the explanatory guidance in the ICPs and develop supporting material in the coming years to make it even more explicit that climate risk needs to be addressed within the scope of the ICPs. For instance, related to supervisory climate scenario analysis, the IAIS agreed on a programme of work on supporting members to address challenges within the emerging field of climate scenario analysis.

On scenario analysis, the IAIS has agreed a programme of work focused immediately on supporting members to address challenges within the emerging field of climate scenario analysis. Over the course 2022, the IAIS will organise a series of workshops to gather practical intelligence on emerging best practice and share these lessons with its members and embed them in supervisory training. Using its unique global footprint, the IAIS will help to drive forward

⁷⁷ See [OSFI \(2022\)](#)

⁷⁸ BoE (2021) [Climate Change Adaptation Report](#), October.

developments in this field, in a way that should help reduce the risk of unnecessary market fragmentation with varying practices developing across the world.

UK

The BoE/PRA is undertaking further analysis to explore enhancements to the regulatory capital frameworks and will publish a follow-up report on the use of capital including on the role of any future scenario analysis.⁷⁹ More specifically:

- For banking, the PRA will explore the balance between an internationally driven Pillar 1 approach and a more domestic Pillar 2 approach.
- For insurers, the PRA will explore making specific changes to the Solvency Capital Requirement calculation.
- For macroprudential and systemic risk, the BoE will conduct further analysis and organise a Climate and Capital conference in Q4 2022.

Where financial institutions are assessed by supervisors as not sufficiently managing their climate-related risks and ensuring capital adequacy, supervisory add-on capital through Pillar 2 is a tool that could be considered.

Europe

The discussion on macroprudential capital-based measures to address climate-related risks are mainly concentrated in the EU, where regulation would allow for instance the possible use of some flexible instruments already available in the macroprudential framework for the banking sector. For example, the ECB and ESRB⁸⁰ are considering the relevance of a *systemic risk buffer* (SyRB), which in the current legislative framework could already be used to address climate-related risks of domestic exposures.⁸¹ Generally, the systemic risk buffer is an additional capital requirement for the banking sector in order to prevent and mitigate macroprudential or systemic risks, namely a risk of disruption to the financial system with the potential for serious negative consequences for the financial system and the real economy in a specific Member State. It is a system-wide buffer, that can be applied either for all banks or for groups of banks or across subsets of sectoral exposures and could be considered to address climate-related risks. Sectoral subset of exposures could be defined in terms of economic activity and/or geographical area. Such a targeted buffer as described above could increase resilience for the potential materialisation of the risk but could also introduce incentives for a financial institution to reduce its exposures to climate-related risks.

For the insurance sector, international and domestic regimes currently do not use macroprudential capital requirements such as systemic risk buffers. The European Commission

⁷⁹ See [BoE \(2021\)](#)

⁸⁰ See [ESRB \(2016\)](#), [CEP \(2021\)](#) and [ECB \(2021\)](#)

⁸¹ The relevant EU competent or designated authority, as applicable, may require a systemic risk buffer to address risks with the potential to have serious negative consequences for the financial system and the real economy in an EU Member State. See [European Commission \(2021\)](#)

proposed the introduction of macroprudential tools for the insurance sector that would require insurers to address, among others, systemic risks arising from climate change in their ORSA reports. In addition, the Commission proposed regular reviews by EIOPA of the Solvency Capital Requirement for natural catastrophe underwriting risk to reflect the expected impact of climate change.⁸²

Targeted measures that set quantitative and qualitative concentration limits on financial institutions' portfolios are typically used for microprudential purposes but could contribute to building resilience against systemic climate risks and exposures, when applied across financial sectors to ensure a minimum level of consistency. A high degree of concentration in climate risk exposures, when observed in conjunction with existing vulnerabilities,⁸³ may call for such an approach.

ECB further highlights that a fundamental review of Pillar 1 prudential framework for banks to address potential gaps in addressing climate-related risks may be warranted. Relevant issues would include the lack of forward-looking estimates, as well as the need to appropriately reflect the long-time horizon of climate-related risks. Examples of measures being considered assessed by the ECB include loan-to-value limits, which places limits on credit by banks to certain sectors that are more sensitive to climate-related risks, increasing risk weights where necessary and determining forward-looking PD and LGD.⁸⁴

Other measures

Other targeted measures contemplated by, for example, the OECD and academia include amended *large exposure limits*.⁸⁵ The large exposures framework could be extended for climate-related risk purposes by considering sectoral concentrations (i.e. lending to several, potentially unrelated, firms in the same sector of activity) or geographical concentrations (e.g. more exposed to physical risk), achieving a similar goal as concentration limits discussed above. This measure could rely on the identification of counterparts that are highly exposed to carbon-intensive activities, which implies reporting every large exposure connected to carbon-intensive firms, whether a single firm, a group of firms, or interconnected firms.

Collectively, institution-specific measures described in the above paragraphs could allow better monitoring, management and potentially also a more direct limitation of identified climate-related risks at the financial institution portfolio or counterparty level. Applying such measures across financial sectors could cumulatively become a tool used for macroprudential purposes for the financial system.

Lastly, another measure that has been suggested by some research is a type of *climate capital buffer*, designed to reflect the structural changes as a result of orderly or disorderly transitions to a low carbon economy. This buffer could be linked to a carbon-intensive credit-to-GDP ratio

⁸² See [European Commission \(2021\)](#)

⁸³ See ESRB-ECB (2021) *Climate-related risk and financial stability*, July.

⁸⁴ These measures may have to be implemented through EU legislative initiatives to apply across the whole EU.

⁸⁵ See [OECD \(2021\)](#)

and would decrease as banks reduce their carbon-intensive exposures.⁸⁶ However, if the carbon-intensive credit-to-GDP ratio exceeds a certain threshold, the buffer could be increased. The premise of this buffer is that a disorderly transition would result in greater financial stress and potential losses to the financial system, and therefore, require a larger capital buffer.

Trade-off considerations

Further work in this area by standard-setting bodies and authorities would help provide more clarity on whether climate related risks are sufficiently captured in established regulatory frameworks or whether there is a need to amend, expand or introduce new measures. Considerations on trade-offs in the use of particular measures may be important to inform any unintended consequences.

Examples of trade-off considerations for specific measures include the following. For loan to value limits, restricting residential and commercial real estate lending to climate-vulnerable areas may also restrict lending to the most disadvantaged communities if those communities are located in climate-vulnerable areas. For large exposure or concentration limits, restricting lending to carbon-intensive industries could have unintended consequences in impacting the value chain that might not be fully understood. Regarding buffers, they require financial institutions to limit the amount of resources that can be used to support lending. This can potentially reduce profitability and impact financial intermediation (e.g. lending decisions) to minimise buffer requirements. As well, reduced lending may have an impact on regional employment and economic activity reflective of the overall trade-off between growth and resilience.

Lastly, as a more general consideration, lending to a carbon-intensive industry may take different forms. For example, the borrower might use loans to expand the production of coal, or the borrower might use the loans to upgrade carbon-scrubbers or put in place climate sequestration equipment.

6. Conclusion

This report, based on a review of current practices, provides recommendations to assist supervisory and regulatory authorities in developing their responses to monitor, manage and mitigate risks arising from climate change and to promote consistent approaches across sectors and jurisdictions.

The recommendations set out in Section 2 encourage authorities to accelerate in the identification of their data needs for supervisory and regulatory objectives, identify relevant types of data and metrics that they may require from financial institutions and provides key policy considerations to assist authorities in their future work, where appropriate, towards expanding regular standardised regulatory reporting requirements.

⁸⁶ D'Orazio and Popoyan (2019) academic report suggests building a buffer during periods of excessive carbon-intensive credit growth. This buffer would increase the bank's resilience during the upswing of the carbon-intensive credit cycle, acting as a "soft" speed limit.

To adopt a system-wide perspective, authorities are encouraged to expand the use of climate scenario analysis and stress tests for macroprudential purposes. The recommendations, set out in Section 5.2, aim to assist authorities in the design and approach for future exercises.

The report also puts forward an early view on the need for tools and policies to sufficiently address systemic risks arising from climate change. Microprudential tools alone may not sufficiently address the cross-sectoral, global and systemic dimensions of climate-related risks, tail risks and the potential for the financial system to amplify its effects.⁸⁷ Authorities and standard-setting bodies are also encouraged to undertake research, analysis and supervisory and regulatory policy actions in the near to medium term on the appropriate enhancements to their regulatory frameworks. This work would further support the link to financial stability mandates of authorities.

⁸⁷ See FSB (2020)

Annex 1: Selected authorities' approaches to gather information from financial institutions on climate-related risks

Examples of ad-hoc surveys, targeted information requests and stocktakes

- **Brazil:** The BCB sent questionnaires to key Brazilian financial institutions to gather insights on how banks are considering climate-related risks within their risk management processes. Aspects such as exposure assessments, climate scenarios and stress testing as well as internal governance have been included in these surveys.
- **France:** The ACPR conducted surveys to size the exposures of French banks and insurance companies to climate change risks (physical, transition and liability risks) in 2016 and 2018, the outcomes of which were published in 2017, in a joint report with the French Treasury and the Banque de France, and in April 2019.⁸⁸ This data collection was carried out as part of the regular assessment of disclosure obligations stemming from article 173 of the French Law on Energy Transition and Green Growth, implemented since 2015. In addition, since 2020 the ACPR has conducted an annual survey on the banking and insurance sectors, to assess the public climate commitments made by French banks, insurers, asset managers. The results are published in a joint report with the French Autorité des marchés financiers (AMF).
- **Germany:** In December 2019, Federal Financial Supervisory Authority (BaFin) issued, in close cooperation with Bundesbank, its *Guidance Notice on Dealing with Sustainability Risks*⁸⁹ for credit institutions, insurance firms, pension funds, asset management companies and financial services institutions. Based on this Guidance Notice, BaFin and Bundesbank have developed a questionnaire with predefined response options to serve supervisors as guidance and checklists in supervisory dialogues. The aim is to gather information to assess supervised entities' efforts to strategically and organisationally implement sustainability risks into their risk management. BaFin also conducted an ad hoc survey in Q2 2021 amongst a representative group of 400 supervised entities from all three financial sectors. The questionnaire comprised 11 high-level questions covering the scope and motivation for dealing with sustainability risks, consideration of such risks for strategies, risk management and internal stress testing, business organisation and outsourcing, and the use of environmental, social and governance (ESG) ratings. BaFin published the survey results in November 2021.⁹⁰
- **Hong Kong:** In 2019, the HKMA conducted a stocktake exercise on 50 banks (about 90% of the banking sector's total assets) to understand local developments in green and sustainable banking. Based on the stocktake results, a common assessment framework was developed for assessing the "greenness baseline" of individual banks. The framework aims to collect information about a bank's stage of development in six areas, namely (i) governance, (ii) corporate planning and tools, (iii) risk management process, (iv) business policies, products and services, (v) performance and resources, and (vi) disclosure and communication. The results of the stocktake exercise and the assessment were published in a white paper and a quarterly bulletin.⁹¹ HKMA also held discussions with banks to understand their approach to and readiness for climate risk management.

⁸⁸ ACPR (2019), *Analysis and synthesis no. 101: French banking groups facing climate change-related risks: Analysis and synthesis n0102: French insurers facing climate change risk*.

⁸⁹ BaFin (2019) *Guidance Notice on Dealing with Sustainability Risks*

⁹⁰ BaFin (2021) *Germany's financial sector and the issue of sustainability risks*

⁹¹ HKMA (2020) *White Paper on Green and Sustainable Banking*; HKMA (2020) *Green and Sustainable Banking: Latest Developments*

- **Saudi Arabia:** Saudi Central Bank (SAMA) has initiated a preliminary assessment on climate-related financial risks to the financial system, starting with the banking sector due to its relative significance within the Saudi Arabian financial system. SAMA's assessment was focused on understanding the nature, level and impact of exposures of Saudi banks, such as exposures to the sectors with greater contribution to greenhouse gas (GHG) emissions. The type of data points collected include banks' exposures through their credit and their investment activities such as debt and equity instruments in both the banking and trading books. These exposures were also mapped to economic sectors using ISIC4 Classifications, and their GHG estimates
- **Singapore:** The MAS has engaged with key financial institutions in Singapore to better understand the processes, data and metrics used for their environmental and climate-related risk management, monitoring and analysis. A thematic review of practices across these key financial institutions was conducted, using a questionnaire followed by further bilateral discussions. Based on this, MAS will publish an information paper sharing observed good practices so as to help level up the risk management standards across the industry. MAS will also look to determine next steps in supervisory engagement of the financial institutions, including the development of a set of metrics to be collected from the financial institutions for the supervision of environmental risk. This effort will factor in global developments both in climate-related, as well as environmental risk disclosures.
- **United Kingdom:** The BoE's PRA currently applies a proportionate approach to assessing firms' management of climate-related financial risks. Collation of climate-related data has mainly been focussed on reviewing the Internal Capital Adequacy Assessment Process (ICAAP) for banks and Own Risk and Solvency Assessment (ORSA) for insurers, where firms are able to reflect climate-related risks. Other sources of information came from financial institutions' internal management information, and presentations provided during supervisory meetings. The PRA has assessed the extent to which firms have met its expectations regarding the management of climate-related financial risks through a series of questionnaires that were summarised in the PRA Climate Change Adaptation Report 2021. The report indicates that the BoE will consider the use of regulatory returns focussed on climate data and metrics in 2022.

Examples of information gathered from climate scenario analysis and stress tests

- **Canada:** In a joint climate scenario analysis pilot project, Bank of Canada and OSFI collected data from participating banks and insurers to assist with the credit analysis. This included LGD, PD and ECL data for a representative sample of commercial borrowers for the banks and for bonds and corporate loans for the insurers. The market risk analysis component applied only to the insurers in the pilot and relied on their private equity and common and preferred shares data. In addition to the quantitative credit and market risk data collected, a survey of the governance and risk management practices of the pilot participants was conducted.
- **EU:** The ECB's economy-wide climate stress test conducted in 2021 used a comprehensive dataset that combines backward and forward-looking climate and financial information from millions of companies worldwide and approximately 1,600 euro area banks and a novel set of climate-specific models, to capture the direct and indirect transmission channels of climate risk drivers over a period of 30 years into the future.⁹²
- **France:** As part of its 2020 climate pilot exercise, the ACPR collected very informative data from banks and insurers, such as the breakdown of their exposures into 56 sectors of activities, for each of the geographical areas considered in the exercise and indications on

⁹² L. de Guindos (2021) "Shining a light on climate risks: the ECB's economy-wide climate stress test," The ECB Blog

how institutions could reshape their balance-sheets according to the various scenarios analysed. Quantitative data on credit and market risks were also collected (cost of risk, probabilities of default, LGDs).

- **Germany:** As part of their 2019 climate stress test, BaFin and the Bundesbank asked 1,400 German small and medium-sized financial institutions about their assessment and current risk management of climate-related risks. For the 2022 stress test, the survey questions will be revised to provide a more comprehensive insight. The stress test will use reporting data (to replicate banks' corporate credit books) and debtor-specific data (balance sheet data, off-balance sheet data, third-party greenhouse-gas emissions data and further information such as industry sectors).
- **Italy:** As part of the climate stress test, Banca d'Italia leverages survey and administrative data to simulate the effects of alternative carbon taxes on the share of financially vulnerable firms and households and, in turn, on the banks' losses. The main data sources for the household sector are the Italian Household Budget Survey and the Bank of Italy Survey on Household Income and Wealth. Banca d'Italia also uses firm-level balance-sheet data from the Cerved database and administrative data from the National Institute of Social Security, integrated with Eurostat industry-level data on firms' energy use, to estimate how energy demand changes with prices. Credit Register data (collected by the Bank of Italy) are used to compute the probability of default at the sectoral level as a function of the share of vulnerable firms (and debt held by them).
- **Japan:** The Japan FSA collects qualitative information such as governance framework, potential management actions, and how to engage in interaction with borrowers, as well as quantitative data such as lending exposures by sector, projections of counterparties' financial indicators (e.g. sales, operational profit, net asset), and credit cost through a bottom-up climate scenario analysis.
- **Singapore:** As part of MAS' 2022 thematic climate scenario analysis exercise, participating banks and insurers will report quantitative information relating to their exposures to selected sectors as well as top counterparties under each of the climate scenarios specified. They will also be required to provide qualitative inputs on their potential management actions and business strategies in response to climate-related financial risks.
- **UK:** The BoE launched the Climate Biennial Exploratory Scenario in June 2021 and has recently announced its second phase. In carrying out the BoE's Climate Biennial Exploratory Scenario (CBES) exercise, banks and insurers were required to gather information from their clients on their exposures and their plans to deal with impacts under different climate scenarios. This could in turn help fill some climate data gaps and prompt climate action across the real economy.