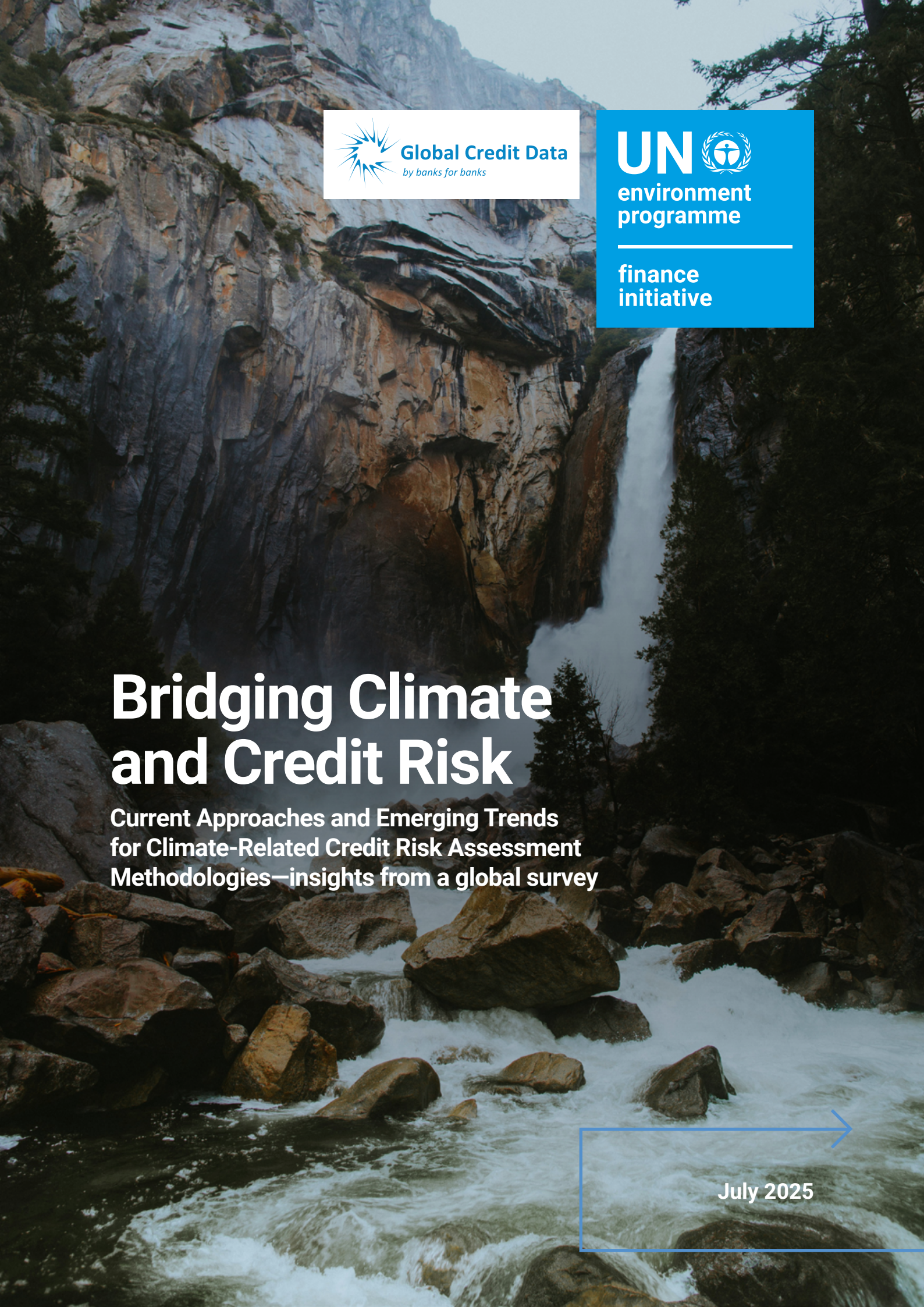

Global Credit Data
by banks for banks

UN environment programme

finance initiative

Bridging Climate and Credit Risk

Current Approaches and Emerging Trends for Climate-Related Credit Risk Assessment Methodologies—insights from a global survey

July 2025

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About UNEP FI

Since 2017, UNEP FI's Climate Risk and the Taskforce on Climate-Related Disclosures (TCFD) programme has taken a leadership role in developing good practices to identify, measure, disclose, and manage climate risk in the financial sector. Working with over 100 banks, insurers, and various investors, the programme has created numerous tools, frameworks, and guides to accelerate the implementation of good practices. It has focused on implementing the recommendations of the TCFD and has covered topics such as legal risks, climate stress testing, climate scenarios, climate tools, and other related areas.

In 2024, UNEP FI launched its Risk Centre. The Risk Centre provides a resource tailored especially for risk managers, integrating all UNEP FI's climate and nature risk-related work programmes, tools, and peer learning opportunities for assessing and managing climate and nature risks. The Risk Centre also aims to cover other sustainability risks, such as pollution and social risks, fostering a holistic approach to sustainability. It consists of a technical programme facilitated by working groups with the aim of producing decision-useful resources for the finance sector, such as cutting-edge tools, guidance, and methodologies.

About GCD

Global Credit Data (GCD) is a not-for-profit association owned by over 50 banks worldwide. With 20 years of experience, GCD is a trusted data consortium in the financial industry, maintaining the world's highest quality and most exhaustive member-bank contributed data source for credit risk.

GCD's activities revolve around pooling credit data, particularly from low default portfolios. Beyond data pooling, GCD further provides benchmarking services, facilitating knowledge exchange, and fostering research with a mission to help banks understand and model credit risks.

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Contents

Executive summary

The purpose of this report is to provide a deep-dive into the credit risk assessment methodologies currently used by banks to evaluate climate risks, and to identify standard practices used across global banks to establish a benchmark for modelling approaches and climate-related credit risk assessment. The findings mentioned throughout this report have been drawn from **a global survey conducted by the United Nations Environment Program Finance Initiative (UNEP FI) and Global Credit Data (GCD), which involved 32 banks from five regions**.

Throughout the report, key themes (detailed below) related to climate-risk-related credit risk assessments are addressed to give the reader insight into the current state of climate risk assessment and management for risk professionals, and to identify areas of further improvements for the global banking sector.

Overview of the scope of climate-related credit risk assessments

The survey identifies the range of exposure classes, sectors, and portfolios incorporated by banks as part of their climate-related credit risk assessment methodologies. The exposure classes most commonly covered are large corporates, commercial and residential real estate, retail and non-retail small and medium-sized enterprises (SMEs), and project finance. Similarly, a broad range of sectors are currently covered as part of banks' climate risk assessments.

Key survey findings on approaches for assessing climate-related credit risks[1,2]

Use of Results and Client Engagement	
Climate risk reporting, key risk indicators, and credit decisioning are the most common use cases for which banks employ the results of their climate risk assessments.	▪ The use of results for climate risk reporting is primarily driven by regulatory mandates, with 62 per cent of banks using the results due to regulatory compliance. ▪ Banks are focused on identifying climate risk indicators which can be factored into their credit decisioning processes. ▪ One quarter (25 per cent) of survey respondents stated that they plan to use the results of their climate risk assessment for strategy planning and economic capital.
The survey found that about two thirds of surveyed banks are using the results to inform client engagement.	▪ For the participating banks that use the results of their climate risk assessment to inform client engagement, most commonly do so through "moderate interventions", such as adjusting client ratings, asking clients to implement time-bound action plans, and adjusting the price of the loan of a client.

Integrating climate risk into credit risk modelling and credit risk management frameworks	
Banks are making progress in incorporating climate risk into credit risk models, though expert judgement remains the dominant approach.	▪ A little less than two thirds of survey respondents (61 per cent) are currently incorporating climate risk into Probability of Default (PD) modelling. ▪ In terms of Loss Given Default (LGD) measurements, 43 per cent of banks surveyed currently incorporate climate risk. ▪ More than one third of respondents (36 per cent) integrate climate risk into IFRS 9 and Current Expected Credit Loss (CECL) estimates. ▪ Only 18 per cent of respondents are incorporating climate risk factors into internal ratings-based (IRB) modelling. ▪ A proportion of respondents (18 per cent) also integrate climate-related factors into their rank ordering models.[3] ▪ Current efforts to quantify climate risk impact on capital requirements (expected credit loss (ECL), risk weighted assets (RWA) and economic capital (ECAP)) are largely in the early, exploratory stages.
Adjusting collateral values for transition risks and physical risks remains low, however a small number of banks are working on developing abilities to adjust these values for future climate risks.	▪ To account for future discounted expected losses when adjusting collateral values for climate-related risks, banks should first ensure that independent market valuators, the initial point of integration, incorporate these risks in their appraisal reports; where significant climate risk remains after valuation, the bank may apply minimal or moderate adjustments.

1 For definitions of key terminology used in this report, please refer to Appendix 1.
2 Appendix 2 highlights the survey findings for regions with the strongest participation.
3 This refers to whether climate risks are considered in existing models for credit ratings or scoring.

Integrating climate risk into credit risk modelling and credit risk management frameworks	
More than half of the surveyed banks have an internal ESG risk scoring[4] methodology in place (also referred to as sustainability scoring).	▪ Almost one quarter of respondents (23 per cent) of surveyed banks have a fully developed internal environmental, social, and governance (ESG) scoring methodology, while 16 per cent are currently developing an internal ESG scoring methodology. Around one in six (15 per cent) have a mix of internal and external ESG scoring methodologies. ▪ More than one third of banks fully or partially integrate ESG scores into credit ratings. ▪ Banks have yet to converge on a preferred method for integrating ESG factors, with some banks aggregating the factors into a single score, while others keep 'E', 'S' and 'G' components separate.

Physical and Transition Risk Assessments, including Scenario Analysis and Data	
The majority of participating banks are assessing climate risk across the various sectors with the real estate activities and construction sector most included to assess physical risk; Oil and Gas, electricity and energy supply sectors most included to assess transition risk.	▪ The most common underlying factors identified in the assumptions and methodology used are fuel mix, compliance with new regulation and related costs and fuel cost for the Transportation and Storage sector, new regulation on costs and operations for the Oil and Gas sector, water availability for the Agriculture Sector and property vulnerability to physical risks, energy efficiency and carbon footprint of buildings for the Real Estate sector. ▪ Common metrics that banks consider for assessing climate risks for real estate are geolocation, property value, building age and condition, and energy certificate.
A range of key risk drivers are used by banks to quantify transition risks, and they apply various underlying assumptions for key transition risk drivers; namely, policy, legal, technology, market trends and reputational risks.	▪ Key risk metrics used to assess credit risk related to transition risks include: emission reduction targets and progress, financed emissions, fossil fuel exposure, and Scope 1, 2, and 3 emissions of counterparties.[5] ▪ Banks are actively working to collect Scope 3 emissions data, primarily through client-reported data and estimates based on industry averages, activity data, and publicly available emission factors. However, data quality remains a significant challenge.
All surveyed banks incorporate first-order impacts when assessing physical risks, but fewer than one third (30 per cent) go further to model second-order impacts.	▪ Key risk metrics used to assess credit risk include the percentage of the portfolio exposed to areas with direct asset-level physical risks, the percentage of at-risk properties within real estate holdings and the distribution of portfolio exposure by physical risk hazard and severity level. ▪ No bank fully integrates tipping points into their assessments, reflecting constraints in available modelling methodologies.

4 ESG scoring in this report refers to the methodology used to evaluate a client's environmental, social, and governance risk profile.

5 A bank's financed emissions are related to the Scope 1, 2 and 3 emissions of its counterparties. In this report, financed emissions are considered at the product and/or exposure level, and Scope 1, 2 and 3 emissions are referenced at the entity level. Although there may be some overlap in coverage between these metrics.

Physical and Transition Risk Assessments, including Scenario Analysis and Data	
The NGFS reference scenarios are the most widely adopted scenarios used to measure climate risks, with 56 per cent of surveyed banks using them to measure physical risks and 85 per cent using them to measure transition risks.	▪ Scenarios by the Network for Greening the Financial System (NGFS) are widely used. When calculating add-ons to current credit risk parameters, impacts are measured either using the gap between two scenarios or a single scenario, with no patterns identified. ▪ Banks more commonly expand scenarios by using internal teams to add greater sectoral and geographical detail, rather than by introducing additional variables or relying on third-party support.
Banks are adapting their data and information and technology (IT) procedures in various ways to collect climate-related data from clients and enhancing their systems for incorporating climate data into their risk assessments and datasets.	▪ Banks most commonly use public data sources, external data providers, climate models and scientific research, and industry benchmarks as data sources. ▪ Banks use clients' climate risk disclosures to a greater extent to gather information on emissions data, decarbonization targets, operational activities, and location-specific climate vulnerabilities.

Despite ongoing challenges, survey findings highlight meaningful progress in how banks are approaching climate-related credit risk assessments. The survey finds that a group of banks are progressing in their efforts to enhance their methodologies, such as through the integration of climate risks into credit risk models, development of internal ESG risk scoring methodologies to use for credit decisioning, model second-order impacts, and estimate capital adjustments. While only a subset of banks currently apply these more advanced methodologies, these developments signal promising potential for further integration and refinement of climate risk into credit risk frameworks. Continued progress will depend on banks taking proactive steps to address persistent challenges such as data quality, the availability of forward-looking climate risk metrics, and a lack of technical expertise. Furthermore, strengthening collaboration between banks and supervisors, along with the provision of detailed and practical guidance from supervisory bodies, will be essential to accelerate methodological improvements and drive efforts against emerging climate-related credit risks.

With a view to strengthening their climate-related risk management strategies, risk professionals and their senior management are encouraged to leverage the insights from this report to identify good practices and to benchmark their approaches against industry peers.

Background and context

2024 was the first year for average temperature to exceed 1.5°C above pre-industrial level. The year broke many global records for emission levels and extreme weather events, such as floods, heatwaves and wildfires (Copernicus, 2025). Rising physical risks can potentially increase the likelihood of asset devaluations, supply chain disruptions, and credit defaults, particularly for banks exposed to vulnerable sectors and regions. A study by S&P Global finds that, without adaptation measures, the physical risks caused by a global temperature rise of 2.7°C could see the world's largest companies assessed incur total annual costs of USD 1.2 trillion by 2050 (S&P Global, 2025). Furthermore, the European Central Bank (ECB) has stated that droughts in the Eurozone could erase 15 per cent of economic output and could put at risk EUR 1.3 trillion in loans (Financial Times, 2025).

Similarly, by June 2024, 107 countries—accounting for about 82 per cent of global greenhouse gas emissions (GHG)—had adopted public net-zero pledges in one form or another (e.g. in law, policy documents or announcements) (UN, 2024). Decarbonization commitments from governments, investors, and corporations can drive a shift in policy, regulation, and market preferences, creating potential transition risks for banks with financing in carbon-intensive industries. Physical and transition risks can impact a bank's credit risk by affecting distinct components of the credit risk process: the borrower's ability to repay, the likelihood of default, and the bank's ability to recover loaned funds in the event of default (BIS, 2021) (Figure 1).

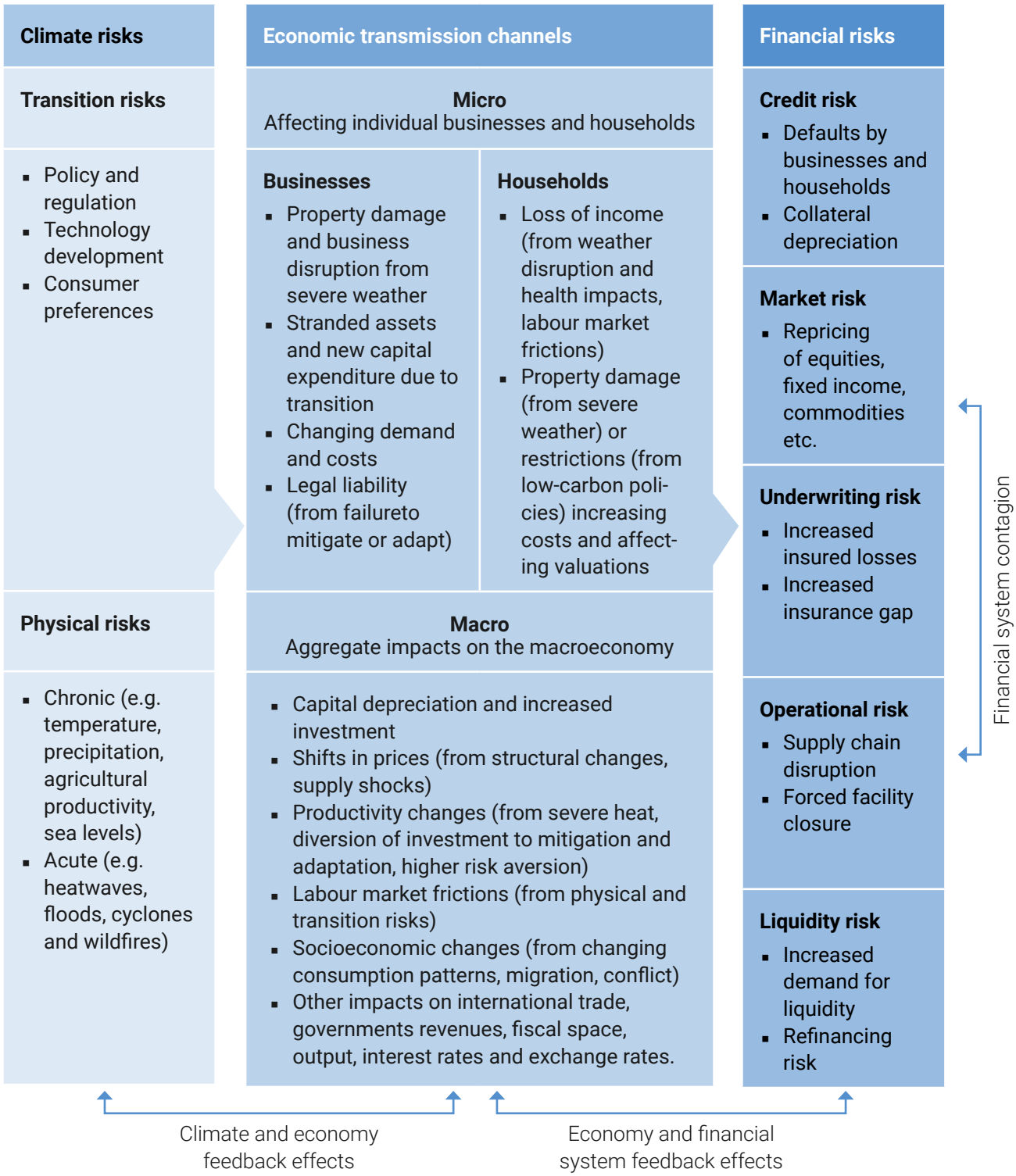


Figure 1: Transmission channels for climate risks to credit risks (NGFS, 2024)

Managing climate-related financial risks has also become a priority for a growing number of supervisory authorities, which now increasingly expect banks to build capabilities and methodologies for integrating climate risk in credit risk management. Table 1 highlights examples of supervisory guidelines published for banks on climate risk management.

Table 1: Example supervisory guidelines on climate risk management

Year	Supervisor	Guideline
2020	European Central Bank (ECB)	Guide on climate-related and environmental risks
2020	Monetary Authority of Singapore (MAS)	Guidelines on Environmental Risk Management for Banks
2021	Australian Prudential Regulation Authority (APRA)	Prudential Practice Guide CPG 229 Climate Change Financial Risks
2021	Hong Kong Monetary Authority (HKMA)	Supervisory Policy Manual GS-1 on Climate Risk Management
2022	Basel Committee on Banking Supervision (BCBS)	Principles for the effective management and supervision of climate-related financial risks
2024	South African Reserve Bank (SARB)—Prudential Authority	G2–2024 Guidance on climate-related governance and risk practices for Banks
2025	European Banking Authority (EBA)	Guidelines on the management of environmental, social and governance (ESG) risks Guidelines on ESG scenario analysis
2025	Office of the Superintendent of Financial Institutions (OSFI)	Guidance on Climate Risk Management (B-15)
2025	Bank of England (BoE)	CP10/25 – Enhancing banks' and insurers' approaches to managing climate-related risks

As climate change continues to pose material financial risks, banks are incorporating climate-related considerations into their credit risk management frameworks. This involves a number of practices, including identifying both physical and transition risks, assessing their materiality to borrowers and portfolios, and evaluating potential exposures to these risks. Banks also employ forward-looking scenario analysis to estimate potential financial losses under different climate scenarios, which helps inform strategic planning and risk mitigation. Additionally, banks are assessing how climate risks may affect the value and quality of collateral; for example, of assets that are impacted by physical risks. They are also embedding climate risk indicators into loan underwriting criteria and credit decision-making processes. Finally, banks are aligning reporting with global and jurisdictional sustainability disclosure standards.

However, the degree to which climate risks are integrated into credit risk management varies considerably across institutions. This variation is shaped by a range of factors, including differences in banks' internal capabilities, levels of organizational maturity, access to relevant data, scope of portfolios, and the extent of supervisory expectations in different jurisdictions. One of the most significant challenges that remains is the difficulty in quantifying the financial impacts of forward-looking climate risks, which are complex, long term, and uncertain. Some banks have advanced further in embedding climate-related risks into their credit risk frameworks than others, yet barriers for effective climate risk assessment and integration still persist.

Overview of the report

This report provides an in-depth analysis of the credit risk assessment methodologies currently used by banks to evaluate climate risks, identifying standard practices to establish a benchmark for modelling approaches and climate-related credit risk assessment more broadly. It covers key themes related to climate-related credit risk assessments and provides insights into the current state of climate risk assessment and management for risk professionals. Finally, it identifies areas of further development for the global banking sector. The themes covered in this report compromise:

- Methodologies and scope of assessing climate-related credit risks
- Use of results of climate-related credit risk assessments
- Integration of climate within credit risk modelling processes
- Physical risk-specific and transition risk-specific credit risk assessments
- Climate-related collateral value adjustments
- Exposure class and sector-specific credit risk assessment
- Scenario analysis
- ESG scoring
- Data collection and governance
- Quantitative impact of methodologies

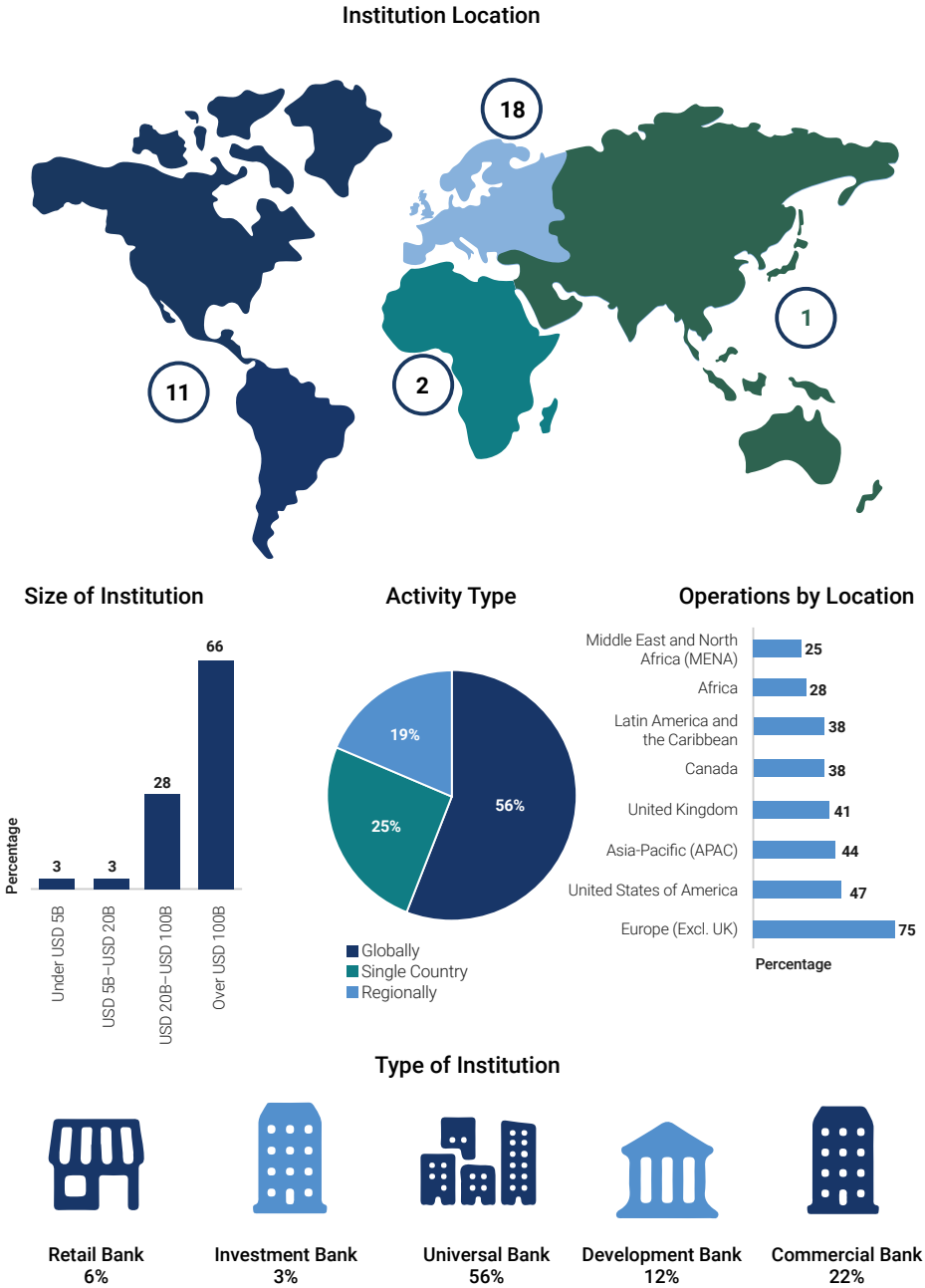
The insights provided in this report are based on findings from a global survey conducted jointly by the United Nations Environment Programme Finance Initiative (UNEP FI) and Global Credit Data (GCD), aimed at enhancing the methodologies and benchmarks that financial institutions use to assess and manage climate risks. The insights from this report will help risk professionals and their (senior) management identify good practices, compare their approaches with industry peers, and refine their credit risk management strategies. Additionally, the report provides supervisory authorities with a global overview of how banks assess climate risks and how they integrate them into credit risk management. It also offers key learnings and recommendations from the survey to help risk professionals and supervisors further strengthen the incorporation of climate risk into credit risk practices, at the firm level and jurisdictional level.

Overview of the survey

The comprehensive survey by GCD and UNEP FI has been designed to evaluate how banks are integrating climate-related risks into their credit risk management frameworks.

Breakdown of respondents

The survey has 32 banking participants from five regions. Summarized below are the key attributes of the survey respondents.



Structure of the survey

The UNEP FI and GCD survey was developed in collaboration with participating institutions and incorporates input and feedback from the banking sector, industry experts, and supervisory authorities. It was conducted between October 2024 and March 2025. The survey was structured to cover ten sections, detailed below. The findings from each section have been integrated into this report.

Table 2: Structure of the survey

Section	Section Name	Section Overview
1A	**Assessment of climate-related credit risk and results of climate-related credit risk assessments**	▪ Overall understanding of a bank's climate-related credit risk assessment ▪ Includes the types of assessments conducted by banks and the scope of those assessments ▪ Examines the outputs of an institution's climate-related credit risk assessments and how these results are being used
1B	**Integration of credit risk modelling processes**	▪ Focus on understanding the modelling approaches banks have undertaken ▪ Approaches used by banks to integrate climate factors into traditional credit risk models. ▪ Methodologies used by banks for assessing the materiality of physical and transition risks.
2	**Transition risk-specific credit risk assessments**	▪ Methodologies used by banks to assess transition risks (as part of their credit risk assessment) ▪ Understanding the transition risk drivers used and the key assumptions incorporated.
3	**Physical risk-specific credit risk assessments**	▪ Methodologies used banks to assess physical risks (as part of their credit risk assessment) ▪ Understanding the physical risk drivers used and the key assumptions incorporated
4	**Climate-related collateral value adjustments**	▪ Approaches that banks use to factor climate risks into collateral valuations.
5	**Exposure class and sector specific credit risk assessment**	▪ Methodologies used by banks to assess climate-related credit risk for specific sectors and exposure classes.
6	**Scenario analysis**	▪ Focus on banks' scenario analysis, including common scenarios used, methodologies for scenario expansions, and key variables used.
7	**ESG scores**	▪ Current approaches undertaken by banks for ESG risk scoring. ▪ Includes internal/external methodologies used to assess a client's ESG performance or risk profile.
8	**Data and IT**	▪ Covers data types, sources and processing at a higher level for climate-related credit risk assessment. ▪ Captures a wider view of data and IT procedures at banks.

Section	Section Name	Section Overview
9	**Integration of sustainability risks beyond climate**	▪ Understanding the broader state of the integration of sustainability risks beyond those related to climate in credit risk assessment. ▪ Designed to help understand if and how banks are assessing nature, pollution and social risks.
10	**Quantitative impact**	▪ Quantitative portion of the survey. ▪ Comparison of quantification of financial impact of climate risks by banks on key metrics.

For certain survey results covered in this report, the percentages may not total 100 per cent because multiple responses were allowed. In these cases, each percentage reflects the proportion of total respondents who selected the specific option in question.

1. Assessment of climate-related credit risk

Chapter overview

Banks conduct climate-related credit risk assessments to achieve multiple key objectives: (i) to understand their potential exposure to climate risks, (ii) to support climate-related risk disclosures, (iii) to raise awareness of climate change and build internal capabilities for assessing climate risks, and (iv) to identify data gaps and methodological limitations. In line with these objectives, this chapter offers a broad overview of banks' climate-related credit risk assessments, outlining the types of assessments conducted, the scope of these assessments across different sectors and exposure classes, and the type of methodological tools used.

1.1 Current scope of climate risk assessment at banks

Expert judgment and data driven assessments

Figure 2 shows the extent to which surveyed banks are using expert judgment versus data-driven approaches in their climate-related credit risk assessments. In the early stages, banks primarily relied on expert judgment due to limited data availability and the absence of standardized frameworks. This began to change over the past one to two years, as methodologies improved and more data became accessible. While expert judgment continues to play a role, it is increasingly being complemented by data-driven insights as banks enhance their capabilities in climate risk assessment.

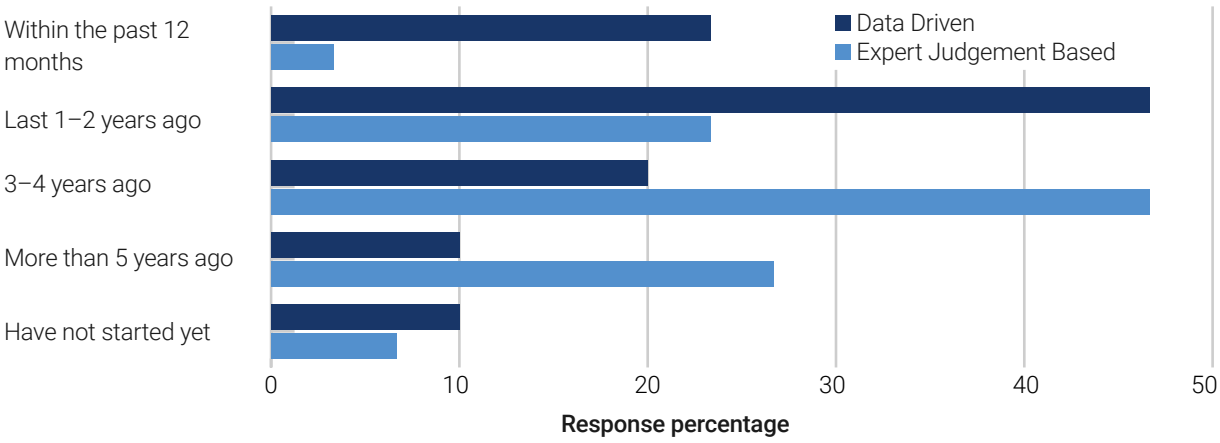


Figure 2: Timing of when participating banks began to conduct expert judgement and/or climate-related credit risk assessment driven by data

Portfolios, exposure classes and sectors assessed for climate risks

1. Exposure classes[6]

Large corporates (90 per cent), commercial real estate (87 per cent), and residential real estate (73 per cent) are the most common exposure classes currently being assessed by participating banks. Three fifths (60 per cent) of the respondents are also assessing retail SMEs, while 57 per cent are assessing non-retail SMEs. Over half (53 per cent), meanwhile, are assessing project finance. Other exposure classes assessed by banks include banks and non-bank financial institutions (NBFIs) (37 per cent), shipping finance (30 per cent), households (27 per cent), and sovereigns (23 per cent). Among the options provided, aircraft finance (17 per cent) and private individuals (3 per cent) were the least commonly assessed, despite aviation being one of the highest-emitting industries. (Figure 3).

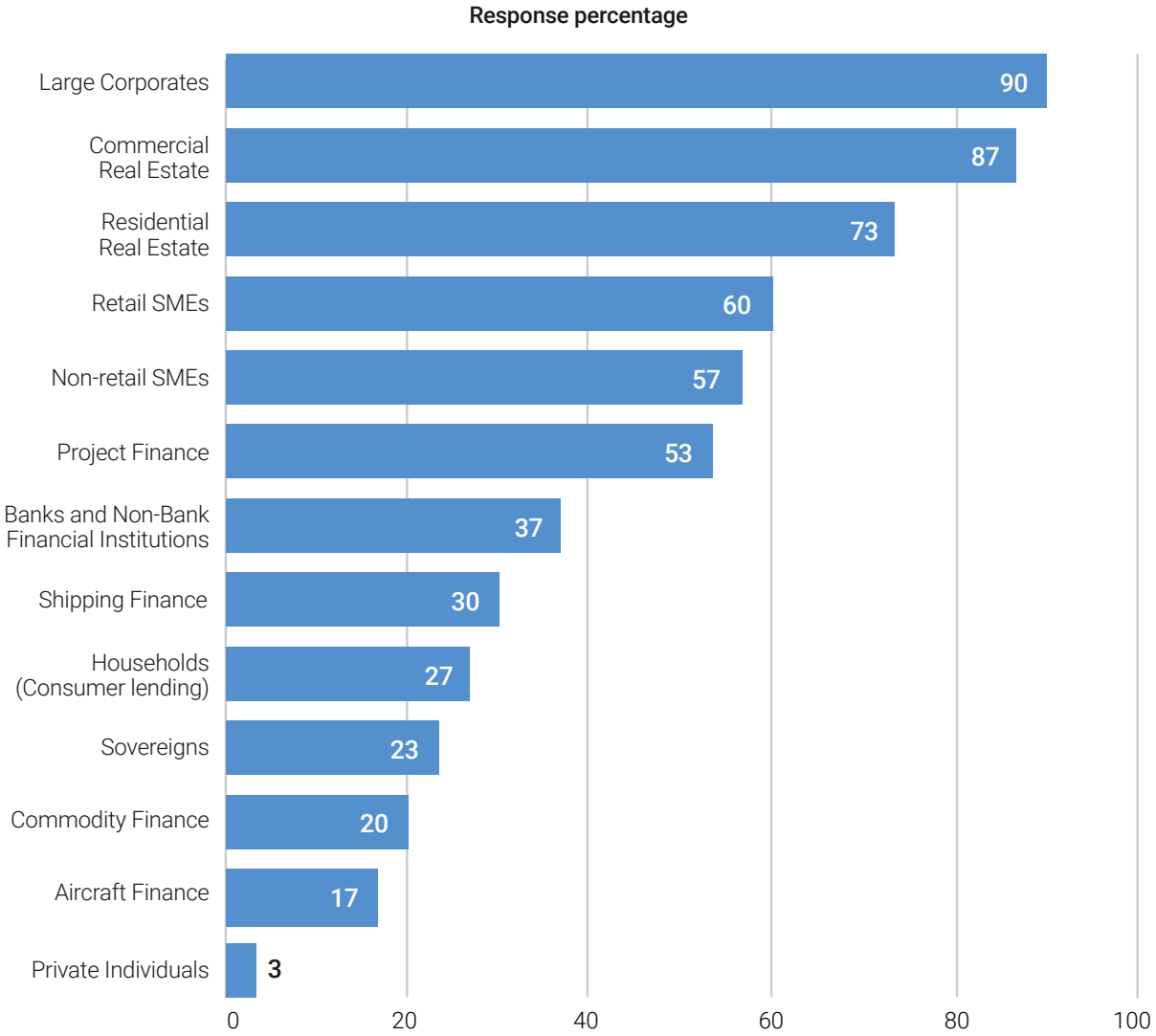


Figure 3: Exposure classes assessed by participating banks as part of their climate-related credit risk assessments

6 Definitions for each exposure class can be found in Appendix 1.

2. Sectors[7]

The majority of participating banks are assessing physical risk across the various sectors with **real estate activities and the construction sector included most frequently to assess physical risk** (90 per cent). In terms of transition risks, the majority of participating banks are assessing transition risk across the various sectors. Emissions-intensive sectors like the **oil and gas, electricity and energy supply, and transportation and storage, plus the mining of coal and lignite, metal ores and other mining** comprise the most common sectors assessed. The level of granularity of the selected sectors varies depending on whether transition or physical risks are being assessed, as well as on the specific exposure classes under consideration (Figure 4).

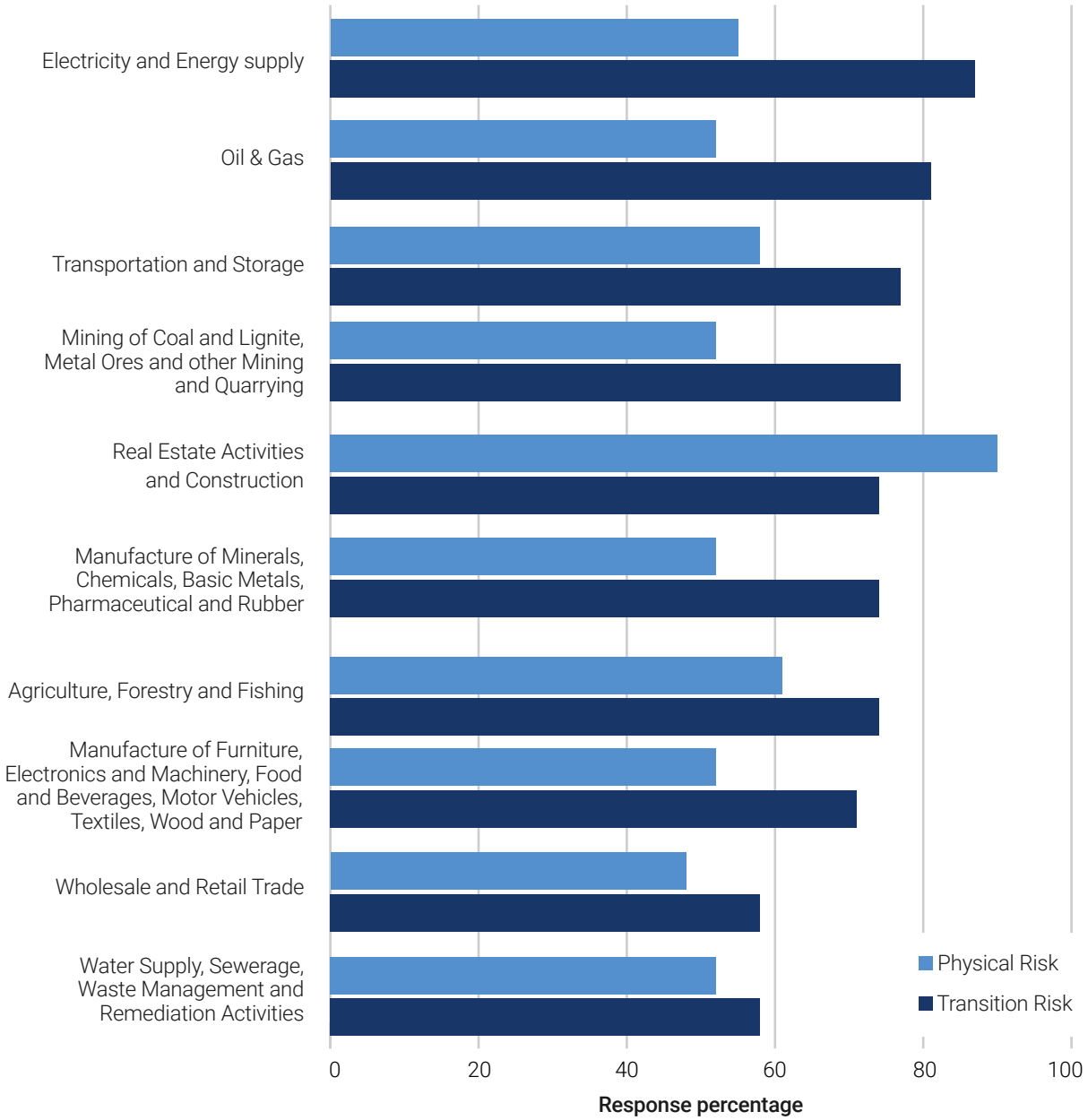


Figure 4: Sectors currently included in participating banks' physical and transition risk-related credit risk assessment

7 Definitions for each sector can be found in Appendix 1.

3. Portfolio types

Survey results show that all wholesale (63 per cent) and mortgage (63 per cent) portfolios are the most common portfolios that participating banks are modelling as part of their climate-related credit risk assessment. Two fifths (40 per cent) of respondents are modelling wholesale but with a focus on specific sectors such as transportation, real estate, and electricity and energy supply. One fifth (20 per cent) of respondents stated that they are modelling their retail portfolios.

Overview of methodologies and approaches used

1. Bottom-up, top-down or a combination of both approaches

Banks are employing a variety of approaches—bottom-up,[8] top-down,[9] or a combination of both[10]—to assess climate-related credit risk across different exposure classes. There is no single approach that could be uniformly applied across all exposure classes as each approach has its own advantages and drawbacks. For example, if an institution lacks granular data, it may be more appropriate to adopt a top-down approach. In contrast, using a bottom-up approach would allow for a more detailed risk assessment at more granular levels; e.g. counterparty or asset level. Based on the survey results, banks are more likely to use a combination of approaches than relying solely on top-down or bottom-up methods, although this can change depending on the exposure class in question.

For instance, Figure 5 shows that a combined top-down and bottom-up approach is most commonly used by surveyed banks to assess climate risks in commercial real estate, large corporates, residential real estate, and non-retail SME exposure classes. In these cases, the bottom-up approach is the second most commonly used. A combination approach is also preferred for assessing climate risks in project finance and shipping finance, rather than relying on top-down or bottom-up methods individually.

For retail SMEs, the bottom-up approach is the most commonly used, followed by top-down and combination approaches.

A top-down approach is more frequently applied to assess climate risks for households and sovereigns. The use of a top-down approach for these exposure classes also reflects the fact that survey respondents assess them less frequently than other exposure classes.

8 Bottom-up approach: Analysing individual assets or sectors or borrowers to understand specific climate risks.

9 Top-down approach: Evaluating climate risk at a macro level, such as the overall impact on the economy, industry, portfolios and sub-portfolios.

10 Integrating detailed asset-level analysis with broader economic assessments to get a comprehensive view of climate risk.

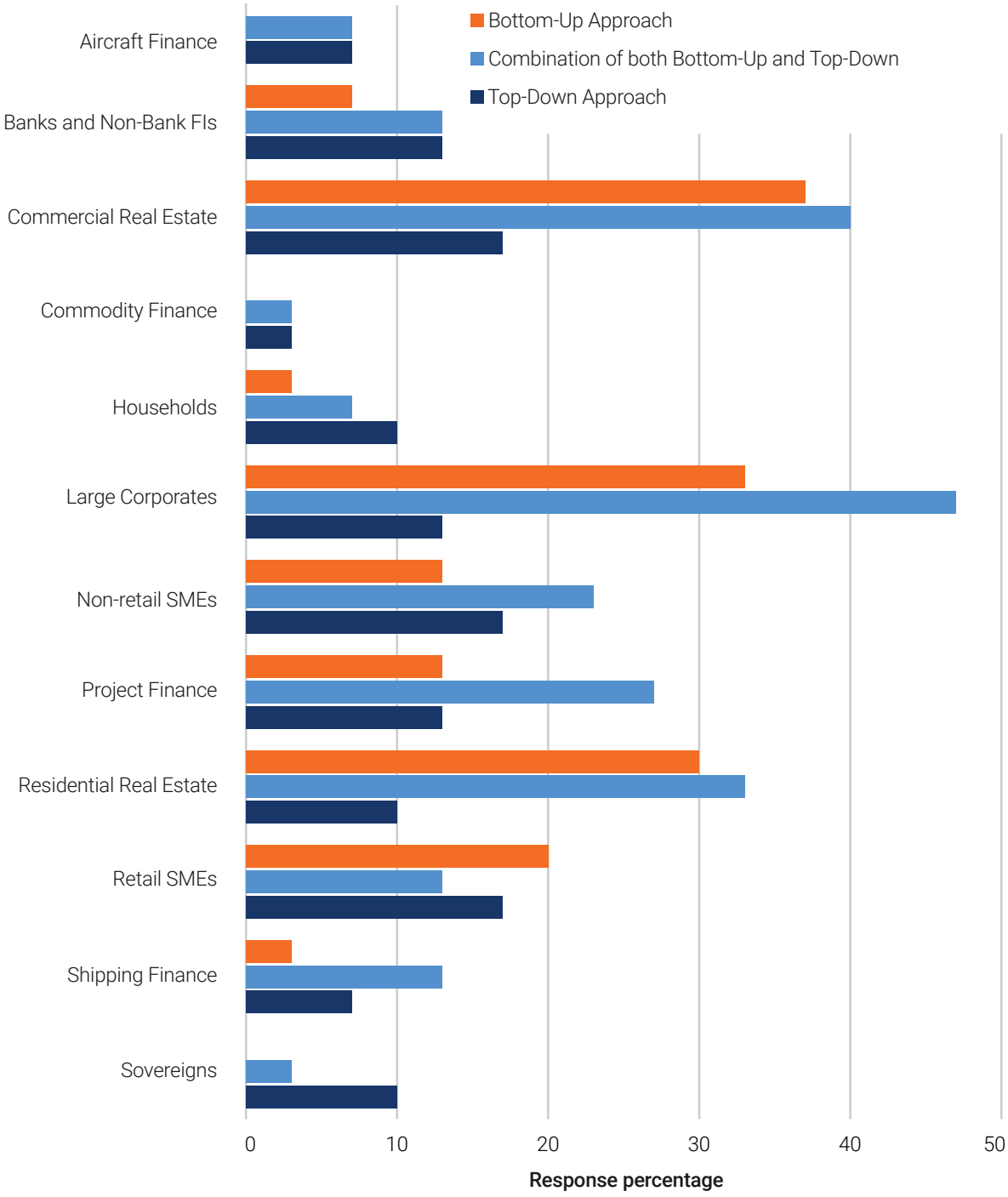


Figure 5: Approaches used by banks for climate-related credit risk assessment per exposure class

2. Common methodological tools used across exposure classes[11]

A number of methodological tools can be performed in-house, through external support, or in combination of both, to assess climate risks across various exposure classes. These methodological tools include:

Overall, **qualitative assessments, scenario analysis, internal climate stress tests, supervisory stress tests, heatmapping and scorecards** are the methodological tools more commonly used by surveyed banks to assess climate risks. However, the methodological tools that are commonly performed can vary depending on the exposure class, as summarized below.

- Qualitative assessments, scenario analysis, internal climate stress tests and supervisory climate stress tests are the most commonly used methodological tools for assessing climate risks in large corporates, non-retail SMEs, and retail SMEs. Qualitative assessments and internal climate stress tests are also frequently applied in-house to assess climate risks for residential real estate and commercial real estate.
- Heatmapping is a preferred tool to assess climate risks for large corporates, retail SMEs, sovereigns and commercial real estate, with some banks either developing heatmaps in-house, using external support, or a combination both.
- Scorecards are commonly used in-house to assess climate risks in project finance, sovereigns and shipping finance.
- A smaller number of banks apply data modelling for climate risk assessment in banks and non-banks FIs, sovereigns and large corporates, using in-house resources, external support, or both.
- Statistical analysis is typically used for residential real estate, and to a lesser extent, for banks and non-banks FIs, sovereigns and households.
- Internal risk models are most often applied for commercial real estate and are also used for households and sovereigns.

11 See Appendix 1 for definitions of the methodologies mentioned.

1.2 Identifying key challenges for climate risk assessment

Banks face a number of challenges in integrating climate into credit risk assessments. Some of these challenges include, but are not limited to: the availability and quality of data; modelling forward looking risks; technical expertise and in-house capacity; and the availability of methodologies to map climate risk drivers to financial drivers. The survey found that some challenges are more suitable to be addressed internally, with respondents indicating plans to address them, while others require greater reliance on third-party support.

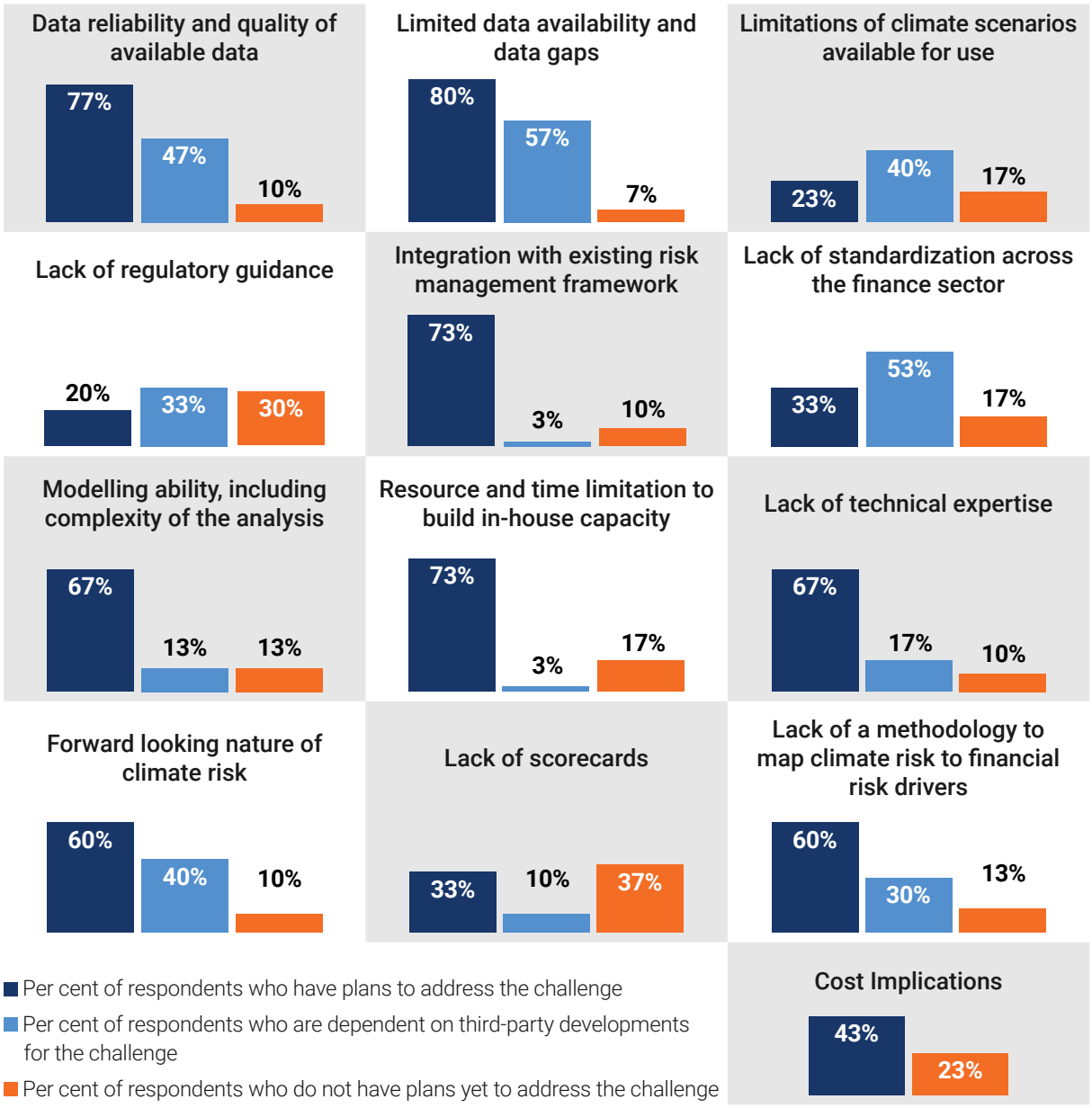


Figure 6: Key challenges faced by participating respondents

1.3 Integration of sustainability risks beyond climate

Along with the assessment of climate risks, banks are expanding their focus to assess the impact of broader sustainability-related risks on credit risk, including social and/or human rights, nature and pollution-related risks. Almost half of the surveyed banks (48 per cent) consider social and/or human rights risks in their credit risk assessments, 44 per cent of respondents consider nature risk, and 30 per cent of respondents consider pollution risk. Furthermore, banks consider a decline in ecosystem services, biodiversity loss, water stress, water pollution, soil contamination, and air pollution as relevant risks for credit risk assessments. Banks are integrating these sustainability risks into existing credit risk assessment frameworks or are developing a separate process to assess them.

As the awareness of sustainability risks continues to grow, expanding the scope of credit risk assessments will be an important way of ensuring that forward-looking risks are effectively identified and quantified, and integrated into risk management.

1.4 Summary and takeaways

- When assessing climate risks, in the early stages, banks typically relied on **"qualitative" expert-based judgment approaches and gradually established more "quantitative" data-driven approaches** as data availability and methodologies improved.
- **Large corporates, commercial real estate and residential real estate** are the most common exposure classes currently included in climate-related credit risk assessments. Whereas, the exposure classes—namely, aircraft finance and private individuals—are the least frequently assessed by banks.
- Physical risks are being assessed for a **range of sectors, with the real estate activities and construction sector** included most frequently in physical risk assessments.
- Transition risks are being assessed for a range of sectors, with **oil and gas, the electricity and energy supply, the mining of coal and lignite, metal ores and other mining and quarrying, and the transportation and storage sectors** being the most commonly assessed.
- **All wholesale and mortgages portfolios** are the most common portfolios modelled as part of climate-related credit risk assessments.
- Overall, there is no single, uniform approach for assessing climate risks across different exposure classes. Banks are more likely to **use a combination of top-down and bottom-up approaches** to assess climate risks in exposure classes that are more frequently evaluated. In contrast, top-down approaches are more commonly applied to exposure classes that are assessed less frequently. The approach an institution adopts also depends on the granularity of available data and the resources that it can allocate.
- **Qualitative assessments, scenario analyses, internal climate stress tests, supervisory stress tests, heatmapping, and scorecards** are common methodological tools used by banks to assess climate risks. The use of internal risk models, statistical analysis, and data modelling are not as widely adopted.
- Banks are actively working to **develop plans to address challenges**, including: data reliability and quality of available data; integration with existing risk management framework; limited data availability and data gaps; and resource and time limitations to build in-house capacity.
- Banks are broadening their **focus to assess how wider sustainability-related risks** impact credit risk, either by integrating these risks into existing credit risk assessment frameworks or by developing separate processes for their assessment.

2. Use of results from climate risk assessments

Chapter overview

This chapter examines the outputs of banks' climate-related credit risk assessments and how these results are being used. It aims to provide insight into their application of these results across key use cases.

2.1 Current use of the results within banks

Use of results of climate risk assessments for given use cases

Climate risk reporting (such as internal reporting, public financial reporting, regulatory reporting), key risk indicators and credit decisioning are the most common use cases for which banks use the results of their climate risk assessments. The use of results for climate risk reporting is primarily driven by widespread regulatory compliance, whereas their use for key risk indicators and credit decision-making is driven by both regulatory requirements and internal business needs. Economic capital, including ICAAP, IFRS 9 or CECL Provisions, Pricing, and Regulatory Capital, are the use cases for which the results are least commonly used by participants (Figure 7).

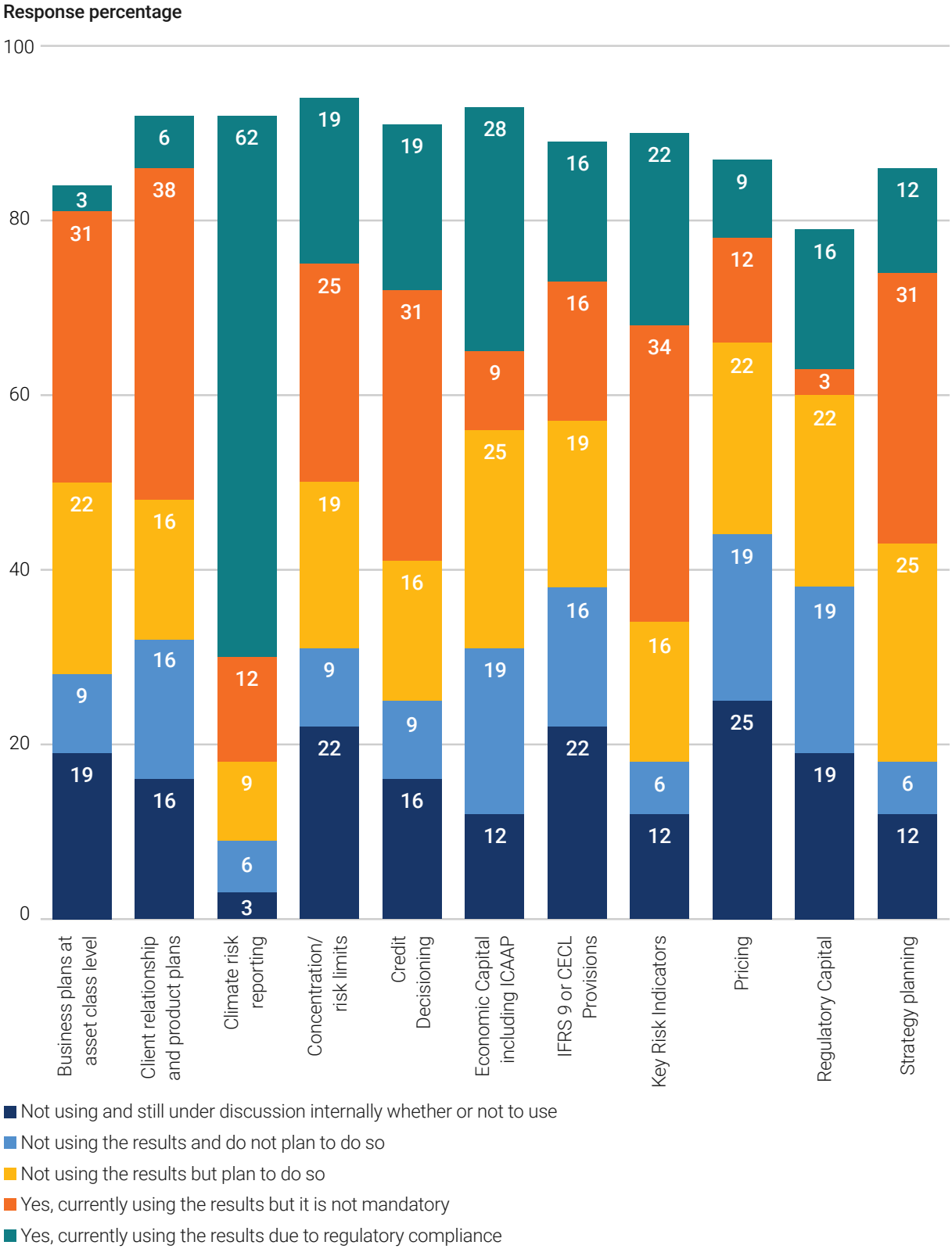


Figure 7: Use of results of climate risk assessments for the given use cases

Use of results to inform client engagement

As for how participating banks are using the results of their climate risk assessment to inform client engagement, the survey found that they are doing so in three primary ways: by **adjusting client ratings; by asking clients to manage climate risks through the implementation of time-bound action plans; and adjusting the price of clients' loans.**

Currently, the results are primarily being used to support more moderate forms of intervention, rather than more severe actions. For example, some of the less commonly employed strategies of the banks include: reducing limits or exposure to facilities of the client; changing product lines and associated pricing; exiting the client relationship; and reducing the loan tenor of the facility.

However, more than one third of survey respondents (38 per cent) do not use their results to inform client engagement. This can be partly attributed to the methodologies being in their early stages and not sufficiently mature to engage with clients. Other possible reasons relate to the inadequate organization structure of the institution; or limitations in the support offered by executives and other stakeholders.

2.2 Summary and takeaways

- Overall, banks are applying the results of their climate risk assessments across multiple use cases; sometimes this is driven by the need to comply with regulatory mandates and at other time driven by internal business objectives.
- Banks leverage climate risk assessment results more fully across **climate risk reporting, key risk indicators and credit decisioning.** However, banks are starting to prepare to use climate risk assessment outcomes in both **economic capital and strategy planning.**
- Climate risk assessment findings can be used to **inform client engagement.** This is something that the majority of the banks surveyed already do. Moderate interventions tend to predominate, such as adjusting client credit ratings, requesting time-bound risk mitigation plans, and aligning loan pricing with climate risk exposure.
- As banks further enhance their methodologies, a greater proportion of banks are expected to use the results of their climate risk assessment to inform client engagement.

3. Integration of climate into credit risk modelling processes

Chapter overview

This chapter explores the modelling approaches that banks are using to integrate climate factors into their existing credit risk assessment frameworks. It examines the extent to which climate considerations have been embedded into key components, including (i) credit risk parameters (PD and LGD), (ii) provisioning and regulatory capital requirements (IFRS 9 or CECL estimates and Internal Ratings-Based (IRB) models), and (iii) rank ordering models.

3.1 Incorporating climate risk into regulatory and economic capital estimates and provisions

The current level of incorporation of climate risk into regulatory and economic capital estimates and provisions reflects an early stage of adoption, with **less than half of the respondents stating that they incorporate climate risk into their economic capital estimates, provisions and/or regulatory capital estimates** (Figure 8). Among the banks that do incorporate climate risk, a greater number focus on integrating it into expected credit loss (ECL) and probability of default (PD) estimates.

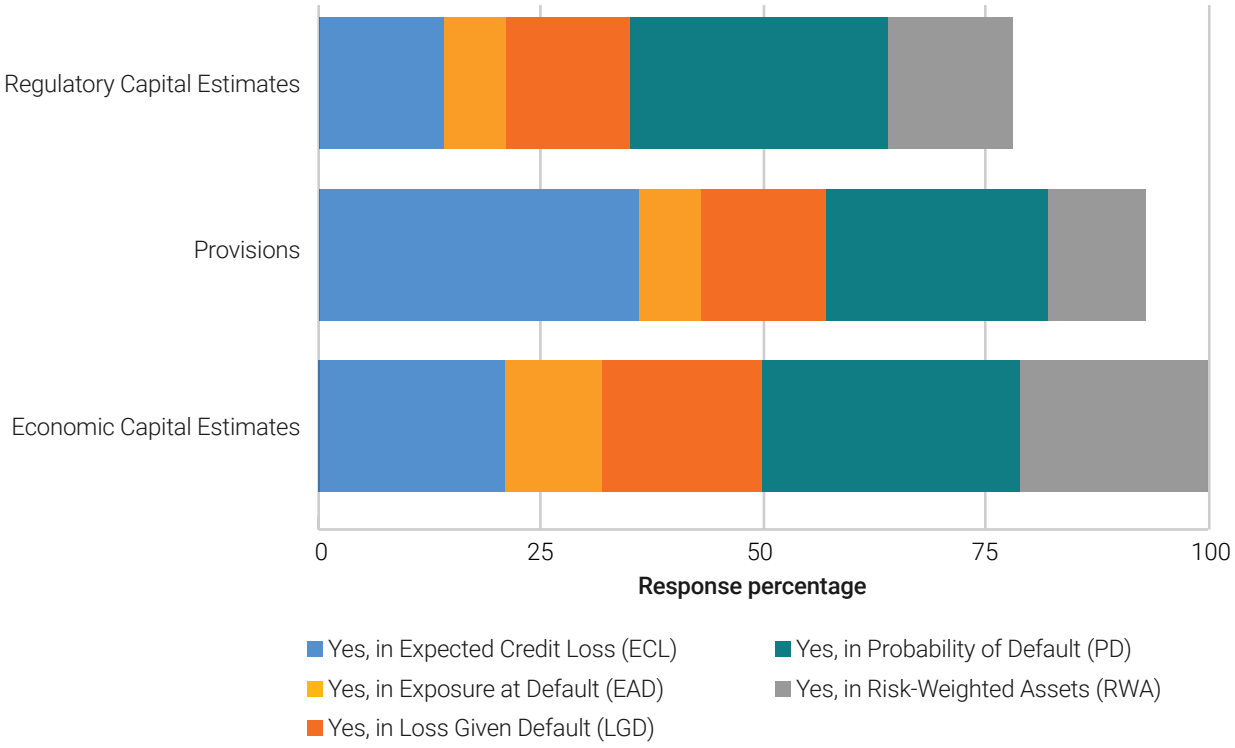


Figure 8: Incorporation of climate risk into regulatory and economic capital estimates and provisions by participating banks

3.2 Incorporating climate risk into financial risk modelling

Approaches for incorporating climate risk into Probability of Default

Integrating climate risk into PD measurements can help capture the financial impact of climate-related events and enhance banks' ability to assess and manage climate-related credit risks. Figure 9 shows what the survey reveals about the approaches that banks are currently using for incorporating climate risk into PD. The most common approaches in this respect are: (i) adjusting existing PD models to include climate risk factors; (ii) using stress testing results to inform PD adjustments at portfolio or obligor level; and (iii) overriding by adjusting existing PD model outcomes, such as manually adjusting the PD for companies highly exposed to climate risks after running the PD model.

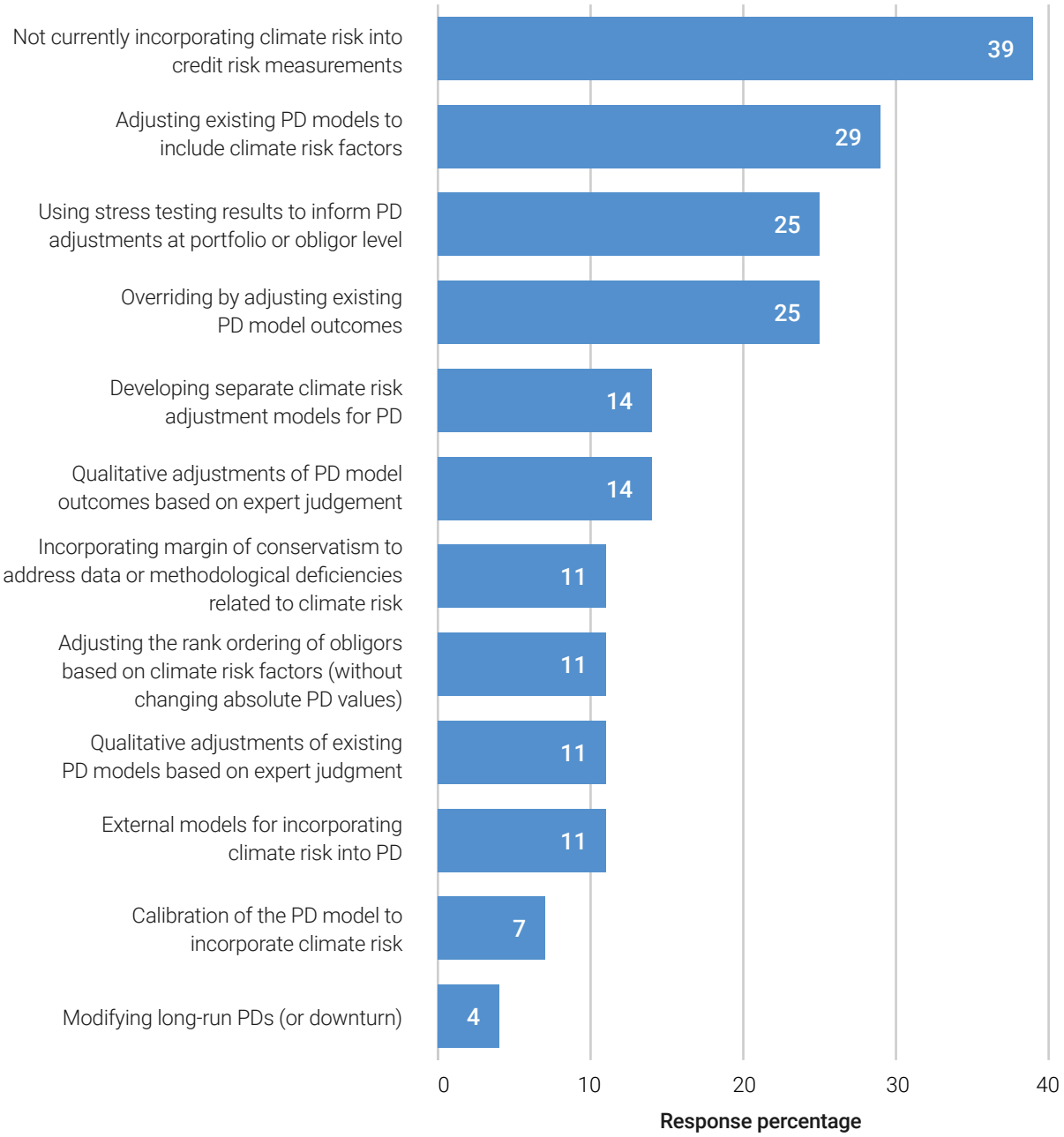


Figure 9: Practices for incorporating climate risk assessments into PDs

At present, the majority of surveyed banks **are not using information from clients' transition plans** in their climate-related PD modelling. Among the banks that do use the information, the most common approaches are for estimating the financial impact of implementing their clients' transition plans and evaluating the impact of the transition plan on client revenue.

Approaches for incorporating into Loss Given Default

Incorporating climate risk into LGD estimates helps banks better reflect potential losses by accounting for the impact of physical and transition risks on asset values and recovery rates. Figure 10 shows the approaches that banks are currently using for incorporating climate risk into the LGD. The two most common approaches used by the highest percentage of respondents are: (i) using stress testing results to inform LGD adjustments at portfolio or obligor/facility level, and (ii) adjusting existing LGD models to include climate risk factors. Even so, these are still adopted by only a minority of banks overall.

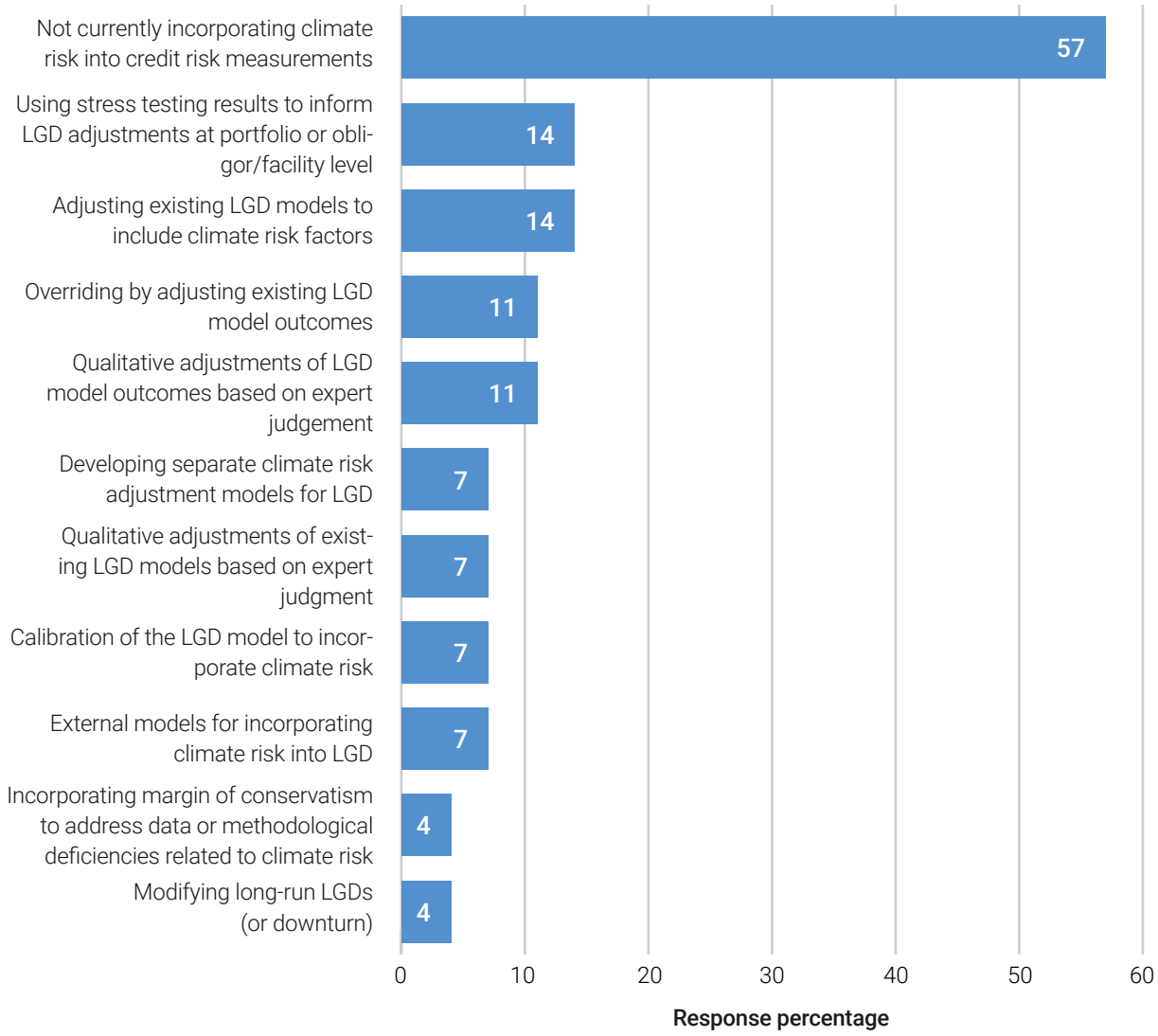


Figure 10: Practices for incorporating climate risk assessments into LGD

Integrating climate risk into IFRS 9/CECL Estimates

Climate risks can potentially impact the valuation of financial instruments and the estimation of ECL, thereby affecting financial reporting. Therefore, incorporating climate-related risks into IFRS 9 or CECL estimates can be important to ensure that financial statements accurately reflect potential future credit losses arising from climate change. **More than one third of respondents (36 per cent) are incorporating climate risk factors into their IFRS 9 or CECL estimates.** There is no clear consensus on a preferred method for incorporating climate risk factors. About 30 per cent of respondents use in-model

adjustment of PD, LGD and macro factors; while another 30 per cent use expert judgment on post-model adjustment. Meanwhile, 20 per cent perform umbrella overlays covering PD, LGD and macro factors; and another 20 per cent use evidence-based overlays across PD, LGD, and macro factors.

Among the subset of respondents that incorporate climate risk factors into their IFRS 9 estimates, 43 per cent allocate clients to Stage 2 due to climate risk, stating that they identify clients for Stage 2 primarily based on rating overlays. The remaining (57 per cent) calculate aggregate add-ons to provisions due to climate risk. This suggests differing levels of integration and preferences across banks.

Integrating climate risk into Internal Ratings-Based (IRB) modelling

Integrating climate risk into IRB modelling can support internal credit risk estimates to better capture the forward-looking impact of climate-related financial risks. However, this remains a challenge as IRB models are inherently backward-looking, relying on historical data. As a result, the integration of climate risk into IRB models by banks is still limited, with **the majority of participating banks (82 per cent) not incorporating climate risk factors into their IRB models.** To address this gap, banks rely on expert judgement on post-model adjustment. Other methods used include in-model adjustment of PD, LGD and macro factors and evidence-based overlay covering PD, LGD and macro factors (post-model adjustment).

Banks report incorporating climate risk into PD and LGD; however, the methodologies are still being developed. As a result, these adjustments are not yet reflected in IRB models. This accounts for variation in survey responses between the integration of climate risks into PDs and LGDs versus into IRB models. Planned integration into IRB frameworks is underway for some institutions but has not been implemented.

Integrating climate risk into rank ordering models

As borrowers' financial performance becomes potentially vulnerable to climate risks, incorporating climate-related factors into rank ordering models can be important to ensure that credit scoring and risk rankings of borrowers account for forward-looking risks.

The majority of respondents (82 per cent) have not integrated climate-related factors into their rank ordering models. Banks that do integrate climate-related factors, the majority do so by using overlays (14 per cent), with only a fraction of banks (4 per cent) developing new scoring or rating models based on historical climate data.

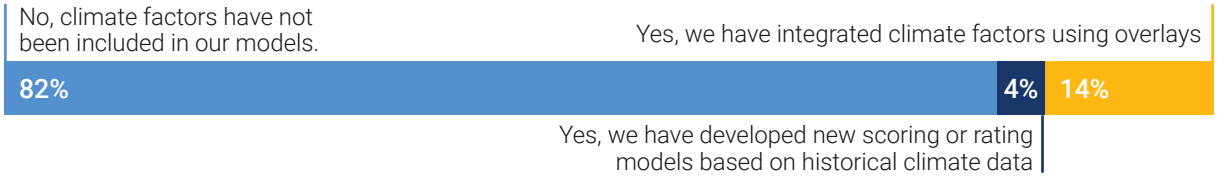


Figure 11: Percentage of respondents integrating climate-related factors into their rank ordering models

3.3 Uncertainties and validation practices

The survey has identified **a number of uncertainties** associated with models used for climate risk assessment. These uncertainties chiefly relate to data quality and availability, sensitivity to model assumptions, and challenges in capturing the long-term nature of climate risks. Other lesser concerns are linked to the introduction by subjective adjustments of bias and inconsistency, as well as a lack of model transparency and limitations in sustainability expertise. Potential overfitting and sensitivity to market volatility are uncertainties surveyed banks perceive to be less associated with the models used.

Conducting validation practices is important for managing and reducing the risks linked to modelling uncertainties. The most commonly used approaches are evaluating conceptual soundness and reviewing documentation and reporting (50 per cent), which relate to the validation of model design and transparency. Other validation practices reported by banks are shown in Figure 12.

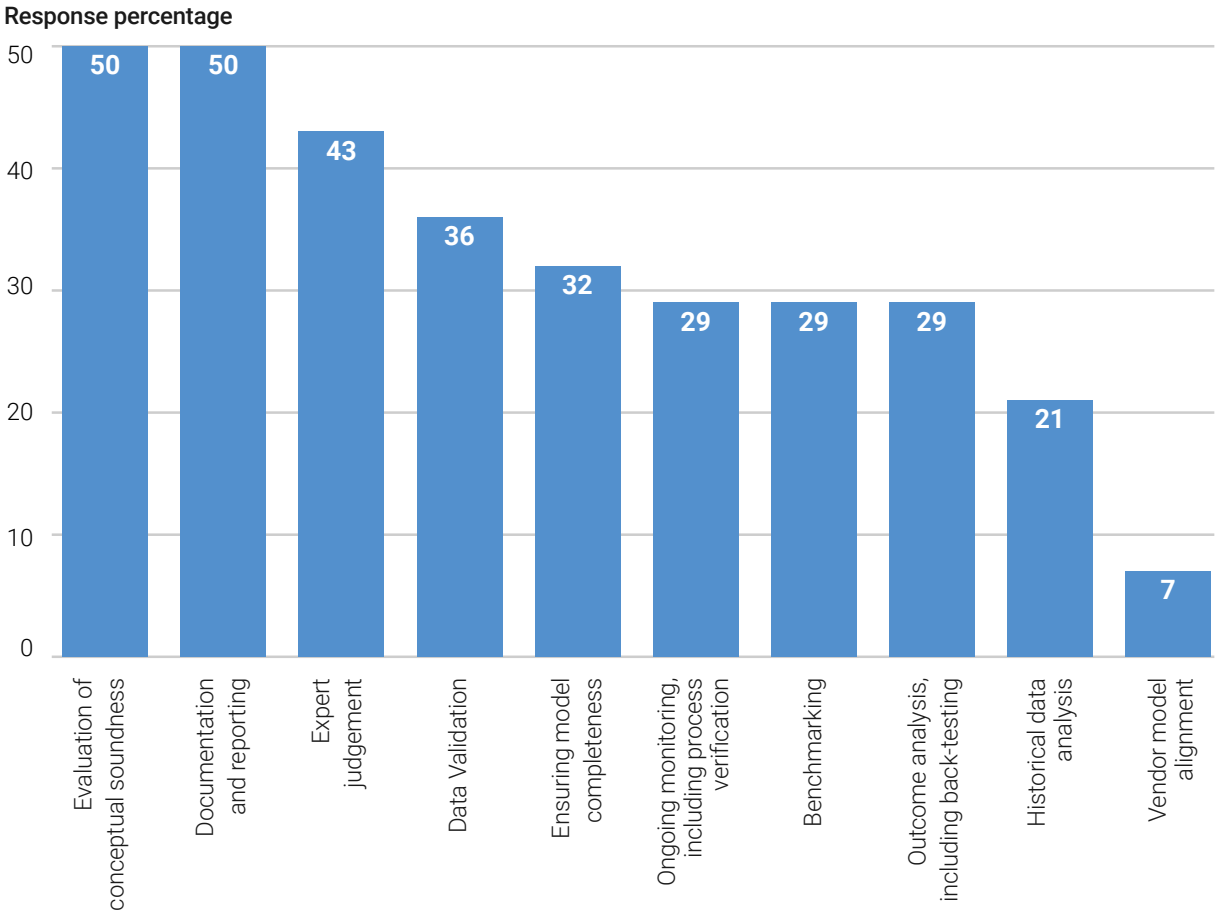


Figure 12: Validation practices used within climate modelling by participating banks

Assessing the impact of alternative assumptions and methodologies on the final modelled measures can help address uncertainties and support the validation of the results. However, only **a quarter of the respondents (25 per cent) assess the impact of alternative assumptions and methodologies.** Approaches for assessing the impact of alternative assumptions and methodologies include comparing model outputs across different vendors, running the model with multiple weightings, comparing results of top-down and bottom-up approaches and backtesting on observed and historical data.

Use of margin of conservatism

When addressing climate data gaps, most surveyed banks apply a moderate margin of conservatism based on expert judgment (65 per cent). A smaller number use a minimal margin (28 per cent), while only a few adopt (7 per cent) a more extensive approach. **Overall, all respondents are applying a margin of conservatism to varying degrees to account for data limitations.**

Expert judgement can be applied by banks at various steps of the climate risk analysis process, such as:

- Addressing data limitations by interpreting and applying data where standard guidance is lacking.
- Conducting climate risk analysis such as scenario analysis, risk identification, and vulnerability scoring.
- Setting appropriate thresholds for methodologies like heatmaps and evaluating sector-level climate adjustments for specific counterparties.
- Interpreting model outputs to support decision-making.
- Engaging directly with clients through on-site analysis and discussions.

3.4 Summary and takeaways

- Overall, the incorporation of climate risk into regulatory and economic capital estimates and provisions remains in the initial stages, with **observed approaches to incorporate climate into credit risk modelling reliant on expert judgement.**
- **As banks develop methodologies to incorporate climate risk into PD, key practices currently used are:**
  - Adjusting existing PD models to include climate-related factors,
  - Using stress testing results to inform PD adjustments at the portfolio or obligor level, or
  - Applying expert judgement to override or adjust existing PD model outcomes.
- **As banks develop methodologies to incorporate climate risk into LGD, available methods include:**
  - Informing LGD adjustments at the portfolio or facility level based on climate stress testing results, or
  - Modifying existing LGD models to account for climate risk factors, even in the absence of standardized industry practices.
- **As banks develop approaches for integrating climate risk into IFRS 9/CECL estimates, available approaches include:**
  - In-model adjustments of PD, LGD, and macroeconomic factors,
  - Post-model expert judgement adjustments,
  - Umbrella overlays that cover PD, LGD, and macro factors, or
  - Evidence-based overlays aligned with observed data.
- Integration of climate risks into IRB models is also still in the early stages, **with banks relying on the use of expert judgement to currently incorporate climate risk into IRB models**, particularly for post-model adjustments.
- **Similarly, a small proportion of banks are integrating climate-related factors into rank-ordering models**, and are doing so by applying overlays, rather than building new scoring or rating models based solely on historical climate data.
- To address uncertainties related to modelling climate risks, **banks are prioritizing validation practices** focused on **assessing conceptual soundness of models** and **strengthening the documentation and reporting** of climate risk modelling approaches.
- Participating banks that reflect climate risk in their credit risk measurement **apply a margin of conservatism based on expert judgement** to a certain extent so as to correct climate data deficiencies.

4. Materiality assessment of climate risks

Chapter overview

Materiality assessments help banks identify and prioritize climate risks by evaluating their potential impact on the business and relevant stakeholders (Manifest Climate, 2024). This chapter explores current methodologies used by banks for evaluating the materiality of physical and transition risks.

4.1 Methodologies for assessing the materiality of climate risks

Time-horizon of assessment

When assessing physical risks, shorter and medium time-horizons of 0–3 years and 3–10 years are the most commonly used, with about 70 per cent of respondents selecting them. More than half of the respondents (57 per cent) are also assessing physical risks across the longer-term time-horizons of 10–20 years and 20–30 years. Only 29 per cent of respondents selected using a long-term time-horizon of 50–100 years.

When assessing transition risks, the time-horizon of 3–10 years is the period most commonly used (68 per cent), followed by 20–30 years (64 per cent) and 0–3 years (61 per cent). Fifty-four per cent of respondents also use a time-horizon of 10–20 years, while only 11 per cent use a time horizon of 50–100 years.

Practices for conducting materiality assessments[12]

The most common practices that participating banks have incorporated into their materiality assessments are risk assessment methods to assess the materiality of exposures and to map out a spectrum of climate risk drivers to identify transmission channels. The most common risk assessment methods used are exposure analysis, qualitative scenario analysis, and quantitative scenario analysis.[13] However, 18 per cent of respondents stated that they do not incorporate materiality yet.

12 Some survey options were adapted from the ECB's Good practices for climate-related and environmental risk management.

13 Risk assessment methods include qualitative and quantitative methodologies to identify exposures.

Figure 13 summarizes the follow-up actions banks undertake as a response to identified areas of material climate risks. **More than 70 per cent of respondents stated that they have taken follow-up actions as a response to identified areas of material climate risks.** Almost half of the participating banks (46 per cent) stated that the identification of material climate risks informs policies and strategies. Examples include decisions to reduce exposure to certain climate-sensitive activities, client types or sectors, and/or to increase exposure to climate-resilient equivalents. Almost two fifths (39 per cent) of participating banks make updates to their risk inventory based on climate risk drivers identified, such as mapping the various drivers of climate risk, plus their transmission channels and theoretical impact on prudential risk categories. Additionally, 25 per cent recalibrate sector limits in risk appetite statement/credit underwriting principles, while 36 per cent reassess risk coverage in stress testing. A small proportion of banks (14 per cent) are allocating economic capital or capital buffers as part of the banks pillar 2 framework to manage material climate risk drivers. Fewer than one third (29 per cent) of banks have not taken any follow-up actions as a response.

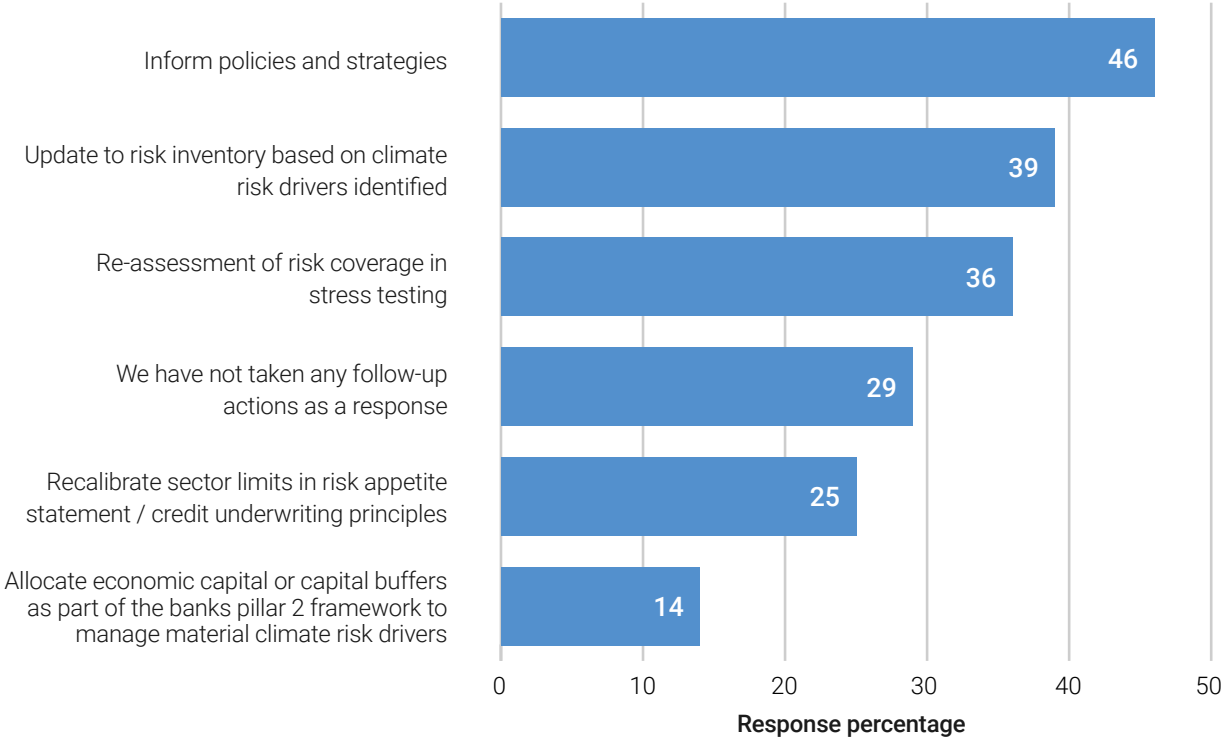


Figure 13: Follow-up actions undertaken by participating banks as a response to identified areas of material climate risks

4.2 Summary and takeaways

- **Adopting time-horizons** of 0–3 years, 3–10 years, and 20–30 years are the most common time periods when assessing transition and physical climate risks.
- **Banks incorporate structured materiality assessment practices**, including:
  - Use of risk assessment methods to evaluate exposure materiality.
  - Mapping a spectrum of climate risk drivers to identify transmission channels.
- **Exposure analysis and qualitative scenario analysis** can be utilized as methods for determining the materiality of both physical and transition climate risk drivers.
- **Banks are establishing follow-up actions in response to material climate risks,** including:
  - Informing policy and strategy development.
  - Updating the institution's risk inventory based on identified climate risk drivers.
  - Recalibrating sector limits within the risk appetite statement and credit underwriting principles.
  - Reassessing risk coverage in stress testing frameworks.

5. Transition risk assessment methodologies

Chapter overview

This chapter explores the methodologies that banks use to assess transition risks within their credit risk assessments, including the key transition risk drivers considered and the underlying assumptions applied to identify transition risks, plus the key metrics used to quantify transition risks as part of the overall transition risk assessment methodology. The chapter also explores approaches for collecting Scope 3 emissions data.

5.1 Transition risk metrics

Overall, the most common transition risk metrics used for assessing credit risk related to transition risks include **emission reduction targets and progress, financed emissions, fossil fuel exposure and Scope 1, 2, and 3 emissions of a company.**[14] Transition risk score in the real estate portfolio, emissions per unit of output of a company, and assets at risk of being stranded are also transition risk metrics used for specific use cases (Figure 14). Summarized below are the most common metrics identified for specific use cases based on the survey responses.[15]

14 A bank's financed emissions are related to the Scope 1, 2 and 3 emissions of its counterparties. In this report, financed emissions are considered at the product and/or exposure level, and Scope 1, 2 and 3 emissions are referenced at the entity level. Although there may be some overlap in coverage between these metrics.

15 Transition risk metrics definitions can be found in Appendix 1.

Climate risk reporting:

Financed Emissions

Scope 1 emissions of a company

Scope 2 emissions of a company

Fossil fuel exposure

Emission reduction targets and progress

IFRS9 or CECL Provisions:

Scope 1 emissions of a company

Scope 2 emissions of a company

Scope 3 emissions of a company

Pricing:

Emission reduction targets and progress

Scope 1 emissions of a company

Scope 2 emissions of a company

Transition risk score in the real estate portfolio

Risk Appetite:

Assets at risk of being stranded

Financed Emissions

Scope 1 emissions of a company

Underwriting Criteria:

Emission reduction targets and progress

Assets at risk of being stranded

Financed Emissions

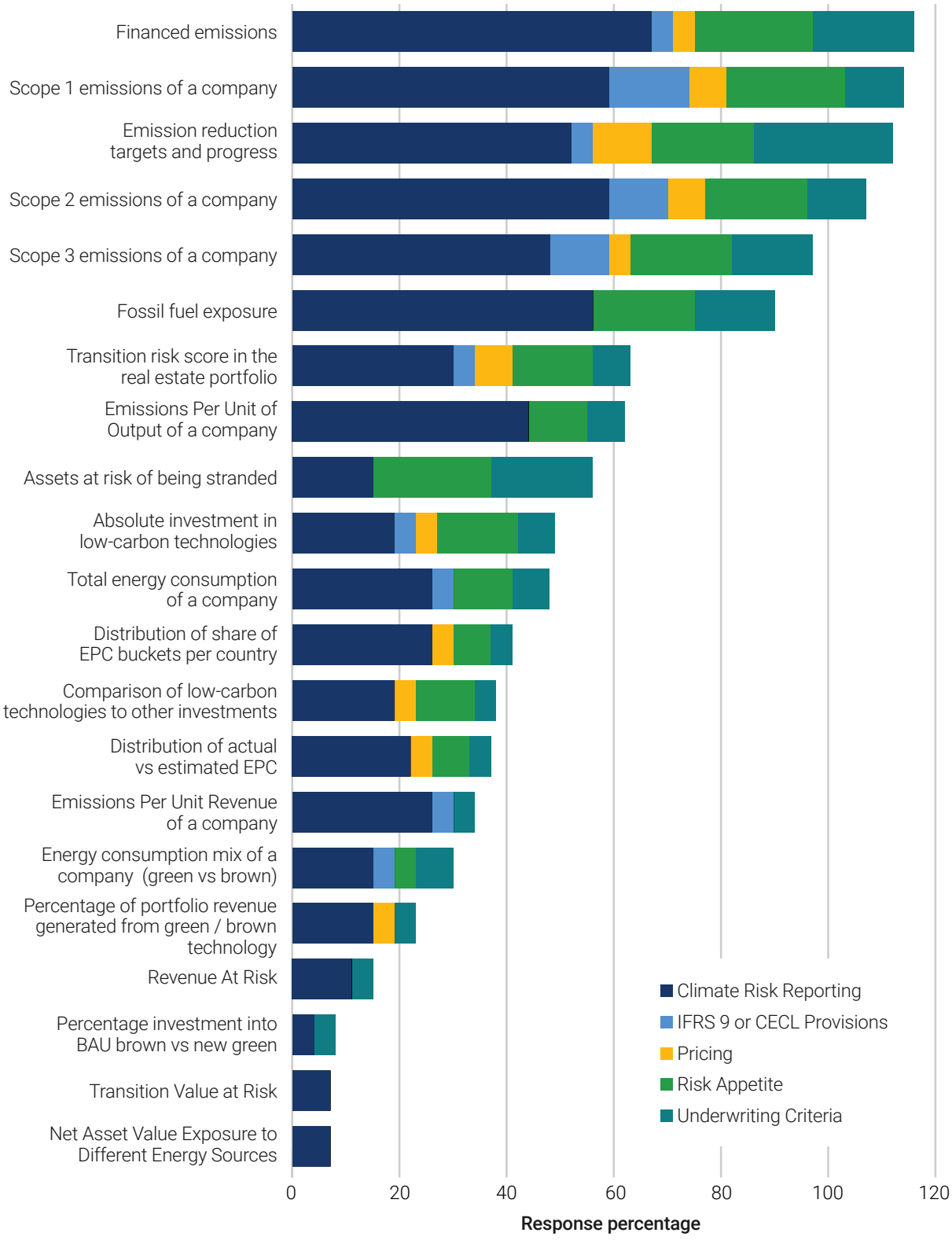


Figure 14: Transition risk metrics for given use cases

The most common balance sheet metrics considered to be impacted by transition risk are **profitability, revenue, total assets, and liabilities.** Less commonly used metrics include costs, debt, residual values, collateral value, cash flow, and interest payments.

5.2 Approaches for Scope 3 data

Scope 3 emissions often make up the majority of a company's total emissions. In sectors such as Financial Services, Oil and Gas, Real Estate and Construction, they are typically the most significant of the three emission scopes. Therefore, incorporating Scope 3 emissions data can offer a more comprehensive view of potential transition risks, but banks continue to face significant challenges in collecting and using these data. Currently, banks most commonly use **reported emissions data from clients (77 per cent) and estimated emissions using industry averages (77 per cent) to collect Scope 3 data about clients.** Estimating emissions through activity data and using public factors are also common methods used to collect Scope 3 data by half of the respondents (50 per cent). Other approaches that are less commonly used to collect Scope 3 data are shown in Figure 15.

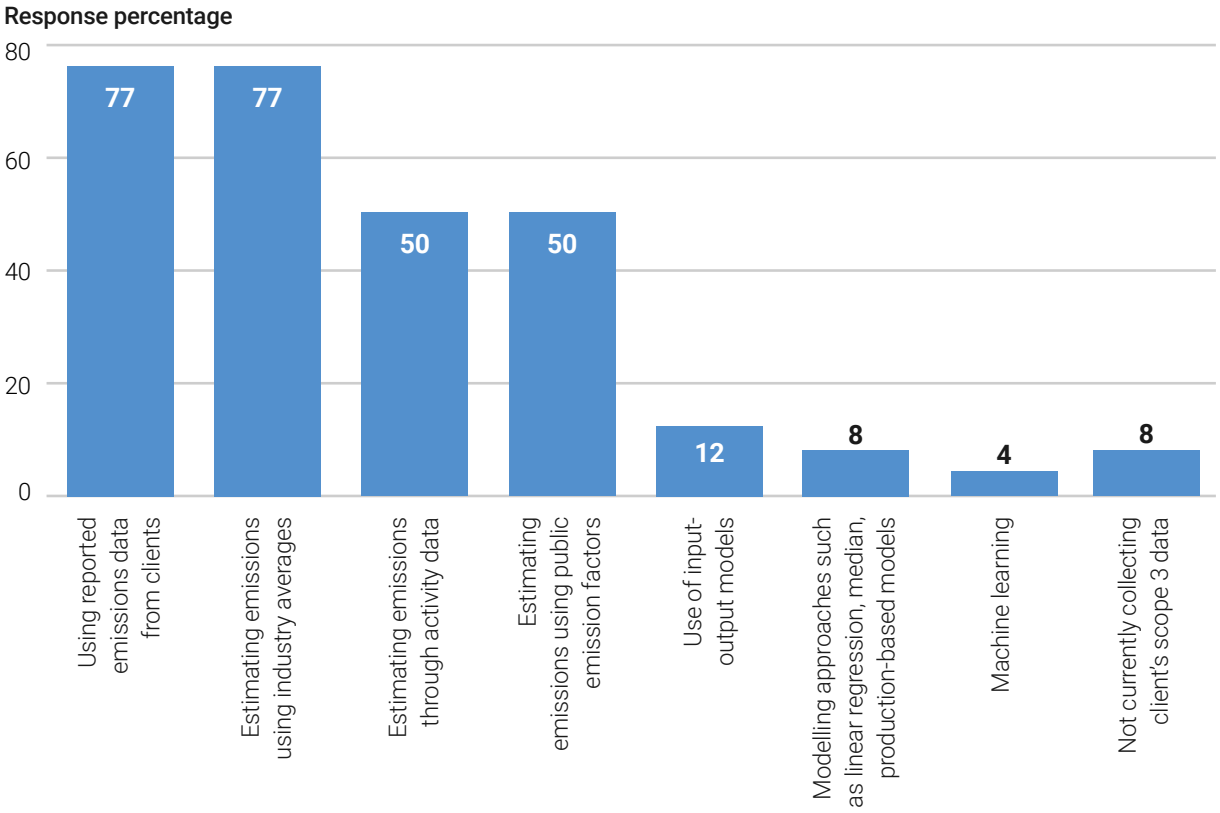


Figure 15: Approaches for collecting the Scope 3 data of clients

The Partnership for Carbon Accounting Financials (PCAF), a global initiative of financial institutions to measure and disclose GHG emissions, provides a standardized and transparent method for GHG accounting. The methodology by PCAF is significantly preferred by banks for emission calculations, with **more than three quarters of the banks surveyed (78 per cent) using the PCAF methodology in their emissions calculations.** Respondents were asked to provide their best estimate for the percentage of each portfolio for which they are able to measure Scope 3 financed emissions according to the PCAF data quality scale[16]. Of the scores subsequently provided, most fit within the lower quality scores.

5.3 Overview of transition risk drivers and approaches

Policy and legal risk

More than half (58 per cent) of the respondents do not assess legal risks. Where legal risks are assessed, 35 per cent of banks **use potential legal impact of future regulation as a transition risk indicator** to assess this risk, while 27 per cent use **the likelihood of compliance breach.**

Examples of underlying key assumptions and methodologies applied by banks include:

- Alignment with climate scenarios and internal firm targets,
- Use of expert judgement to identify sectors likely to face climate-related regulatory pressure, and
- Established processes to monitor upcoming regulations, legal requirements, and proceedings.

Banks most commonly use **carbon pricing scenarios (62 per cent), climate policy alignment (50 per cent) and government policies, and changes to policy (50 per cent)** as forward-looking transition risk indicators to assess policy risks. Other risk indicators used to assess these risks include regulatory change forecasts (35 per cent) and fiscal policies (such as tax incentives and capital investment allowances) (19 per cent). Almost one third (31 per cent) of survey respondents do not assess policy risks.

Examples of underlying key assumptions and methodologies applied by banks include:

- Use both short-term and long-term climate scenarios, incorporating carbon efficiency, and carbon pricing from relevant scenarios to quantify direct and indirect carbon costs for companies.
- Taking into account regional legislation, international climate agreements (e.g. Paris Agreement), and industry-specific regulations (e.g. Poseidon Principles).
- Use of expert judgement to identify sectors potentially vulnerable to regulation.
- Process in place to monitor proposed and passed legislation.
- Conduct a policy risk assessment based on client's transition plan.

16 PCAF has developed a data quality scorecard to assess the quality of data for calculating financed emissions and ranges from a scale of 1 to 5, where a score of 1 is the highest quality data and a score of 5 is the lowest quality data.

- Analysing the financial benefits of incentives and incorporating them into investment decision-making processes.
- Benchmarking the bank's portfolio against climate targets and adjusting investment strategies to reduce exposure to high-risk sectors.
- Key assumptions include: carbon prices are expected to rise which impact profitability of emissions-intensive sectors; new regulations increase operating costs in sectors not aligned with climate targets as climate policies directly affect financial flows to more sustainable sectors; and tax incentives facilitate adoption of low-carbon technologies.

Technology risk

A majority (65 per cent) of surveyed banks stated that they do not assess technology risks. Of those who do **assess technology risks, emerging new technologies (27 per cent), research and development (R&D) investment in green technologies (23 per cent), and technological obsolescence risk (23 per cent)** are more used transition risk indicators than innovation adoption rates (12 per cent) and technology learning curves (8 per cent).

Examples of underlying key assumptions and methodologies applied by banks include:

- Using expert-driven judgement to examine industries that will experience changes in demand due to the transition to a green economy.
- Monitoring technological indicators by sector specialists and engaging with industry experts to stay informed about the latest technological developments.
- Developing in-house tools, conducting analysis of investments to capital, reviewing business plans and liaising with clients.
- Focusing on proven technologies rather than technologies that are still in development.
- Analysing industry reports, market trends, and investment patterns to assess the pace of technology adoption, the likelihood of breakthroughs, and their potential impact on the bank's clients and overall risk exposure.
- Including assumptions such as the likelihood of existing technologies being replaced by newer, more efficient alternatives, and assessing the financial implications of transitioning to new technologies and the potential impact on asset valuations and credit risk.
- Another assumption is that the risk to a sector is considered proportional to the absolute carbon costs it may incur, relative to its capacity to absorb those costs—taking into account the technological investments required for decarbonization.

Market trends

More than half (58 per cent) of the respondents do not assess trends/risks related to market changes. Of those who do assess market trends/risks, **market demand and consumer behaviour shifts (38 per cent) and green investment trends (31 per cent)** comprise the forward-looking transition risk indicators that are more commonly used as compared to commodity price volatility (15 per cent) and carbon prices and the Carbon Border Adjustment Mechanism (CBAM) (15 per cent).

Examples of underlying key assumptions and methodologies applied by banks include the use of:

- Expert-based judgement and the involvement of sector specialists.
- Indirect assessment of market trends/risks by comparing a client's transition risk to the sector that it operates in.
- Climate scenario parameters.
- Questionnaire to gather customer data.
- Market research, consumer surveys, and trend analysis to assess potential changes in consumer behaviour.
- Investment data, market reports, and engagement with industry stakeholders to understand investment trends.
- Carbon price forecasts, analysis of policy developments, and the integration of these factors into financial models to assess their impact.

Reputational risk

Almost half of the respondents (46 per cent) do not assess reputational risks. Of those who do assess these risks, **brand value impact from climate issues (35 per cent), stakeholder perception indices (35 per cent), and media sentiment analysis (31 per cent)** are common indicators used. Only 4 per cent of respondents selected the use of wallet shares and league tables as forward-looking transition risk indicators.

Examples of underlying key assumptions and methodologies applied by banks include:

- Use of expert judgement and qualitative analysis.
- Leveraging third-party data and tools to monitor and analyse media content, track reputational risk across channels, and assess a client's competitive position within its sector.
- Conducting brand value assessments by analysing the correlation between climate-related actions and brand perception, and commissioning of brand valuation reports based on metrics such as financial performance, brand strength, and market position.
- Gathering of feedback from customers through surveys, focus groups, stakeholder engagement sessions, and other feedback mechanisms to understand customer perceptions.
- Undertaking of market research on industry trends and competitor performance.
- Undertaking of a double materiality assessment to identify reputational risks as the risks being non-compliant with climate policies and legal frameworks.
- Use of the International Financial Corporation's Performance Standards and the translation of the results of the scorecard into reputational risks.

5.4 Summary and takeaways

- Key transition risk metrics used to assess credit risk related to transition risks include **emission reduction targets and progress, financed emissions, fossil fuel exposure, and Scope 1, 2, and 3 emissions** of counterparties.
- When collecting Scope 3 emissions data, banks **use reported emissions data from clients**, but also **rely on estimated emissions** using industry averages, activity data and public factors, while also adopting standardized methodologies for emissions calculations by PCAF. Furthermore, the quality of Scope 3 emissions data collected remains low.
- **Key forward-looking transition risk indicators** to incorporate into risk assessments, include:
  - **Legal risks:** Potential legal impact of future regulation, and the likelihood of compliance breach.
  - **Policy risks:** Carbon pricing scenarios, climate policy alignment, and government policies and changes to policy.
  - **Technology risks:** Emerging new technologies, R&D investment in green technologies, and technological obsolescence risk.
  - **Market trends/risks:** Market demand and consumer behaviour shifts, and green investment trends.
  - **Reputational risks:** Brand value impact from climate issues, stakeholder perception indices, and media sentiment analysis.

6. Physical risk assessment methodologies

Chapter overview

This chapter examines the methodologies that banks use to assess physical risks, highlighting the most common physical risk drivers and the key assumptions underlying these assessment approaches, as well as the risk metrics used to quantify physical risk. The chapter also explores how banks are modelling both first-order and second-order physical risks.

6.1 Common physical risk metrics used

Overall, the most common physical risk metrics used for assessing credit risk related to physical risks include **percentage of portfolio exposed areas with direct asset level physical risks, percentage of at-risk properties in real estate, and distribution of portfolio per physical risk hazard and severity of physical risks** (Figure 16). Summarized below are the most common metrics identified for specific use cases based on the survey responses.[17]

17 Physical risk metrics definitions can be found in Appendix 1.

Climate risk reporting:

Distribution of portfolio per physical risk hazard and severity of physical risks

Percentage of portfolio exposed areas with direct asset level physical risks

Percentage of at-risk properties in real estate

IFRS9 or CECL Provisions:

Distribution of portfolio per physical risk hazard and severity of physical risks

Percentage of portfolio exposed areas with direct asset level physical risks

Pricing:

Ratings of asset resilience to physical climate risk

Percentage of portfolio exposed to insured losses due to climate events

Risk Appetite:

Percentage of portfolio exposed areas with direct asset level physical risks

Percentage of at-risk properties in real estate

Underwriting Criteria:

Ratings of asset resilience to physical climate risk

Physical Value at Risk

Percentage of portfolio exposed areas with direct asset level physical risks

Percentage of at-risk properties in real estate

Distribution of portfolio per physical risk hazard and severity of physical risks

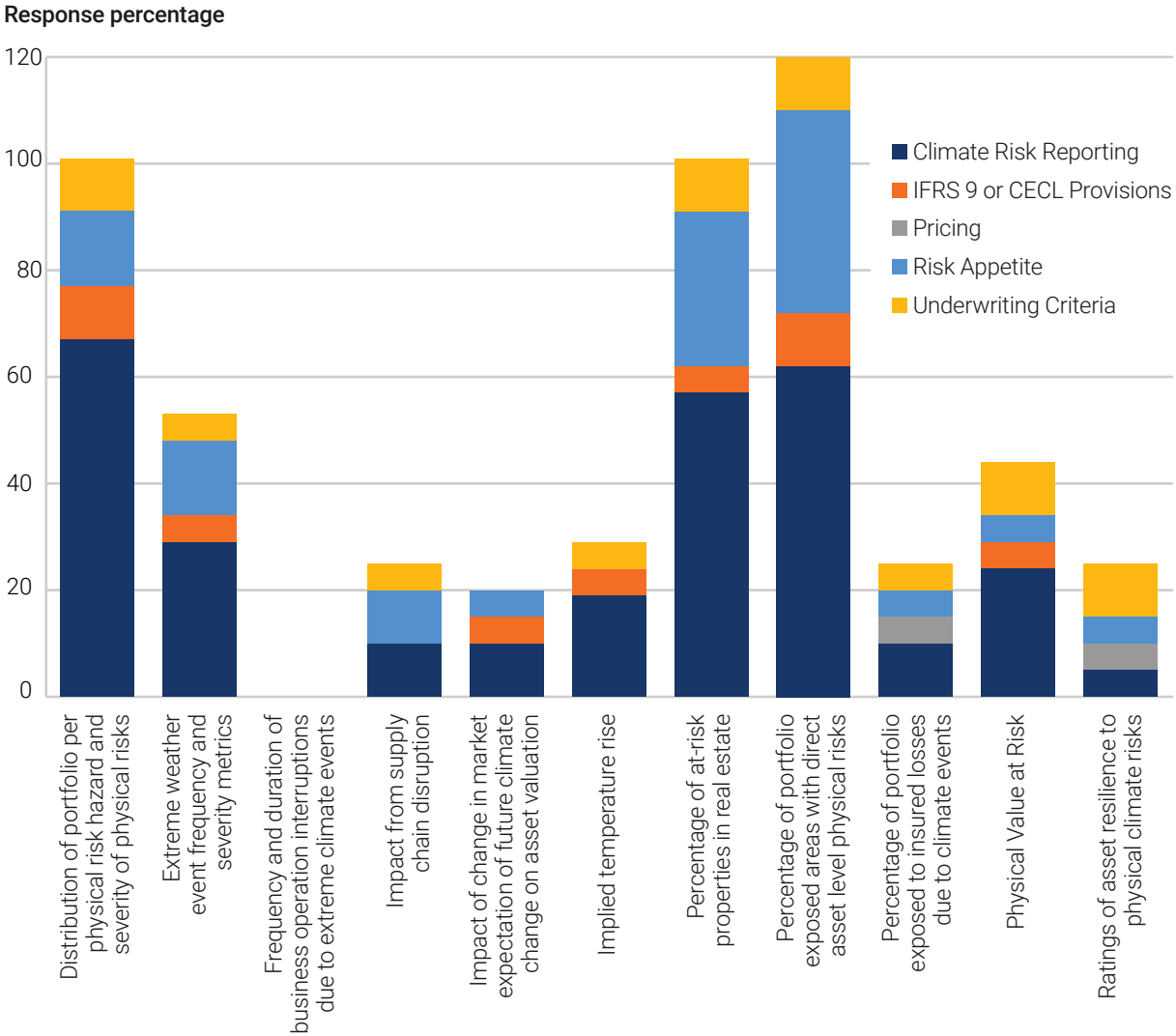


Figure 16: Physical risk metrics used for given use cases to assess physical risk-related credit risk

The most common balance sheet metrics considered to be impacted by physical risk are **profitability, revenue and total assets.** Debt and liabilities are also metrics considered by some banks. Less commonly used metrics include costs, debt, residual values, collateral value, cash flow and interest payments.

6.2 Modelling first-order and second-order impacts of physical risks

When assessing physical risks, all surveyed banks incorporate first-order impacts, such as direct damages to properties and assets. However, modelling second-order impacts remains a challenge, with **less than one-third of surveyed banks (30 per cent) modelling second-order impacts.** Examples of second-order impacts include indirect impacts caused by a deteriorating macro environment or damage to local infrastructure. Such impacts can potentially be significant, and failing to account for them may lead to underestimating the overall damages and exposure to risks.

Common transmission channels used to model first-order impacts include **market value decline in assets and infrastructure damage and outage.** Transmission channels most commonly used to model second-order impact include **labour productivity and market value decline in assets.** Transmission channels of climate migration, financial stability risks, impacts on global supply chains and impacts on regional supply chains are not used by the majority of surveyed banks. This reflects the complexity in modelling these transmission channels and the consequent difficulty faced by banks in quantifying them (Figure 17).

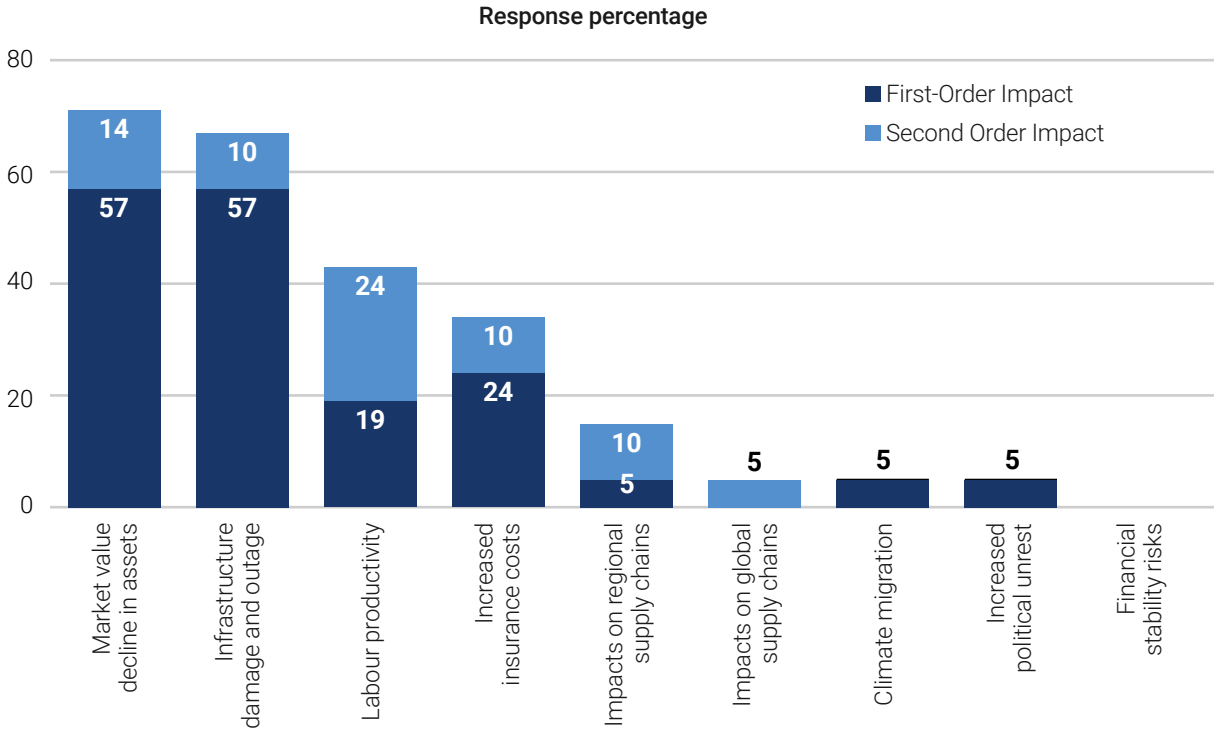


Figure 17: Transmission channels being used to model first-order and second-order impact

First-order risks refer to direct and immediate climate-related hazards that can cause physical damage or operational disruption. In contrast, second-order risks are indirect, emerging from the consequences of first-order hazards, often involving complex interactions and developing over time. Banks most commonly model first-order risks using physical hazards such as **rising sea levels, changes in precipitation patterns, increased frequency and severity of extreme weather events, and heatwaves or rising temperatures.** For second-order risks, banks frequently use **water scarcity, changes in precipitation patterns, extreme weather events, and rising temperatures or heatwaves** as key hazard inputs (Figure 18).

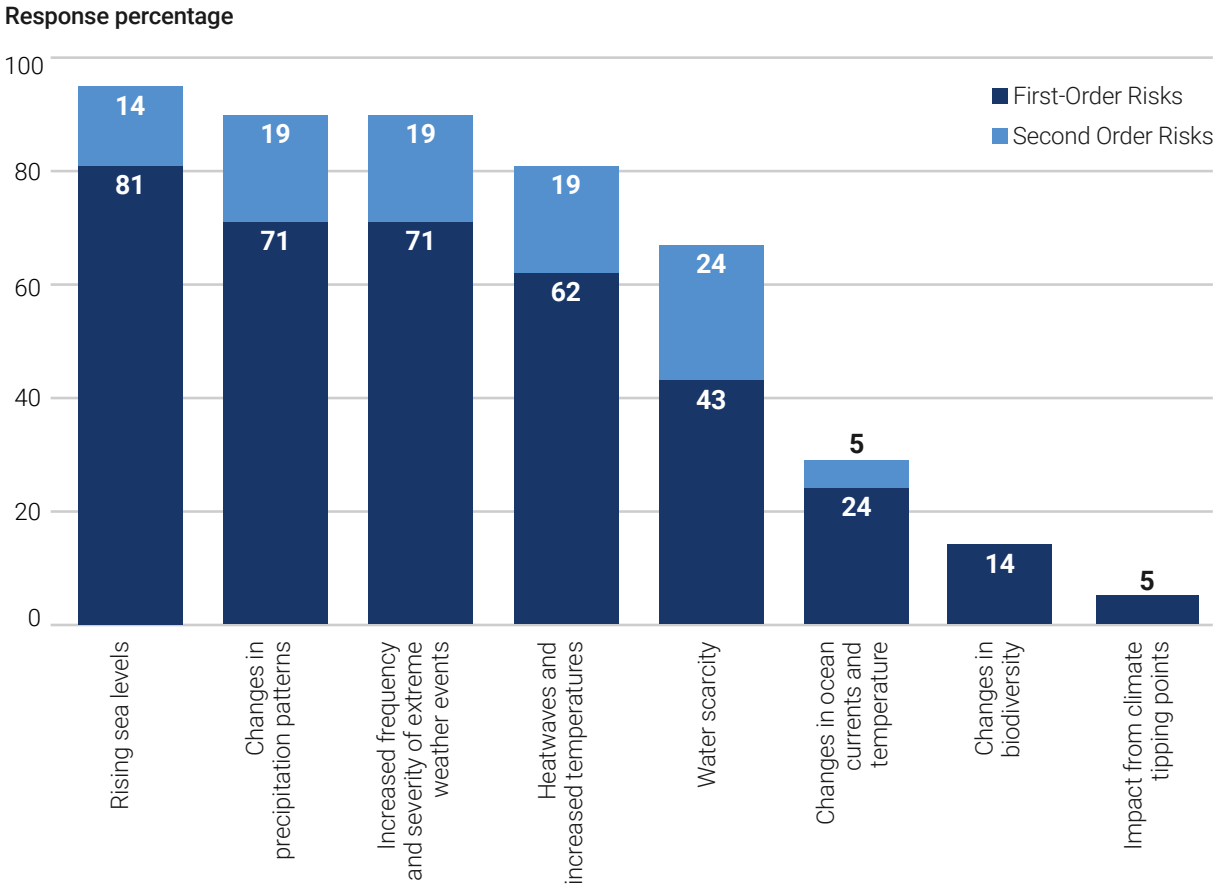


Figure 18: Physical hazard types being used to model first-order and second-order risks[18]

6.3 Underlying assumptions and methodologies

The underlying assumptions and methodologies used by banks to calculate credit risk driven by **acute physical risk** typically include a combination of historical data and climate scenarios. Banks employ both bottom-up and top-down approaches and often consider the financial impact of damage and business interruptions on borrowers. Examples of assumptions include uniform impacts on properties located in high-risk areas and whether affected areas experience first-of-its-kind hazard events. Banks

18 Some survey options were adapted from The Challenge of Climate Risk Modelling in Financial Institutions—Overview, Critique and Guidance, published by the Centre for Greening Finance and Investment (CGFI).

also define how a property is considered impacted by a physical hazard, and apply various methodologies—such as path simulations, regression modelling, and probabilistic modelling—to estimate damage rates for different hazard types.

For **chronic physical risks,** methodologies are generally grounded in global climate scenarios and assume a continued increase in the frequency and severity of physical hazards over time. Banks also adopt both bottom-up and top-down modelling approaches. A likelihood-and-magnitude framework can be used to assess risk exposure. Some banks also factor in macroeconomic impacts, such as effects on the labour force, when modelling the credit risk implications of chronic physical risks.

Constructing damage functions

As part of assessing physical risks, damage functions are used to model the economic impact of physical hazards on businesses. When constructing damage functions, the **use of historical damage data analysis and expert judgement** are the most common practices applied among surveyed banks. Other types of practices used by banks include vulnerability assessment models, damage scoring systems, and hazard-specific catastrophe models. Generalized linear models and insurance claim models are the least commonly used practices for constructing damage functions (Figure 19).

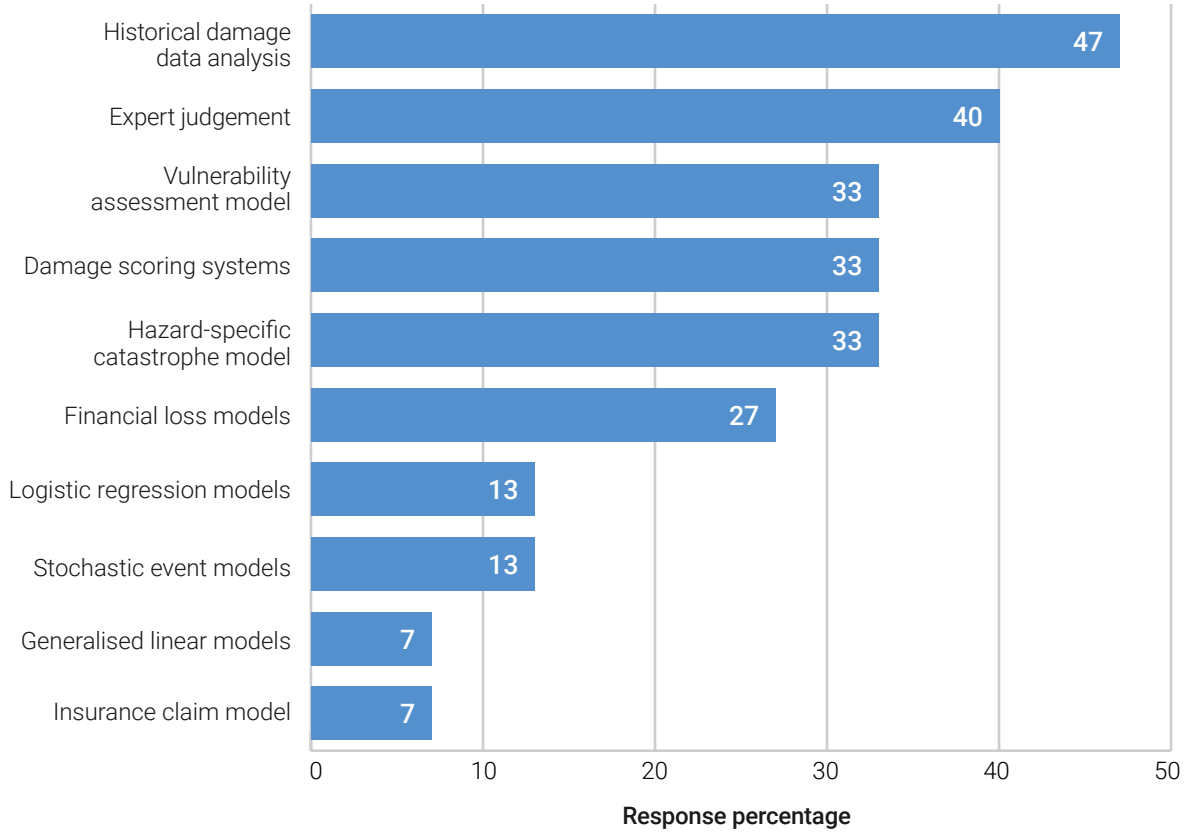


Figure 19: Practices used for constructing damage functions

Accounting for tipping points

Potential climate tipping points can introduce abrupt, non-linear, and irreversible changes that are disproportionate to gradual warming. The exclusion of accounting for tipping points as part of assessing forward-looking climate risks can lead to an underestimation of physical risk impacts. This is because they fail to account for the cascading nature of the physical, social, and financial impacts of tipping points.

At present, none of the respondents have fully integrated tipping points into their physical risk assessments (Figure 20)**.** Of the 5 per cent of banks that are partially accounting for tipping points in assessing physical risks, current practices to account for these include using expert judgment and incorporating climate tipping point modules into climate scenario analysis.

Figure 20: Accounting for tipping points in assessing physical risks

Considering compound risks as part of climate risk assessments

Climate risks can interact across systems or sectors, amplifying existing risks or creating new ones. These interlinked effects, known as compound risks, highlight the importance of considering how physical and transition risk drivers influence each other (Carbon Brief, 2021). However, the survey results show that **almost three quarters (71 per cent) of survey respondents are not considering compound risk, while 10 per cent are considering compound risks.** This can be attributed to various factors related to the limitations and difficulties of current methodologies, which often rely on qualitative approaches and the risk of overlapping impact estimates. As a result, some institutions opt not to incorporate compound risks due to these methodological constraints, while others may lack the technical capacity or guidance to do so. However, the NGFS has recently released short-term climate scenarios that account for compound physical risks. This is expected to support banks in more effectively incorporating compound risks into their assessments.

Figure 21: Percentage of respondents considering compound risks

6.4 Summary and takeaways

- **Key physical risk metrics** used to assess credit risk related to physical risks include: percentage of the portfolio exposed to areas with direct asset-level physical risks; percentage of at-risk properties within real estate holdings; and the distribution of portfolio exposure by physical risk hazard and severity level.
- To model first-order impacts of physical risks, transmission channels such as declines in **asset market value and damage or outages to infrastructure** can be incorporated. Depending on the location in question, first-order physical hazard inputs can include water scarcity, changes in precipitation patterns, extreme weather events, and rising temperatures or heatwaves.
- **Modelling second-order impacts of physical risks remains limited among banks** but can incorporate transmission channels such as labour productivity and further declines in asset values, as well as hazard inputs such as water scarcity, changes in precipitation patterns, extreme weather events, and rising temperatures or heatwaves, depending on the location.
- To **construct damage functions**, banks utilize **historical damage data analysis and expert judgment** more frequently, as well as considering methods such as vulnerability assessment models, damage scoring systems, and hazard-specific catastrophe models.
- Taking into account tipping points when modelling physical risks is **still in the early stages**, with no banks fully integrating tipping points into their physical risk assessments. This reflects the lack of standardized methodologies and available climate scenarios that fully capture tipping points. As a result, current practices to partially integrate tipping points rely on expert judgment and incorporate climate tipping point modules into climate scenario analysis.
- The modelling of compound risks as part of assessing climate-related credit risks **remains modest**, which can be partly attributed to the methodologies available for use or the availability of current technical guidance.

7. Sector-specific approaches for assessing physical and transition risks

Chapter overview

This chapter focuses on identifying common methodologies used by banks to assess climate-related credit risk for specific sectors.

7.1 Sector specific underlying factors included in the assumptions and methodology for assessing climate risk-related credit risks

Detailed below are the underlying factors that banks are including in the assumptions and methodology for assessing climate-related credit risks for specific sectors.

Table 3: Underlying factors used by banks as part of the methodologies for assessing sector-specific climate risks

Commonly used underlying factors	Moderately used underlying factors	Least used underlying factors
Transportation and Storage sector		
▪ Fuel mix ▪ New regulation and related costs ▪ Fuel cost	▪ Vehicle sales ▪ Fuel efficiency of vehicles ▪ Infrastructure vulnerabilities	▪ GHG emissions ▪ Research and development ▪ Supply chain and logistics ▪ Insurance costs
Oil and Gas sector		
▪ Impact of new regulation on costs and operations ▪ Market demand and change in consumer preferences ▪ Potential for stranded assets	▪ Advancements in alternative green energy sources	▪ Labour productivity ▪ Infrastructure vulnerabilities

Commonly used underlying factors	Moderately used underlying factors	Least used underlying factors
Mining of coal and lignite, metal ores and other mining and quarrying sector		
▪ Energy consumption ▪ Compliance to new regulations ▪ Market demand	▪ Extreme weather events	▪ Water need and availability ▪ Commodity price volatility
Electricity and Energy Supply sector		
▪ Energy source mix ▪ Compliance with new regulation related to emissions and fossil fuels ▪ Renewable energy mandates	▪ Financial impacts of decommissioning power plants ▪ Cost and availability of critical minerals ▪ Research and technological development	▪ Infrastructure vulnerabilities ▪ Temperature sensitivity of power plants ▪ Grid integration and storage capacity ▪ Water consumption for power generation
Agriculture, Forestry and Fishing sector		
▪ Water availability	▪ Available technologies and resiliency practices/ innovation ▪ Water use and efficiency ▪ Agricultural yield	▪ Impact of new regulation on costs and operations ▪ Infrastructure vulnerabilities ▪ Supply chains ▪ Agricultural demand ▪ Growing season length ▪ Energy use ▪ Efficiency ▪ Crop mix ▪ Crop adaptability
Manufacturing of minerals, chemicals, basic metals, pharmaceutical and rubber sector		
▪ Market demand ▪ Regulatory compliance due to environmental impact of operations	▪ Supply chain disruptions ▪ Technological advancements	▪ Market volatility ▪ Energy use and efficiency ▪ Infrastructure vulnerabilities ▪ Potential for stranded assets ▪ Capital investment
Real Estate Activities and Construction Related		
▪ Property vulnerability to physical risks ▪ Energy efficiency and carbon footprint of buildings ▪ Insurance costs ▪ Compliance costs for new regulation and building codes ▪ Property value trends	▪ Building resilience	Not applicable—none of the given underlying factors were selected by only a minority of respondents.

Additional sector-specific approaches for the real estate activities and construction sector

Common metrics considered for assessing climate risks for real estate are geolocation, property value, building age and condition and energy certificate rating. For measuring energy efficiency of buildings as part of the assessment, the Energy Performance Certificate (EPC) is the most common measurement used with half (50 per cent) of the surveyed banks using the measurement. Around one quarter of surveyed banks also use internal energy efficiency proxy measures (27 per cent) and energy efficiency performance (23 per cent).

7.2 Summary and takeaways

- **Common underlying factors used in the assumptions and methodology to assess climate risks for specific sectors can be identified among banks**. For example, for the oil and gas sector, common underlying factors identified are the impact of new regulations on costs and operations, coupled with market demand and changes in consumer preferences. Similarly, for the electricity and energy supply sector, energy source mix and compliance with new regulation related to emissions and fossil fuels and renewable energy mandates are common underlying factors identified.
- For assessing climate risks specifically for the real estate sector, key approaches that are being incorporated include:
  - **Use of the following underlying factors:** property vulnerability to physical risks, energy efficiency and carbon footprint of buildings, insurance costs, and compliance costs for new regulation and building codes.
  - **Use of the following metrics:** geolocation, property value, building age and condition and energy certificate ratings.
  - **Use of EPC** as a measurement of energy efficiency.

8. Climate-related collateral value adjustments

Chapter overview

Climate risks, such as physical risks (e.g. flooding, storms) and transition risks (e.g. regulatory changes, carbon pricing), can affect the long-term value of collateral assets, especially in sectors like real estate and transportation. Therefore, it is essential to understand how these risks are being factored into collateral valuations. As a result, this chapter explores the approaches used by banks for undertaking climate-related collateral value adjustments.

8.1 Approaches for adjusting collateral values for physical risk

Just over one in eight (12 per cent) of the banks surveyed are taking into account future physical risks for adjusting collateral values (appraisals), meanwhile, nearly two fifths (38 per cent) are actively working toward doing so. Half (50 per cent) of the respondents stated that they are not considering future physical risks.

Of the respondents that are considering (or planning to consider) future physical risks, some banks **formally require internal or external valuators to assess and incorporate physical risks into their valuations.** For example, institutions have a policy mandate that valuators incorporate climate-related risks such as storm damage or rising insurance premiums into their valuations. **Some apply moderate adjustments, but only for high-risk assets or regions.** For example, valuators apply moderate reductions in value for properties in regions with moderate exposure to physical climate risks, such as coastal areas with rising sea levels. A small proportion of banks **apply minimal or no adjustments, but valuators are encouraged to consider physical risks in their assessments.** None of the surveyed banks make significant adjustments to collateral valuations (Figure 22).

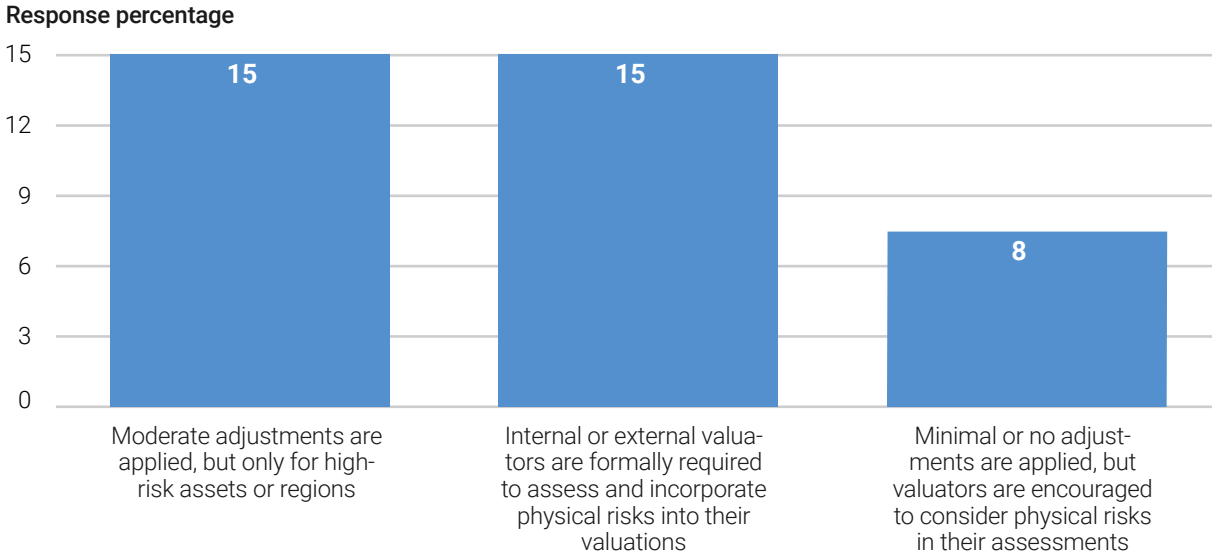


Figure 22: Extent to which physical risks are accounted for in the collateral valuation process

To account for future discounted expected losses when adjusting (or planning to adjust) collateral values due to physical risks, three quarters (75 per cent) of surveyed banks **reduce collateral values by the full amount of future discounted expected losses.** For example, the collateral value is fully reduced by the total sum of future expected losses over its life. A quarter (25 per cent) of the banks surveyed reduce collateral values by less than the full amount of the future discounted expected losses, such as applying a smaller reduction rather than the full sum of future expected losses.

8.2 Approaches for adjusting collateral values for transition risk

Only four per cent of surveyed banks account for future transition risks for adjusting collateral values (appraisals), while 19 per cent of respondents are working on it. More than three–quarters (77 per cent) of respondents stated that they are not considering future transition risks. One method that banks use to account for future discounted expected losses when adjusting collateral values due to transition risk is to reduce collateral values by the full amount of future discounted expected losses.

In terms of the extent to which transition risks are accounted for in the collateral valuation process, responses were received from only a small subset of banks, each indicating a different approach. These included: (i) placing a formal requirement on internal or external valuators to assess and incorporate transition risks into their valuations; (ii) requiring valuators to apply minimal or no adjustments but encourage them to consider transition risks; (iii) applying moderate adjustments based on industry or regulatory exposure; and (iv) applying significant adjustments.

8.3 Summary and takeaways

- Adjusting collateral values for future transition risks and physical risks is less prevalent among banks. This is more the case for transition risks than for physical risks. However, a proportion of banks are working on developing abilities to adjust collateral values for future climate risks.
- To account for future discounted expected losses when adjusting collateral values for climate-related risks, including physical hazards, **banks should first ensure that independent market valuators, the primary point of integration, embed these risks in their appraisal reports**; where significant physical risk remains after valuation, the bank may apply moderate adjustments to assets or regions deemed high risk.

9. Climate scenario analysis

Chapter overview

This chapter examines how banks conduct scenario analysis for climate risks, including the commonly used scenarios, their methods for expanding those scenarios, and the key variables involved.

9.1 Methodology for modelling parameters and commonly used climate scenarios

When calculating add-ons to current credit risk parameters, such as PD, LGD, and EL, banks can consider two types of impacts; either the impact of a gap between two scenarios or the impact of a single scenario. Figure 23 shows the proportion of banks that are considering the impact of a gap between two scenarios compared to the impact of a single scenario.

For considering **a gap** between two scenarios, the most commonly selected pair of scenarios are the **disorderly transition and hot house world scenarios**, followed by the **orderly transition and hot house world scenarios.** The Net Zero 2050 and current policies scenarios and a non-climate scenario with a climate scenario are less commonly used. Overall, different gaps between scenarios might be used depending on whether transition or physical risks are being measured.

When using **a single scenario**, the most commonly selected scenario is the orderly transition scenario, followed by the hot house world scenario and disorderly transition scenario.

Figure 23: Proportion of banks considering the impact of a gap between two scenarios compared to the impact of a single scenario

Figure 24 shows the types of climate scenarios that banks use to assess transition and physical risk. **The NGFS reference scenarios are the most widely adopted,** with 56 per cent of surveyed banks using them to measure physical risks and 85 per cent using them to measure transition risks. Regulatory climate stress test scenarios based on the

NGFS scenarios are also commonly used, followed by internally developed scenarios and other publicly available scenarios. Other types of publicly available scenarios used by respondents include scenarios by the Intergovernmental Panel on Climate Change (IPCC) and Oxford Economics.

In terms of internal scenario development, surveyed banks report a range of practices. These include: identifying changes needed in reference scenarios, such as the global context, progress in policy, technological advancements and geopolitical shifts; constructing internal climate scenario based on weighted average outcomes of various reference climate scenarios; and leveraging regulatory climate stress test data as inputs for internal modelling.

Only a small proportion (7 per cent) of surveyed banks use regulatory scenarios that are not based on the NGFS scenarios for both physical and transition risks.

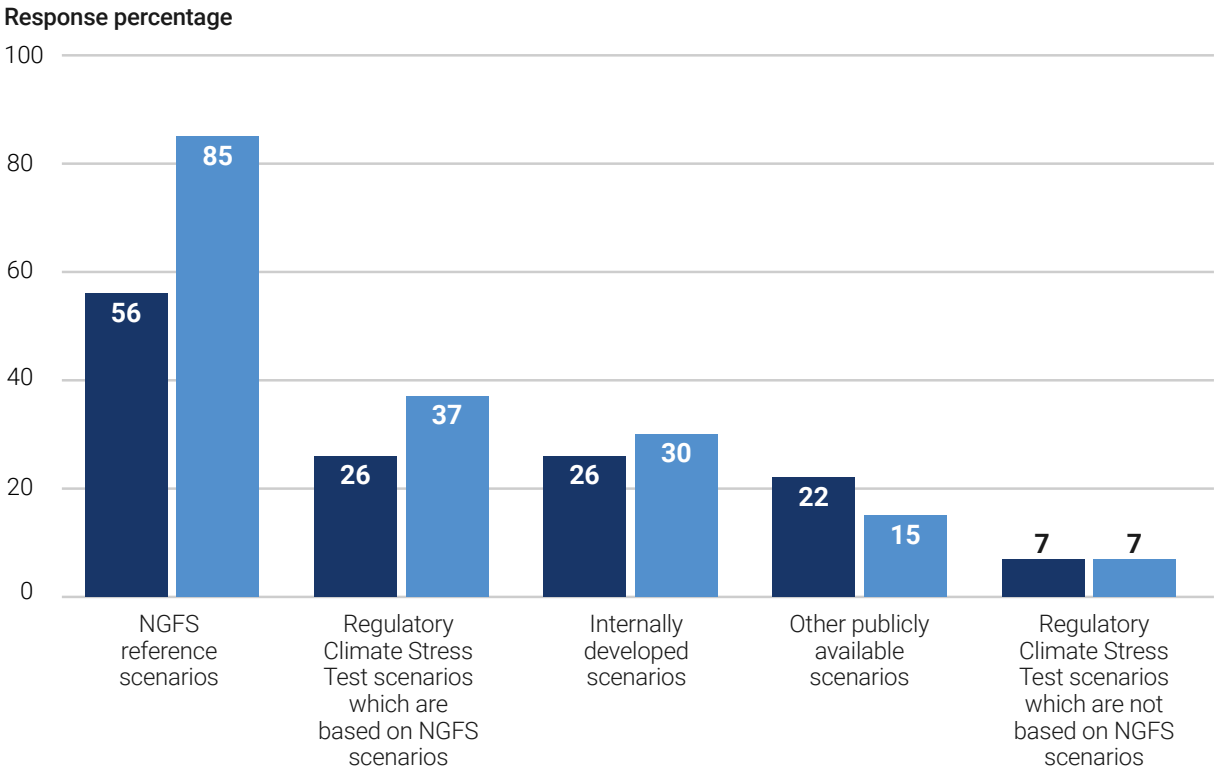


Figure 24: Climate scenario types used to assess climate-related credit risk for transition and physical risk

9.2 Methodologies for scenario expansion and enhancement

Sectoral and geographical granularity of climate scenarios remain a key challenge. As a result, the most common practices used by surveyed banks to perform scenario expansion are the **leveraging of internal teams to provide greater sectoral granularity and greater geographical granularity.** A small proportion of banks also leverage internal teams to provide incremental variable types. In comparison, less banks are likely to engage with a third party to enhance scenarios.

Examples of practices undertaken by banks to adapt scenarios to a more granular level and to meet region specific requirements include weighting average of outcomes from various climate scenarios, complementing data from the supervisor with country-specific data, overriding scenario hazard and sensitivity score with improved, granular data, and supplementing integrated assessment models (IAMs)—such as GCAM, MESSAGE and REMIND[19]—with each other.

19 The Global Change Analysis Model (GCAM), REgional Model of INvestment and Development (REMIND), and MESSAGE-GLOBIOM (MESSAGE) are global models that integrate economic, energy, land use, and climate systems. Specifically, GCAM is a global market equilibrium model that models interactions between human activities and environmental changes by combining these systems. REMIND is a numerical model with a focus on the energy sector and its climate implications; it is coupled with a global land use allocation model called MAgPIE (Model of Agricultural Production and its Impacts on the Environment). MESSAGE combines energy systems, environmental impacts, and economic analysis to assess the long-term implications of energy and climate policies (NGFS, 2024).

9.3 Common variables used and integration with macroeconomic factors

Commonly used transition risk variables

GHG emissions, energy prices, carbon prices and investment in green technologies and energy efficiency are the most commonly used transition risk variables across the exposure classes (Figure 25).[20]

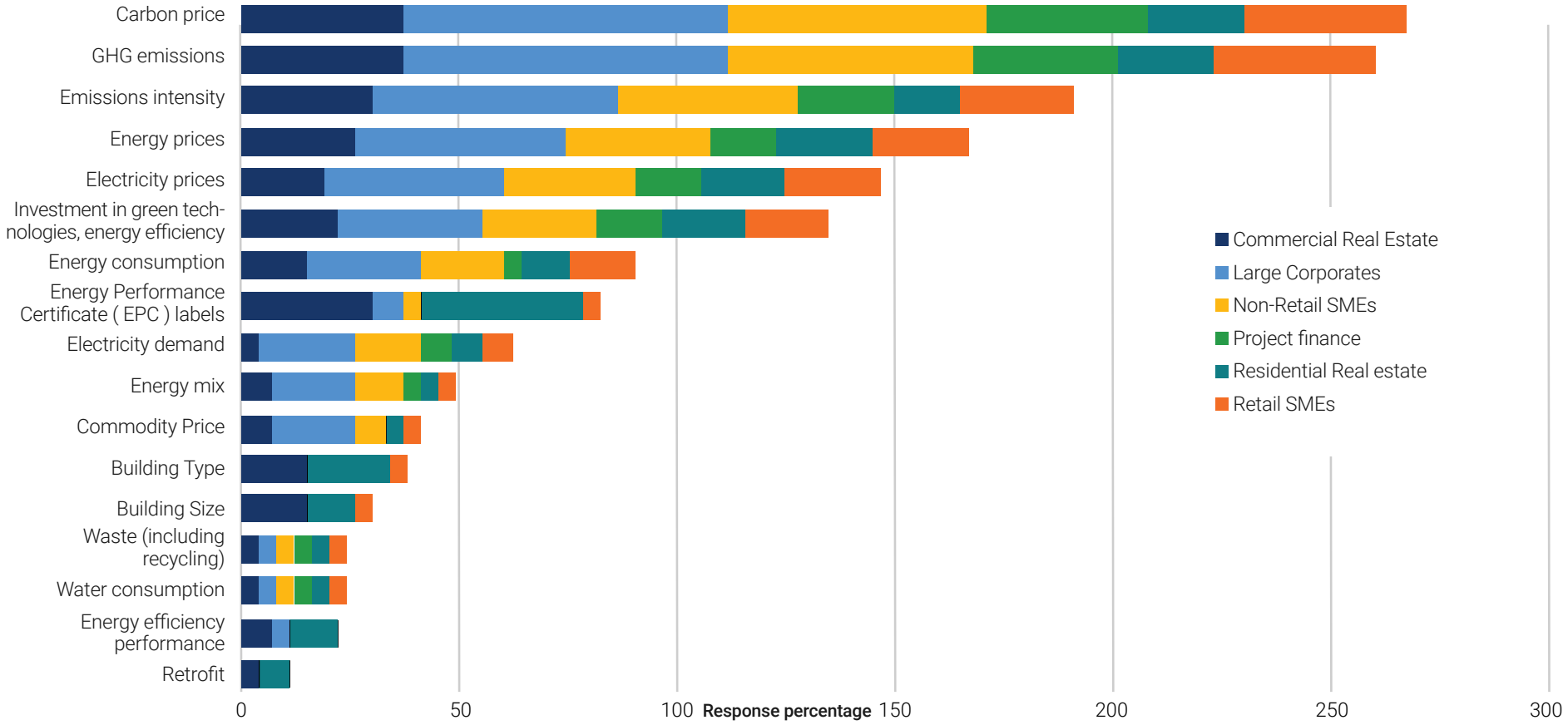


Figure 25: Transition risk variables included for scenario analysis per exposure class

20 The percentage responses for this question reflect the proportion of respondents assessing each specific exposure class.

Commonly used physical risk variables

Severity of physical hazard and frequency of physical hazard are the two most commonly used physical risk variables across the exposure class, along with temperature (Figure 26).[21]

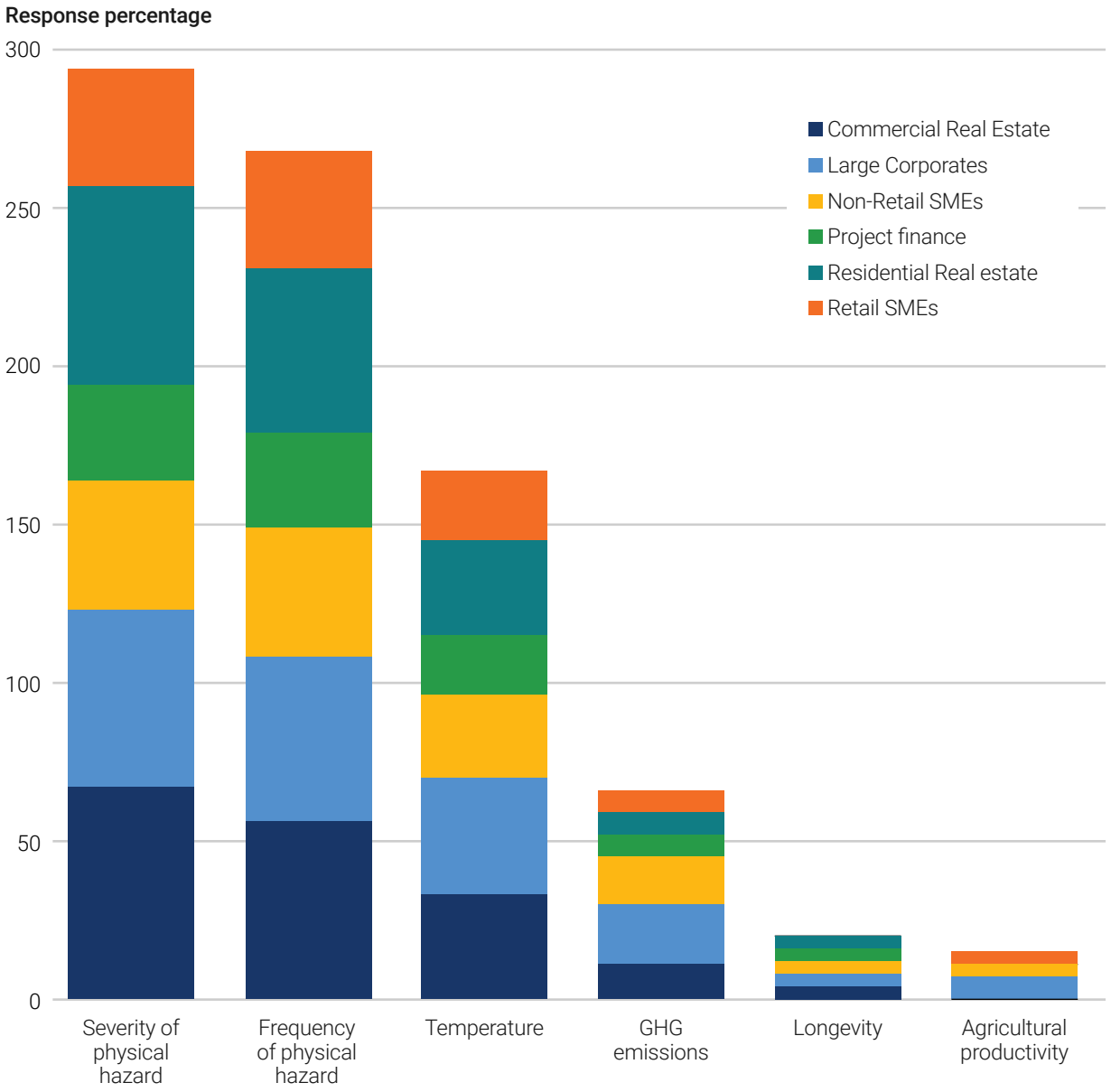


Figure 26: Physical risk variables included for scenario analysis per exposure class

21 The percentage responses for this question reflect the proportion of respondents assessing each specific exposure class.

Commonly used macroeconomic variables

Gross Domestic Product (GDP) growth, interest rate, inflation/price index, unemployment rate, exchange rate and Commercial Real Estate (CRE) price shock are the most common macroeconomic variables used across the exposure classes.[22]

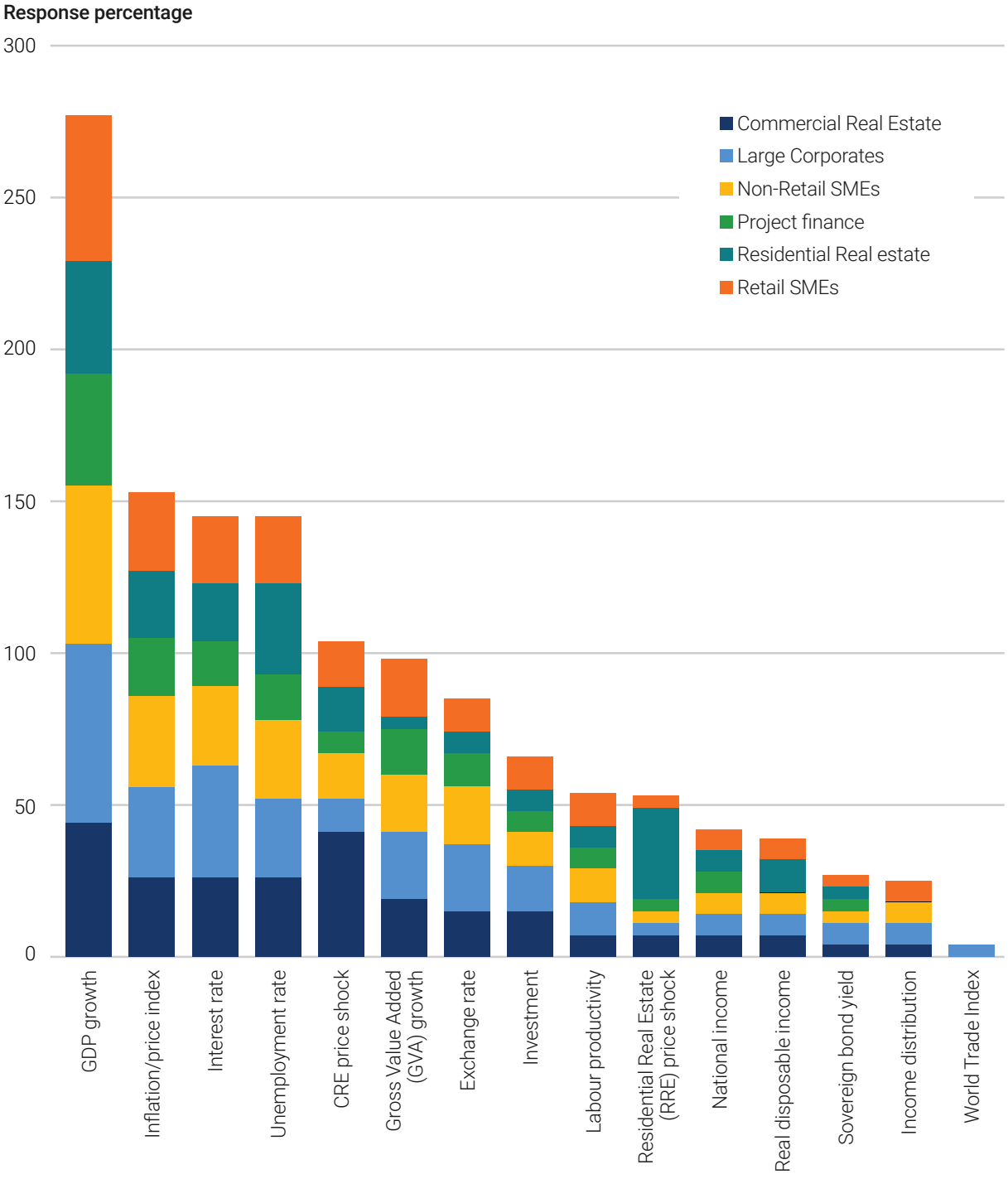


Figure 27: Macroeconomic variables included in scenario analysis per exposure class

22 The percentage responses for this question reflect the proportion of respondents assessing each specific exposure class.

Aggregating climate scenarios with broader economic and geopolitical scenarios

The aggregation of climate scenarios with broader economic and geopolitical scenarios is still at an early stage. Fewer than one third of surveyed banks (29 per cent) currently combine climate scenarios with wider macroeconomic or geopolitical scenarios. One example of how they do so includes assessing the impact of climate scenarios on property collateral values under macroeconomic stress. Another example is the layering of climate-related adjustments ("climate deltas") onto other scenario types.

9.4 Performing backtesting for climate risk assessments

Performing general backtesting of credit risk models for climate risk assessments remains limited among banks. Only 4 per cent of surveyed banks regularly perform backtesting of their credit risk models. No surveyed bank occasionally performs backtesting. Almost three quarters (73 per cent) perform no backtesting, meanwhile, and an additional 23 per cent perform no backtesting but plan to incorporate it in the future. The survey insights highlight the constraints and difficulties associated with backtesting credit risk models for climate risk assessment due to limited data availability and the uncertainty in modelling forward-looking climate risks. These factors make traditional practices difficult to apply effectively.

9.5 Summary and takeaways

- When calculating add-ons to current credit risk parameters, there is **no clear observed pattern** as to whether the impact should be measured using the gap between two scenarios or based on a single scenario.
- The NGFS reference scenarios are the most prevalent among current practices to measure physical risks and transition risks.
- **A greater proportion of banks leverage their internal teams than engage with third parties** to perform scenario expansion.
- Common scenario variables used across the various exposure classes include:
  - **Transition risk variables**: GHG emissions, energy prices, carbon prices and investment in green technologies and energy efficiency.
  - **Physical risk variables**: Severity of physical hazard, and frequency of physical hazard and temperature.
  - **Macroeconomic variables**: GDP growth, interest rate, inflation/price index, unemployment rate, exchange rate, and CRE price shock.
- Aggregating climate scenarios with broader economic and geopolitical scenarios is not conducted by the majority of banks.
- Only **a small fraction of banks backtest** their credit risk models as part of their climate risk assessments reflecting the limitations of traditional practices to assess model soundness for climate risk assessments.

10. Approaches and integration of ESG scores for risk assessment

Chapter overview

While the terminology referring to ESG scores may vary by institution—such as Environmental and Social (E&S) assessment score, impact score, or sustainability score—it broadly refers to an internal or external methodology used to evaluate a client's Environmental, Social, and Governance (ESG) performance or risk profile. This chapter focuses on how banks currently approach ESG scoring in relation to climate risk management.

10.1 Approaches for internal and external ESG scoring methodologies

Figure 28 shows the percentage of banks with an internal ESG scoring methodology. **More than half of the surveyed banks have an internal ESG scoring methodology in place,** either through a fully developed internal ESG scoring methodology, a mix of internal and external ESG scoring methodologies, or are developing an internal ESG scoring methodology. Almost half of the respondents (46 per cent) stated that they do not use ESG scoring methodologies.

Three quarters (76 per cent) of surveyed banks use their ESG scoring methodology to assess financial materiality.

Figure 28: Percentage of banks with an internal ESG scoring methodology

10.2 Integration of ESG scores into current risk framework

Almost half of the surveyed banks (47 per cent) use ESG scores to enhance compliance and regulatory reporting and to inform investment decisions and portfolio management. More than one third of surveyed banks (35 per cent) are also using ESG scores for guiding corporate strategy and policymaking and for sector-specific risk analysis. Almost a quarter of respondents (24 per cent) are integrating ESG scores into their overall credit risk assessment scorecards which in turn are linked to credit risk ratings. Meanwhile, a minority of banks (18 per cent) do not currently use ESG scores in their risk framework, and 6 per cent of banks stated that ESG scores are independent of credit risk scorecards, with the two scorecards being merged at the PD modelling stage (Figure 29).

In terms of integrating ESG scores into credit ratings, **a majority of banks do not currently integrate ESG scores into credit ratings.** However, some banks are integrating ESG scores into their credit ratings to varying degrees. Only 6 per cent of the surveyed banks fully integrated ESG scores into credit ratings, and 29 per cent of respondents partially integrated ESG scores into credit ratings. Banks that partially integrate their ESG scores rely on qualitative methods and use the scores primarily for risk analysis rather than fully embedding them into credit ratings. More than one third of banks (36 per cent) have plans to integrate them in the future.

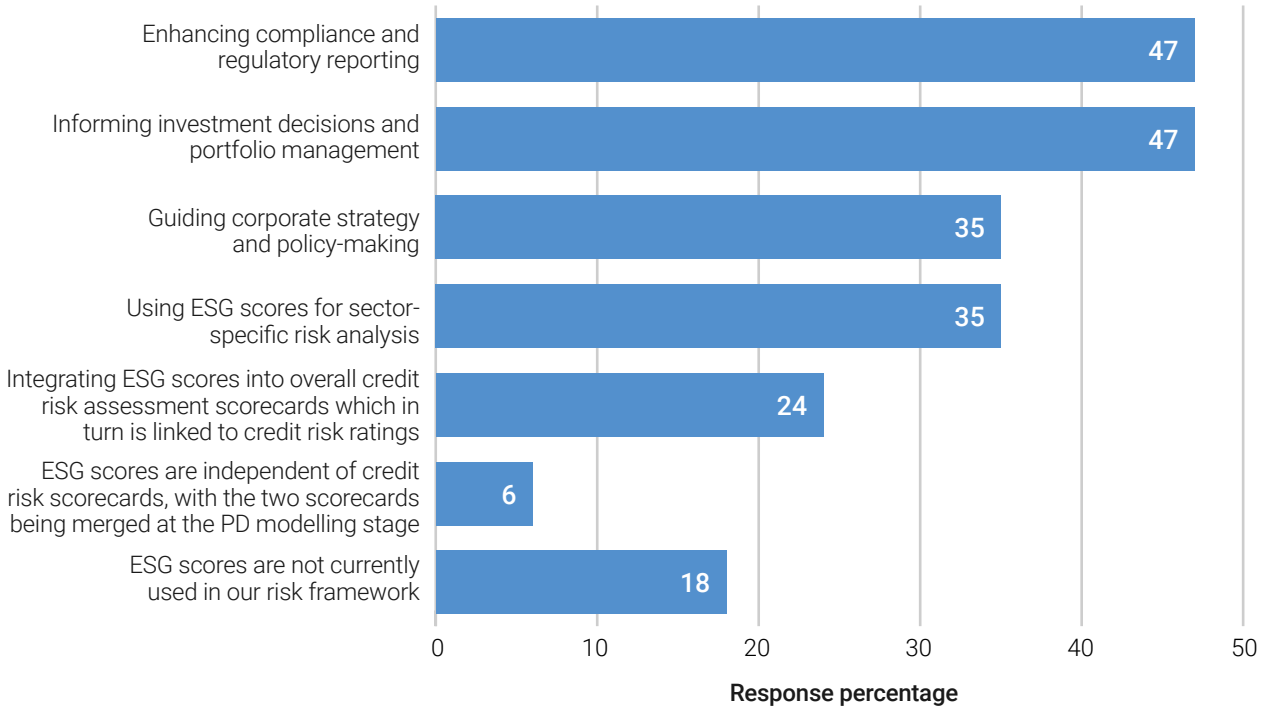


Figure 29: Using ESG scores in the current risk framework

Only a proportion of ESG scores used by banks are designed specifically for credit risk decisioning. Survey results show that just about a quarter of surveyed banks (23 per cent) use ESG scores specifically designed for credit risk decisioning, with calibrated weights for creditworthiness. Some banks (41 per cent) use a general-purpose score that is not specifically calibrated for credit risk decisioning, and 18 per cent of surveyed banks use a general-purpose ESG score but apply internal adjustments to reflect its impact on credit risk. A share of respondents (18 per cent) do not use ESG scores in their credit risk decisioning.

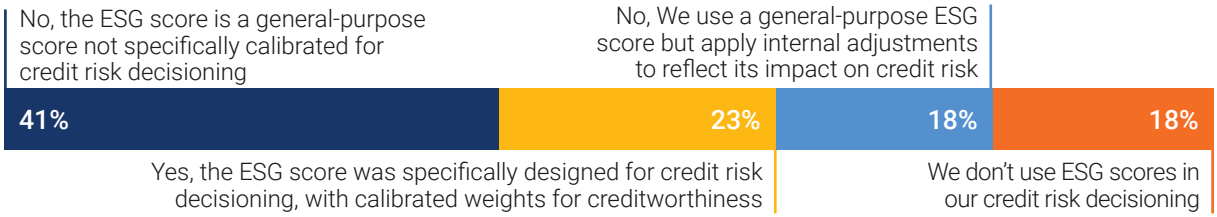


Figure 30: Percentage of (internal or external) ESG scores used that are designed specifically for credit risk decisioning

10.3 Assessing ESG scores

Banks have yet to converge on a preferred method for integrating ESG factors—some aggregate them into a single score, while others keep 'E', 'S', and 'G' components separate. Of the surveyed banks that have an ESG scoring methodology in place, 47 per cent of surveyed banks are aggregating 'E', 'S', and G factors into a single ESG score, while 46 per cent of surveyed banks have separate scores for each component. Seven per cent of respondents stated that they use a combination of both separate and aggregate scores (Figure 31).

From the subset of surveyed banks that aggregate 'E', 'S', and 'G' factors into a single ESG score, there is no consistent trend in how banks assign weights to each component. Some banks apply equal weighting across all components, while others place greater emphasis on certain components—such as Social (S) and Environmental (E)—over others.

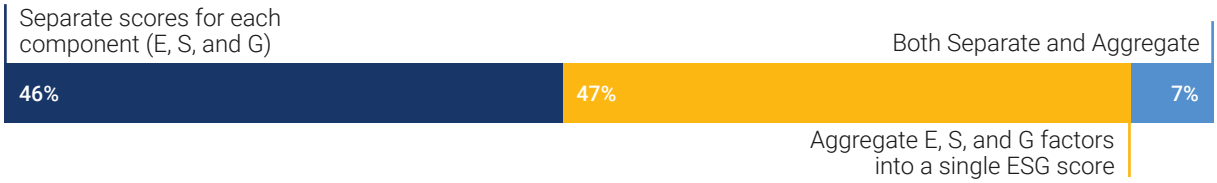


Figure 31: Aggregating E, S and G factors in ESG scores

10.4 Summary and takeaways

- Among the banks that use ESG scoring methodologies, banks **prefer to use internal ESG scoring methodologies, rather than a solely external methodology**.
- Within the risk framework, **ESG scores are used** to enhance compliance and regulatory reporting, inform investment decisions and portfolio management, guide corporate strategy and policymaking, and assist sector-specific risk analysis.
- While not adopted widespread, **banks are integrating ESG scores into their overall credit risk assessment scorecards.**
- Only a minority of ESG scores are independent of credit risk scorecards, which are merged at the PD modelling stage.
- At present, integration of ESG scores into credit ratings remains limited, but banks are planning to include such integration in the future.
- Only a proportion of ESG scores **are designed specifically for credit risk decisioning**.
- Banks **do not have a preferred method** for integrating ESG factors, as some aggregate them into a single score, while others keep 'E', 'S', and 'G' components separate.
- When aggregating 'E', 'S', and G factors into a single ESG score, there is **no consistent trend in how banks assign weights to each component.**

11. Data collection and governance

Chapter overview

This chapter explores the data types, sources, and processing methods used in climate-related credit risk assessment. It aims to provide a broader understanding of how banks currently manage data and IT processes to integrate climate-related information into their credit risk assessment.

11.1 Common data sources used and granularity

Common data sources used for transition and physical risk assessment

Banks use a range of data sources to assess climate-related risks. **Public data are the most widely used,** with 82 per cent of surveyed banks relying on it for physical risk and 71 per cent for transition risk assessments. External data providers are also common, used by 79 per cent and 71 per cent of banks for physical and transition risks, respectively. More than half of the respondents also draw on climate models, scientific research, and industry benchmarks (57 per cent for physical and 54 per cent for transition risks), while internal data is used by 54 per cent of banks for physical risks and 71 per cent for transition risks (Figure 32).

In comparison, data sources that are less frequently used by banks to assess climate risks comprise artificial intelligence, satellite and remote sensing data, and collaborative data sharing with industry groups. Additionally, **more than half of the banks surveyed reported using proxy climate data,** with many leveraging existing frameworks such as by PCAF and relying on academic institutions and government bodies to ensure quality.

When it comes to collecting data to assess climate risks across different exposure classes, banks rely on a variation of approaches—ranging from public disclosures to open-source platforms, in-house methods (directly through clients or use of proxies) and purchased data—with varying levels of data granularity. Data collection is particularly challenging for project finance and retail SME exposures, with banks reporting limited in-house data and a limited use of granular data such as address-level or latitude/longitude. Non-retail SME exposures face similar limitations in terms of granularity. While large corporates are generally better covered in terms of data sourcing and granularity, banks are often incorporating country-level data in their estimates, accompanied by granular data, such as at the district level and postal/zip code level. By contrast, commercial and residential real estate exposures benefit from better data availability and granularity at the postal (or zip code) level.

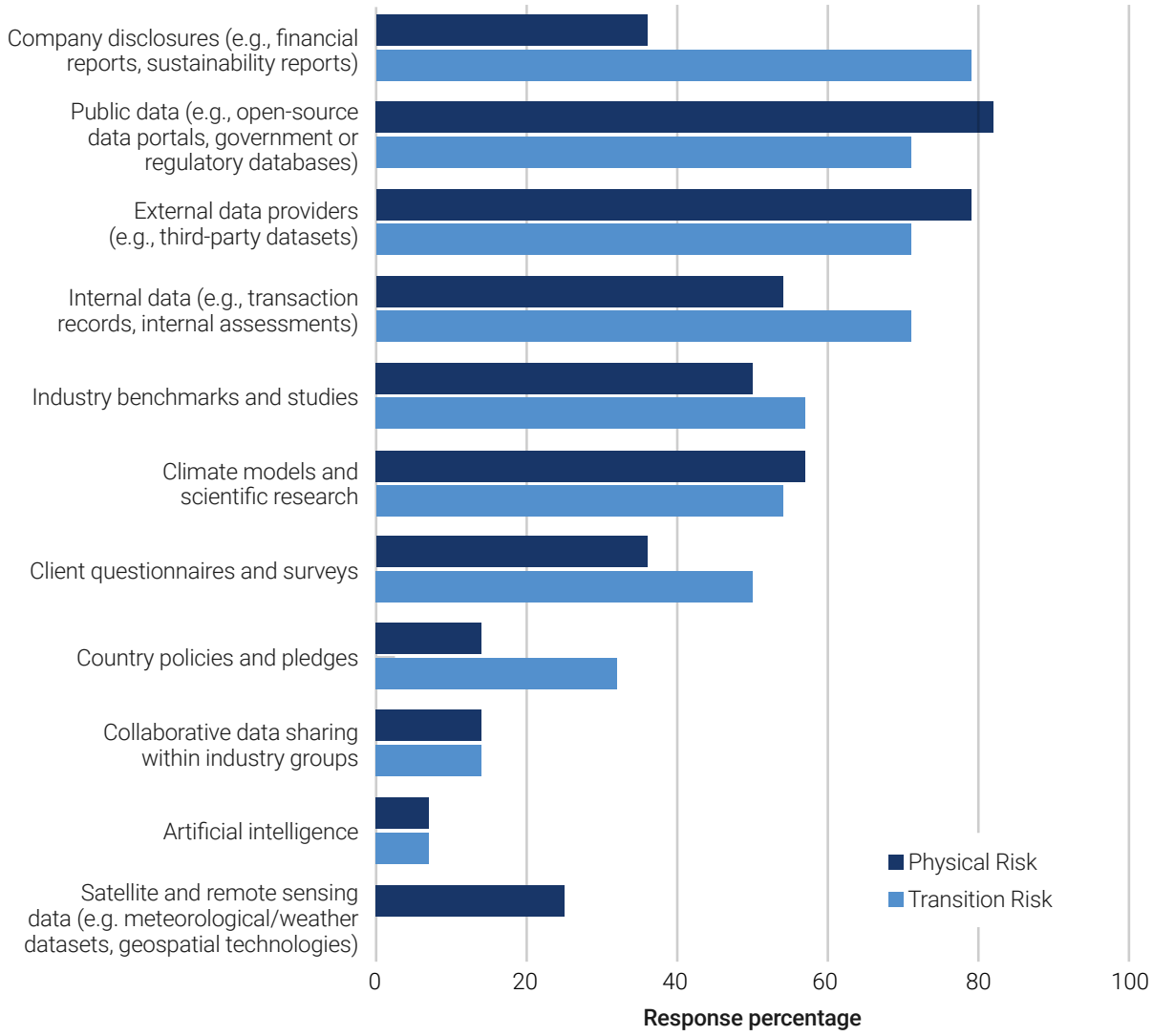


Figure 32: Data sources used for climate risk assessments

Gathering information from clients' climate risk disclosures

Banks **most commonly gather emissions data** (79 per cent) from clients' climate risk disclosures. This is followed by information on client commitments and decarbonization targets, such as pledges or goals related to emissions reductions (61 per cent), and the nature of clients' activities and operations (61 per cent); for example, sector, industry, and specific business activities or assets that may be exposed to climate risks.

More than half of banks (57 per cent) collect information on the location of client operations, particularly geographic data indicating whether clients operate in areas vulnerable to physical risks (e.g. flood zones). In addition, 43 per cent of banks gather information on climate risks identified by the client—such as physical, transition, or regulatory risks—as well as details on the client's governance structure. Doing so enables them to better understand how climate-related risks and opportunities are being managed.

In contrast, fewer banks collect information related to potential financial exposure to identified climate risks such as capital at risk or assets located in vulnerable areas (21 per cent). The same is true for the existence of catastrophe and business interruption insurance, which would indicate whether the client has coverage to mitigate losses from

climate-related events (14 percent). Notably, 18 per cent of banks reported that they do not collect any information from clients' climate risk disclosures (Figure 33).

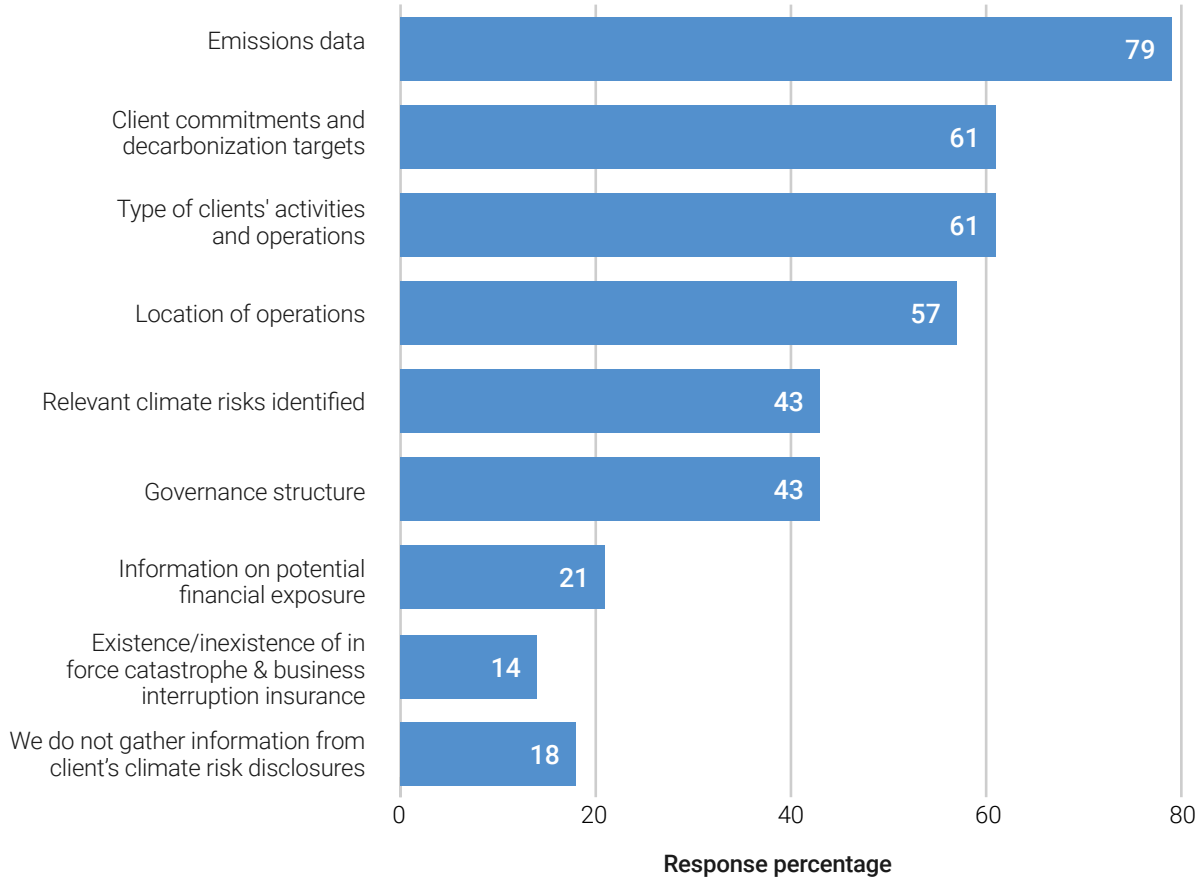


Figure 33: Information gathered from client's climate risk disclosures that are used in credit risk analysis

11.2 Practices for incorporating climate data into business procedures

To collect climate-related data from clients, banks are adapting their procedures in various ways. The most common changes implemented by banks surveyed are the introduction of new questionnaires and surveys and staff training to collect and assess climate-related data. Additionally, some banks have adopted new software or technology to improve data collection. A subset of banks have also implemented additional reporting requirements for clients.

Following these changes in data collection procedures, **banks are also enhancing their internal processes and IT infrastructure for incorporating and managing climate-related data.** Most commonly, surveyed banks use application programming interfaces (APIs) or integrate with third-party platforms to incorporate climate data into their risk assessment systems and datasets. In addition, some banks have also implemented audit trails and data governance measures for climate data, along with updated data warehousing or storage solutions to handle large volumes of climate data. The adoption of big data technologies to analyse climate datasets remains less common.

11.3 Summary and takeaways

- **Public data are the most commonly used data source** used by banks when assessing climate-related risks. External data providers are also widely relied upon.
- To collect data for different exposure classes, banks **use a mix of in-house collection, external providers, and open-source platforms**, with approaches varying by exposure class. Banks rely more on purchased data for commercial and residential real estate exposure classes, and more on in-house data sources for large corporates and SMEs.
- **Granular data** such as address-level and latitude/longitude data are more commonly used for **real estate exposures**. In comparison, banks rely on less detailed data for other exposure classes, especially SMEs and project finance. This can limit the precision of climate risk assessments for these exposure classes.
- Banks primarily use clients' climate risk disclosures **to gather core information** such as emissions data, decarbonization targets, operational activities, and location-specific climate vulnerabilities. However, they place less emphasis on collecting data related to financial exposure and insurance coverage for climate risks.
- Banks have **adapted their procedures in various ways** to collect climate-related data from clients by introducing new questionnaires and surveys, as well as by training staff to collect and assess climate-related data.
- Banks are **enhancing their systems for incorporating climate data** into their risk assessments and datasets by implementing audit trails and data governance measures for climate data. Alternatively, they are updating their data warehousing or storage solutions to handle large volumes of climate data.

12. Quantitative impact on key metrics

As part of the survey, a quantitative portion looked at the financial impact of climate risks measured by banks on key metrics such as ECL, RWA, and economic capital (ECAP). For each metric, survey participants were asked to provide an estimate on the climate-risk-related adjustment for ECL, RWA and ECAP, as a percentage of the total metric.[23,24] Banks were asked to provide separate estimates for physical and transition risks where available, and, if not possible, to provide a combined estimate. Respondents also indicated when the estimate provided was based on actual data or a proxy estimate.

In total, 68 per cent of the surveyed banks provided financial impact estimates for the key metrics across a set of exposure classes and sectors. Large corporates, residential real estate, and commercial real estate exposure classes were the most common exposure classes for which the surveyed banks estimate the impact due to climate-risk-related adjustments. The same inquiry for sectors led to responses for the following sectors: real estate activities and construction; agriculture, forestry and fishing; oil and gas; transportation and storage; and electricity and energy supply.

23 Banks were able to select from the following ranges: not assessed, 0 per cent (assessed, but equal to zero), <0 per cent, 0-2.5 per cent, 5-10 per cent, 10-15 per cent, 15-20 per cent, 20-30 per cent, >30 per cent.

24 Banks were asked to use 2023-year end reporting date.

12.1 Estimating climate-risk related adjustments on ECL, RWA and ECAP

Impact on ECL

Surveyed banks were asked to estimate the percentage impact of climate-risk-related adjustments on ECL for each credit portfolio and sector, comparing the adjusted ECL to a business-as-usual scenario.

Exposure class level

Most banks reported only small changes in ECL due to combined physical and transition risks, typically between 0–2.5 per cent, though a few observed higher impacts (up to 20 per cent) in portfolios such as large corporates and real estate. When assessed separately, transition risks led to estimate adjustments of 5–10 per cent, while physical risks generally resulted in smaller adjustments, with banks estimating 0 per cent impact for specific portfolios. In a few cases, some reported up to 10 per cent for large corporates, residential real estate, and commercial real estate. Banks primarily relied on proxy estimates for these assessments, with few using actual estimates or combination of both.

Sector level

At the sector level, most banks reported modest changes in ECL from combined physical and transition risks, typically within the 0–2.5 per cent range. For transition risks alone, banks estimate ECL adjustment of 5–10 per cent across sectors, while for physical risks, smaller adjustments were estimated (0–2.5 per cent), with only a few higher estimates (5–10 per cent) in real estate and construction. Banks primarily used proxy estimates or a combination of both actual and proxy estimates, reflecting a cautious and early-stage approach to integrating climate risks into ECL assessments. This indicates a preliminary stage in incorporating climate risks into ECL assessments, with a clear trend towards caution and reliance on estimation techniques.

Impact on RWA

Respondents were asked to estimate the climate-risk-related adjustments to RWA as a percentage change compared to business-as-usual RWA, which excludes explicit consideration of climate risks.[25] These adjustments were requested separately for Pillar 1 (minimum capital requirements via internal ratings-based (IRB) parameters or climate-specific overrides) and Pillar 2 (additional capital determined through internal capital adequacy assessments and stress testing).

The majority of respondents indicated **"not assessed"** when estimating the percentage impact on RWA related to climate risks at the credit portfolio level. This applied consistently to both Pillar 1 and Pillar 2.

25 Only a subset of banks provided responses in this section, as some were unable to disclose impact results or reported no impact as of the survey's reporting date. A proportion of banks indicated plans to conduct estimates for next year. As a result, the findings on climate-risk-related adjustments to RWA do not directly reflect the survey results on integrating climate risk into IRB modelling—an approach used for RWA calculations.

Similarly, when examining RWA impacts at the sector-specific level, most respondents selected **"not assessed",** reflecting limited progress in quantifying climate risk effects across industries. This trend persisted regardless of whether physical and transition risks were evaluated separately or in combination, under both Pillar 1 and Pillar 2 frameworks.

Impact on economic capital (ECAP)

Respondents were asked to quantify the percentage change in economic capital allocated to credit risk resulting from climate-risk-related adjustments, compared to a business-as-usual scenario excluding explicit climate considerations. Institutions could provide these estimates separately for physical and transition risks or as combined adjustments, across multiple credit portfolios (including large corporates, SMEs, commercial and residential real estate, and project finance) as well as across specific economic sectors. In response, the majority selected **"not assessed"** for adjustments of economic capital across all exposure classes and sectors, irrespective of risk type.

These responses underscore a critical insight: while institutions recognize the importance of integrating climate risks into capital assessments, **actual quantification remains limited and largely preliminary.** This widespread selection of "not assessed" highlights significant gaps in current analytical capabilities and methodologies. Closing this analytical gap represents a critical priority for banks, regulators, and industry stakeholders in order for climate-related risks to be effectively managed and accurately incorporated within capital frameworks.[26]

26 There is ongoing regulatory work aimed at closing the capability gap in modelling climate risks for capital-related calculations, as reflected in publications such as the Bank of England's report on climate-related risks and the regulatory capital frameworks, and the EBA's report on data availability and the feasibility of a common methodology for ESG exposures.

12.2 Summary and takeaways

- Despite the recognized importance of integrating climate risks into capital assessments, current efforts to quantify these risks remain limited. Although such efforts exist, they tend to be in an early and exploratory stage. While methodologies for adjusting ECL have progressed more than those for calculating RWA or economic capital, these too are **still developing—often showing minimal or no measurable impact in current calculations**.
- Many banks are actively working to develop approaches for incorporating climate risks into ECL and other financial metrics, including **efforts to link climate risk indicators with ECL components**.
- Some approaches remain **ad hoc and/or qualitative**, rather than based on adjustments to key input factors such as PD or LGD.
- To improve the integration of climate-related financial risks into capital frameworks, stronger collaboration among banks, regulators, and stakeholders is needed.

Conclusion

The joint survey by UNEP FI and GCD highlights how banks are integrating climate-related risks into credit risk methodologies. It reveals commonly preferred approaches, variations in practice, key challenges, and areas where methodologies are still underdeveloped. These insights can be categorized into the following four themes: methodologies and scope of assessment, integration into credit risk modelling and framework, and use of assessment results, and supporting infrastructure. The insights from this report can be used by risk professionals to compare their approaches with industry peers and refine their climate-related credit risk methodologies. Supervisory authorities can also use them to gain a global perspective of how banks are currently assessing climate risks and integrating them into credit risk management.

Overall, climate-related credit risk assessments by banks cover a wide range of exposure classes and sectors, with varying levels of granularity and with the use of either top-down, bottom-up, or combined approaches. Wholesale and mortgage portfolios are the most commonly modelled portfolios. Institutions are most typically using a combination of methodological tools to assess climate risks. Notable among these are qualitative assessments, scenario analysis, internal and supervisory climate stress tests, heatmapping, and scorecards.

Currently, banks are primarily using climate risk assessment outcomes for climate risk reporting, key risk indicators, and credit decisioning. Their use for areas such as regulatory capital and pricing is lower, although some banks intend to expand in these areas. A majority of banks are already using climate assessment findings to support client engagement. Examples of such activities include adjusting credit ratings, requesting time-bound risk mitigation plans, and aligning loan pricing with climate risk exposure. As methodologies improve, more banks are expected to use these results to inform client engagement.

Key takeaways from the survey on methodologies for assessing climate-related credit risks

1. Key areas of progress identified

- Banks are attempting to develop methodologies to incorporate climate risk into PD modelling, despite the challenge of aligning forward-looking climate and environmental risks with historically based models. Various practices for doing so are now emerging. Examples include adjusting existing PD models to reflect climate-related factors, and using stress testing results to inform PD adjustments at the portfolio or obligor level.
- For assessing transition risks, a wide range of transition risk metrics are in use. These range from emission reduction targets and progress to financed emissions, fossil fuel exposure, and Scope 1, 2, and 3 emissions of counterparties. Forward-looking indicators are also in use for legal, policy, technology, market trends, and reputational risks.
- Most surveyed banks are collecting Scope 3 data, doing so primarily though client-report emissions data. That said, many still rely on estimations based on industry averages, activity data and public factors.
- For physical risk assessments, banks are incorporating first-order transmission channels—such as asset value declines and infrastructure damage—which often translate into adjustments to collateral values and LGD. These assessments typically involve modelling a range of physical hazards, including both acute and chronic risks, based on the geographic location of the exposures.
- Banks have developed or are in the process of developing internal ESG scoring methodologies to assess financial materiality. ESG scores are used across multiple use cases within the risk framework. In some cases, these are integrated into the overall credit risk assessment scorecards. Few are specifically designed for credit risk decisioning. There is no preferred method for integrating ESG factors. Some aggregate them into a single score, while others keep 'E', 'S', and 'G' components separate.
- Climate scenario analysis practices vary, with some banks measuring the gap between two scenarios when calculating add-ons to current credit risk parameters, and others basing it on a single scenario. The widespread adoption of the NGFS reference scenarios plays a crucial role in assessing climate-related credit risks.

2. Aspects requiring further development

- Many approaches for integrating climate risk into credit risk models still rely heavily on expert judgement highlighting the need for methodological improvements.
- Second-order physical risk impacts and tipping points are not fully incorporated into physical risk assessments, reflecting methodological and data gaps.
- Adjusting collateral values for future transition risks and physical risks are limited, especially for transition risks. When adjusting collateral values for future discounted expected losses from climate risks, integration of climate considerations into valuation reports as part of the appraisal practices of independent valuators should serve as the primary entry point.

- Banks have to rely on various data sources to collect data for different exposure classes. In addition, data granularity varies across exposure classes, while limits assessment precision. Use of proxies is common, with banks implementing various practices and frameworks to ensure their quality.
- Despite the importance of integrating climate risks into capital assessments (e.g. ECL, RWA, and economic capital), quantification remains limited and in its early stages, with most calculated adjustments showing minimal or no measurable impact.

Next steps and recommendations

As detailed above, despite progress in developing a range of climate-related credit risk methodologies, further refinement and enhancements are still needed, especially:

The integration of climate risks into credit risk models, the development of internal ESG risk scoring methodologies, the modelling of second-order impacts, and the integration of climate considerations into collateral valuations

As highlighted by the survey results, banks have established ongoing plans to address persistent challenges. To address these fully, however, sustained effort is required across institutions involving various teams across their three lines of defence. One of the key challenges in the integration process for banks is embedding ESG risks within the existing risk management framework. Additional challenges include:

- Poor data reliability and poor quality of available data
- The forward-looking nature of climate risk
- Lack of a methodology to map climate risk drivers to financial risk drivers
- Lack of technical expertise
- Limited data availability and data gaps
- Resource and time limitation to build in-house capacity

Moving forward, there is a need for greater transparency and standardization in practices that could be applied by banks. The need for clearer regulatory guidance was also cited by banks throughout the survey as one of the reasons for current methodological limitations. Enhanced collaboration between banks and supervisors is therefore critical to improving both the robustness and usability of climate-related credit risk methodologies. For such improvements to be realized, supervisors will need to issue more detailed and practical guidance that banks can apply so as to strengthen their approaches. Supervisory mandates also play an essential role in shaping the pace and direction of methodological development. The trend of regulators establishing clearer expectations and more detailed guidance on incorporating climate-related considerations is already underway, as evidenced by the supervisory guidelines referenced in Table 1, among others.

Although methodological gaps persist in assessing climate-related credit risks, it is important to acknowledge that meaningful progress has been made which offers a valuable basis for continued development. Moreover, global collaboration remains important to ensure peers exchange good practices and share lessons learned to help further enhance methodologies.

Appendix 1: Glossary

Definitions on exposure classes

Aircraft finance: This refers to the method of funding an acquisition of physical assets (aircraft) where the repayment of the exposure is dependent on the cash flows generated by the specific assets that have been financed and pledged or assigned to the lender. This asset class does not include any general financing of aircraft companies or loans to corporates or individuals secured by an aircraft [Basel Framework, CRE 30.11]

Banks and non bank financial institutions (NBFIs): Exposures to banks and other financial institutions such as banks investment firms, insurance companies and asset managers.

Commercial real estate: This comprises exposure to non-residential property used for business or land that can generate income, including multi-family real estate, office space, retail space, industrial real estate and mixed-use space.

Commodity Finance: This comprises structured, short-term lending to finance reserves, inventories, or receivables of exchange-traded commodities (e.g. crude oil, metals, or crops), where the exposure will be repaid from the proceeds of the sale of the commodity and the borrower has no independent capacity to repay the exposure [Basel Framework, CRE 30.12].

Households (consumer lending): This comprises exposures to individuals and households, such as: revolving credits and lines of credit (e.g. credit cards, overdrafts, or retail facilities secured by financial instruments); and personal term loans and leases (e.g. instalment loans, auto loans and leases, student and educational loans, personal finance, or other exposures with similar characteristics).

Large corporates: This includes exposures to companies and businesses that do not fall under retail or SME categories. These are defined as corporate exposures where the reported sales for the consolidated group of which the firm is a part is equal to or greater than 50 million.

Non-retail SMEs: This refers to SME exposures that do not meet the criteria to be classified as retail exposures. These are defined as corporate exposures where the reported sales for the consolidated group of which the firm is a part is less than €50 million.

Project finance: This includes exposures to specialized lending project finance. Project finance is a method of funding in which the lender looks primarily to the revenues generated by a single project, both as the source of repayment and as security for the exposure. This type of financing is usually for large, complex and expensive installations. This category might include, for example, power plants, chemical processing plants, mines, transportation infrastructure, environment, and telecommunications infrastructure. Project finance may take the form of financing of the construction of a new power plant, a petrochemical complex, or an oil refinery. Alternatively, it could comprise the refinancing of an existing project, with or without improvements [Basel Framework, CRE 30.9].

Residential real estate: This refers to exposures to real property, land, or a building used for residential purposes.

Retail SMEs (Small and Medium-sized Enterprises): This includes exposures to SMEs that meet specific criteria to be classified as retail exposures. Loans are extended to small businesses and managed as retail exposures. They are eligible for retail treatment provided the total exposure of the banking group to a small business borrower (on a consolidated basis where applicable) is less than EUR 1 million.

Shipping Finance: This refers to the method of funding the acquisition of physical assets (ships) where the repayment of the exposure is dependent on the cash flows generated by the specific assets that have been financed and pledged or assigned to the lender. The asset class does not include any general financing of shipping companies or loans to corporates or individuals secured by a ship [Basel Framework, CRE 30.11].

Sovereigns: These are exposures to national governments, plus central banks and similar sovereign entities.

Others: This can include various other exposures that do not fall into the specified categories above.

Sector classification definitions

Sector classification used in this report is aligned with the recognized industry classification systems; i.e. NACE (mostly used in Europe) and NAICS (used in North America).[27]

Survey Sector Group	NACE Codes	NAICS codes
Agriculture, forestry and fishing	Agriculture, forestry and fishing (NACE sector—A): includes crop and animal production, forestry	Agriculture, forestry and fishing (NAICS 2022 codes: 111, 112, 113, 114, 115)
Oil & Gas	Oil and Gas (NACE sector—B6 , C19.2, D35.2, H49.5): includes extraction of crude petroleum and natural gas; manufacture of refined petroleum products; manufacture of gas; and the distribution of gaseous fuels through mains/ transportation of oil and gas through pipelines	Oil and Gas (NAICS 2022 codes: 211,213111, 213112, 213118, 2212, 324, 486)
Manufacture of minerals, chemicals, basic metals, pharmaceutical and rubber	Manufacture of minerals, chemicals, basic metals, pharmaceutical and rubber (NACE sector—C20, 21, 22 23, 24, 25)	Manufacture of minerals, chemicals, basic metals, pharmaceutical and rubber (NAICS 2022 codes: 325, 326, 327, 331, 332)
Manufacture of furniture, electronics and machinery, food and beverages, motor vehicles, textiles, wood and paper	Manufacture of furniture (C31), electronics (C26), electrical equipment (C27) and machinery (C28), food (C10), beverages (C11) and tobacco (C12), motor vehicles and other transport vehicles (C29, C30), textiles, and wood and paper (NACE sector—C13, C16, C17	Manufacture - other (NAICS 2022 codes: 311, 312, 313, 314, 321, 322, 333, 334, 335, 336, 337, 339)
Mining of coal and lignite, metal ores and other mining and quarrying	Mining of coal and lignite, metal ores and other mining and quarrying (NACE sector —B5, B7, B8)	Mining of coal and lignite, metal ores and other mining and quarrying (NAICS 2022 codes:212, 213113, 213114,213115

27 The sectors covered in this report were selected based on their classification as 'high-impact climate sectors' in Sections A to H and Section L of Annex I to Regulation (EC) No 1893/2006 of the European Parliament and Council.

Survey Sector Group	NACE Codes	NAICS codes
Electricity and energy supply	Electricity and energy supply (includes electric power generation, transmission and distribution) (NACE sector—D35.1)	Electricity and energy supply (includes electric power generation, transmission and distribution) (NAICS 2022 codes: 2211)
Water supply, sewerage, waste management and remediation activities	Water supply, sewerage, waste management and remediation activities (NACE sector—E)	Water supply, sewerage, waste management and remediation activities (NAICS 2022 codes 2213, 562)
Wholesale and retail trade	Wholesale and retail trade (NACE sector—G)	Wholesale and retail trade (NAICS 2022 codes: 423, 424, 425, 441, 442, 443, 444, 445,449, 451, 452, 453, 454, 455, 456, 457 458, 459
Transportation and storage	Transportation and storage (include water transportation, air transportation, land transportation, storage and post) (NACE sector—H except H49.5)	Transportation and storage (NAICS 2022 codes: 481, 482, 483, 484, 485, 487
Real estate activities and construction	Real estate activities and construction (NACE sector F and L): includes buying and selling of own real estate; renting and operating of own or leased real estate; real estate activities on a fee or contract basis and construction of buildings; civil engineering; demolition and site preparation; and building completion and finishing	Real estate activities and construction (NAICS 2022 codes: 236, 237, 238, 531)
Others	Other (other NACE codes)	Other (other NAICS codes)

Definitions on methodological tools used for climate-related credit risk assessments

Data modelling: The creation of quantitative models to simulate outcomes based on a wide range of inputs, such as algorithms, and climate, financial, and economic data, thereby generating insights about climate risks under specific conditions.

External risk models (e.g. third-party tools or services): A tool that utilises third-party tools or services to assess risks; notably, it leverages external data, methodologies, and expertise to provide an independent perspective on potential threats.

Heatmapping: An approach that visually represents risk levels across different areas or factors using colour coded grids, thus helping to identify and prioritize high-risk areas and industries for further analysis.

Internal climate stress testing: A method to evaluate an organization's resilience to climate-related risks by simulating adverse scenarios internally in order to assess potential impacts on operations and financial stability.

Internal risk models: Custom-built tools within an organisation that use proprietary data and assumptions to predict potential risks within portfolios and assess their impact on the business.

Qualitative assessments (e.g. expert judgment, internal discussions): A method of assessing risks based on expert judgement, internal discussions and non-quantitative methods.

Scenario analysis: A forward-looking tool to assess the resiliency of a bank's business model and strategy using a range of plausible climate-related pathways for determining the potential impact of climate-related risk drivers; for example, scenario analysis could either imply a temperature rise scenario or a shock scenario but would include the use of multiple scenarios (e.g. 2-3 scenarios for comparison)

Scorecards: A tool for quantify risk by assigning weighted scores to various risk factors using a predefined set of criteria to assign scores, thus enabling a structured and comparative evaluation of existing and potential risks.

Statistical analysis: The use of historical data and the identification of patterns, trends, and correlations, to forecast and quantify risk.

Supervisory climate stress testing: An approach deployed by regulatory authorities to assess the broader financial system's vulnerability to climate-related risks, ensuring that institutions are prepared for potential climate impacts.

Transition risk metrics definitions

Absolute investment in low-carbon technologies: This refers to the total capital or percentage of funds allocated to technologies that contribute to reducing carbon emissions by a company.

Assets at risk of being stranded: This metric identifies assets that could lose value or become obsolete due to the transition to a low-carbon economy (e.g. fossil fuel reserves that might not be extracted).

Comparison of investment in low-carbon technologies to other investments: This metric relates to the relative proportion of funds allocated to low-carbon technologies compared to other types of investments made by a company.

Distribution of actual vs. estimated EPC: This metric compares the real EPC ratings of properties against their estimated values.

Distribution of share of EPC buckets per country: This refers to the proportion of properties in different EPC rating categories (A-G) within a real estate portfolio, broken down by country.

Emissions from a company: This metric refers to the total amount of greenhouse gases (GHGs) emitted directly by a company (Scope 1), indirectly from purchased electricity (Scope 2), and indirectly from the company's value chain (Scope 3). This helps in assessing a company's overall carbon footprint and its contribution to climate change.

Emissions per unit revenue: This is the ratio of total emissions (usually Scope 1 and 2) to the revenue generated by a company.

Emission reduction targets and progress: This metric tracks the targets of a company or portfolio goals for reducing emissions and the progress made towards these targets over time.

Financed emissions: These are the GHG emissions associated with the assets and projects a financial institution finances or invests in.

Fossil fuel exposure: This is the extent to which a company's operations or a portfolio's investments are tied to fossil fuels (e.g. coal, oil, gas).

Net asset value exposure to different energy sources: This measures the proportion of a company net asset value (NAV) that is tied to various energy sources (e.g. coal, oil, renewables).

Revenue at risk: This quantifies the proportion of a company's revenue that could be impacted by climate-related transition risks, such as policy changes, market shifts, or reputation damage.

Percent of portfolio revenue generated from green/brown technology: This metric shows the percentage of revenue in a portfolio generated from technologies considered green (e.g. renewable energy) versus brown (e.g. fossil fuels). It primarily refers to the operational revenue generated by the companies or assets in a bank's portfolio from their business activities in either green or brown technologies.

Percentage investment into business-as-usual brown vs new green: This refers to the proportion of total investment made by a company into traditional, carbon-intensive industries (brown) versus sustainable, low-carbon technologies (green).

Transition risk score in real estate portfolio (EPC Ratings): This score is based on the weighted average of Energy Performance Certificate (EPC) ratings across a real estate portfolio, reflecting the energy efficiency and potential transition risks.

Transition value at risk: This is a financial metric used by a financial institution, for estimating the potential loss in portfolio value due to transition risks (e.g. policy changes, technological advancements).

Physical risk metrics definitions

Distribution of portfolio per physical risk hazard and severity of physical risks: A breakdown of a portfolio's exposure to different types of physical climate risks (e.g. floods, heatwaves) and their severity.

Extreme weather event frequency and severity metrics: Data on how often and how severely extreme weather events occur, affecting assets in a portfolio.

Frequency and duration of business operation interruptions due to extreme climate events: The measure of how often and for how long business operations are disrupted by extreme climate events.

Impact from supply chain disruption: The measure of the financial or operational impact on a company due to disruptions in its supply chain caused by climate events.

Implied temperature rise: The estimated increase in global average temperature associated with the current or projected emissions of a company or portfolio.

Ratings of asset resilience to physical climate risks: The scores or ratings that assess the ability of assets to withstand physical climate risks.

Percentage of at-risk properties in real estate: The share of real estate properties in a portfolio that are at risk due to climate-related events.

Percentage of portfolio exposed to insured losses due to climate events: The percentage of assets in a portfolio that could suffer insured losses from climate-related events.

Percentage of portfolio exposed to areas with direct asset-level physical risks: The proportion of assets in a portfolio located in regions susceptible to physical climate risks (e.g. floods, hurricanes).

Physical value at risk: A financial estimate of potential losses in asset value due to physical climate risks.

Appendix 2: Regional focus

This appendix highlights the survey findings for the three regions with the strongest participation: Europe (excluding the United Kingdom), Canada and the United States of America (USA). While responses were received from other geographies, sample sizes outside these blocs were not large enough to support regional analysis, so they are not shown here. Focusing on the largest respondent groups allows to present data-driven view of current practice and emerging strengths.

1. Asset-class coverage

Across all three regions, institutions focus their climate-risk assessments on **core credit books,** commercial real estate, large corporates and residential mortgages. Coverage peaks near 100 per cent in Canada, ranges from roughly 70–85 per cent in continental Europe (excluding the United Kingdom), and sits between 80–100 per cent in the USA. By contrast, **specialized lending** such as aircraft finance, shipping, sovereign debt and banks/NBFIs rarely exceeds 40 per cent coverage, highlighting a shared blind spot where banks would need to broaden their efforts.

2. Sectoral coverage

- **Real estate and construction** is the most assessed sector for ***both*** transition and physical risk.
- **Electricity and energy supply** shows strong transition risk coverage in every region, but physical risk analysis lags most notably in the USA.
- **Oil and gas, mining and metals** receive more transition than physical risk scrutiny, reflecting their carbon intensity.
- **Agriculture, forestry and fishing** attracts the lowest physical risk attention despite high weather sensitivity.

3. Use of expert judgement and data-driven tools

Canada and Europe moved earlier as 60–100 per cent of respondents began using expert judgement three to four or one to two years ago, and about half have already added data-driven analytics. Participating banks from the USA comprise the largest group that reports “have not started” data-driven assessments; institutions that have embraced data driven tools mostly did so only in the past one to two years. The result is an earlier, broader rollout in Canada and Europe.

4. Bottom-up vs. top-down methodologies

Regardless of geography, the common practice is to **combine bottom-up and top-down approaches,** particularly for the largest portfolios (commercial real estate, large corporates, residential mortgages).

5. Use of climate-risk results

Europe leads as roughly 60–70 per cent of respondent banks already feed climate-risk outputs into business planning, credit decisions, client relationship management, reporting and strategy.

Canadian institutions limit active use almost entirely to **mandatory climate-risk reporting.** In the USA, a majority of participating banks remain in the discussion or planning phase for every use case except climate risk reporting, with fewer than one third citing any current use.

6. Capital, provisions and impairment

- **Regulatory and economic capital:** About half of European banks now incorporate climate risk in at least one core credit metric, especially PD and RWA. While only one in five USA banks adjusts any credit parameter, and almost none assess EAD or LGD. Canada occupies a middle ground with two thirds already factoring climate into loan-loss provisioning (ECL) but exclude it from regulatory capital.
- **IFRS 9 / CECL impairment models:** Europe sets the pace, with roughly two in five institutions embedding climate variables directly in impairment estimates. Adoption in the USA is incremental; and Canada is still early-stage. Globally, climate-integrated impairment modelling remains emerging and uneven.

7. Transition-risk metrics in external reporting

Region	Metrics in Widespread Use (≈ ≥ 50 per cent of respondents)	Metrics with Limited Uptake
Europe (excl. UK)	Financed emissions; Scope 1/2/3 emissions; Fossil-fuel exposure; *Real estate specific:* EPC distributions and transition-risk scores	Energy mix (green vs brown); Investment in low-carbon tech; Transition Value at Risk
USA	Emission-reduction targets & progress; Financed emissions; Scope 1/2	Fossil-fuel exposure; Emissions per unit of output; Scope 3 emissions
Canada	Emission-reduction targets & progress; Financed emissions; Fossil-fuel exposure	Emissions per unit of output; Total energy use

8. Physical-risk metrics in external reporting

Region	Metrics in Widespread Use	Metrics with Limited Uptake
Europe (excl. UK)	Distribution of portfolio per physical risk hazard and severity of physical risks	Percentage of portfolio exposed to insured losses due to climate events, Ratings of asset resilience to physical climate risks
USA	Percentage of at-risk properties in real estate and areas with direct asset level physical risks	Extreme-weather frequency & severity
Canada		Physical Value at Risk

9. Internal ESG scoring methodologies

Europe is more advanced in comparison, with more than half (≈ 56 per cent) of respondents at some stage of their internal methodology journey. It is also the only region with a sizeable cohort of banks currently building one. In the USA, one quarter of banks already have a fully developed framework, but the remainder have none. Canada shows a hybrid approach with one third of surveyed banks use a combined internal and external approach, yet no respondent has completed or is building a stand-alone internal score, and roughly two-thirds lack any ESG scoring methodology.

10. Use of client climate-risk disclosures in credit analysis

All three regions now treat **client-level emissions data** as a baseline input for climate-aligned underwriting. European banks go further by capturing catastrophe and business-interruption insurance details, allowing a more forward-looking view of borrower resilience. Respondents from both Europe and the USA routinely collect information on potential financial exposure, while respondents from every region request decarbonization commitments, governance structures, operational locations, activity types and identification of relevant climate risks.

Bibliography

Acharya, V. V., Berner, R., Engle, R. F., Jung, H., Stroebel, J., Zeng, X., & Zhao, Y. (2023). Climate Stress Testing, *FRB of New York Staff Report No. 1059.* Rev. June 2023. doi.org/10.2139/ssrn.4413834

Arnold, M., & Bryan, K. (2025). Droughts are major threat to Eurozone economy, warns ECB. *Financial Times,* 22 May. ft.com/content/2b19b5f5-69c2-4d31-aac7-28b975487d4a?accessToken=zwAGNc9b380Akc8rGbX1acJNMdOqxyi5dUh9Sg.MEQCIAV9u-wUTZTnrxxh_xmfm9jVsK0O9wR0ioHhvl4tJppZQAiBpHyYUakAT-4Txho0Y0y3on-MMFjG9x6ZMKGyH8i8pqqQ&sharetype=gift&token=508e09ed-0b28-462f-a20b-8d8eee767079

Australian Prudential Regulation Authority (2021). *Prudential Practice Guide Prudential Practice Guide Cpg 229 Climate Change Financial Risks.* apra.gov.au/sites/default/files/2021-11/Final%20Prudential%20Practice%20Guide%20CPG%20229%20Climate%20Change%20Financial%20Risks.pdf

Bank for International Settlements (2021). *Basel Committee on Banking Supervision Climate-related risk drivers and their transmission channels.* bis.org/bcbs/publ/d517.pdf

Bank for International Settlements (2022). *Principles for the effective management and supervision of climate-related financial risks.* bis.org/bcbs/publ/d532.htm

Bank of England (2025). *CP10/25—Enhancing banks' and insurers' approaches to managing climate-related risks.* bankofengland.co.uk/prudential-regulation/publication/2025/april/enhancing-banks-and-insurers-approaches-to-managing-climate-related-risks-consultation-paper

Carbon Brief (2021). *Guest post: How to assess the multiple interacting risks of climate change.* 27 April. carbonbrief.org/guest-post-how-to-assess-the-multiple-interacting-risks-of-climate-change/

Copernicus (2025). *Global Climate Highlights 2024.* 10 January Copernicus.eu.climate.copernicus.eu/global-climate-highlights-2024

European Banking Authority. (2024). *Guidelines on ESG scenario analysis.* eba.europa.eu/activities/single-rulebook/regulatory-activities/sustainable-finance/guidelines-esg-scenario-analysis

European Banking Authority. (2025). *Final Report Guidelines on the management of environmental, social and governance (ESG) risks.* eba.europa.eu/sites/default/files/2025-01/fb22982a-d69d-42cc-9d62-1023497ad58a/Final%20Guidelines%20on%20the%20management%20of%20ESG%20risks.pdf

European Central Bank (2020). *Guide on climate-related and environmental risks.* bankingsupervision.europa.eu/ecb/pub/pdf/ssm.202011finalguideonclimate-relatedandenvironmentalrisks~58213f6564.en.pdf

Hong Kong Monetary Authority (2021). *HKMA Banking Regulatory Document Repository.* brdr.hkma.gov.hk/chi/doc-ldg/spm/current/GS-1

Manifest Climate (2024). *Decoding Materiality Assessments Using Peer Examples.* manifestclimate.com/blog/decoding-materiality-assessments-using-peer-examples/

Monetary Authority of Singapore (2020). *Guidelines on Environmental Risk Management for Banks.* mas.gov.sg/regulation/guidelines/guidelines-on-environmental-risk-management

Network for Greening the Financial System. (2024). *NGFS Climate Scenarios Technical Documentation V5.0.* ngfs.net/system/files/2025-01/NGFS%20Climate%20Scenarios%20Technical%20Documentation.pdf

Office of the Superintendent of Financial Institutions (2025). *Climate Risk Management.* osfi-bsif.gc.ca/en/guidance/guidance-library/climate-risk-management

S&P Global (2025). *For the world's largest companies, climate physical risks have a USD1.2 trillion annual price tag by the 2050s.* 10 March.spglobal.com/esg/insights/featured/special-editorial/ceraweek-physical-risk

South African Reserve Bank. (2024). *Guidance on climate-related governance and risk practices for Banks.* resbank.co.za/en/home/publications/publication-detail-pages/prudential-authority/pa-deposit-takers/banks-guidance-notes/2024/G2-2024-Climate-Guidance-Risk-Banks

United Nations (2024). *For a livable climate: Net-zero commitments must be backed by credible action.* un.org/en/climatechange/net-zero-coalition

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