# Climate Change and Financial Risk

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## Abstract

Climate change, and the actions taken in response to it, introduces both risks and opportunities for financial institutions. The Reserve Bank continues to monitor the build-up of climate-related financial stability risks, including how these risks are priced and who ultimately bears the physical and transition risks arising from climate change. Globally and in Australia, most analysis has found limited direct effects of climate risks on the financial system as a whole. Those that do arise fall unevenly, with the largest risks concentrated in specific geographic regions and sectors. Much of the analysis to date has been exploratory in nature and analytical frameworks continue to develop. This reflects, in part, the complexity of bringing together elements of climate science, economics, finance and regulation. Commonly identified areas for improvement relate to data availability and coverage, consistent disclosure requirements, and the design of scenarios used to assess climate-related risks to financial stability. Ongoing engagement and coordination between the public and private sectors, domestically and internationally, will be required to effectively monitor and ultimately manage the physical and transition risks arising from climate change.

## Introduction

Australia's climate has warmed by nearly 1.5°C since national records began in 1910, according to the Bureau of Meteorology's latest 'State of the Climate' report (BoM 2022). Average sea surface temperatures have increased by over 1°C since 1900, and rainfall patterns have changed significantly in many regions. In the coming decades, Australia is expected to see ongoing changes to its weather and climate, including decreased winter rainfall in southern and eastern agricultural regions, more periods of extreme heat, longer fire seasons and fewer but higher intensity tropical cyclones (BoM 2022).

These changes, and the actions taken in response, introduce opportunities (e.g. in the development of green technologies) but also risks for Australia's economy and financial system (Summerhayes 2017; Debelle 2019). Economic and financial risks arising from climate change are typically divided into two types:

- **Physical risks** refer to the potential damage and losses from the increasing severity and frequency of climate-related events. These can be acute (as in the case of a destructive tropical cyclone) or chronic (such as rising sea levels and temperatures).
- **Transition risks** result from the actions taken to reduce greenhouse gas emissions, mitigate climate change and adjust to a lower emissions economy. This encompasses changes in government policies, technology, and investor and consumer preferences, which have the potential to result in substantial and, in some cases, unexpected changes to the functioning of the economy and financial system. Transition risks can arise domestically or internationally, transmitted through trade flows or financial markets.

These climate risks will affect financial institutions via a number of channels.[1] Physical risks from increased variability and extremity of climatic conditions will reduce the value of certain assets and income streams. This could result in increased claims on insurers, unexpected credit losses for banks and write-downs to the value of financial investments. Policy and technological changes that address climate change will moderate these physical risks; however, they may increase the transition risks associated with the move to a lower emissions global economy. Sudden or unexpected changes in regulations, technology or consumer preferences, or uncertainty about prospective policy settings, could quickly lower the value of assets or businesses in emissions-intensive industries, some of which may become economically unviable or 'stranded'.

This article provides an update on international and domestic research into the financial risks of climate change from a financial stability perspective, including some recent modelling undertaken by the Reserve Bank. To date, much of this work has been exploratory in nature. Key aims have been to understand the data and capabilities needed to better evaluate climate risks and to build capacity in this area within regulatory and financial institutions, with the ultimate goal of more effectively managing these risks.

## International developments in climate scenario analysis

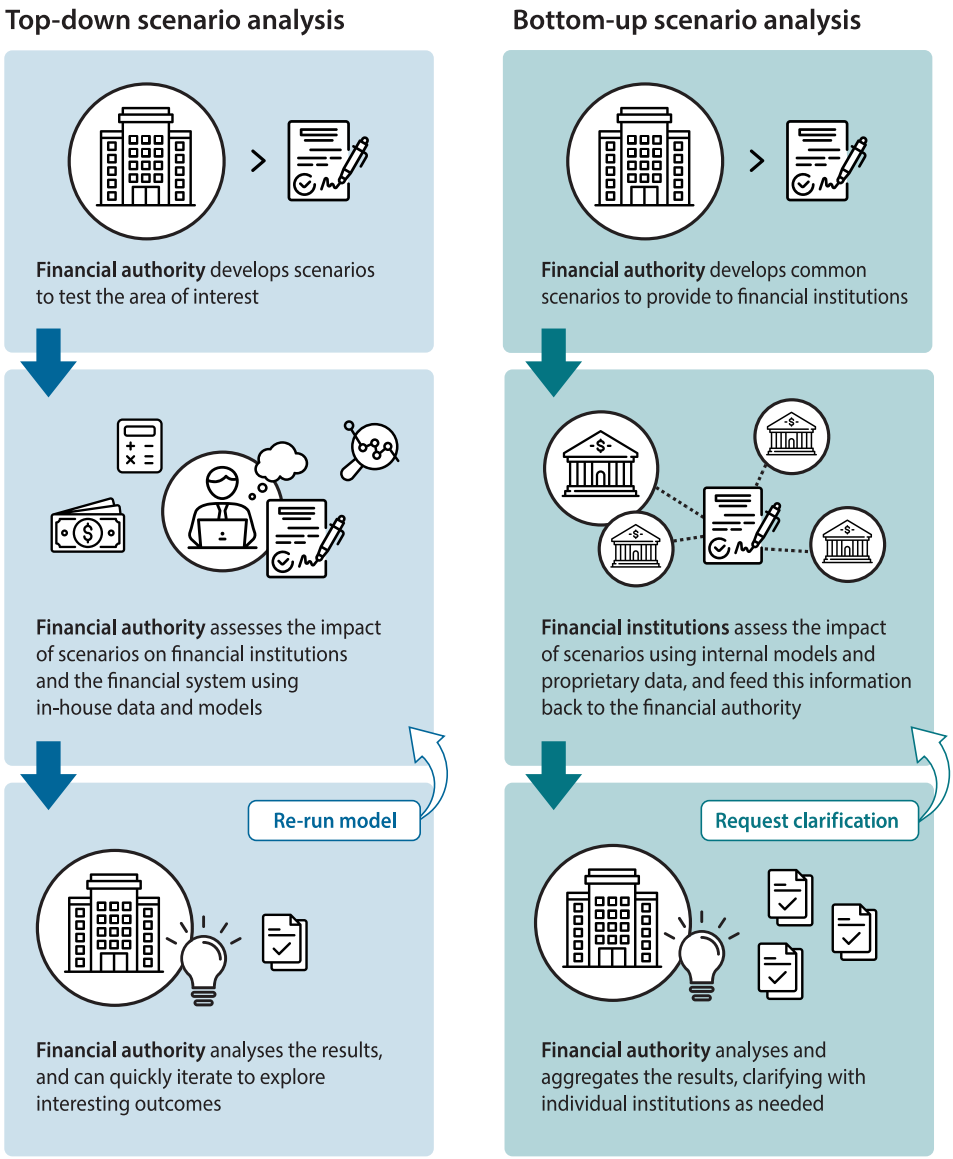
Integrating measures of climate risk into monitoring and regulatory frameworks is a recent development for financial authorities. It is complicated by significant uncertainty about the impact of a warming climate on global weather patterns, how government policy will respond, how these actions will transmit to economic and financial sectors, and how individual institutions are exposed to these risks. Traditional risk-analysis methods, which rely on historical data, are less useful given the unprecedented and wide-ranging nature of climate risks.

To fill this gap, scenario analysis has emerged as a key tool for evaluating climate risks. Scenario analysis deals with uncertainty by assessing future outcomes based on a plausible set of assumptions; scenarios are best understood as 'what if' narratives rather than as a set of forecasts. While it is unlikely that any specific scenario will eventuate, investigating possible outcomes under a wide range of assumptions helps to draw out the key factors that may drive future developments and to assess the potential implications. The Network for Greening the Financial System (NGFS) – a group of central banks and supervisors created to design and share best practice for climate risk management in the financial sector – has developed a set of climate scenarios designed to be a common reference point for understanding how climate change, climate policy and technological trends could evolve in the future (NGFS 2022).[2]

There are two main approaches to scenario analysis, although hybrid methods are also possible:

- **Top-down** approaches are model-based exercises that apply a consistent set of decision

**Figure 1: Top-Down and Bottom-Up Scenario Analysis**




rules to all institutions and are generally run in-house by authorities, allowing for quick iterations to explore interesting results.

- **Bottom-up** exercises involve authorities providing common scenarios to financial institutions that then assess the implications for themselves and their counterparties using internal models and processes. The results are submitted back to the relevant authority to be collated and analysed, and individual institutions are asked for clarification if required. Bottom-up exercises tend to contain richer and more realistic detail than top-down approaches, but they are significantly more resource intensive and take much longer to complete.

Over the past two years, more than 50 climate scenario analysis exercises have been completed or are currently underway by NGFS members using top-down, bottom-up and hybrid approaches. The majority of these exercises have focused on credit risk or market risk, using metrics such as the probability of default or loss-given-default for credit exposures (FSB and NGFS 2022). These exercises have covered a range of objectives in addition to providing an initial assessment of the magnitude of climate risks (Graph 1). Common themes included: identifying data needs for climate risk analysis; building capabilities within financial authorities (like the Reserve Bank); and facilitating dialogue with industry about climate-related vulnerabilities.

In general, these exercises have not found severe macroeconomic and financial impacts at a system-wide level, although in some cases adverse impacts were found for individual sectors or institutions (FSB and NGFS 2022). However, many jurisdictions felt that the measures of exposure and vulnerability were likely understated, noting that the initial modelling did not account for second-round effects or potential climate non-linearities. Offsetting this, in general the scenarios did not factor in adaptation measures taken by financial and non-financial firms that might mitigate the risks. Another finding from these exercises related to the material differences in estimated climate-risk exposures between countries, industries and institutions. While this result may be partly due to the different methods employed, it also highlights the underlying diversity of climate risks. For Australia, this implies a need to look beyond aggregate results and develop a deeper understanding of the regions and sectors where risks are most concentrated.

## Climate change risks to Australian banks

### Previous Reserve Bank work

Bellrose, Norman and Royters (2021) provided a preliminary assessment of climate change risks to Australian banks. The work examined banks' exposures to physical climate risks associated with bank mortgages and transition risks from bank business lending. Residential mortgages account for approximately two-thirds of major Australian banks' loan portfolios, with housing collateral backing the loans. If current property values do not fully reflect the long-term risks of climate change, banks will be more exposed to the risk of credit losses in the case of borrower default. The research found that overall losses for the financial system due to climate-related declines in property value are likely to be manageable, and only a small share of housing in regions most exposed to extreme weather would experience price falls that could worsen credit losses to banks.

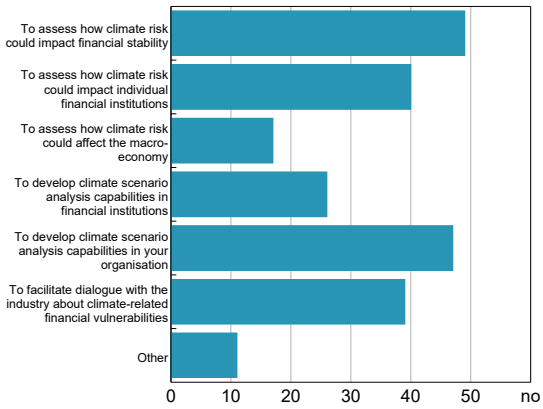
To examine the impact of transition risks on business lending, the authors constructed a measure of emissions intensity by sub-industry.[3] Using this as a proxy for exposure to transition risk, they then measured banks' credit exposures to each of these sub-industries. They found that bank lending to industries with a high level of emissions is typically small, while banks' largest exposures are to industries with relatively low emissions intensity. As a result, banks' lending portfolios were found to be less emissions intensive than the Australian economy as a whole, indicating banks are not carrying outsized exposures to transition risks.

A number of limitations were noted in this analysis, such as the assumptions that banks' balance sheet structures do not change over time and that all firms within a sub-industry have the same emissions intensity. However, it provided a preliminary examination of potential climate risks facing Australian banks and identified areas where more information is needed, such as data on the location of business assets. As the authors noted, a range of approaches will need to be used to better capture the different facets of climate change and their potential impact on the financial system.

**Graph 1**

**Main Purpose of Climate Scenario Analysis Exercises***

Number of observations




* Reproduced from Graph 2 in 'Climate Scenario Analysis by Jurisdictions: Initial Findings and Lessons' (FSB and NGFS 2022).

Sources: FSB and NGFS; RBA

### Climate Vulnerability Assessment

The Australian Prudential Regulation Authority (APRA), on behalf of the Council of Financial Regulators, recently published the results of a Climate Vulnerability Assessment (CVA) undertaken with Australia's five largest banks during 2021–2022. The CVA was a bottom-up scenario analysis designed to provide insights into the potential financial risks to banks, the financial system and the

economy posed by both physical and transition climate risks. It also aimed to improve banks' climate risk management capabilities and to understand how banks may adjust their business models in response to climate change (APRA 2022).

The exercise drew on two global scenarios developed by the NGFS, tailored with additional Australia-specific economic and physical risk data:

- The **Current Policies** scenario explored a future where global emissions remain broadly similar to current levels to 2050 before growing slowly to 2100, resulting in higher physical risks for the economy. Many physical risks become more severe in the second half of the century under this scenario.
- The **Delayed Transition** scenario explored a future with the same global emissions trajectory to 2030 as the Current Policies scenario. Global policy action on climate change in 2030 leads to a rapid reduction in global emissions from 2030 onwards, introducing transition risks as climate policies take effect.

The scenarios were chosen to gain insights into the potential impacts on banks under markedly different assumptions and climate outcomes.

Overall, the CVA results reported by the participating banks indicated that the climate risks considered in both scenarios would increase losses on bank lending in the medium-to-long term but were unlikely to cause severe stress to banks. Higher mortgage lending losses were reported in regions that were exposed to more severe and prolonged physical risks, and these losses were marginally higher under the Current Policies scenario. For business lending, several sectors – including mining, manufacturing, transport and wholesale trade – showed higher losses due to transition risks, especially under the Delayed Transition scenario. Lending losses were concentrated in specific regions and industries that represent only a small proportion of banks' overall lending exposures. These conditions, however, could present a risk to less-diversified banks that have greater concentrations of their exposures in these regions and sectors. The participating banks indicated they would adjust their risk appetite and lending approaches in response to growing climate risks.

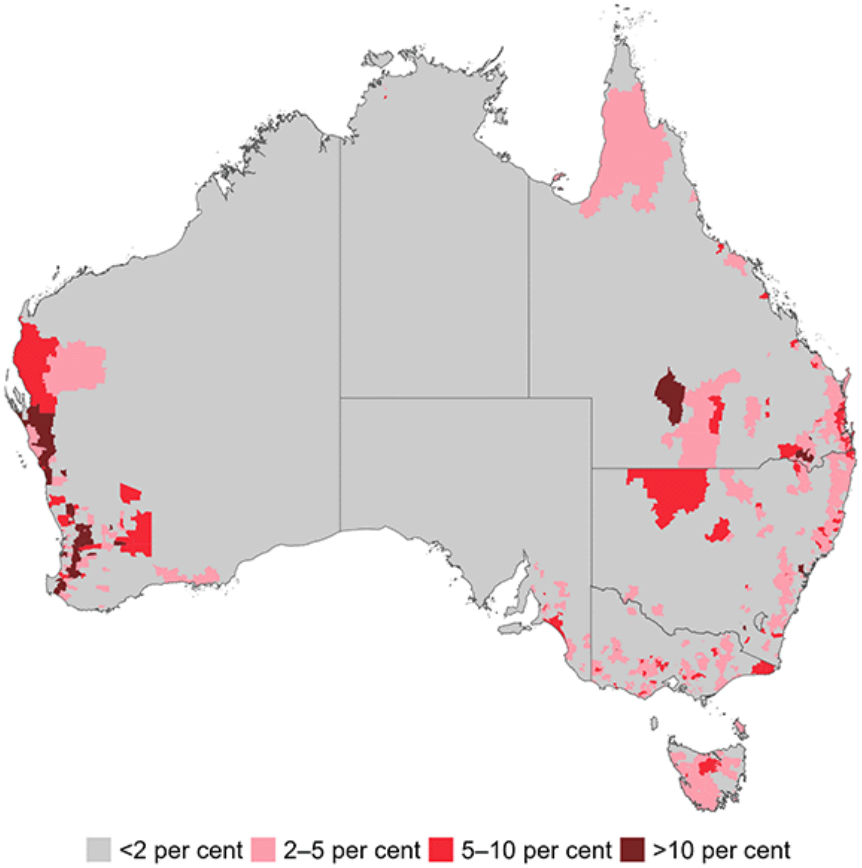
There were several limitations to the CVA exercise, including issues with climate-related data quality and accessibility and the extended time horizon of the scenarios (beyond typical business and capital planning cycles). There were significant differences in the scale of the impacts reported across the banks for their portfolios. The largest driver of these differences was considered to be variations in the ability of banks to capture climate change impacts in their internal models, rather than reflecting the uneven impact of climate change on banks' differing balance-sheet structures.

### Climate scenario analysis using the Bank's macrofinancial model

As a complement to the CVA, the Reserve Bank also undertook a climate scenario analysis exercise. This was a top-down exercise, using the Bank's existing stress-testing framework to assess how climate risks might impact the banking sector. However, it is important to note that this analysis was undertaken largely to establish and refine analytical techniques; it was not intended to be a formal and fully fledged stress test. It focused primarily on possible financial risks, rather than being a broader assessment of different climate policies. As with the CVA, it looked at the banking system; other important parts of the financial system, such as insurers and asset managers, will be considered in future work.

The exercise was conducted using the Bank's macrofinancial stress-testing model described by Garvin *et al* (2022). At a high level, the model involves estimating how adverse macroeconomic conditions affect bank capital ratios using a set of common assumptions and balance sheet decision rules.[4] The exercise used the Current Policies and Delayed Transition macroeconomic climate change scenarios from the CVA (as discussed above), along with a baseline scenario of steady growth, no macroeconomic shocks and no change in climate risks.[5] The CVA scenarios, in particular the Delayed Transition scenario, were devised with a focus on key regions for exploratory analysis. As such, they contain known limitations and this exercise was

**Figure 2: Housing Price Effects of Physical Risk***




* Estimated effect of increased climate hazard risk on housing values in 2050, by postcode, relative to current climate hazard risk.

Sources: ABS; RBA; XDI-Climate Valuation

undertaken primarily with a view to testing analytical methods.

To better capture the physical climate risks to residential housing, we overlaid the housing price falls in the CVA scenarios with climate hazard data provided by XDI Climate Valuation and Munich Re.[6] These hazard data measure the expected increase in insurance costs due to climate-related damage – for example, more frequent flooding or more damaging cyclones – and were translated into housing price falls using the user cost method as described in Fox and Tulip (2014) and Bellrose *et al* (2021).[7] This was calculated at the postcode level of geographical disaggregation for the XDI Climate Valuation hazards and the SA3 statistical area level for the MunichRe hazards. Figure 2 shows the estimated housing price impacts in 2050 due to increased physical climate risk using data from XDI Climate Valuation, noting that the equivalent Munich Re data provides very similar results. These estimates suggest that around 7.5 per cent of properties are situated in postcodes that could see property price effects of 5 per cent or more, relative to the case where there is no change in climate risks from current levels.[8]

Graph 2 shows the effect of the climate scenarios on banks' CET1 ratios relative to the baseline scenario for the case of the XDI Climate Valuation hazard overlay. The MunichRe hazards show an almost identical pattern. In the Current Policies scenario there is a small fall in the aggregate CET1 ratio, but banks do not experience significant deteriorations in capital. While we might expect minimal effects in the near term under this scenario, the lack of impact on bank capital in later periods raises questions about how well physical climate shocks have been captured. The Delayed Transition scenario shows a pronounced, albeit small, fall in

capital as the peak climate transition shock occurs around 2030–2031. The results appear to be driven by the aggregate macro-economic conditions in the scenario, rather than region or sector-specific risk overlays. In neither case, however, do banks experience severe stress.[9]

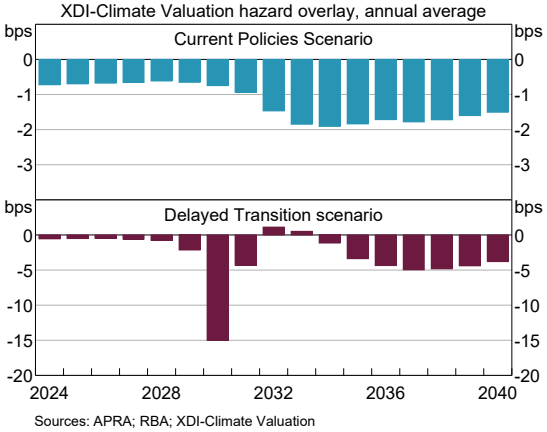
There are some important caveats to these results. Within the scenarios, physical risks to businesses are not captured due to a lack of data on the locations of business assets. In addition, the model contains an implicit assumption of full insurance; in other words, it assumes dwellings are not destroyed or can be rebuilt (and without frictions in the process). As a result, the Current Policies scenario in particular may underestimate the impact of physical risks on banks' CET1 ratios. The availability and extent of insurance is an important factor to consider in future work as it involves the transfer of risk – if a dwelling becomes effectively uninsurable, the risks from physical damage are transferred to the homeowner and to banks if the asset is collateral for a loan. Finally, only credit risk is captured using this framework. A fuller analysis would consider other metrics like liquidity risk and market risk, as well as hard to quantify factors such as legal or reputational risk.

In general, models such as the Bank's macrofinancial stress-testing model require significant amounts of macroeconomic stress, typically associated with severe but plausible recessions, to generate material deteriorations in bank capital. The climate scenarios used in this exercise did not contain the amount of stress that would generate significant losses in traditional macrofinancial stress testing.[10] This should not be read as saying that climate change could not cause significant losses, but rather that the development of climate scenarios is an ongoing process and future iterations may better capture the extent of second-round effects, better account for interactions between climate shocks and wider macroeconomic downturns, and contain higher frequency data to avoid smoothing over periods of financial stress. Climate shocks are also expected to have localised effects that could have larger impacts on smaller regional lenders; however, these were not examined in this analysis, and may require a different analytical approach such as regionally disaggregated models or local case studies.

**Graph 2**

**CET1 Ratio Deviation From Baseline**

XDI-Climate Valuation hazard overlay, annual average




Sources: APRA; RBA; XDI-Climate Valuation

The results described here were broadly in line with those found in the CVA and the earlier results reported by Bellrose *et al* (2021). However, it is important to note that the work to date has been largely exploratory in nature as researchers develop and improve analytical techniques and fill data gaps for capturing climate risks. A number of limitations and areas for development have been repeatedly noted, including the availability of appropriate data, the need to adapt bank risk models for longer time horizons and the omission of second-round (or 'spillover') effects.

## Climate change risks for non-banks

To date, most analysis of climate-related financial risks has focused on the banking system. However, understanding the impacts of climate change on other participants in the financial system – including insurers and asset managers – is important for assessing financial system risks.[11] In 2022, the NGFS's international survey found that only around one-third of initial climate scenario analysis exercises included the insurance sector, with far fewer including other non-bank institutions (FSB and NGFS 2022).

Insurers are exposed to climate change as underwriters of insurance products. More frequent or more severe weather events are expected to increase claims on damaged property and other assets. Given this increased risk, insurers are likely to increase premiums to cover their expected claims. Australian insurers also partly rely on reinsurance

contracts to meet payouts for large events; as these events become more frequent, reinsurers may raise prices or reduce the cover they offer, which would affect the price and availability of domestic insurance. However, insurers' ongoing exposure to physical climate risks is limited because the majority of general insurance contracts in Australia are written year to year (ICA 2022). This means that insurers can pass on increased costs to their customers or withdraw coverage from high-risk regions to adapt to changing climate risks.

As insurance costs rise and availability declines or becomes less certain, some households and businesses may choose to reduce their coverage, resulting in higher rates of non-insurance and under-insurance. These parties will bear more of the costs in the case of a severe climate event and these costs may be passed on to lenders in the case of loan defaults where affected assets are used as collateral (Kearns 2022).[12] This reflects a tension between annually renewed insurance contracts and long-term bank loans and has implications for who bears the risks from climate change and how these risks are managed.

In response to challenges related to the affordability and availability of insurance, governments in Australia and overseas have generally aimed to either reduce the costs of natural disasters or to expand insurance availability. The cost of natural disasters may be reduced through mitigation measures (such as retrofitting homes for cyclone resilience) and managed retreat, which involves moving vulnerable people and assets away from high-risk areas. Managed retreat can include land buy-backs, relocations or land swaps as in the case of Grantham, Queensland following severe flooding in 2011 and more recently in northern New South Wales following flooding in 2022 (Moore 2020; Cross and Herbert 2023). In response to concerns about the diminishing availability of insurance, some governments abroad have created government-run insurers and government-backed reinsurance pools, and have provided direct subsidies or rebates (ACCC 2020). In 2021, a cyclone reinsurance pool was introduced by the Australian Government (Treasury 2021).[13] International examples include the FloodRe scheme in the United Kingdom and the National Flood Insurance Program in the United States. To help manage financial risks for government-sponsored schemes and encourage adaptation, some schemes include lower premiums for mitigation measures and exclude properties built in high-risk areas after the scheme was introduced (ACCC 2020).

Insurers are also exposed to climate risks through the large asset portfolios they hold to cover expected claims, which are vulnerable to significant falls in value. The risks to this part of their operations are similar to those facing other asset managers such as superannuation funds, although Australian insurers typically have asset allocations skewed towards lower risk assets. Physical climate risks can cause the value of property and infrastructure assets to fall, whether through direct damage or reduced productivity. Transition risks may affect the valuation of firms, especially in emissions-intensive sectors, both through decreased profitability (if, say, an emissions price is introduced and emissions-related business costs increase) and through changes in investor preferences. A severe stress scenario could see the asset management sector amplify a negative shock through fire sales of assets, increasing systemic risk and leading to a 'green swan' event (Bolton *et al* 2020; OECD 2021).[14] In a less severe illustration of the scale of potential losses, the Bank of England's 2021 Climate Biennial Exploratory Scenario modelled insurers' asset values falling between 8 per cent and 15 per cent across three different scenarios (Bank of England 2021).

## Next steps for climate risk analysis

As noted above, the majority of analytical work to date, in Australia and internationally, has found limited impacts from climate risks for financial stability at a system level. However, these exercises have largely been designed to build capacity, develop frameworks and identify issues and constraints with existing risk-analysis methods. These exercises have yielded a common set of recommendations to enable more rigorous assessment of climate risks: filling data gaps; introducing common reporting and disclosure standards; and developing more comprehensive climate scenarios.

### Filling data gaps

Climate change is a global phenomenon and impacts multiple sectors, markets and jurisdictions. However, the effects of climate change may vary substantially between geographic locations and economic environments. To accurately capture financial institutions' potential exposures to climate risks, institutions and regulators will require new and detailed data.[15] For example, assessing firm-level climate exposures will require granular data on firm-level emissions, transition plans and the location of assets. Consistent analysis across industries and countries will require comparable data – for example, emissions will need to be measured in the same way. In some cases, analysis will require data not previously collected by regulators, such as information on insurance coverage. Financial institutions themselves are likely to want these data for their own risk-management purposes, while regulators need to combine the various data sources to accurately capture potential exposures of financial firms and the risk across the system. The task of gathering and managing appropriate access to these data will be made easier by consistent reporting.

### Introducing reporting standards

Part of the solution to filling data gaps is to introduce a common framework for reporting climate risks. Climate risk disclosures should be consistent and comparable between firms, industries and countries to allow for the global nature of climate shocks and financial linkages. The Taskforce on Climate-related Financial Disclosures (TCFD) has prepared a set of recommendations for best practice, aimed at creating a global standard (TCFD 2017). Domestically, current guidelines from the Australian Securities and Investments Commission encourage listed companies to use the TCFD recommendations as the primary framework for voluntary climate change-related disclosures (ASIC 2021). The Australian Treasury is consulting on a climate risk reporting framework that outlines standardised, internationally aligned requirements for disclosure of climate-related financial risks by large businesses and financial institutions while minimising the regulatory burden (Treasury 2022). This framework will be based on TCFD principles, with the flexibility to adapt to changes in global best practice.

### Improving scenario analysis

Scenario analysis has emerged as a leading approach for assessing climate risks to the financial system. However, robust scenario analysis requires appropriate scenarios tailored for different jurisdictions. It is becoming widely recognised that climate impacts can differ substantially between regions and industries, and even within industries – for example, between firms using energy-efficient best practice and those relying on older technology. There are numerous uncertainties in mapping the impact of climate change to financial stability, from understanding how weather patterns will change in a warming climate, to the adaptation measures taken by governments and others and the effects this will have on economies and financial markets, through to the impact on individual financial institutions and financial stability.

There are several approaches available to better understand the range of possible outcomes. These include examining results over different time horizons, looking at distributions of outcomes rather than just the central tendency, and using a wider range of models. This will require a multi-faceted approach combining elements of climate science, economics, finance and regulation. Finally, having access to sufficiently detailed data and disclosures will support the preparation of more comprehensive and detailed scenarios, allowing regulators and financial institutions to better assess the implications of how climate change will affect systemic risk.

## Conclusion

Climate change introduces new sources of risk that financial authorities and institutions need to monitor and manage. In Australia and around the world, quantitative analysis undertaken to date has found relatively minor impacts on financial stability at a system level, although several analyses have noted uneven impacts across geographic areas and industries. However, these exercises have encountered limitations and have largely been

aimed at building capacity and identifying knowledge and information gaps. Improved data availability, aided by comprehensive and consistent climate risk disclosures, will help the development of climate scenario analysis and other modelling and monitoring techniques. Coordination across the public and private sector, along with continued engagement with global best practice, is critical to the effective monitoring and ultimately management of climate risk in the Australian economy and financial system.

## Endnotes

[*] The authors undertook this work while in Financial Stability Department. They would like to thank Michelle Lewis, Anna Park, Andrea Brischetto, Brad Jones and colleagues at APRA for their contributions. They would also like to thank XDI-Climate Valuation and MunichRe for supplying data used in this work.

[1] Financial regulators typically view climate risks in terms of their effects on the traditional categories of credit risk, market risk, liquidity risk and operational risk (BCBS 2021). For example, a fall in the value of collateral due to climate change increases credit risk, while write-downs to the value of financial assets is a type of market risk. Reputational and litigation risks are sometimes separated from operational risk as discrete categories.

[2] The NGFS was created in 2017 by a group of eight central banks and supervisors, and now contains over 120 members. The Bank has been a member of the NGFS since 2018 and contributes to multiple work streams.

[3] This accounted for direct greenhouse gas emissions from operations and production, and indirect emissions from inputs and the upstream supply chain.

[4] The core of the stress-testing model involves mapping a scenario for GDP, the unemployment rate and property prices to three key variables: bank profits; the amount of profits retained as capital; and the change in banks' risk-weighted assets in response to the macroeconomic conditions. These three variables can then be used to estimate how banks' capital ratios change quarter to quarter in the model.

[5] The baseline scenario was also provided by APRA but did not form part of the CVA exercise.

[6] The hazard data provided by XDI-Climate Valuation covered coastal flooding, riverine flooding, surface water flooding, extreme wind and forest fire. Other hazards provided, which may damage structures without a severe event, were freeze-thaw cycles and soil subsidence. MunichRe provided data on riverine flooding and tropical cyclones.

[7] Intuitively, this can be thought of as a decrease in the capital value of a property as higher future insurance costs increase the cost of servicing the property.

[8] This is not to say that property prices fall by 5 per cent, as both scenarios anticipate property prices to rise over time. Rather, it indicates that, due to increased physical climate risks, the level of property prices is 5 per cent lower than it would have been in the hypothetical case where there is no change in physical climate risks from current levels out to 2050.

[9] The peak fall in banks' capital ratios modelled in this exercise was 15 basis points on an annual average basis. By comparison, modelling of a severe downside scenario during the COVID-19 pandemic resulted in banks' CET1 ratios falling almost 200 basis points (Garvin *et al* 2022). The average CET1 ratio of banks in the model is currently around 11.6 per cent.

[10] Previous research has found evidence supporting the 'double trigger' hypothesis that mortgage defaults require both negative equity and a reduction in borrowers' ability to repay their mortgage (Bergmann 2020). In the current exercise, neither condition reached levels seen in previous stress events.

[11] In its recent Supervisory Priorities publication, APRA indicated that it is considering a climate vulnerability assessment for the insurance sector in 2023 (APRA 2023).

[12] This also raises distributional and affordability issues. An Actuaries Institute report found that the households that are already struggling to pay home insurance premiums will be most affected by the impacts of climate change on home insurance premiums (Actuaries Institute 2022).

[13] This covers property damage caused by cyclones and cyclone-related flood damage, with the goal of improving accessibility and affordability of insurance for households and small businesses in cyclone-prone areas. The pool is backed by a government guarantee and is designed to decrease premiums in cyclone-prone regions. One desired outcome is a reduction in under-insurance and non-insurance in affected regions.

[14] A 'green swan' refers to a potentially extremely disruptive financial event, triggered by a climate shock, which could lead to a systemic financial crisis. See Bolton *et al* (2020) for more detail.

[15] See FSB (2021) for a full discussion about data needs for monitoring and assessing climate-related risks to financial stability.

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