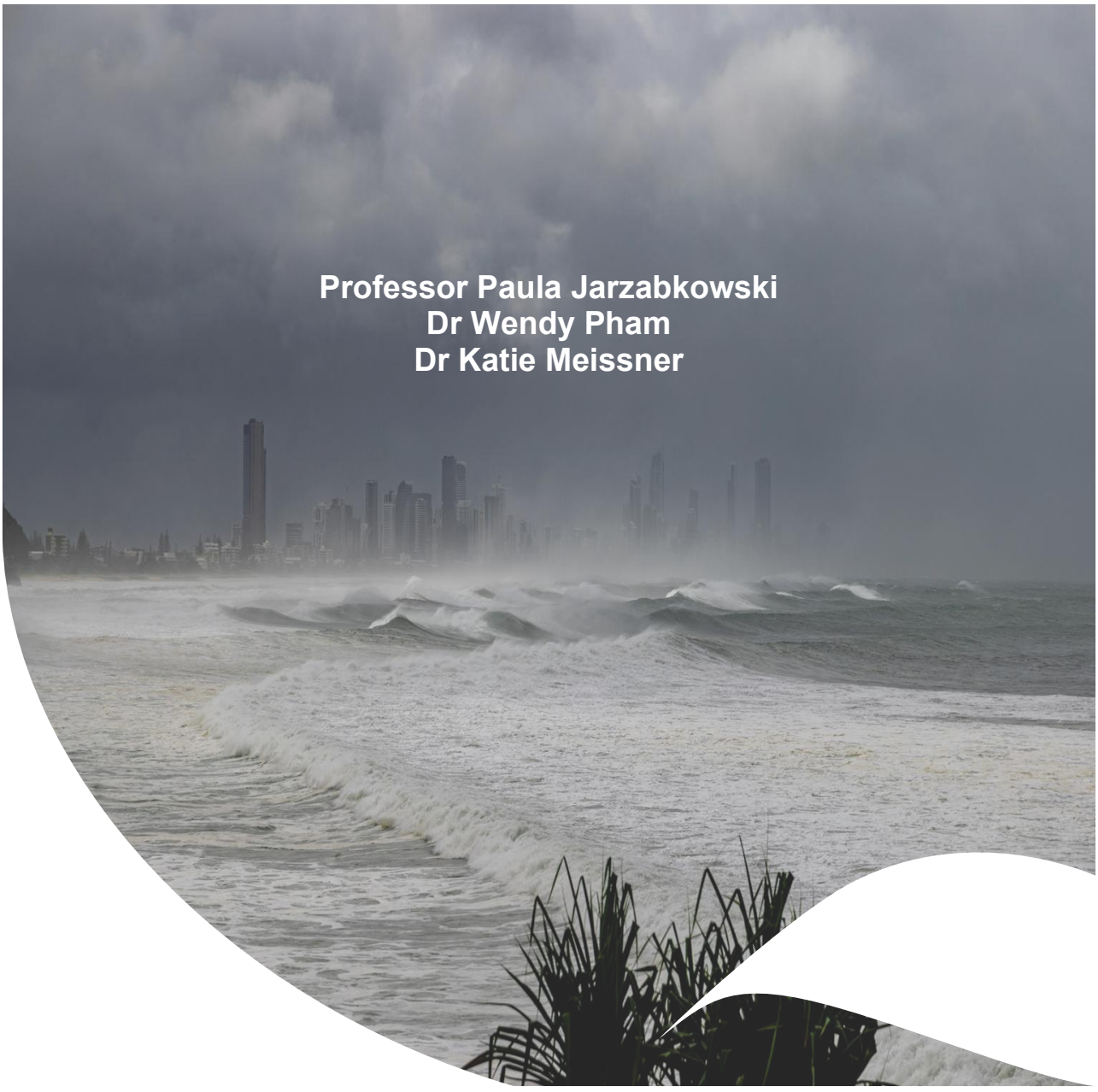
January 2026

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA
CREATE CHANGE

BUILDING RESILIENCE: Linking Disaster Insurance and Risk Mitigation for a Sustainable Future



Professor Paula Jarzabkowski
Dr Wendy Pham
Dr Katie Meissner

Contents

Tables

Figures

Disclosure statement

This research program is a collaboration between the University of Queensland (UQ) and the Australian Reinsurance Pool Corporation (ARPC). While the report, and the associated research program, is sponsored and endorsed by ARPC, all insights and findings are drawn from independent work conducted by the authors at UQ and are not influenced by ARPC.

Acknowledgements

The authors thank Patricia Sheehan for her valuable work as research assistant on this project.

Acknowledgement of Country

We acknowledge the Traditional Owners and their custodianship of the lands on which this project originated. We pay our respects to their Ancestors and their descendants, who continue cultural and spiritual connections to Country. We recognise their valuable contributions to Australian and global society.

Suggested citation

Jarzabkowski, P., Pham, W., & Meissner, K. (2026). *Building resilience: Linking disaster insurance and risk mitigation for a sustainable future*. The University of Queensland.

Executive Summary

Extreme weather events and natural hazard-related disasters are increasing in frequency and severity across the globe, placing growing pressure on economies and societies. Disaster insurance is a key tool to address disaster vulnerability and support resilience of individuals and communities to natural hazards. Yet the disaster insurance landscape in Australia, and globally, is becoming increasingly unsustainable – characterised by rising premiums, market withdrawals, and widening protection gaps that disproportionately affect members of vulnerable and often culturally diverse communities. This has widespread impacts on the property market and homeownership, which in turn have social implications for both individual property owners and society as a whole.

This report explains why disaster insurance is a societal good, articulates the trade-offs involved in sustaining a viable and inclusive property insurance sector, and provides a framework for insurance industry, government, and consumer collaboration in a sustainable disaster insurance system.

First, disaster insurance is established as a societal good, demonstrating that a sustainable and inclusive insurance system delivers benefits far beyond the private financial interests of individual policyholders. At the individual and household level, insurance supports post-disaster reconstruction and recovery, while also facilitating psychological wellbeing and long-term stability through enabling access to mortgage and homeownership. At the community level, it underpins community recovery, social cohesion and collective confidence in the face of increasing disaster risks. Beyond this post-disaster role, insurance contributes to financial and social inclusion and stability by helping individuals and communities access the resources and protections necessary to fully participate in society.

Second, on the basis that disaster insurance is a desirable societal good, four key and interlinked trade-offs in maintaining a sustainable and inclusive insurance sector are explored:

1. **Insurance provision and risk sharing:** Balancing the roles and interests of the public and private sectors in ensuring sustainable insurance provision and affordability.
2. **Risk pricing approaches:** Weighing up the principles and consequences of risk-reflective and solidarity approaches to premium pricing.
3. **Risk reduction linkages:** Aligning financial protection with physical mitigation measures and exploring the role of insurance as a possible lever for risk reduction.
4. **Insurance continuity:** Maintaining long-term enrolment and protection for the majority of the population while managing the constraints of annual or fixed-term nature of insurance policies.

Third, a framework is provided for recognising and managing the key decisions within these trade-off areas, to help foster collaboration between the insurance industry, government, and consumers in designing solutions for a more resilient and equitable insurance system. Finally, the perspectives of these different stakeholders are explained, identifying their distinct needs and priorities as well as their potential use of these trade-offs as a tool for collaboration. The report concludes with reflections on ways forward, highlighting key areas for future research to advance a more sustainable and inclusive insurance system.

Section 1: Introduction – an unsustainable disaster insurance landscape

Extreme weather events and natural hazard-related disasters are increasing in frequency and severity across the globe, placing growing pressure on economies and societies. The International Disaster Database EM-DAT reported 393 natural hazard-related disasters worldwide in 2024, with economic losses totalling US$242 billion.[1] This represents an increase compared to the annual average of 371 disaster events and losses of US$210 billion recorded between 2004 and 2023. These global trends are mirrored in Australia, where both the number and cost of disaster events are on the rise. It is estimated that natural disasters will cost Australia at least AU$73 billion by 2060.[2] However, referring to these as 'natural' disguises the fact that disasters are socially constructed – vulnerability to them is an economic problem with deep social roots, stemming from systemic failures in risk management, development planning, and resource allocation.[3] Disasters have widespread adverse effects on socio-economic systems,[4] often amplifying and exposing existing inequalities among affected populations.[5] In response, disaster victims are increasingly directing blame towards the actions (or inaction) of key industry and governmental institutions, rather than attributing losses to 'acts of God'.[6]

Disaster insurance is a key tool to address disaster vulnerability and support resilience of individuals and communities to natural hazards. Insurance is typically associated with increased financial resilience to disasters because it enables financial planning for policyholders while providing post-disaster funds for reconstruction. Yet the links between insurance and resilience are more complex, encompassing physical, emotional and social dimensions as well. In particular, assurance of post-disaster financial recovery is integral to the wellbeing of individuals, households, businesses, and communities. Building on this premise, disaster insurance, as a key source of that assurance, is more than simply a financial product for individuals. Rather, it is a societal good that needs to be sustained.

Yet the disaster insurance landscape in Australia, and globally, has become increasingly unsustainable due to issues of affordability and availability. Around 15% of Australian households are experiencing extreme home insurance affordability stress, with an average of 9.6 weeks of gross annual income needed to buy an insurance policy to cover their key disaster exposure.[7] Meanwhile, insurers are withdrawing from high-risk regions, leaving properties under-insured or uninsured.[8] Insurance affordability and availability pressures have widespread impacts on the property market and homeownership, which in turn have many social implications (see Section 2).

Given these climate and development effects that are rendering the current disaster insurance landscape unsustainable, this report aims to explain why disaster insurance should be regarded as a societal good, and to articulate the trade-offs involved in sustaining a viable and inclusive property insurance sector. Section 2 explains the links between disaster insurance and individual wellbeing, community wellbeing, and financial-social inclusion. Section 3 identifies four key areas of trade-offs that need to be addressed to make disaster insurance sustainable: 1) the roles of public and private sectors in insurance provision and risk sharing; 2) approaches to risk pricing that balance risk-reflective and solidarity principles; 3) the integration of financial and physical risk reduction; and 4) challenges in maintaining continuous enrolment of the population in insurance. The section concludes with a framework to support collaboration in managing these trade-offs. Section 4 considers the perspectives and interests of key stakeholders – insurers, governments, and consumers – whose collaboration is essential to any long-term solution. Finally, Section 5 offers concluding reflections and outlines key areas for future research to advance a more sustainable and inclusive disaster insurance system.

Section 2: Disaster insurance – moving beyond an individual's financial product to a societal good

Property insurance is typically a financial product purchased by individual property owners to protect their homes, assets and/or businesses against future misfortunes such as natural disasters. The decision to take out or renew an insurance policy is often viewed as a matter of personal responsibility, subject to an individual's financial capacity and risk aversion.[9] From this perspective, insurance functions much like any other market commodity: people choose to buy it if they can afford it and perceive sufficient value in the protection it provides.

Yet, disaster insurance extends beyond the private financial interests of individual policyholders. Sustaining a viable insurance system has broader societal implications, underpinning community recovery, social stability and economic resilience in the face of growing disaster risks. A well-functioning insurance market not only supports individuals to rebuild their homes and lives after a disaster but can also reduce pressure on public spending and expedite community recovery process.[9] By contrast, an unsustainable insurance market, where insurance is unaffordable or unavailable for those at most risk, can erode social cohesion and resilience. When large segments of the population, particularly members of vulnerable communities, are priced out or excluded from insurance coverage, disaster impacts are amplified, recovery becomes uneven and inequitable, and public resources are stretched thin.

This section explains three key reasons why sustainable and inclusive disaster insurance can be regarded as a desirable societal good rather than merely a private financial product, by examining its links to (1) individual and household wellbeing, (2) community wellbeing, and (3) financial and social inclusion.

2.1. Insurance and individual-household wellbeing

Insurance plays a vital role in supporting individual and household wellbeing, particularly in the context of increasing climate-related risks. One of the key ways insurance contributes to individual wellbeing is by mitigating financial stress, which is closely linked to psychological distress. Research shows that financial worries (for example, the costs of home repair following a weather event) are significantly associated with higher levels of psychological distress, especially among unemployed or lower-income households who often have fewer financial buffers.[10] Conversely, favourable financial conditions, such as having an insurance policy that supports financial capacity for recovery, are associated with a lower risk of depression and reduced anxiety levels.[11] Insurance not only supports post-disaster recovery but also provides property owners with pre-disaster assurance against future losses, representing a sense of security and control in uncertain circumstances. As such, insurance contributes to policyholders' peace of mind prior to disasters as well as their emotional recovery and confidence to move forward in the aftermath.[12]

This pre-disaster assurance also makes insurance integral in enabling access to secure housing – a key determinant of wellbeing across an individual's life course from young adulthood through to retirement.[7] Home insurance is typically a prerequisite for mortgage loans, making it a critical step towards homeownership, which in turn supports individual stability and broader family wellbeing.[7] [13] Stable and affordable housing is also strongly linked to improved financial security, physical and mental health, and overall quality of life.[14] [15] These findings highlight that insurance is not merely a financial product but a crucial instrument for enhancing psychological resilience, household stability, and long-term individual wellbeing.

Nevertheless, an ill-managed or inequitable insurance system can also lead to negative impacts on individual and household wellbeing. While insurance is not a perfect product nor a universal necessity, its absence or inaccessibility can deepen existing inequalities. When coverage is limited to those who can afford high premiums, disadvantaged individuals and households are effectively denied a critical safety net that enables recovery after disasters.[16] For those who do hold policies, complex claims processes and prolonged disputes with insurers can become major sources of stress, compounding the emotional and financial toll of disaster experiences.[17] [18] Vulnerable households, such as those of low socio-economic status

or culturally and linguistically diverse communities, often face power imbalances when negotiating with private insurers due to limited risk expertise and insurance language literacy.[19] Ultimately, while insurance is one important source of individual wellbeing, an inequitable insurance market risks widening the wellbeing gap among individuals of different socio-economic groups,[20] undermining both personal resilience and broader community recovery.

2.2. Insurance and community wellbeing

The impact of insurance on community wellbeing is also evident in post-disaster recovery and resilience. By enabling restoration of the built environment, insurance facilitates the re-establishment of vital community infrastructure and services, allowing people to return to their homes, schools, and workplaces.[21] This restoration not only supports physical safety but also promotes social connectedness by enabling individuals and families to re-engage with their local networks and routines. Continuity in the aftermath of disruption is essential in helping to maintain a functioning society and ensuring that communities can rebuild with a sense of stability and cohesion.[22]

In addition, insurance contributes to the social wellbeing of communities by supporting businesses' economic recovery. The viability of small businesses is especially important in post-disaster contexts, as they provide employment, essential services, and social gathering points that help communities reconnect and thrive.[23] When these businesses are able to reopen quickly due to timely insurance payouts, they can anchor a return to normality and stability in affected areas.[24] Thus, through both direct financial support and broader contributions to social infrastructure, insurance helps sustain and rebuild the social fabric of communities in times of disaster, fostering both economic resilience and collective wellbeing.

However, when insurance is inaccessible to an increasing share of the population, the opposite effect can occur, undermining collective wellbeing and widening social disparities. Limited insurance coverage in high-risk areas due to issues of affordability or availability can leave households and local businesses without the financial means to repair or rebuild, prolonging displacement and economic disruption.[8] This exacerbates inequalities as non-insurance is prevalent among disadvantaged communities, who are often located in disaster-prone regions.[25] Evidence from research also shows that communities with higher social vulnerability scores (encompassing socio-economic status, household characteristics, racial and ethnicity composition, housing, and transportation variables) tend to experience more denied claims of post-disaster insurance payouts.[26] In addition, there is a misfit between the insurance industry and Indigenous communities due to divergent views about land possession and cultural values of assets and places, which in turn may lead to the systemic exclusion of Indigenous communities, their lands and cultural assets from disaster insurance coverage.[27] [28] These findings demonstrate the duality of insurance in expediting community recovery while potentially amplifying social disparities.[19] An unsustainable and inequitable insurance system can perpetuate cycles of vulnerability and marginalisation, restricting opportunities for disaster recovery and collective wellbeing of disadvantaged communities.

2.3. Insurance and financial-social inclusion

In addition to its impacts on wellbeing, insurance also plays a critical role in advancing both financial and social inclusion by helping individuals and communities access the resources and protections necessary to fully participate in society. As discussed above, insurance is often a prerequisite for accessing mortgages, which are key to securing stable housing. Secure housing in turn provides a foundation for maintaining familial and social relationships, accessing healthcare and education, staying connected to employment networks, and enhancing social cohesion.[29] Thus, from a societal perspective, broad access to insurance supports more equitable participation in the economy and in society. Indeed, holding insurance can also serve as a social signal of being a responsible member of society, while those who do not hold insurance can be disparaged as irresponsible,[20] reinforcing insurance as a source of inclusion within societal structures.[30]

However, the relationship between insurance and financial-social inclusion is complex and shaped by systemic inequities. As discussed above, those without insurance – often lower-income households, small businesses, or disadvantaged communities in disaster-exposed areas that have cheaper housing stock – face greater losses and are less able to recover from setbacks, thereby limiting their capacity to improve their financial and social standing. This inequity is especially stark following weather-related disasters, which tend to have a disproportionate impact on already vulnerable populations.[31] [32] The broader community also bears the cost of these disasters through depreciating property values, increased insurance premiums, and public spending on recovery.[33] Moreover, when insurance is withdrawn at a large scale in high-risk regions, this devalues people's largest financial asset – their homes – which can undermine the property market and put the broader economy at risk given the banking sector's heavy reliance on mortgage lending.[8] [34] As population growth increasingly drives housing into higher-risk areas,[35] the need for sustainable and inclusive insurance systems becomes even more urgent, not just to protect individuals, but to promote resilient and equitable societies overall.

Section 3: Key trade-offs in making a sustainable and inclusive insurance sector

In principle, the insurance market is built upon the privatisation and individualisation of risk and responsibility.[25] It assumes 'a level playing field of individual rational agency',[25] whereby individual property owners are capable of understanding and managing their own risk, and responsible for making rational decisions regarding insurance purchases. However, in the face of climate change and escalating disaster risks, insurance premiums have surged to unaffordable levels, while insurers increasingly withdraw from offering policies in regions deemed too high-risk.[8] The 'playing field' is no longer level, and a growing proportion of the population, particularly vulnerable individuals and communities, are effectively excluded from the insurance system and its critical protection, which can lead to negative implications for individuals, communities, and financial and social inclusion (see Section 2).

There is no simple solution to the problem of increasingly unaffordable and/or unavailable disaster insurance. The sources of the problem are complex and compounding, arising from increasingly severe weather events, a legacy of existing properties that were not built to be resilient to these weather conditions, growing urbanisation, and pressure to increase housing in high-risk areas.[36] In such conditions, potential solutions will be multi-faceted and will involve trade-offs.

Trade-offs are defined as 'compromise situations when a sacrifice is made in one area to obtain benefits in another'.[37] Trade-offs are a helpful lens for addressing complex or 'wicked' problems, such as how to sustain an inclusive disaster insurance system. Trade-offs provide the basis for collaboration by acknowledging different stakeholders and their interests. In particular, trade-offs enable stakeholders to acknowledge the competing demands that need to be addressed and consider how these might be balanced at any moment in time or addressed sequentially to meet different interests over time.

Any potential solution for the issues facing the disaster insurance sector will bring variable benefits and detriments to different stakeholders, necessitating trade-offs, as it will not be possible to satisfy all stakeholders simultaneously. We therefore express the key challenges to be addressed in generating a sustainable and inclusive disaster insurance sector for societal good through the lens of multiple trade-offs (see Table 1).

Table 1: Key trade-offs involved in sustaining disaster insurance for societal good

Trade-offs	Key decisions
Trade-off 1: Insurance provision and risk sharing	1a. Who will hold the (uninsurable) risk and where in the risk-transfer chain, to ensure the continuity of insurance provision – the public or private sector? 1b. To what extent, and for how long, should the risk be shared to sustain the insurance market?
Trade-off 2: Risk pricing	2a. How should premiums be priced – risk-reflective or solidarity pricing? 2b. Who should be responsible, thus paying, for risk exposure – the individual or the collective?
Trade-off 3: Risk reduction	3a. Who should be responsible for risk reduction? 3b. How can insurance become a lever for risk reduction?
Trade-off 4: Insurance continuity	4. How do we balance continuous protection with fixed-term insurance contracts, to maintain the majority of society in insurance for the long term?

3.1. Trade-off 1: Insurance provision and risk sharing between public and private sectors

On the basis that disaster insurance is a desirable societal good, a key consideration when insurance becomes increasingly unaffordable or unavailable is how to ensure continuity of insurance provision to the population. There are trade-offs concerning the roles of the private sector and the public sector, via the government, in ensuring sustainable insurance provision and how the input of the two sectors might be coordinated and balanced. This area of trade-offs is the focus of this section.

3.1.1. Uninsured risks already reside within the public sector

Before considering the different trade-offs involved in public or private sector ways of addressing uninsurable risks, we first emphasise that there is no 'fully private' model. Uninsured risks already reside within the public sector both because the government is insurer of last resort and because the means of addressing uninsurable risks lies, at least partially, in government legislation.

When insurance becomes unaffordable or unavailable in the private insurance sector, the government becomes, by default, the insurer of last resort.[38] While small government grants are often provided to affected residents to support minor disaster recovery and response activities in many countries, they are not usually for the more expensive costs of post-disaster home repair and reconstruction. In advanced economies, these bigger recovery expenses, including temporary accommodation while reconstruction is being done, typically come from insurance claims. However, when a growing swathe of the population does not have insurance, the burden of reconstruction falls directly on those uninsured property owners, who may lack the resources to rebuild their homes or cover rent while they are out of their homes. These costs then fall, indirectly, upon the government to provide for displaced residents, which is the meaning of the government as insurer of last resort.[39] While this does not mean the government literally provides insurance, the economic and social costs of lack of insurance resound across all levels from the local governments in which the disasters occur, to state and federal governments.[40] Hence, the costs of uninsured risks are not borne by individuals alone but are ultimately distributed across society as a whole.

Furthermore, moving from government as insurer of last resort to any formal insurance mechanism to address the protection gap typically requires government legislation. There are several examples of how insurance can be provided through some form of public sector provision or public-private collaboration. Specifically, many countries have developed 'Protection Gap Entities' (PGEs), which are government-legislated, usually not-for-profit, entities to provide insurance that would otherwise not be affordable or available in the private insurance market.[41] Examples include the Australian Reinsurance Pool Corporation (ARPC, Australia), California Earthquake Authority (CEA, USA), Flood Re (UK), and the Taiwan Residential Earthquake Insurance Fund (TREIF, Taiwan). These PGEs cover different types of risk from terrorism to flood to earthquake and have different governance models, in that some are fully regulated by the public sector, some are a public-private collaboration, and some use public-sector legislation to organise private-sector insurance capital.[36] However, they share a common feature: each was established through government legislation in response to a recognised need at the time to create a mechanism addressing a specific insurance protection gap. Hence, public sector involvement in the insurance market is essential, via government as insurer of last resort and as legislator of any mechanism to address a protection gap.[42] As such, trade-offs involved in the relationship between the public and private sectors are key to any solution to the protection gap.

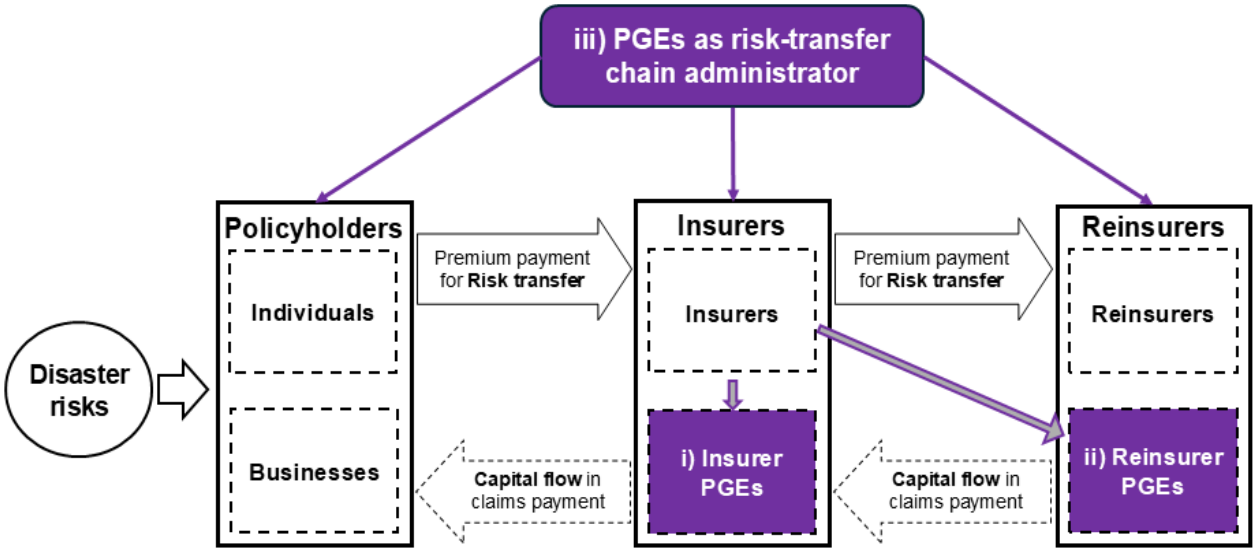
PGEs are a useful way to consider the trade-offs involved in public-private insurance provision. They come about when it becomes clear that disaster insurance is not affordable or available for a section of society, that this is not simply a failure in individuals' financial responsibilities to protect their properties, and that the market will not self-correct to address the insurance protection gap, typically because the risk is too high, volatile or systemic for policies to become affordable. At this stage, public sector involvement in the insurance market occurs, usually through some form of PGEs. As much has been written about these

PGEs,[36] [41] we will not explain their specific workings here but rather focus on how learnings from these PGEs inform the key trade-offs to be considered in balancing public-private interests in developing a sustainable and inclusive insurance sector for societal good.

3.1.2. Trade-offs over who holds risk and where in the risk-transfer chain

The first set of trade-offs are over where in the risk-transfer chain – Insurer, Reinsurer, or Administrator – any public-private collaboration should be located (see Figure 1). This is important because it specifies who will hold the otherwise uninsurable risk, meaning be on the hook for paying the claims, and where in the insurance risk-transfer chain that risk will be held. We now explain key areas of trade-offs in navigating where otherwise uninsurable risk is held between the public and private sectors.

Figure 1: Who will hold the risk and where in the risk-transfer chain [36]



1. *Insurer PGEs:* Typically, government intervention occurs because of a breakdown in the primary insurance market meaning that property owners cannot get affordable insurance. This problem can be addressed by developing a government-legislated Insurer PGE, which offers insurance policies directly to consumers for the specified risk on which there is a protection gap (Figure 1i). The Toka Tū Ake Natural Hazards Commission (NHC – previously EQC, New Zealand) and the Kantonale Gebäudeversicherungen (KGVs, Switzerland) are examples of PGEs that offer such direct insurance policies. An Insurer PGE has the most control over the availability of insurance policies because it directly offers the policies and holds risks on its balance sheet. This model can, therefore, be valuable in ensuring widespread access to and uptake of insurance against a specific hazard.[43] However, such a PGE cannot control the costs of reinsurance capital, which it is still likely to need since it will be exposed to the domestic risks in a country that is the source of the protection gap.[44] It may, therefore, struggle to keep premium prices down (unless it can also keep risks down as per Trade-off 3).
2. *Reinsurer PGEs*: One of the reasons that insurance becomes unaffordable or unavailable is that the costs of reinsurance to cover catastrophic losses such as major floods, cyclones, or earthquakes have risen, or because reinsurance is unavailable. Therefore, a government-legislated Reinsurer PGE can be formed, such as Flood Re (UK) or Caisse Centrale de Réassurance (CCR, France), to provide reinsurance to the primary insurance market on the specified risk (Figure 1ii). A Reinsurer PGE has less direct influence over availability of insurance policies, as it enables the private insurers

to continue to offer policies but incentivises them to lower their premium prices by ceding a specified, otherwise unaffordable insurance risk, to the Reinsurer PGE.[41] The Reinsurer PGE can, in turn, keep costs down because of a government guarantee, such as with Pool Re (UK), or because, as a not-for-profit (e.g., Flood Re, UK), it has a lower-cost business model than a private-sector reinsurer.

3. *Risk-transfer chain administrator PGEs:* Another option is the PGE acting as an administrator of the risk-transfer chain, lowering the friction involved in transferring risks from policyholders to insurers and ensuring reinsurance capital, but without holding any of the risks (Figure 1iii). For example, the multi-country risk pools such as Caribbean Catastrophe Risk Insurance Facility (CCRIF) do not take risks themselves but do provide the operating capital and capability to help member countries develop sovereign insurance risk policies and attract global reinsurance capital.[45] In the USA, the Terrorism Risk Insurance Act (TRIA) is also a hybrid form of risk-transfer chain administrator and reinsurance PGE. It does not hold risks, or issue insurance or reinsurance polices per se. Rather, it provides a legislative mechanism for terrorism insurance to continue to be offered and provide a backstop to manage post-disaster payment of claims before recouping the costs of any such claims arising from an insured terrorism event.[46] A risk-transfer chain administrator PGE is not typically used in the context of property insurance because it does not have any direct way of influencing the availability and affordability of insurance policies. However, it does allow an insurance market to persist that might otherwise collapse (e.g., terrorism insurance in the USA), or for an insurance market to be formed that would otherwise not exist (e.g., drought liquidity insurance in Africa). It also comes with low costs to the PGE, which does not hold the risks on its books.

3.1.3. Trade-offs over the extent and duration of public-private risk sharing collaboration

1. *Risk-sharing via Insurer or Reinsurer PGEs:* In both cases of Insurer and Reinsurer PGE, the PGE is an active participant in the insurance market because it takes either insurance or reinsurance premiums to hold some of the risks and, therefore, to pay the claims incurred from loss. Government participation in the insurance market can be exercised on a risk-sharing basis between the private and public sectors and the threshold for this sharing is a key area for considering trade-offs. The Insurer PGE can establish a threshold of how much of the otherwise uninsurable risk it will hold on its balance sheet and share the remainder with the private sector. For example, the Toka Tū Ake NHC (New Zealand) insures the first layer of homeowner natural-hazard risks, meaning that they will pay claims on all losses up to that threshold.[44] People who want more cover than that can buy above the threshold in the private sector. By contrast, Consorcio de Compensación de Seguros (CCS, Spain), insures losses on multiple hazards above a specified threshold, meaning that the private sector pays for all claims to that threshold, but higher losses are all paid by the PGE.[36]

   A Reinsurer PGE is automatically a form of risk-sharing with the private sector since the private insurers offer policies to the consumers and then cede a proportion of that risk to the Reinsurer PGE. Pool Re (UK) and ARPC (Australia) are examples where private insurers retain some of the risk for terrorism losses on their own balance sheets and cede some to the Reinsurer PGE.

   The extent of risk sharing is a key area for trade-offs since a higher proportion retained by the private sector gives them greater incentives to remain engaged with and manage risks, whereas a higher proportion to the public sector gives greater control over premium pricing and availability. Risk-sharing thresholds are not static but can be part of an evolving collaboration between public and private sectors.[41]

2. *How 'permanent' is the public-private collaboration?* PGEs are typically developed to address a specific protection gap at a point in time. Questions thus arise over whether the collaboration is considered temporary, to address a specified problem, or a more enduring feature of the insurance landscape. There are two key arguments against prolonged public sector engagement in the insurance market. First, that it may generate a crowding out effect,[38] weakening the private sector's risk appetite by removing the most volatile or problematic risks from its portfolio. This, in turn, can

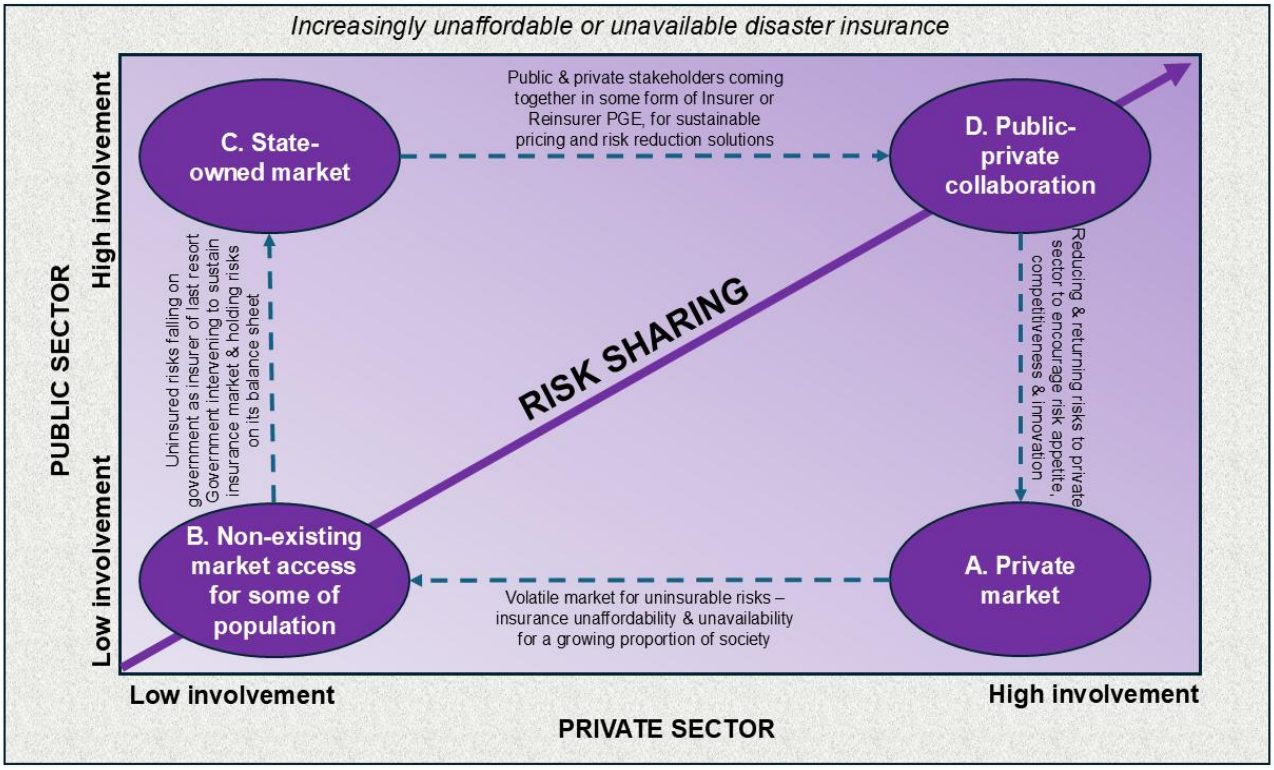
dampen private sector innovation on such risks.[41] Second, that public sector involvement and subsidisation of insurance will create the 'moral hazard' of disincentivising risk mitigation and encouraging continued building and living in high-risk areas, by artificially suppressing the insurance price signal.[38] [47] Hence, a key trade-off is considering whether the collaboration that is designed, in whatever form it takes, should be ongoing or should have a sunset clause.

Some PGEs, in France, New Zealand, Spain and Switzerland, have been designed with longevity in mind, becoming part of the economic and risk mitigation fabric of their countries.[36] The rationales for such longevity are complex but include that these protection gaps are not temporary aberrations but rather enduring features of the risk landscape, such as New Zealand earthquakes, that social and economic stability are well served by a highly-insured population over the long term, and that the risk knowledge generated by a long-term PGE can be deployed for wider physical resilience (see Trade-off 3). Enduring PGEs do not mean static since they can evolve with the evolving risk profile of a society, including taking on new risks where protection gaps emerge.

Some PGEs are designed to be, if not temporary, at least not enduring, being subject to regular government and industry reviews to determine whether they are still necessary. For example, ARPC (Australia), TRIA (USA), and Pool Re (UK) all undergo regular government reviews at which their remit may be expanded or reduced, as part of their ongoing governance.[46] These reviews thus enable a specified collaboration to expand, contract, or evolve according to changes in the insurance landscape and stakeholders' interests in that landscape. Others, such as Flood Re (UK) are designed with a sunset clause, meaning that they have a specified end date, in this case 25 years, imposed at their origin.[48] The purpose of a sunset clause is to ensure that any collaboration does not become a permanent feature of the insurance landscape, because of the potential negative consequences of reducing risk appetite in the private sector and enabling ongoing building and living in high-risk areas. The end date is intended to be an incentive for stakeholders to resolve the protection gap that led to the initial PGE.

Drawing together the above points, Figure 2 illustrates four typical scenarios with varying degrees of public-private involvement that the disaster insurance market can evolve into, and maps the relationships between these scenarios. Typically, as mapped on the horizontal axis of Figure 2, the insurance market in advanced economies operates as a private competitive market, with private insurers trading risks for profit. When disasters are relatively infrequent and randomly occurring across a population, this private market works well, with minimal public sector involvement beyond standard industry regulations and consumer protection (see Figure 2, A). However, as the disaster insurance market in Australia and globally becomes more volatile, insurance is increasingly unavailable or unaffordable to a growing proportion of the population. For this population, without any public sector intervention, access to the insurance market is collapsing or non-existent (Figure 2, B). There is thus a growing role for public sector involvement in the insurance market,[49] [50] as mapped on the vertical axis of Figure 2. As uninsured risks will fall on government as insurer of last resort, in some cases the government may step up to establish a state-owned market to control insurance affordability and availability, as seen in countries such as Spain (Figure 2, C). A purely public-sector solution means the government will have to hold the risks on its balance sheet and does not necessarily ensure a sustainable insurance market in the longer term. A more sustainable solution is for the public and private sectors to share the risks and establish a public-private collaboration though some form of Insurer or Reinsurer PGEs (Figure 2, D). Eventually, once the PGEs serve their purpose in addressing the protection gap, which will include issues of pricing (Section 3.2) and risk reduction (Section 3.3), more risks can be returned to the private sector to maintain their risk appetite, encouraging market competitiveness and competition.

Figure 2: Different scenarios of public-private involvement in sustaining the disaster insurance market



IN SUMMARY

There are trade-offs over who holds (uninsurable) risks and where in the risk-transfer chain between the public and private sectors.

- Public-private collaboration takes place through various forms of Protection Gap Entities (PGEs) – Insurer PGE or Reinsurer PGE.
- The extent of risk sharing is a key area for trade-off – a higher proportion retained by the private sector gives them greater incentives to remain engaged with and manage risks, whereas a higher proportion to the public sector gives greater control over insurance affordability and availability.
- Another key trade-off is the duration of the public-private collaboration – whether it should be ongoing or should have a sunset clause. PGEs can be designed either to evolve alongside the evolving risk landscape of a society, to undergo regular government and industry reviews for continuity, or to have a specified end date imposed at their origin.

3.2. Trade-off 2: Risk pricing – risk-reflective versus solidarity approaches

This section explains the trade-offs involved in different approaches to premium pricing on otherwise uninsurable risks. While premium pricing is complex,[50] fundamentally insurance becomes unaffordable or unavailable to some individuals because their properties are considered to have high exposure and, therefore, likely to incur claims with higher losses. In what is known as risk-reflective pricing, those individuals' premiums are higher to reflect their categorisation as high risk. By contrast, solidarity-based pricing smooths the effects of high risk by subsidising premiums to those at higher risk, typically from those at lower risk.[51] While risk-reflective pricing can be used in either the public or private sector, the mechanisms for solidarity-based pricing typically require at least some government intervention or legislation. Hence, the trade-offs in this section are linked to the decisions made in Trade-off 1 about public-private collaboration. We first define the two terms, risk-reflective and solidarity pricing, and explain their underlying principles before discussing the trade-offs they give rise to in considering which to enact.

3.2.1. What is risk-reflective pricing?

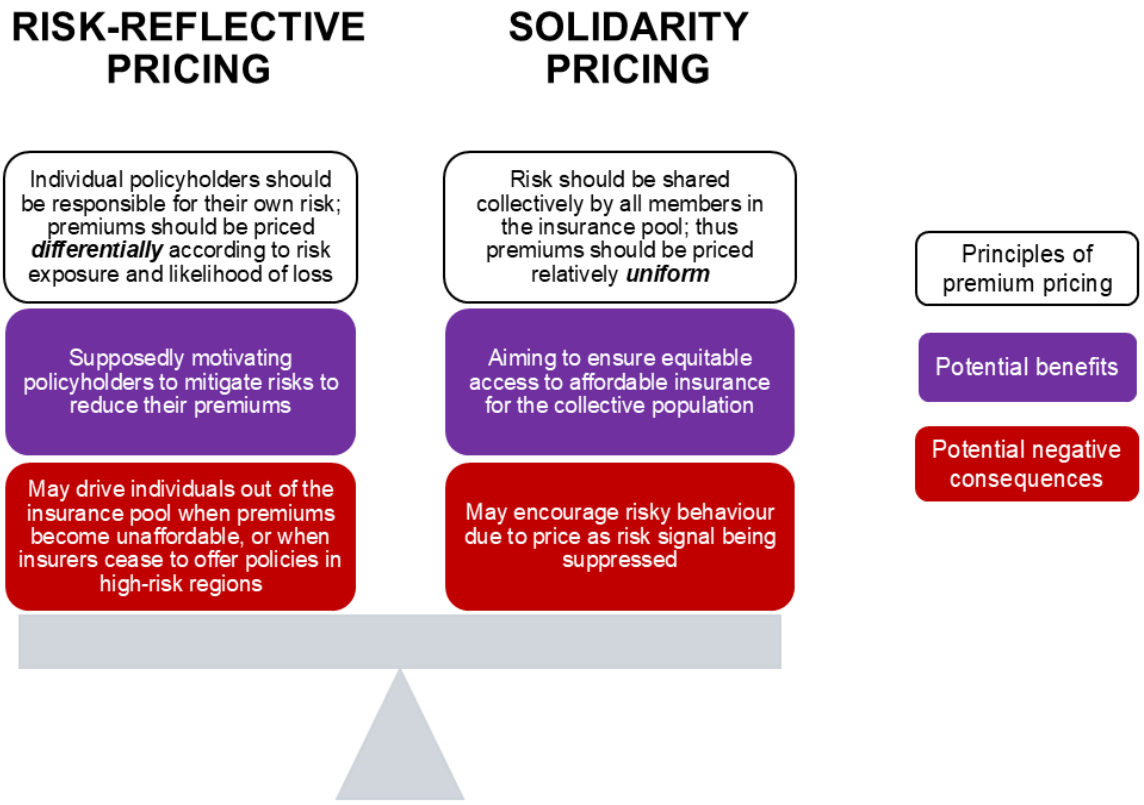
One of the major drivers of unaffordable or unavailable insurance is the rise of risk-reflective pricing. With access to ever more detailed data, the insurance industry has adopted an increasingly technical approach to modelling and pricing potential losses.[52] [53] This approach is known as risk-reflective pricing[54] and is based on modelled assessments of individual properties to determine potential losses from specific hazards.[55] [56] Properties that are not well adapted to withstand a specified hazard, such as flood or cyclone, and that are in higher-risk locations are charged higher premiums on the basis that these reflect the property's risk of damage and loss.[38] [57] The risk assessments that support risk-reflective pricing may also lead some insurers to withdraw from offering policies on properties in regions where risks are deemed particularly high, such as the withdrawal of hurricane insurance policies in Florida and wildfire policies in California.[58] Hence, risk-reflective pricing is a way that insurers use price to differentiate the levels of risk exposure in a pool of insureds and signal their assessment of specific properties and areas as high risk.

3.2.2. What is solidarity pricing?

While risk-reflective pricing is directed at charging differentially for properties based on their risk, a solidarity approach assumes that those participating in insurance share the risk similarly and hence should all face relatively uniform pricing. The underpinning principle of this approach is that disasters are considered random misfortunes that could occur to anyone.[59] Hence, instead of differentiating between individuals and pricing their participation in insurance based on their risk exposure and likelihood of loss, the guiding principle emphasises sharing the risk of loss.[60] [61] A loss to any specific individual properties is shared collectively by all members in the insurance pool.[62] [63] For example, in the Swiss cantonal insurance system and in the French CCR-backed system, all homeowners pay a flat-rate premium that protects them from disasters, regardless of the specific risk exposure of their properties.[36] The solidarity approach draws from the initial premise of insurance as a pooling mechanism, in which the premiums of the many across different risks provide a diversified pot of capital from which to pay for the losses of those few individuals who may be highly exposed to one or more of those risks.

Figure 3 depicts the contrasting characteristics of the two risk pricing approaches, which lay the foundation for the trade-offs to be considered in choosing which approach to adopt.

Figure 3: Risk-reflective versus solidarity pricing



3.2.3. Two key trade-offs – who is responsible for risk and who should pay for it?

Essentially each of these approaches to pricing is based on different concepts of how to control risk and what constitutes fairness or equity.[64] We identify two key trade-offs to consider in evaluating these two approaches. First, who is responsible for risk, which encapsulates trade-offs between price as risk signal and behavioural deterrent versus price as equitable access and inclusion. Second, who pays for risk exposure, which encapsulates how solidarity pricing is attained, and also raises the question of how affordable solidarity pricing can be sustained in the face of increasing disaster risks.[51]

1. *Who is responsible for risk?* This trade-off is grounded in different understandings about who is responsible for different risk profiles and the role of price as a means of attributing that responsibility. Under risk-reflective pricing, price is a signal of high risk and should therefore serve as a behavioural deterrent to building or remaining in areas of high risk. The assumption is that individuals are responsible for their risk exposure and should be charged accordingly. For example, a home beside a river attracts a higher flood insurance premium than a home on a hill, with everyone's premium priced according to their potential flood risk and further increased where the property has incurred flood losses.[63] [64] Risk-reflective pricing is, therefore, intended to encourage policyholders to lower their risk,[60] for example, by upgrading their homes to meet new building standards where these are available or by moving if not.[55] [56] Risk-reflective pricing holds individuals responsible for their losses, with high prices signalling people's responsibility to reduce their risk.[64] [65] Hence, the key argument against suppressing this price signal is that it will cause free riding, where insured individuals are able to remain highly risk-exposed knowing their losses are covered by subsidised insurance rather than taking responsibility to reduce their risk.[38] [66]

By contrast, solidarity pricing is grounded in concepts of equitable access to and inclusion in financial systems. From this perspective, discriminatory pricing that excludes individuals from insurance should be avoided,[65 67 68] because the reason that they are categorised as high-risk may be outside their control.[20 69] For example, older housing stock may not have been designed to withstand flood or earthquake damage, or building may have been approved in high hazard zones without consideration of resilient building codes. The costs to upgrade these properties or to move may be beyond the resources of their owners, leaving them with no way to reduce their risk.[20] Under a solidarity model, higher pricing for risk factors that are not within the control of property owners is considered discriminatory, particularly when it disproportionately affects socio-economically disadvantaged groups;[68] such as a 2022 Australian study that found that 50% of those who were uninsured were also vulnerable in terms of income security, social background, and education.[70] Inequity and financial exclusion arise when such individuals are unable to access affordable premiums and have no means to improve their risk profile.[65 67] Solidarity pricing is thus one means by which society takes collective responsibility for the financial inclusion of those individuals who are otherwise unable to participate in affordable insurance.[49]

2. *Who pays for risk exposure?* A second key trade-off in considering these two pricing models is who pays for risk exposure. Ostensibly in the risk-reflective model, everyone pays according to their specific risk exposure with those at high risk paying the most. However, this is not strictly true since, even under risk-reflective pricing, insured individuals implicitly accept at least some notion of pooling and non-differentiated pricing in which their premiums may cover other's losses in exchange for their own access to that same protection.[61] Otherwise, full risk-reflective pricing would confound the principles of insurance because those at high risk may find premiums too high and simply drop out of the pool, while low-risk individuals could choose other means than insurance to cover their potential losses so also not joining the pool.[60] Hence, even within a risk-reflective framework, all insured individuals still share some collective responsibility to pay for each other's risk.[62 71] Nonetheless, payment for risk exposure falls predominantly on the individual property owner in the risk-reflective model, and even more so when that individual falls out of the pool of insureds. Of course, as explained in Trade-off 1, when individuals are uninsured, payment for risk exposure after a loss also falls onto the government as insurer of last resort.

   By contrast, solidarity pricing is an effort to ensure collective payment towards risk exposure through risk redistribution.[72] Risk redistribution reduces payments from a highly exposed group of policyholders by subsidising them from the wider pool of policyholders. Low-risk policyholders pay a slightly higher premium, which in turn is used to subsidise affordable premiums for high-risk policyholders. While this concept of distributing risk across a pool of insureds is the basic principle of insurance, solidarity pricing goes further by deliberately subsidising from those at lower risk to those at higher risk. Since this decision to impose costs on one customer to pay for another cannot be taken unilaterally by the private sector, any such decision involves government legislation, so bringing in Trade-off 1.

   The most typical models of solidarity pricing involve PGEs, typically formed as a government-legislated insurance or reinsurance pool, that receives premiums from all policyholders and levies these to reduce pricing to those at highest risk.[36] Examples are the flood insurance scheme Flood Re in the UK, where a government-enabled levy on lower-risk policyholders subsidises higher-risk policyholders in order to offer them affordable insurance, or the KGV (Cantonal Building Insurance) in Switzerland, where a not-for-profit government monopoly makes insurance mandatory for all property owners, generating a wide pool of insureds from which premiums can be offered at a fixed affordable price to everyone regardless of their risk profile.

Highly individualised payment means people fall out of insurance, causing personal hardship as well as societal cost in both supporting recovery for those people and also loss of the societal good generated by inclusion in insurance (see Section 2). Yet subsidised solidarity pricing is not sustainable either in the face of

increasing risk exposure. As more properties become high-risk due to changing weather patterns and non-resilient buildings, the costs to the collective rise meaning that relatively low-cost subsidisation can no longer be maintained. For example, Flood Re in the UK can no longer afford its initial subsidisation of high-risk properties due to a combination of increased costs of reinsurance capital and of reconstruction alongside an increasing number of high-risk properties. It will, therefore, be increasing the costs of its premiums, particularly to those in the highest-value homes.[73] Other PGEs that adopt a subsidised model to enable solidarity pricing, such as the French CCR, are also implementing increases to cover the increasing costs of climate adaptation.[74] Hence, a solidarity model also has to account for the sustainability of payments for risk exposure. The only way to keep payments for risk exposure low over the long term is to engage seriously with not only the financial protection gap but also to address the physical protection gap, leading to our discussion of Trade-off 3.

IN SUMMARY

There are two approaches in pricing insurance premiums – risk-reflective and solidarity pricing. The decision of which pricing approach to adopt raises two key trade-offs over who is responsible for risk exposure and under what model of payment.

- Risk-reflective pricing holds individuals accountable for their risk, thus motivating them to reduce risk in ways that would lead to a tangible reduction in their premiums, but can also lead to their financial exclusion from the insurance system if their risk becomes too high to afford.
- Conversely, solidarity pricing aims to ensure equitable access to affordable insurance, but can also negate individual responsibility to contain risk by suppressing the price signal.

Neither choice is simple, as both have flow-on consequences on risk signalling and inclusion in the insurance system.

3.3. Trade-off 3: Risk reduction – linking financial protection with physical mitigation

In the above trade-offs, it is important to realise that risk transfer does not reduce risk. Focusing on disaster insurance as a financial product for a price prioritises risk transfer whilst not addressing the underlying problem of reducing exposure to growing climate-related risks.[75] Building from Trade-off 2, therefore, we emphasise that risk-reflective pricing will continue to widen the financial protection gap without physical mitigation of risk. While solidarity pricing may bridge that financial gap, it will become unsustainable due to population growth, increased demand for dwellings, and changing weather patterns, meaning a growing number of properties are at risk of loss. In a time of escalating disaster risks, the only way that insurance can remain sustainable is to reduce physical risk of loss.

Yet, insurance has typically had few levers by which to mitigate the physical risk of properties.[38] [76] Furthermore, data on risk mitigation at either the infrastructure level, such as levee banks and drainage systems, or the property level, such as build-back-better and resilient homes' initiatives, are often sparse, not publicly available, or not provided in ways that can feed directly into insurance pricing models.[77] [78] Hence, the next key area of trade-offs in maintaining disaster insurance as a societal good is moving beyond insurance as primarily a mechanism for financial coverage to being one for physical risk reduction. To reduce the physical risk of properties, it will be necessary to establish who is responsible for risk reduction and understand how insurance can absorb a level of responsibility in becoming a lever for risk reduction.

3.3.1. Who is responsible for risk reduction?

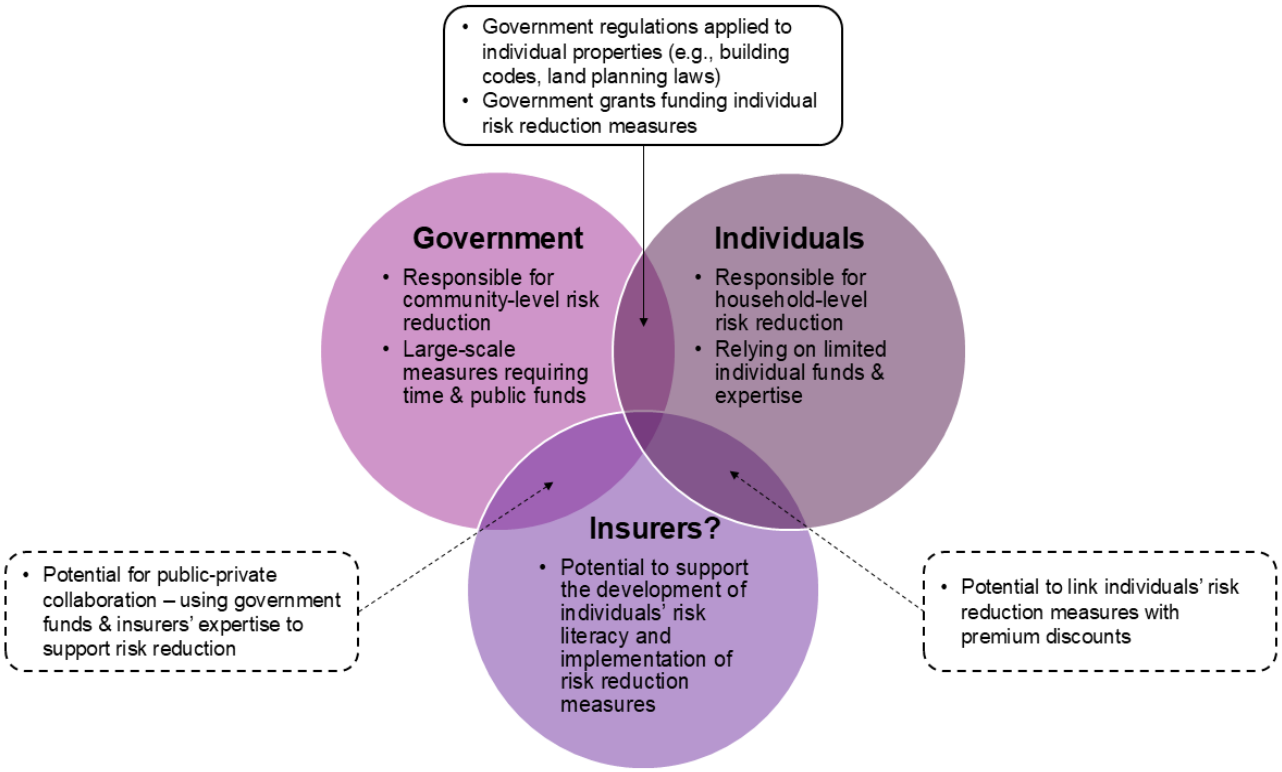
To date, physical protection has traditionally been a complex combination of government and individual responsibilities. The government is responsible for some overarching levers of risk reduction, for example, through building codes, planning laws, or infrastructure works such as improving drainage, constructing levees and raising bridges.[8] These forms of physical protection can safeguard many homes and communities/regions from loss following a weather event. In turn, they provide broad societal benefits by reducing demand on public funds for recovery, enabling a quicker return to 'business as usual' through restored infrastructure and services, and lessening the emotional and social upheaval for households and communities.[79] However, these government measures only provide a broad brushstroke across households for two reasons.[80] First, levers such as building codes and planning laws are applied across properties in the jurisdiction but are not necessarily tailored or specific to a particular home and may not be implemented uniformly across a population (e.g., new building codes or planning laws may not be applied retrospectively to existing dwellings). Meanwhile, large-scale community infrastructure works are time-consuming and expensive, which constrains their execution. Second, changing climate and increased severity of weather events as well as urbanisation and population growth mean that weather events are affecting communities in new or different ways. This leaves properties continuously exposed to loss following disaster events despite government enacting levers within their remit.

The government is not responsible for ensuring physical protection at the household level for privately owned assets. Instead, individuals are responsible for their own private assets and thus making specific asset-based decisions regarding physical protection that fall outside of government remit mentioned above.[60] As such, there are some levers of physical protection that individuals are responsible for, for example, retrofitting homes with flood-resilient and non-flammable materials or raising homes above flood levels. However, implementing such physical protection measures is challenging for individual property owners in several ways.[75] Individuals, particularly members of vulnerable communities, may lack the appropriate funds and technical knowledge to assess their risk and subsequently undertake insufficient physical protection measures on their property.[57] [81] Given these limitations, it is possible that property owners may not find out until after the disaster event that their physical protection measures have not been effective.

While it is well established that reduced risk is beneficial for individuals and society, there is a gap between government and individual responsibilities and the levers within their respective remits.[75] We now propose

insurance as a lever for implementing physical protection measures. Insurers, traditionally, have not had responsibility for risk mitigation,[57] [76] and their business model of rebuilding 'like-for-like' has not traditionally had suitable levers for post-disaster risk reduction measures. Instead, insurers provide financial protection in return for a premium. We, therefore, outline opportunities for insurance premiums to become a lever for risk reduction and move towards bridging the gap between the limitations of government and individual responsibilities. Figure 4 depicts how the key stakeholders can share responsibility for risk reduction and the interrelationships among them.

Figure 4: Sharing responsibility for risk reduction



3.3.2. How can insurance be a lever for risk reduction?

Despite risk reduction measures being historically beyond the remit of insurers, there are ways in which public and private insurance can be levers for risk reduction.

1. *Public-sector insurer's levers for risk reduction:* Public insurance models can incentivise risk reduction through government funding for resilience works on privately owned assets. This method of risk reduction benefits society in two ways. First, where governments operate public insurance, it is in the government's interest to improve the resilience of assets and thus reduce the demands on public insurance and other public funds following loss from a disaster event.[43] Public insurance models must offer insurance the following year, and in many subsequent years, at an affordable price. Thus, financially supporting risk reduction for properties improves weather resilience across a population and ensures the future viability of a public insurance model. Second, helping larger numbers of property owners become better prepared for weather events can lead to financial, social and emotional benefits across society. Such a risk reduction program is built into some PGEs, such as the Swiss KGV (Cantonal Building Insurance) where payment of claims for damage to existing buildings also requires those buildings to implement specific risk reduction measures that will make them less susceptible to future loss. At the same time, to receive approval newly proposed buildings

must go to the PGE insurance system to ensure risk reduction measures are included from the start. Such measures have the advantage of being able to operate at scale and linked into the broader risk reduction system of a country.

2. *Public-private levers for risk reduction:* Insurance as a lever for risk reduction does not have to be the sole responsibility of public insurance models. Examples exist of government and insurers collaborating to expand beyond their historical remits regarding risk reduction. In response to the flood events of 2022, the Queensland Government's Resilient Homes Fund financially supported homeowners to 'build back better' using grants for homeowners to install flood-resilient materials as part of their rebuilding efforts.[82] [83] The program successfully piloted delivering the grant for resilient materials through the homeowner's insurance claims with their own private insurer. This grant delivery model via the insurance rebuilding process benefitted homeowners in that they had access to their insurance builders to assist with reconstruction, even as they had government support for risk reduction through the government grants. The government funds, which were additional to the insurers' scope of works, facilitated the implementation of approved risk reduction measures, so surmounting the insurers' like-for-like limitations. While only a pilot program, and so not delivered at scale, this public-private collaboration might increase private-sector insurance's levers for risk reduction.
3. *Private-sector insurance's incentives to individuals:* One of the few levers that private sector insurance has is to reduce premiums to property owners who have taken specific risk reduction measures.[76] Some initiatives show how private insurers are collaborating with governments, NGOs, and the construction sector in supporting the development of consumer-friendly resilience rating systems that incentivise individuals to reduce their property's risk. The purpose of such rating systems is two-fold. First, to develop individuals' knowledge and understanding of their property's particular vulnerability to severe weather events. Second, given that home construction and weather patterns vary greatly across Australia, to facilitate the property owners undertaking resilience measures that are appropriate to their unique combination of construction, location and weather risk. The benefit being that property owners develop knowledge around risk and that personal funds invested in resilience are spent in ways that are more likely to reduce their loss following a weather event. An example is the Resilient Building Council's Bushfire Resilience Rating. Funded by the Australian Government and further supported by the insurance and construction sectors, the Bushfire Resilience Rating is a self-assessment app that homeowners use to gauge their bushfire risk and know which resilience measures can be implemented to reduce their risk of loss. Some reports suggest that these ratings are not only reducing homeowners' risk but also providing them with a reduction in insurance premiums. Again, while not tested at scale, such initiatives indicate additional ways to bridge the gap between individual responsibilities for risk reduction and their access to insurance.

Figure 5 summarises how public/private insurance models can become a lever for risk reduction.

Figure 5: Insurance as lever for risk reduction

IN SUMMARY

The only long-term solution to address the insurance protection gap is to reduce the physical risk of loss, yet historically insurers have had few levers to influence this. Risk reduction has largely been divided between government – through building codes, planning laws and infrastructure works – and individuals, who are responsible for protecting their own properties. However, government measures are broad and not always retroactive, while individuals often lack the funds, knowledge, or capacity to implement effective protection, leaving a gap between these responsibilities.

To bridge this gap, insurance could evolve beyond providing financial compensation to become a lever for physical risk mitigation by supporting government and individuals' risk reduction measures.

3.4. Trade-off 4: Insurance continuity – balancing continuous protection with fixed-term contracts

In this section, we consider the trade-offs necessary to ensure that society benefits from continuous long-term enrolment of the population in disaster insurance within the constraints that insurance is typically a fixed-term, one-year contract. A robust insurance system needs a wide pool of participants, and, to benefit from their membership of the pool, participants need to remain within it over the long term, since they cannot know when a disaster will strike for which they need insurance.[84] Yet, because insurance contracts are typically repriced and renewed each year, people can easily fall out of the long-term benefits of insurance by failing to renew in any given year. After any disaster, there are always tragic stories of property owners who, having been insured throughout much of their life, were not insured in the year of that disaster and so had no financial protection. Hence, continuous long-term enrolment in insurance is essential for it to function as a societal good and this must be balanced against insurance as a fixed-term, typically annual product.[85] [86] We now explain the two aspects of this trade-off, in terms of why insurance is renewed annually even as continuous enrolment in insurance is necessary. We then address several options of balancing this tension, based on continuing voluntary renewal of annual contracts by individual property owners or ongoing enrolment through compulsory or multi-year insurance contracts.

3.4.1. Fixed-term annual contracts as industry norms

Insurance policies are typically 12 months in duration. Insurers sell 12-month policies so they can periodically review the factors that go into premium pricing such as changing risk profiles (e.g., updates to flood maps) and other economic factors (e.g., reinsurance costs, inflation, construction costs). In addition to these general factors that might change pricing, typically policies that have had a significant claim in a given year will experience a price rise when renewed. A policyholder therefore, typically, has a maximum of 12 months of financial protection against loss from weather events at any point.[87] At the 12-month expiration point, policyholders need to decide to renew their policy. As noted in the introduction and Trade-off 2, some policyholders do not renew their policy due to risk-reflective pricing that makes it unaffordable, and some may even find that insurance is no longer available for specific hazards to which they are most exposed. Other property owners may engage in underinsurance, taking out a policy that is not sufficient because it does not cover the value of the property, or because it excludes some hazards.[88] Such non-renewal, or underinsurance from key hazards, means that these people fall out of the continuous benefits of insurance.

3.4.2. Societal benefits of insurance are dependent on continuity

Falling out of insurance is not only a problem for property owners – it is also a problem for insurance.[89] For a market to exist and thrive, a sufficient number of people need to remain in insurance consistently (year-on-year) to maintain a viable pool of insureds and spread the risk of weather events across a diverse population. Furthermore, society is dependent on continuous insurance to realise its benefits (see Section 2).

The duration of the assets that insurance protects, such as homes, far exceeds the fixed-term contract of a one-year insurance policy. For example, the most common length of a homeowner mortgage in Australia is 30 years.[90] Insurance provides an important safety net for, and is often a requirement of, such mortgages. Yet a homeowner with several years to run on a 30-year mortgage may fall out of insurance due to price increases in their annual insurance policy, meaning that their primary asset is no longer secured against disaster. Loss of access to continuous insurance means that such homeowners will struggle to rebuild after disaster and may also struggle to maintain a mortgage, or to sell their uninsurable home, so depreciating its value to them as a source of wealth and potential future provision for retirement and aged care.[7] [8] This financial challenge will be accompanied by social and emotional stress at the inability to protect a property that is not simply a key long-term asset but also a home.[75]

The problem extends beyond homeownership. Communities in which insurance becomes scarce will struggle to have a robust residential and commercial rental market, as landlords require property

insurance.[75] Local businesses, as sources of employment, and societal services such as aged and health care, and education, will also be compromised, struggling to get credit or take risks due to their uninsured status, even as they are also affected by the downturn in their local rental and homeowner community. Continuous insurance is thus key to both post-disaster reconstruction, and also to pre-disaster stabilisation of communities that can thrive because of the confidence that insurance provides to undertake medium and long-term activities such as running a business, owning a home, or renting properties.

3.4.3. Trade-offs in maintaining long-term enrolment in insurance

As explained above, there is an underlying tension between the fixed-term annual nature of insurance policies, the financial protection these policies provide against weather events, and the long-term individual and societal benefits of continuous financial protection. Therefore, mechanisms are needed to move from fixed-term insurance contracts to a longer-term strategy of a more resilient society underpinned by the financial, social and emotional benefits of insurance. We now outline three potential strategies for addressing this tension: motivating voluntary uptake of continuous insurance, establishing compulsory uptake of continuous insurance, and a hybrid solution of multi-year insurance contracts.

1. *Motivating voluntary uptake of continuous insurance:* One key way to support individuals to renew their annual insurance policy is to ensure that those policies remain affordable and available. This is the key to a thriving private insurance market; a fiscally prudent population will make sound decisions to protect their assets and will be able to meet requirements on them by mortgage lenders, by buying an annual insurance policy. Given that properties such as homes and businesses are private assets, there are good reasons to expect the owners of those properties to protect them by continuously renewing their annual insurance policy.[91] However, as we have established in this report, other trade-offs will need to be addressed to move to such a situation, including significant risk reduction that is clearly linked to premium pricing (Trade-off 3), so enabling risk-reflective pricing to also be affordable (Trade-off 2). Furthermore, individuals will need confidence that insurance policies will remain affordable at least for the term of any mortgage, and ideally for the tenure of their ownership of the property. If society is to move to a position in which individual property owners can balance the fixed-term nature of annual insurance contracts with their need for continuous protection, there will need to be a major change in the current insurance ecosystem.
2. *Establishing compulsory uptake of continuous insurance:* Another means of ensuring continuous uptake of insurance, is to make disaster insurance compulsory, as seen for multiple hazards in countries such as France, Spain and Switzerland and for earthquake in New Zealand.[36] [41] While being government-legislated and owned, these compulsory PGE schemes are still fixed-term annual contracts, so conforming to existing risk-transfer models and, therefore, enabling risk sharing with the private sector (see Trade-off 1). Despite being annual contracts, their compulsory nature makes insurance continuous, since all property owners must renew their insurance every year. Compulsory insurance is binding on both the property owner and what is usually an Insurer PGE, because the property owner must buy a policy, which the insurer is required to accept, regardless of the risk exposure of that property.[43] Importantly, compulsory insurance can be enforced in the above examples because it pays attention not only to availability but also affordability, due to a combination of solidarity pricing (see Trade-off 2) and, in Switzerland at least, extensive risk reduction to reduce risk exposure (see Trade-off 3). Compulsory insurance is thus another way to maintain a long-term and diversified pool of insureds to underpin the societal benefits realised from continuity of insurance. However, compulsory insurance can also only be realised by addressing the prior trade-offs discussed.
3. *A potential hybrid – multi-year insurance contracts:* A third way to ameliorate the effects of fixed-term contracts on insurance continuity could be to make insurance contracts longer in duration, spanning multiple years. That is, an insurance contract that renews and reprices over a fixed term of five or more years.[85] There is little empirical evidence of such contracts in the primary insurance market

because insurers, understandably, wish to retain the freedom to reprice policies each year to reflect changing risk exposure and costs. Some multi-year contracts have been negotiated in the reinsurance sector, as evidenced in the three-year reinsurance contracts negotiated by primary insurer QBE in 2010 and these multi-year initiatives seem to be increasing. For example, both IAG and Suncorp in Australia have negotiated multi-year reinsurance contracts in 2024 and 2025 respectively.[92] This is important to any potential multi-year insurance contract; for insurers to hold risk from property owners at a stable premium rate over multiple years, they will also need to have reinsurance pricing security over multiple years as the cost of reinsurance is one area of premium volatility.[87] While not widespread or embedded in insurance sector or consumer practice, there are some theoretical papers arguing for the potential advantages of multi-year homeowner insurance contracts in managing insurance pricing volatility.[85] [93] These papers suggest that fixed-term contracts of anything from 5 to 20 years, potentially with periodic reviews of premium price at intervals of five or more years, would have several advantages in smoothing the volatility of insurance pricing. This would strengthen policyholder confidence – for example, in their ability to take out a mortgage, and would also foster a longer-term relationship in which both the policyholder and insurer benefit from jointly investing in risk mitigation for the insured property.

Figure 6: Potential options to encourage continuous long-term enrolment in insurance

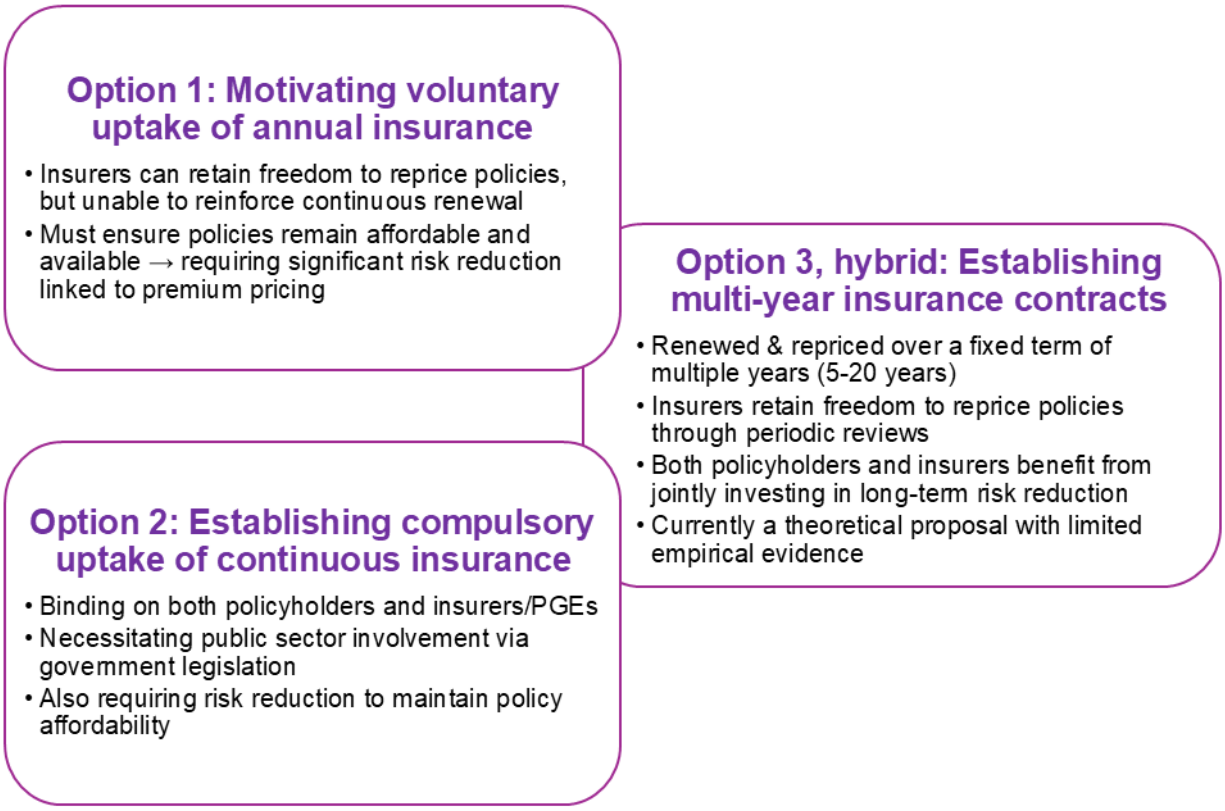


Figure 6 summarises the potential strategies to address the trade-offs in maintaining continuous long-term enrolment of the population in insurance. Multi-year fixed-term contracts would be a radical departure from existing public or private insurance models, necessitating consideration of many other issues beyond pricing and the length of the contract, such as potential exit costs if a property is sold, or whether and how the insurance policy is tied to the property. Furthermore, such a radical change would be difficult to implement in a competitive market where there is little evidence about consumer demand and where insurers may have low appetite for such shifts that may not yield any competitive advantage, or may even increase costs of capital.[87] Therefore, in theoretical argument,[85] such changes would best be implemented through a PGE, for

example the National Flood Insurance Program, a government-owned and operated primary insurance PGE in the USA. Hence, multi-year fixed-term contracts may be considered a hybrid proposition for Trade-off 4 because they could potentially stabilise affordable pricing through a compulsory scheme, which already has some elements of a multi-year model because compulsion requires ongoing insurance even when it is renewed annually.[94] Implementation of such contracts would require strong links to all other trade-offs and could provide a period of stable pricing and insurance continuity within which to implement risk reduction solutions, as discussed in Section 3.3. Government legislation would be required and, while it might begin as a solidarity pricing model, to be sustainable at offering affordable long-term premium pricing, issues of risk mitigation would need to be addressed, and the fixed term of the contract would give a period in which that risk mitigation might take place.

IN SUMMARY

Insurance continuity is critical for ensuring that individuals and society benefit from long-term protection against disasters, yet most current policies are fixed-term annual contracts that risk lapses in coverage. Annual repricing and renewal allow insurers to adjust for changing risks and costs, but this creates affordability and availability challenges that can push policyholders out of coverage. Because homes, mortgages, and businesses depend on long-term protection, continuous insurance is essential for financial, social, and emotional resilience of individuals and communities.

To balance the need for continuous protection with the fixed term annual nature of insurance policies, three strategies are considered: voluntary renewal supported by affordable pricing, compulsory insurance schemes that ensure continuous uptake, and multi-year contracts that stabilise premiums and build confidence in long-term commitments.

3.5. Using trade-offs to support collaboration on solutions towards a sustainable and inclusive disaster insurance landscape

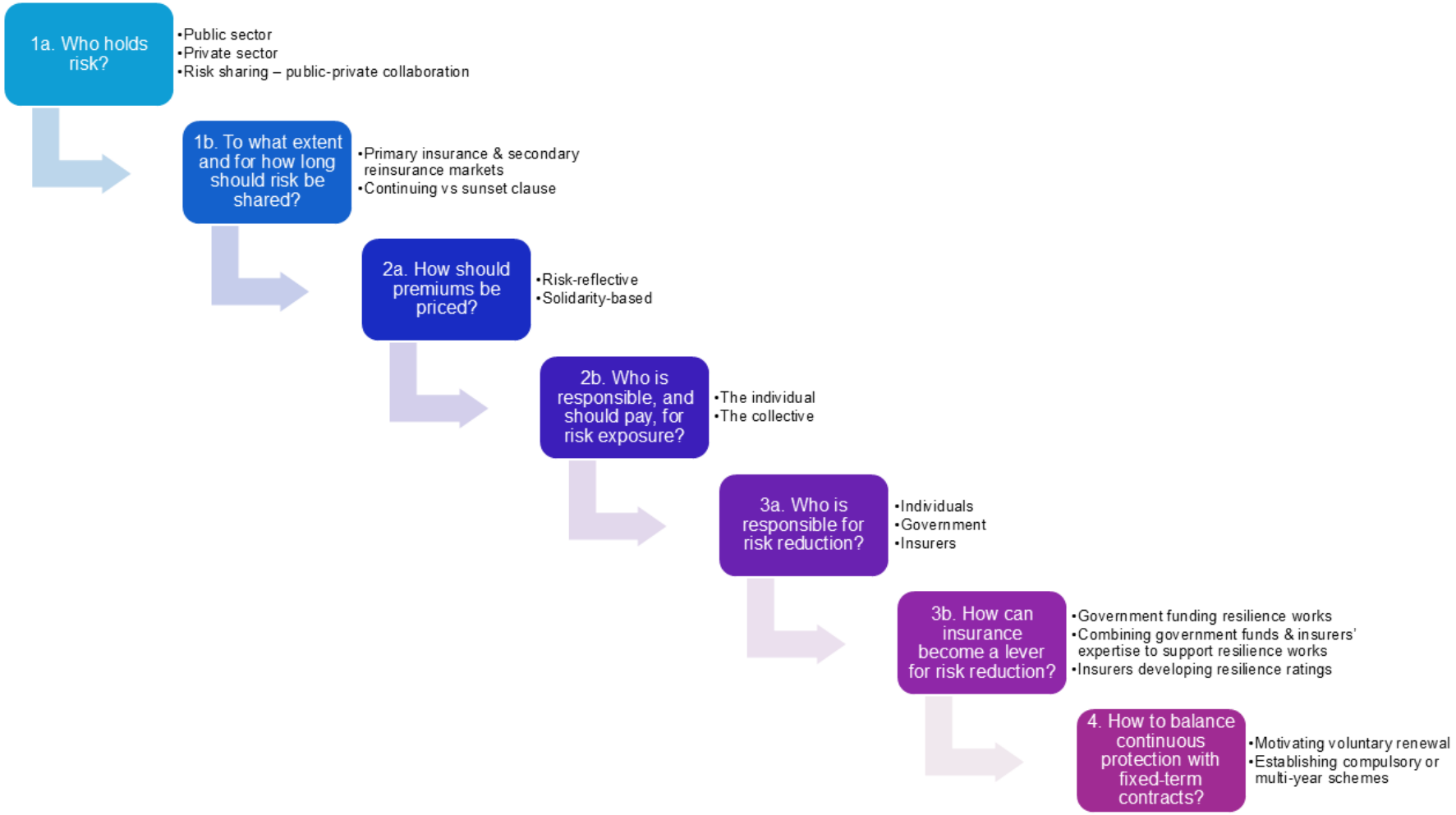
In this report we have identified four key areas of trade-offs that encapsulate the challenges to be addressed in generating a sustainable and inclusive disaster insurance sector for societal good. Trade-offs provide a useful basis for collaboration because they ensure that different facets of the problem and different stakeholders' interests are considered in discussing potential solutions.[95] No solution will be able simultaneously to satisfy:

- all stakeholders' interests;
- both aspects of a single trade-off; or
- all trade-offs.

However, by working through the trade-offs, each of which involves the key decisions outlined in Table 1, stakeholders will be able to consider the multiple facets of any potential solution. Furthermore, they will be able to identify what is being sacrificed in any decision, consider what benefits will be realised from that sacrifice, and note the consequences of any decision. Here, two important features of using trade-offs to support collaboration on potential solutions need to be understood. First, decisions to sacrifice one aspect of any specific trade-off can be sequenced to enable the desired benefits, with a view to later addressing the other aspect of the trade-off.[96] [97] Both aspects of a trade-off, therefore, may be satisfied at different points in time, as part of aiming for a comprehensive solution over time. Second, trade-offs are linked, in so much as decisions on any specific trade-off will have implications for decisions on the other trade-offs.[84] [98] Hence, working through the trade-offs identified in this report will enable consideration of how sacrifices and benefits connect across trade-offs, ensuring that any solution is not unidimensional but, rather, considers the multiple facets that must be joined together to work towards a solution. Figure 7 provides a summary of the interconnected nature of the key trade-offs, while Figure 8 depicts the sequential nature of the decisions involved.

Figure 7: Summary of interconnections between key trade-off areas

Figure 8: Summary of sequential key trade-off decisions to sustain the disaster home insurance market



In Box 1 we provide a brief example of the case of Flood Re in the UK. In doing so, our aim is neither to exhaustively explore all aspects of the Flood Re approach, nor to recommend Flood Re as the 'right' solution, as that will depend on the decisions of stakeholders in any specific context. Rather, our aim is to illustrate how aspects of any single trade-off can be sequenced in order to address each at different points in time, and also how decisions on trade-offs are linked.

As the example of Flood Re shows, trade-offs can enable stakeholders to work through the different aspects of any solution, deciding which sacrifices will be made at which time point to generate some other benefit, and also, importantly, to consider whether that sacrifice may be addressed at a future point in time to realise other benefits, potentially linked to a different trade-off.[51] [99] In the Flood Re case, staggering the return to risk-reflective, private sector insurance provided a period in which uninsured homeowners could return to being insured. During that period, those homeowners could remain insured and be supported with measures to make their homes more physically resilient to flood. Of course, neither risk nor housing remain stable. Thus, Flood Re, or any other solution aimed at generating a sustainable insurance sector for societal good that can incorporate long-term, affordable protection and risk reduction, needs to be dynamic; continuously balancing and rebalancing aspects of the linked trade-offs to reflect both the changing context and the trajectory of decisions being made.[99]

Flood Re: An example of sequencing and linking trade-offs

Flood Re was established in 2016 in the UK as a Reinsurer PGE with a mission to provide affordable insurance premiums for those at highest risk of flooding, and also with a sunset clause of 25 years at which Flood Re was to exit the insurance market and return it to risk-reflective pricing. Decisions on Trade-off 1 about public or private provision had already been made, with the establishment of a government-legislated PGE to hold risk at the reinsurance level of the risk-transfer chain, and without any government guarantee. To ensure that the affordable premium aspect of the mission could be met without government funding, a decision was, therefore, also made on Trade-off 2 about how risk should be priced. Premiums for those at highest flood risk would not be differentiated by risk exposure but rather would be cross-subsidised by a levy of GBP10 on each homeowner policy, which would be used to create a fund to lower premiums for high-risk properties. Hence, to ensure affordable insurance pricing, decisions on one aspect of Trade-off 1 had been made to transfer risk from the private market to a government-legislated PGE and linked to one aspect of Trade-off 2 to legislate for a form of solidarity-based rather than risk-reflective pricing.

Yet another decision on Trade-off 1 had also been made, which was to limit the duration of Flood Re to 25 years at which point risk would revert to the private market, and this was linked to Trade-off 2, which was to return to risk-reflective pricing at that point. This set of linked decisions thus sequenced one aspect of each trade-off at a point in time, with a view that the other aspect would be addressed at a specified future point in time.

To meet this sequencing of aspects of Trade-offs 1 and 2, Flood Re therefore needed to address Trade-off 3 on how risk should be mitigated. If they simply switched to the other aspect of Trade-offs 1 and 2, that would not build a sustainable insurance sector, since the highly flood-exposed properties would again be risk-reflectively priced out of any return to a private market. At their next government review, they therefore worked with stakeholders to expand to a dual mission of moving to affordable risk-reflective pricing at the 25-year exit. With this as their mission, they were then able to link to Trade-off 3 on risk mitigation. They addressed one aspect of Trade-off 3, by providing grants to individual homeowners for build-back-better, enabling these homeowners to make their properties more flood resilient. The aim was that such flood resilient measures would mean these homes would then attract lower insurance premiums to reflect their lower risk. In this way they aimed to use an aspect of Trade-off 3 to be able to sequentially address the other aspects of Trade-offs 1 and 2.

Section 4: Considering the key stakeholders' needs and interests

Following our discussion of the trade-offs to sustain disaster insurance as societal good, we now consider the three key groups of stakeholders – insurers, government, and consumers/policyholders. In particular, we will discuss their interests in, and ability to work through, the abovementioned trade-offs, as well as the interconnection among these stakeholders.

4.1. Insurer perspectives

Clearly insurers play a central role in sustaining disaster insurance, as their primary interest lies in managing risk while maintaining profitability and solvency. They are naturally inclined to maintain a private market for competitiveness and innovation (Trade-off 1) as well as risk-reflective premium pricing for optimal profitability (Trade-off 2), but this can conflict with the broader societal goal of insurance affordability and inclusivity. Insurers also face limits on the risk they can reasonably absorb; highly volatile or systemic risks may be deemed uninsurable without some degree of public sector involvement.[46] This creates tension around the question of who ultimately holds uninsurable risks, and whether mechanisms such as public-private partnerships or PGEs should be established to sustain the market (Trade-off 1).

Insurers are also interested in encouraging risk reduction (Trade-off 3) because safer properties mean fewer claims. However, they have limited influence beyond linking premiums to individual or community risk mitigation measures, the effectiveness of which may be difficult to verify until post-disaster. They may support innovations such as 'build back better' initiatives or premium incentives tied to hazard-proof construction, yet these depend on consumer uptake and government regulation. Their ability to sustain long-term coverage also depends on maintaining a large and diverse pool of insureds, but this is constrained by the traditional fixed-term annual nature of insurance policy contracts (Trade-off 4). As climate change and development trends are rendering the current disaster insurance landscape increasingly unsustainable, insurers will need to consider some radical changes in the insurance market; that is, to collaborate openly with the government to share uninsurable risks, and to work with both government and consumers on facilitating risk reduction responsibilities.[36] [50] The trade-offs explained here will allow insurers to consider those aspects of insurance provision that are challenging to their existing incumbent model and provide the basis for a dialogue on how they might support movement through our Figure 2 to establish a public-private collaboration that has the opportunity to build strong between a risk sharing model (Figure 2, D) and a private sector market (Figure 2, A).

4.2. Government perspectives

Government has a multifaceted interest in sustaining disaster insurance, as both regulator and, ultimately, insurer of last resort.[38] [39] A growing insurance protection gap has negative implications for the economy, the financial system and fiscal budgets. Therefore, government is often called upon to absorb or share uninsurable risks. At the same time, it must consider the extent of such involvement, weighing whether risk sharing should be ongoing or subject to sunset clauses to avoid distorting the market or creating moral hazard (Trade-off 1). Government is also motivated to ensure broad access to insurance, especially for vulnerable populations, which necessitates some degree of price smoothing through solidarity-based mechanisms (Trade-off 2). Beyond pricing, government is directly responsible for levers of risk reduction such as infrastructure investment, land-use planning, and building codes, which shape the overall exposure of communities to disasters (Trade-off 3). Its role as regulator can extend to mandating insurance uptake – for example, whether insurance should be voluntary, compulsory, or offered through multi-year contracts (Trade-off 4). Thus, government must strike a delicate balance between protecting fiscal stability, ensuring fairness in insurance access, and maintaining incentives for individuals and insurers to manage risks. Ultimately, its interest lies in ensuring that the disaster insurance system remains both socially inclusive and

economically viable, thereby supporting resilience at both household and community levels.[36] Governments can draw on the trade-offs explained in this report to understand the implications for other stakeholders and work with them on collaborative solutions that enable a shift towards as much private sector involvement as possible whilst still ensuring societal protection and consumer access.

4.3. Consumer perspectives

The perspectives of insurers and government on insurance as a tool to manage disaster risk are relatively clear. Consumer perspectives, in contrast, are complex, heterogeneous, and ambiguous.[75] In particular, some property owners may have a relatively weak understanding of how insurance works, leaving them feeling powerless and aggrieved about changes in their access to affordable insurance. Furthermore, in any situation of underinsurance or lack of insurance, property owners bear the greatest risk, because they stand to lose their homes and businesses, heightening their concerns about loss of access to insurance.[20 49] Hence, working with consumers' understanding, attitudes, and risk literacy is key to ensuring informed property owners have a seat at the table in collaborations aimed at realising the societal value of insurance.[80] Specifically, property owners as potential policyholders are the group most directly affected by the decisions made on trade-offs in disaster insurance. Their primary interest is in securing affordable and reliable protection against loss, while also minimising the financial and emotional upheaval caused by disasters. However, tensions arise over how premiums are priced: risk-reflective premiums may incentivise individual risk reduction but can make insurance unaffordable or unavailable for those living in high-risk areas, while solidarity pricing spreads costs more broadly but may be seen as unfair by lower-risk households (Trade-off 2). Property owners also have differing capacities to invest in risk reduction (Trade-off 3). Their long-term participation in insurance pools is also uncertain, since annual voluntary contracts risk lapses when premiums become too expensive or when insurers cease to offer policies. In particular, those experiencing compounding inequities including linguistic and cultural diversity, poor health, indigeneity, and/or income instability,[27 28 70] may be excluded from becoming consumers and, so, may not have their interests adequately represented. Compulsory or multi-year insurance can provide stability, but this may be unpopular with those who value flexibility or perceive the mandate as unfair (Trade-off 4). Overall, consumers want a disaster insurance system that balances affordability, fairness, and reliability, while providing real support in times of crisis. The trade-offs here provide a basis for consumer advocacy groups to participate in discussions of how to generate a sustainable and inclusive insurance sector for societal good.

Section 5: Concluding thoughts on ways forward

This report focuses on the issues involved in ensuring a viable disaster insurance sector that meets stakeholders' needs for sustainable and inclusive insurance as a societal good. Australia, like many other advanced economies, has been able to take property insurance for granted, assuming that, other than a few highly exposed or 'financially irresponsible' individuals, property owners have widespread coverage to meet their needs for pre-disaster financial stability and post-disaster reconstruction. As private-sector disaster insurance erodes in the face of climate exposure, legacy properties, and ongoing urbanisation in high-risk areas, that assumption is breaking down. The question, therefore, is how Australia will manage the increasing costs of disasters, and what role insurance will play in that future. Working through the trade-offs in this report, with consideration for the different needs of stakeholders, provides a way to consider how insurance as we currently know it might be reconstructed to better meet the current and future demands of increasing climate risks.

One consideration that is likely to arise as stakeholders work through these trade-offs is what are the alternatives to insurance. If insurance were not considered a necessary financial product that most people have, what would fill its place and how would those unspecified mechanisms enrol the many parts of society necessary for a disaster resilient future? While the potential set of answers to that question is beyond the scope of this report, keeping this potential counter-position in mind – a future in which most people do not have insurance – can be a useful way to ensure that the many valuable underpinning aspects of insurance remain present in any reconfiguration of the insurance sector and disaster resilience landscape.

This report raises many important areas for research that can support the changes in policy and practice needed to ensure a sustainable and inclusive disaster insurance system. The structure of the report around specific trade-offs, and the key decisions they entail, invites deep investigation of each to support evidence-based decision making. However, some of these areas have already attracted significant research, particularly around different public-private arrangements for providing ongoing insurance. Furthermore, some areas, such as shifts in public sector intervention in the insurance market or moves towards solidarity-based pricing, necessitate legislation.

We, therefore, suggest that 'the middle' set of trade-offs, addressing risk reduction (Section 3.3), may be a good entry point for future research for two reasons. First, risk reduction will be essential for the ongoing financial and physical viability of any public-private insurance provision and pricing system that is established. Second, reduced risk, whether or not tied to insurance premium reductions, will improve property owners' and societal outcomes after a disaster, in terms of reduced physical and financial damage, more rapid recovery, and greater sense of security and peace-of-mind.

As noted in Section 4.3, consumers are the least represented stakeholder in most of the research and the public dialogue about disaster insurance protection gaps. Yet, they disproportionately bear the risk of lack of access to insurance. We propose that understanding current and potential policyholders' attitudes to, understanding, and implementation of risk mitigation measures constitutes one important area of research. This research should endeavour to understand risk mitigation for those who currently or until recently have had access to insurance as well as those who are long-term uninsured. Such research would contribute to the empowerment and greater inclusion of less-represented individuals and communities, by ensuring their experiences and voices are part of the evidence base for any future solutions.

[1] Centre for Research on the Epidemiology of Disasters. (2025). *2024 Disasters in numbers: A hot and stormy year*. https://files.emdat.be/reports/2024_EMDAT_report.pdf

[2] Deloitte Access Economics. (2021). *Update to the economic costs of natural disasters in Australia*. https://www.deloitte.com/content/dam/assets-zone1/au/en/docs/services/economics/deloitte-au-economics-abr-natural-disasters-061021.pdf

[3] Mora, S. (2009). Disasters are not natural: Risk management, a tool for development. *Engineering Geology for Tomorrow's Cities*, *22*(1), 101–112. https://doi.org/10.1144/EGSP22.7

[4] Mata-Lima, H., Alvino-Borba, A., Pinheiro, A., Mata-Lima, A., & Almeida, J. A. (2013). Impacts of natural disasters on environmental and socio-economic systems: What makes the difference? *Ambiente & Sociedade*, *16*(3), 45–64. https://doi.org/10.1590/S1414-753X2013000300004

[5] Reanos, M. A. T. (2021). Floods, flood policies and changes in welfare and inequality: Evidence from Germany. *Ecological Economics*, *180*, Article 106879. https://doi.org/10.1016/j.ecolecon.2020.106879

[6] Kumagai, Y., Edwards, J., & Carroll, M. S. (2006). Why are natural disasters not "natural" for victims? *Environmental Impact Assessment Review*, *26*(1), 106–119. https://doi.org/10.1016/j.eiar.2004.06.013

[7] Grace, E. (2025). *Housing in Australia: Financial journeys through affordability, retirement and climate challenges*. Actuaries Institute. https://content.actuaries.asn.au/resources/resource-ce6yyqn64sx3-2093352434-60163

[8] Climate Council. (2025). *At our front door: Escalating climate risks for Aussie homes.* https://www.climatecouncil.org.au/wp-content/uploads/2025/04/CC_CV-Report-At-Our-Front-Door-2025_Final.pdf

[9] Zhao, J., Lee, J. Y., Li, Y., & Yin, Y. J. (2020). Effect of catastrophe insurance on disaster-impacted community: Quantitative framework and case studies. *International Journal of Disaster Risk Reduction*, *43*, Article 101387. https://doi.org/10.1016/j.ijdrr.2019.101387

[10] Ryu, S., & Fan, L. (2023). The relationship between financial worries and psychological distress among U.S. adults. *Journal of Family and Economic Issues*, *44*(1), 16–33. https://doi.org/10.1007/s10834-022-09820-9

[11] Bialowolski, P., Weziak-Bialowolska, D., Lee, M. T., Chen, Y., VanderWeele, T. J., & McNeely, E. (2021). The role of financial conditions for physical and mental health. Evidence from a longitudinal survey and insurance claims data. *Social Science & Medicine, 281,* Article 114041. https://doi.org/10.1016/j.socscimed.2021.114041

[12] Eriksen, C., McKinnon, S., & de Vet, E. (2020). Why insurance matters: Insights from research post-disaster. *Australian Journal of Emergency Management, 35*(4), 42–47. https://knowledge.aidr.org.au/media/8219/ajem_15_2020-10.pdf

[13] Bratt, R. G. (2002). Housing and family well-being. *Housing Studies, 17*(1), 13–26. https://doi.org/10.1080/02673030120105857

[14] Matthews, V., Longman, J., Berry, H. L., Passey, M., Bennett-Levy, J., Morgan, G. G., Pit, S., Rolfe, M., & Bailie, R. S. (2019). Differential mental health impact six months after extensive river flooding in rural Australia: A cross-sectional analysis through an equity lens. *Frontiers in Public Health*, *7*, Article 367. https://doi.org/10.3389/fpubh.2019.00367

[15] Trounson, A. (2020). *Too many eggs in the property wealth basket*. The University of Melbourne. https://pursuit.unimelb.edu.au/articles/too-many-eggs-in-the-property-wealth-basket

[16] Kousky, C., Wiley, H., & Shabman, L. (2021). Can parametric microinsurance improve the financial resilience of low-income households in the United States? A proof-of-concept examination. *Economics of Disasters and Climate Change*, *5*(3), 301–327. https://doi.org/10.1007/s41885-021-00088-1

[17] Bourova, E., Ramsay, I., & Ali, P. (2022). The arduous work of making claims in the wake of disaster: Perspectives from policyholders. *Geographical Research, 60*(4), 534–548. https://doi.org/10.1111/1745-5871.12553

[18] He, L., Dominey-Howes, D., Aitchison, J. C., Lau, A., & Conradson, D. (2021). How do post-disaster policies influence household-level recovery? A case study of the 2010-11 Canterbury earthquake sequence, New Zealand. *International Journal of Disaster Risk Reduction*, *60*, Article 102274. https://doi.org/10.1016/j.ijdrr.2021.102274

[19] Lucas, C., & Young, T. (2022). After the flood: Diverse discourses of resilience in the United States and Australia. In C. Lucas, K. Booth, & S. French (Eds.), *Climate, society and elemental insurance* (pp. 70–82). Routledge. https://doi.org/10.4324/9781003157571-8

[20] Elliott, R. (2021). *Underwater: Loss, flood insurance, and the moral economy of climate change in the United States*. Columbia University Press. https://doi.org/10.7312/elli19026

[21] Hofmann, S. Z. (2022). Build back better and long-term housing recovery: Assessing community housing resilience and the role of insurance post disaster. *Sustainability, 14*(9), Article 5623. https://doi.org/10.3390/su14095623

[22] Benz, J. (2025). *Stronger together: How social resources influence disaster recovery outcomes*. NORC at the University of Chicago. https://www.norc.org/research/library/stronger-together-how-social-resources-influence-disaster-recovery-outcomes.html

[23] Xiao, Y., Wu, K., Finn, D., & Chandrasekar, D. (2022). Community businesses as social units in post-disaster recovery. *Journal of Planning Education and Research, 42*(1), 76–89. https://doi.org/10.1177/0739456X18804328

[24] Cambridge Centre for Risk Studies & AXA XL. (2020). *Optimising disaster recovery: The role of insurance capital in improving economic resilience*. Cambridge Centre for Risk Studies at the University of Cambridge Judge Business School. https://axaxl.com/-/media/axaxl/files/optimizing-disaster-recovery.pdf

[25] Booth, K. (2018). Profiteering from disaster: Why planners need to be paying more attention to insurance. *Planning, Practice & Research, 33*(2), 211–227. https://doi.org/10.1080/02697459.2018.1430458

[26] Hedquist, A., Salas, R. N., Soto, M., Orav, E. J., & Figueroa, J. F. (2023). Disparities in property insurance relief among socially vulnerable Texas communities after Winter Storm Uri. *Health Affairs Scholar*, *1*(5), Article qxad062. https://doi.org/10.1093/haschl/qxad062

[27] Indigenomics Institute. (2022). *Indigenous insurance: Literature review.* https://assets.cmhc-schl.gc.ca/sf/project/archive/research_6/indigenous-home-insurance-literature-review.pdf

[28] Iorns, C., & Godfery, M. (2024). *Ka mate kāinga tahi, ka ora kāinga rua: Legal barriers and obligations in improving Māori access to dwelling insurance for natural hazards*. Toka Tū Ake Natural Hazards Commission. https://www.naturalhazards.govt.nz/assets/Publications-Resources/Funded-Research-papers/Iorns-Godfery-final-EQC-report-w-Exec-Summary-March2025.pdf

[29] Hulse, K., & Saugeres, L. (2008). *Housing insecurity and precarious living: An Australian exploration*. Australian Housing and Urban Research Institute.

https://www.ahuri.edu.au/sites/default/files/migration/documents/AHURI_Final_Report_No124-Housing-insecurity-and-precarious-living.pdf

[30] Feinman, J. (2025). Designing public solutions for disaster insurance market failures. *Journal of Insurance Regulation, 44*(2), 1–29. https://doi.org/10.52227/26934.2025

[31] Bradshaw, S., Gardner, J., Gergis, J., & Blashki, G. (2023). *Climate trauma: The growing toll of climate change on the mental health of Australians*. Climate Council. https://www.climatecouncil.org.au/wp-content/uploads/2023/02/Report-Climate-Change-and-Mental-Health.pdf

[32] Fletcher, C. S., Rambaldi, A. N., Lipkin, F., & McAllister, R. R. J. (2016). Economic, equitable, and affordable adaptations to protect coastal settlements against storm surge inundation. *Regional Environmental Change, 16*(4), 1023–1034. https://doi.org/10.1007/s10113-015-0814-1

[33] Fletcher, C. S., Ganegodage, K. R., Hildenbrand, M. D., & Rambaldi, A. N. (2022). The behaviour of property prices when affected by infrequent floods. *Land Use Policy*, *122*, Article 106378. https://doi.org/10.1016/j.landusepol.2022.106378

[34] Taylor, Z. J. (2020). The real estate risk fix: Residential insurance-linked securitization in the Florida metropolis. *Environment and Planning. A*, *52*(6), 1131–1149. https://doi.org/10.1177/0308518X19896579

[35] Queensland Government. (2011). *Understanding floods: Questions & Answers*. https://www.chiefscientist.qld.gov.au/__data/assets/pdf_file/0022/49801/understanding-floods_full_colour.pdf

[36] Jarzabkowski, P., Chalkias, K., Cacciatori, E., & Bednarek, R. (2023). *Disaster insurance reimagined: Protection in a time of increasing risk*. Oxford University Press. https://doi.org/10.1093/oso/9780192865168.001.0001

[37] Byggeth, S., & Hochschorner, E. (2006). Handling trade-offs in Ecodesign tools for sustainable product development and procurement. *Journal of Cleaner Production, 14*(15), 1420–1430. https://doi.org/10.1016/j.jclepro.2005.03.024

[38] McAneney, J., McAneney, D., Musulin, R., Walker, G., & Crompton, R. (2016). Government-sponsored natural disaster insurance pools: A view from down-under. *International Journal of Disaster Risk Reduction, 15,* 1–9. https://doi.org/10.1016/j.ijdrr.2015.11.004

[39] Boyer, M. M., & Nyce, C. M. (2013). Insuring catastrophes and the role of governments. *Natural Hazards and Earth System Sciences, 13*(8), 2053–2063. https://doi.org/10.5194/nhess-13-2053-2013

[40] Insurance Council of Australia. (2022). *Insurance catastrophe resilience report 2021–22*. https://insurancecouncil.com.au/wp-content/uploads/2022/09/20683_ICA_Final_WebOptimised.pdf

[41] Jarzabkowski, P., Chalkias, K., Cacciatori, E., & Bednarek, R. (2018). *Between state and market: Protection Gap Entities and catastrophic risk.* Cass Business School, City, University of London. https://www.wfcatprogrammes.com/documents/20142/34131/Between_State_and_Market_PGE.pdf/befe4338-b5ab-dfb7-961e-c2f7af88a92c

[42] Kousky, C. (2022). *Understanding disaster insurance: New tools for a more resilient future*. Island Press.

[43] Jarzabkowski, P., Cacciatori, E., Chalkias, K., & Gallagher-Rodgers, R. (2022). *Disaster insurance in Switzerland: The cantonal public sector insurance system.* Bayes Business School, City, University of London. https://paulajarzabkowski.com/wp-content/uploads/2024/11/Report-2022-DISASTER_INSURANCE_IN_SWITZERLAND_THE_CANTONAL_PUBLIC_SECTOR_INSURER_SYSTEM-EN.pdf

[44] Mumo, R., & Watt, R. (2016). The dual insurance model and its implications for insurance demand and supply post-Christchurch earthquakes in New Zealand. *Insurance and Risk Management, 83*(3–4), 135–167. https://ssrn.com/abstract=2902142

[45] Broberg, M., & Hovani, E. (2019). Disaster risk reduction through risk pooling: The case of hazard risk pooling schemes. In K. L. H. Samuel, M. Aronsson-Storrier, & K. N. Bookmiller (Eds.), *The Cambridge handbook of disaster risk reduction and international law* (pp. 257–274). Cambridge University Press. https://doi.org/10.1017/9781108564540.015

[46] Kunreuther, H. C., & Michel-Kerjan, E. O. (2004). Policy watch: Challenges for terrorism risk insurance in the United States. *The Journal of Economic Perspectives, 18*(4), 201–214. https://doi.org/10.1257/0895330042632717

[47] Lo, A. Y. (2013). Household preference and financial commitment to flood insurance in South-East Queensland. *Australian Economic Review*, *46*(2), 160–175. https://doi.org/10.1111/j.1467-8462.2013.12009.x

[48] Surminski, S., & Eldridge, J. (2017). Flood insurance in England – an assessment of the current and newly proposed insurance scheme in the context of rising flood risk. *Journal of Flood Risk Management*, *10*(4), 415–435. https://doi.org/10.1111/jfr3.12127

[49] Collier, S. J., Elliott, R., & Lehtonen, T. K. (2021). Climate change and insurance. *Economy and Society, 50*(2), 158–172. https://doi.org/10.1080/03085147.2021.1903771

[50] Jarzabkowski, P., Meissner, K., & Mason, M. (2025). Insurance options in a climate changed future: The way forward for urban climate policy and practice. *Journal of City Climate Policy and Economy, 4*(1), 15–35. https://doi.org/10.3138/jccpe-2024-0029

[51] Chalkias, K., Jarzabkowski, P., Kavas, M., & Krull, E. (2025). That's not fair! Navigating the duality of fairness in insurance. *The British Journal of Sociology.* https://doi.org/10.1111/1468-4446.13206

[52] Carrillo, G., Telljohann, D., & Nyce, C. (2022). The 30th anniversary of hurricane Andrew: Evolution of the Florida homeowners insurance market. *Risk Management and Insurance Review, 25*(3), 239–270. https://doi.org/10.1111/rmir.12222

[53] Jarzabkowski, P., Bednarek, R., & Spee, P. (2015). *Making a market for acts of God: The practice of risk-trading in the global reinsurance industry*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199664764.001.0001

[54] Hampton, S., & Curtis, J. (2022). A bridge over troubled water? Flood insurance and the governance of climate change adaptation. *Geoforum, 136,* 80–91. https://doi.org/10.1016/j.geoforum.2022.08.008

[55] Bouk, D. (2015). *How our days became numbered*. University of Chicago Press.

[56] Meyers, G., & Van Hoyweghen, I. (2018). Enacting actuarial fairness in insurance: From fair discrimination to behaviour-based fairness. *Science as Culture, 27*(4), 413–438. https://doi.org/10.1080/09505431.2017.1398223

[57] de Vet, E., Eriksen, C., Booth, K., & French, S. (2019). An unmitigated disaster: Shifting from response and recovery to mitigation for an insurable future. *International Journal of Disaster Risk Science, 10*(2), 179–192. https://doi.org/10.1007/s13753-019-0214-0

[58] Gall, M. (2023, June 7). *Why insurance companies are pulling out of California and Florida, and how to fix some of the underlying problems.* The Conversation. https://theconversation.com/why-insurance-companies-are-pulling-out-of-california-and-florida-and-how-to-fix-some-of-the-underlying-problems-207172

[59] Ewald, F. (2020). *The birth of solidarity: The history of the French welfare state*. Duke University Press. https://doi.org/10.1515/9781478009214

[60] Abraham, K. S. (1985). Efficiency and fairness in insurance risk classification. *Virginia Law Review, 71*(3), 403–451. https://doi.org/10.2307/1072963

[61] Dixon, L., & Anderson, J. M. (2024). *Public attitudes toward risk-based pricing and risk-sharing in insurance*. RAND Corporation. https://www.rand.org/pubs/research_reports/RRA2872-1.html

[62] Lehtonen, T. K., & Liukko, J. (2011). The forms and limits of insurance solidarity. *Journal of Business Ethics, 103,* 33–44. https://doi.org/10.1007/s10551-012-1221-x

[63] O'Neill, J., & O'Neill, M. (2012). *Social justice and the future of flood insurance*. Joseph Rowntree Foundation. https://www.jrf.org.uk/report/social-justice-and-future-flood-insurance

[64] Frezal, S., & Barry, L. (2020). Fairness in uncertainty: Some limits and misinterpretations of actuarial fairness. *Journal of Business Ethics, 167*(1), 127–136. https://doi.org/10.1007/s10551-019-04171-2

[65] Ericson, R., Barry, D., & Doyle, A. (2000). The moral hazards of neo-liberalism: Lessons from the private insurance industry. *Economy and Society, 29*(4), 532–558. https://doi.org/10.1080/03085140050174778

[66] Baker, T. (2000). Insuring morality. *Economy and Society, 29*(4), 559–577. https://doi.org/10.1080/03085140050174787

[67] Charpentier, A. (2024). *Insurance, biases, discrimination and fairness*. Springer International Publishing AG. https://doi.org/10.1007/978-3-031-49783-4

[68] Frees, E. W., & Huang, F. (2023). The discriminating (pricing) actuary. *North American Actuarial Journal, 27*(1), 2–24. https://doi.org/10.1080/10920277.2021.1951296

[69] Horan, C. (2021). The unisex insurance debate and the triumph of actuarial fairness. In *Insurance era: Risk, governance, and the privatization of security in postwar America* (pp. 167–189). University of Chicago Press.

[70] Paddam, S., Liu, C., & Philip, S. (2022). *Home insurance affordability and socioeconomic equity in a changing climate*. Actuaries Institute. https://actuaries.logicaldoc.cloud/download-ticket?ticketId=38cecc1c-68e2-4433-8822-58cd3d0ccf42

[71] Lehtonen, T. K., & Liukko, J. (2015). Producing solidarity, inequality and exclusion through insurance. *Res Publica, 21*(2), 155–169. https://doi.org/10.1007/s11158-015-9270-5

[72] Schanz, K. U., Jarzabkowski, P., Cacciatori, E., Chalkias, K., Kavas, M., & Krull, E. (2021). *Public-private solutions to pandemic risk: Opportunities, challenges and trade-offs*. The Geneva Association. https://www.genevaassociation.org/sites/default/files/research-topics-document-type/pdf_public/pandemic_solutions-report_final.pdf

[73] Harris, L. (2025, July 21). *Investors hitting 'limit' for insuring against UK floods, warns Flood Re chief.* Financial Times. https://www.ft.com/content/c439d9c2-d3ad-4e26-b746-0b5d670e3613

[74] Atlas Magazine (2023). *Natural catastrophe insurance in France: Rates to increase in 2025*. https://www.atlas-mag.net/en/category/pays/france/natural-catastrophe-insurance-in-france-rates-to-increase-in-2025

[75] Birss, M., Casey, A., Esposito, M., Graetz, N., Knuth, S., Ponder, C. S., & Taylor, Z. J. (2024). *Shared fates: A housing resilience policy vision for the home insurance crisis*. Climate & Community Institute. https://climateandcommunity.org/wp-content/uploads/2024/09/Shared-Fates_10-09-24_3.pdf

[76] Kousky, C. (2019). The role of natural disaster insurance in recovery and risk reduction. *Annual Review of Resource Economics*, *11*(1), 399–418. https://doi.org/10.1146/annurev-resource-100518-094028

[77] Seifert-Dähnn, I. (2018). Insurance engagement in flood risk reduction – examples from household and business insurance in developed countries. *Natural Hazards and Earth System Sciences*, *18*(9), 2409–2429. https://doi.org/10.5194/nhess-18-2409-2018

[78] Surminski, S., Roezer, V., Golnaraghi, M. (2020). *Flood risk management in Germany. Building flood resilience in a changing climate.* The Geneva Association. https://www.genevaassociation.org/sites/default/files/flood-risk-management-germany.pdf

[79] Le, T. M., Leow, W. J., & Seiderer, F. (2020). Building resilience in infrastructure to climate change. In M. Fouad, G. Verdier, T. Hansen, & G. Schwartz (Eds.), *Well spent: How strong infrastructure governance can end waste in public investment* (pp. 282–300). International Monetary Fund. https://doi.org/10.5089/9781513511818.071

[80] Cox, S., Taylor, Z., Collier, S., & Bulkeley, H. (2025). Changing urban riskscapes: Climate change, finance, and the built environment. *Journal of City Climate Policy and Economy*, *4*(1), 2–14. https://doi.org/10.3138/jccpe-2025-0013

[81] Glencross, K., Warren, R., Eunson, J., & Ansons, T. (2021). *Understanding the barriers to uptake of Property Flood Resilience (PFR) in Scotland*. ClimateXChange. http://dx.doi.org/10.7488/era/947

[82] Queensland Government. (2022, October 27). *Insurers sign up to help flooded homeowners build back better* [Media release]. https://statements.qld.gov.au/statements/96426

[83] Queensland Government. (2024). *Insurance and the Resilient Homes Fund*. https://www.qld.gov.au/housing/buying-owning-home/homeowners-financial-help/resilience-to-floods-and-cyclones/resilient-homes-fund/other-assistance/insurance-and-the-resilient-homes-fund#insurance-repairs

[84] Jarzabkowski, P., Bednarek, R., Chalkias, K., & Cacciatori, E. (2022). Enabling rapid financial response to disasters: Knotting and reknotting multiple paradoxes in interorganizational systems. *Academy of Management Journal, 65*(5), 1477–1506. https://doi.org/10.5465/amj.2019.0745

[85] Jaffee, D., Kunreuther, H., & Michel-Kerjan, E. (2010). Long-term property insurance. *Journal of Insurance Regulation, 29,* 167–187. https://research.ebsco.com/c/nsk4sj/viewer/pdf/rfykjg4xhb

[86] Kunreuther, H. C., Michel-Kerjan, E. O., Doherty, N. A., Grace, M. F., Klein, R. W., & Pauly, M. V. (2009). *At war with the weather: Managing large-scale risks in a new era of catastrophes*. MIT Press. https://doi.org/10.7551/mitpress/9780262012829.001.0001

[87] Maynard, T., & Ranger, N. (2012). What role for "long-term insurance" in adaptation? An analysis of the prospects for and pricing of multi-year insurance contracts. *Geneva Papers on Risk and Insurance – Issues and Practice*, *37*(2), 318–339. https://doi.org/10.1057/gpp.2012.10

[88] Settle, A. (2024). *Unsettled: Climate risk and cash settlements in home insurance*. Financial Counselling Victoria Inc. https://fcvic.org.au/publications/unsettled-climate-risk-and-cash-settlements-in-home-insurance/

[89] Herweijer, C., Ranger, N., & Ward, R. E. T. (2009). Adaptation to climate change: Threats and opportunities for the insurance industry. *Geneva Papers on Risk and Insurance – Issues and Practice*, *34*(3), 360–380. https://doi.org/10.1057/gpp.2009.13

[90] Mertz, B. (2024, June 23). *What is the average length of a house loan?* The Money Know How. https://themoneyknowhow.com/average-length-of-house-loan/

[91] Kunreuther, H. C., Pauly, M. V., & McMorrow, S. (2013). *Insurance and behavioral economics: Improving decisions in the most misunderstood industry*. Cambridge University Press. https://doi.org/10.1017/CBO9781139050319

[92] Bible, K. (2025). *Reinsurance explained: A pillar of strength for general insurers.* Actuaries Institute. https://content.actuaries.asn.au/resources/resource-ce6yyqn64sx3-2093352434-60255

[93] Michel-Kerjan, E. O., & Kunreuther, H. C. (2011). Redesigning flood insurance. *Science, 333*(6041), 408–409. https://doi.org/10.1126/science.1202616

[94] Molk, P. (2024). Florida's homeowners insurance problems. *Connecticut Insurance Law Journal, 31*(1), 40–84. https://scholarship.law.ufl.edu/facultypub/1324/

[95] Putnam, L. L., Fairhurst, G. T., & Banghart, S. (2016). Contradictions, dialectics, and paradoxes in organizations: A constitutive approach. *The Academy of Management Annals*, *10*(1), 65–171. https://doi.org/10.5465/19416520.2016.1162421

[96] Jarzabkowski, P., Lê, J. K., & Van de Ven, A. H. (2013). Responding to competing strategic demands: How organizing, belonging, and performing paradoxes coevolve. *Strategic Organization*, *11*(3), 245–280. https://doi.org/10.1177/1476127013481016

[97] Smith, W. K., & Lewis, M. W. (2011). Toward a theory of paradox: A dynamic equilibrium model of organizing. *The Academy of Management Review*, *36*(2), 381–403. https://doi.org/10.5465/AMR.2011.59330958

[98] Sheep, M. L., Fairhurst, G. T., & Khazanchi, S. (2017). Knots in the discourse of innovation: Investigating multiple tensions in a reacquired spin-off. *Organization Studies*, *38*(3–4), 463–488. https://doi.org/10.1177/0170840616640845

[99] Bednarek, R., Chalkias, K., & Jarzabkowski, P. (2021). Managing risk as a duality of harm and benefit: A study of organizational risk objects in the global insurance industry. *British Journal of Management, 32*(1), 235–254. https://doi.org/10.1111/1467-8551.12389