

Between State and Market: Protection Gap Entities and Catastrophic Risk

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We gratefully acknowledge the financial support of our sponsors, below, that enabled us to conduct the research for this report. Their sponsorship does not imply any endorsement of the results reported and any analysis, findings or errors are totally our own.



Executive summary

The protection gap. The economic and social impact of disasters is increasing all around the world. In 2017, Hurricanes Harvey, Irma and Maria were so destructive as they swept through the Caribbean that they decimated many of these small island economies. Even in a wealthy country like the USA, the economic impact of these natural disasters was enormous. In recent years, earthquakes dealt a blow to Mexico, France saw the worst rains in 50 years with floods peaking in Paris, typhoons and storms shook the Philippines and Hong Kong, and wildfires ravaged California and Australia.

Yet, the economic losses from such disasters are underinsured. In what is known as the protection gap, some 70% of global losses from natural catastrophes are not insured, equating to \$1.3 trillion over the past 10 years. In 2017 alone, uninsured losses for weather-related disasters were estimated to be around \$180 billion. At the same time, other forms of large-scale risk, such as terrorism, cyberattacks and pandemics are also increasing, with little financial protection to address the aftermath.

The social and economic resilience of a country, and its political stability, are dependent on the ability to recover from disasters. In the short-term, immediate post-crisis financial response is critical. Failure to provide a rapid injection of capital in response to disaster puts lives at risk. In Puerto Rico, the death toll of Hurricane Maria rose above 4,000, with one-third of the deaths being caused by delayed or interrupted medical care. In the longer-term, reconstruction of housing, infrastructure and businesses after a disaster is essential for recovery. Bridging the protection gap provides one way to underpin such financial recovery.

Protection Gap Entities (PGEs): Marrying market solutions to social objectives. In their quest to address some of their social objectives in protecting their citizens from disaster, governments are increasingly turning to market solutions, such as innovative means of insuring for potential loss. They do so through the establishment of Protection Gap Entities (PGEs) that operate between state and market in developing novel solutions/schemes that mobilize global (re)insurance capital in addressing the aftermath of disaster.

This report draws on a large-scale research study of different PGEs around the world, in both developed and developing economies, to explain their role, their effects and their limitations in managing risk and alleviating the financial consequences of disaster. While such government interventions are growing, lessons need to be learnt about how to maximize their positive effects and guard against potential unintended consequences that can exacerbate the protection gap. This report shows the strategic implications of different types of PGEs, what they may be best used for, and how they can evolve to better help society and government to protect against the growing threats of natural and manmade disasters.

Who should read this report? This report is useful for the different stakeholders involved in the work of PGEs: from policy makers and governments, to NGOs, to those running PGEs or insurance market organizations. These stakeholders often have very different interests and goals, which are reflected in the way they understand the purpose of PGEs and insurance. This report provides valuable insights into the common features of PGEs, and also examines some of their key differences, providing an opportunity for learning across stakeholders, PGEs, sectors and countries.

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SECTION 1. Introduction

1.1 PROTECTION GAP ENTITIES

The challenges posed by the growing catastrophe insurance protection gap, particularly those of rebuilding in the aftermath of disaster, have prompted the generation of entities, which we label Protection Gap Entities (PGEs). These PGEs bring together market and non-market stakeholders in an effort to address the protection gap. They differ considerably in governance, political economies, points of origin, perils, and means of funding loss^{1,2,3} (see Exhibit 1). Yet PGEs have the same broad goal:

To transform uninsured risk into insurance-based products that can be transferred into global financial markets to provide capital for recovery following a disaster.

This report examines the nature, characteristics and activities of PGEs. It provides information for the diverse stakeholders involved in some aspect of the work of PGEs, from policy makers to those running PGEs or depending upon them for financial products. These stakeholders often have very different understandings about the insurance market and the remit of their own and other PGEs. The report will therefore provide insights into the common features of these entities and some of their key differences, providing an opportunity for learning across stakeholders, PGEs, sectors and countries.

In this section we first define the protection gap, and then provide an overview of some key common elements across the PGEs examined in our research study: the multiple and diverse stakeholders with whom they engage, the tension between the pursuit of market and social objectives that characterises these stakeholders, and the tension PGEs face between pursuing their mission strictly by developing financial products to 'bridge' the protection gap or expanding their remit to also 'reduce' the gap through improved physical resilience to disaster. This information provides the background for the analysis presented in this report.

Examples of PGEs

Caribbean Catastrophe Risk Insurance Facility (CCRIF), a multi-sovereign risk pool set up to provide its member States with access to rapid capital for responding to the aftermath of natural disasters as diverse as tropical cyclone, earthquake, and excess rainfall.

California Earthquake Authority (CEA), a privately funded, publicly managed PGE set up to support the primary

insurance market in providing earthquake insurance to Californian homeowners.

Australian Reinsurance Pool Corporation (ARPC), a terrorism reinsurance pool set up to provide reinsurance to insurance companies offering terrorism cover on commercial businesses in Australia.

1.2 THE PROTECTION GAP

The term '*insurance protection gap*' refers to the gap between the insured and actual economic losses caused by large-scale catastrophic events. Some 70% of global losses from natural catastrophes are uninsured, equating to \$1.3 trillion over the past 10 years.⁴ Indeed, uninsured natural disaster losses for weather-related risks are estimated to be around \$180 billion in 2017. Significant gaps in protection exist not only for natural disasters but also for other large-scale threats such as terrorism, cybercrime and epidemics. This gap is a problem in both developed and developing economies.

Impact. Economic resources are crucial in allowing societies to recover from devastating disasters. In the absence of adequate insurance, the burden of paying for losses falls largely on citizens, governments or aid organizations, with significant impact upon already straining government budgets, and economic and social hardship for those affected.⁵

The growing exposure to disaster was shown in 2017; a very active year for natural catastrophes, with earthquakes, floods and hurricanes inflicting devastation on communities around the world. As Table 1.1 shows, the impact was particularly severe in developing economies. In these countries, where insurance penetration is typically low and governments and citizens have few financial reserves, losses from catastrophic disasters can devastate the economy, rolling back development gains for the country and exacerbating global inequality.⁶ Protecting the GDP is critical for such countries, which are more vulnerable, proportionally, to the losses from large-scale events than developed economies.

Table 1.1 The Protection Gap in developing and developed economies, 2017

Region	Economic losses	Insured losses		Protection Gap	
	in USD bn	in USD bn	% of economic losses	in USD bn	% of economic losses
Latin America & Caribbean	31.6	5.1	16.1%	26.5	83.9%
Africa	2.9	0.8	27.6%	2.1	72.4%
Asia	31.2	5.0	16.0%	26.2	84.0%
North America	244.2	119.1	48.8%	125.1	51.2%
Europe	23.7	12.0	50.6%	11.7	49.4%

Adapted from Swiss Re Institute ^{4,7}

Under-insurance is also a concern for developed economies.^{4,8} While the insurance market is developed in these economies, the protection gap is also increasing.⁴ Such countries typically have high-value assets and infrastructure that, when under-insured, contribute to a wide protection gap. For example, in the aftermath of Hurricane Harvey only some 20% of eligible domestic properties in Texas and Louisiana had flood insurance.⁹ Hence, despite their relative economic strength, citizens, businesses and governments in such counties also suffer devastating losses that contribute to increased inequality in the aftermath of a disaster, as shown in Table 1.1.

Specifying the protection gap. While the protection gap is a global problem, affecting all countries, and referring to the whole uninsured population, the uniform use of the term is problematic. Typically, states and markets direct their efforts to address the protection gap at specific and local protection gaps, rather than aiming to solve the overall problem of under-insurance. We will see examples in this report of such different protection gaps as: a lack of reinsurance capital available to insurers who write terrorism cover for city-centre business districts; insufficient emergency capital reserves in developing economies to maintain essential services after natural disaster; or unaffordable premiums for homeowners in highly exposed flood plains, or in earthquake-prone regions (even in mature insurance markets).

The protection gap as a generic term refers to all uninsured risk, but the initiatives attempting to address the protection gap are specific to particular social, political or economic problems caused by under-insurance in a region. In this report, therefore, we either specify “the global protection gap” or we use the term “protection gap” in relation to specific social, political or economic problems in a region, which may be addressed by insurance.

1.3 STAKEHOLDERS OVERVIEW

The existence of a protection gap shows, by definition, that market mechanisms alone are failing to protect against the specific peril involved. This prompts governments and inter-governmental organizations to intervene in the market, and generate some form of PGE. These PGEs draw together government, market and non-market stakeholders with different expertise and interests relevant to the specific protection gap problem. They may include:

Insurance market stakeholders: In markets for risk, such as flood and terrorism, *insurers* accept the responsibility for paying claims for post-disaster reconstruction in return for a premium. Some part of these insurer’s risk of payout is transferred to *reinsurers* and other capital providers through a range of financial products. Insurers pay a premium to these *capital providers*, who in exchange pay a share of the large-scale claims incurred by the insurers following a disaster. Reinsurance capital therefore allows insurance companies to remain solvent after major claims events. This risk transfer is facilitated by *reinsurance brokers*. As procuring agents, they support the transfer of both capital and information amongst these parties, helping to make these high-value, highly-complex deals work.

Modellers: Catastrophe models are used to estimate the likelihood and severity of financial loss from catastrophes before they occur. Modellers in academia, government and industry provide analyses that inform the sophisticated mathematical and computing models used to understand and price the risks being transferred. Their work on the impact of disasters can also inform improved resilience to disaster.

Government: Central government has political, social and economic reasons to protect its citizens. Its engagement as a stakeholder usually takes place through various entities, including its Financial Ministries, which aim to protect the government balance sheet; and its Environmental and Agricultural departments, which promote disaster mitigation and resilience. Government is a key stakeholder in the protection gap problem and usually initiates the development of a PGE. Often, government departments are gatekeepers of fragmented, but crucial data for understanding disasters.

Inter-governmental organizations: Given the global and interconnected nature of the protection gap problem, inter-governmental organizations can promote mutual interests across countries in dealing with disasters. Developmental Banks (e.g. World Bank) and International Development Organizations (e.g. the UK’s Department for International Development – DFID) are key actors that bring together countries, particularly in the developing world, through PGEs that develop market-based mechanisms to narrow the protection gap.

Many of these various stakeholders are to some extent already interdependent, in ways which will shape the activities of the PGE in which they participate – but the PGE's activities will in turn modify those interdependencies.

1.4 SOCIAL AND MARKET IMPERATIVES

These various stakeholders are characterised by a mix of differing market and social objectives.

Governments tend to have a socially-focused understanding of the problem, with an objective to protect their citizens and communities from disasters: *“Government's role is to protect its citizens and its communities. We have a social responsibility with the local population. At the end this is our main mandate; to support them.”* (Government Stakeholder)

The (re)insurance industry stakeholders have a market-focused understanding of the problem, with market objectives that can often clash with the social objectives. For example, insurers charge premiums that reflect the risk they take and thus for high-risk areas they charge a market price that is often high enough to make insurance unaffordable:

“Financially it doesn't make sense [to provide low price insurance cover for high-risk areas]. I do get the social thing and there's a responsibility and a concern for the industry. Affordability is always a concern for the industry but at the same time, we're publicly listed companies, we are not charities. We have shareholders, so we have to charge an appropriate premium.” (Market stakeholder)

PGEs are often formed through joint action between the government and/or intergovernmental organizations on the one side; and various market organizations on the other. Their mandate often requires them to pursue 'social' objectives through market means. PGEs sit at the nexus of a range of stakeholders, often coordinating or combining these market and social objectives. Therefore, the creation of PGEs introduces a new type of actor, operating on a market basis but with a clear social mission.

1.5 BRIDGING AND REDUCING THE GAP

When formed, a PGE's primary mandate is to provide the capital to support recovery following a disaster. Such initiatives *help* bridge the protection gap by providing financial solutions. However, if financial solutions lead purely to reconstruction of what was destroyed, they leave the underlying vulnerability unchanged. Therefore, PGEs social objectives often push them to attempt to *reduce* the gap by reducing vulnerability through more resilient forms of building and other initiatives. PGEs thus often face a tension between these two ways of addressing a protection gap - by bridging it (finding insurance solutions with greater reach than the existing ones) or by *reducing* it (risk reduction through either removing risk or bringing more risk within tradable range).

1.6 REPORT MAP

The report is structured in 7 sections and an appendix.

Section 1 is the introduction of this report (current section).

Section 2 outlines PGE origination, in which multiple stakeholders must come together with their different interests. Three objectives of PGEs are introduced, alongside examples of how PGEs pursue them. How PGEs evolve in relation to these objectives, and the key challenges which commonly arise in pursuit of them is then discussed.

Section 3 is about PGEs in developed economies with mature insurance markets. It presents a Protection Gap Strategic Response Framework that can be used to differentiate PGEs according to the way they intervene in the market for risk. We identify the pros and cons of three different types of PGE strategic positions in the value chain for risk transfer, providing a practical model for PGE design.

Section 4 is about PGEs triggered by a desire to protect sovereign states, with fragile economies that are highly exposed to natural catastrophe, and where there is low insurance penetration. We explain how the particular demands of such economies for immediate capital to cope with crisis post-disaster has led to innovations in protection gap products.

Section 5 discusses PGE contributions to disaster resilience. The PGE Resilience Framework is introduced to examine how PGEs can support key aspects of resilience. Areas and challenges that are beyond the direct control or influence of PGEs are discussed.

Section 6 introduces the PGE Evolution Framework to identify key mismatches between different stakeholder interests, the evolving protection gap, and the remit of the PGE. Ways of resolving these mismatches are suggested.

Section 7 issues a call to arms to learn from and make better use of these already established PGEs to better understand and address the growing threat of natural and man-made disasters.

The **Appendix** presents the methodology of the research study and a glossary with key terms used in this report.

SECTION 2. Origination and Objectives of Protection Gap Entities (PGEs)

Despite the great variety of local circumstances,^{7,8} and the highly variable design and remit of the resulting PGEs, our research study has found that PGEs typically originate at the instigation of government in consultation with market players.

They come about at their outset to fulfil objectives that fall into three categories.

Objective 1: Resolve disruption in (re)insurance supply in mature markets;

Objective 2: Mitigate the threat of unaffordable insurance in mature markets;

Objective 3: Increase the financial viability of sovereign states with fragile economies.

We find that these objectives not only shape the remit and strategies of the PGEs at their point of origin. They also act as anchors for the evolution of PGEs. While PGEs are typically established with a relatively narrow mandate to act on a specific local gap, some PGEs have evolved over time to tackle changes in the nature of their protection gap.

2.1 PGE ORIGINATION: AN ‘UNEASY’ TRUCE AMONGST STAKEHOLDERS

Government has a socio-political and often an economic interest in protecting its citizens and communities. When part of the society is not protected by the existing market mechanisms, it has the legislative power to bring about change. One course of action may be to set up a PGE to fulfil these public interests through the implementation of a market solution – finding a way to provide insurance.

Establishing a PGE is inevitably a complex and sometimes protracted process, as can be seen in our case study of the formation of Flood Re in the UK. It requires negotiations between multiple stakeholders that have different world views, different technical understanding of risk, and crucially, different objectives – social and/or commercial.

It can take many iterations to engineer what can be an ‘uneasy’ truce between these stakeholders into the founding remit of a PGE. However, only once it begins to operate will the different stakeholders really see how their interests are served by the PGE and its remit. As a result, the remit of the PGE may have to evolve; a recurrent theme in this report.

The origin of Flood Re: A ‘truce’ between state and market stakeholders

The autumn of 2000 was one of the wettest ever recorded in the United Kingdom and prompted a dialogue between the Government and the insurance industry about how to manage growing flood losses. Working through their professional body, the Association of British Insurers (ABI) the industry drew up a Statement of Principles (SoP) with Government to stabilize flood insurance provision. Under this agreement, existing insurer members of the ABI promised to continue insuring properties at high risk of flooding and the Government on its side would continue to invest in flood defences.

The SoP was renewed in June 2008 to last until July 2013. After a Flood Summit in September 2010, three working groups comprising representatives from Government, the Environment Agency, the insurance industry and related organizations met regularly to try to agree key principles for a shared approach to managing flood risk, despite considerable scepticism about each other’s motivations.

In the move to austerity, government spending on flood defences had been reduced; a move that was not well received by insurers. At the same time, a two-tier insurance market had been created by the SoP, as new insurance companies entering the market did not have to insure properties in high risk flood areas, and so could adopt different strategies about which consumers to target. The SoP conditions were affecting the competitive state of the market.

Over the following two years there were heated negotiations about the different government and industry objectives. Insurers preferred a free market where they could decide which risks made sense to trade commercially, and at what price. Government did not want high prices to be a deterrent, as they wanted to make sure that high-risk areas were covered by insurance. Yet they did not want to take any extra liability on the public purse.

For insurers, there was the real threat that Government could legislate an obligation to provide flood insurance, while for Government, the threat of a free market could leave high-risk properties uninsured. Leaving a swathe of such properties uninsured was not good for the reputation of the insurance industry either, as an insurance stakeholder argued: *“the incentive for us was reputational; we knew there was a*

problem, the market wasn't servicing these very high flood risk homes, so how could we deal with that, rather than just saying it's too high a risk, we're not going to insure you". A solution had to be found.

The insurance industry drew on modelling and data from insurers to understand the extent of the problem: how many homes were at high risk of flood? They also examined models for the setting up of a PGE, such as the California Earthquake Authority (CEA), National Flood Insurance Program (NFIP), and the UK terrorism pool. The Government proposed different options, not wanting to leave that task completely to the industry. After much push back from both sides, the compromise Flood Re model was agreed in 2014. Flood Re would be run by the insurance industry, supported by government legislation to levy all policyholders to fund the pool, and the Government would increase spending on flood defences.

More working groups brought together the ABI, representing the industry, the Department for Environment, Food and Rural Affairs (DEFRA) for the legislation, and other insurance market parties such as modellers, brokers and reinsurers. The often messy elements of the emerging solution were presented to a committee of MPs, progressively establishing the legislation that would be passed as a Bill in UK parliament on 2015 – a full fifteen years after the start of discussions. Flood Re was born, and now had to execute its remit.

2.2 OBJECTIVE 1: RESOLVE DISRUPTION IN (RE)INSURANCE SUPPLY IN MATURE MARKETS

Extreme events which cause unexpectedly high losses can result in sudden large-scale disruption, or even failure, in the supply of (re)insurance for a specific peril. This is because:

- a) unexpected large losses can jeopardize (re)insurers' capital reserves and thus the ability to pay claims; and
- b) industry participants may lose confidence in their ability to quantify and manage exposure to such events.

In such situations, insurers may stop offering policies so that citizens and/or business cannot get insurance cover. This disruption may be compounded when reinsurers stop offering capital to insurers to cover catastrophic losses; the result is insurers not being able to remain solvent to cover the risk of a large-scale loss themselves. For example, Pool Re in the UK was formed following the terrorist bombing of the Baltic Exchange in London, which disrupted the supply of insurance and reinsurance capital to cover terrorist attack on high-value commercial properties.

Supply disruption in either the primary or secondary market translates into short-term disruption in the ability to transfer risk, and longer-term loss of trust in the market as a means to respond to disasters. Such disruption creates a socioeconomic crisis that may spur the establishment of a PGE whose objective is to restore supply as quickly as possible, as shown in the CEA case study (below).

The case of CEA: Solving the problem of supply

The 1994 Northridge 6.7 magnitude earthquake in southern California caused insured losses of \$12.5 billion USD. This reportedly equated to more than 80 years of premiums for earthquake in California: a clear message to the market that existing earthquake pricing had not reflected the actual risk.

Residential insurers in California were concerned about their ability to price correctly for earthquake risk, for two reasons:

- They could not simply stop offering it because, since 1986, it was (and remains) mandatory by California law to offer earthquake cover with all residential-property-insurance policies. However, offerees are free to decline the offer, and lenders do not require earthquake cover as a condition of mortgage issuance.
- California in 1988 enacted a new, strict, insurance-rate-regulation law that dramatically restricted insurers' ability to implement rates for personal lines insurance, such as home insurance.

The effect of Northridge in 1994 on the primary home-insurance market was rapid and severe: insurers simply withdrew, or severely restricted the availability of, new home-insurance policies for any peril, not just earthquake. This market constriction eventually extended to almost 95% of the California home-insurance market. Californians requiring a new home-insurance policy were threatened with inability to insure new homes.

A local protection gap for home insurance in California was created. While supply was disrupted, there was still strong demand, as homeowners could not get a mortgage without a home insurance policy in place. Although mortgagees did not, and do not, require mortgagors to buy earthquake insurance, they still required insurance on a range of perils beyond earthquake.

Faced with a severe crisis, the State of California, led by the insurance commissioner, worked with insurance markets and the state Legislature to find a solution. This led to the creation of the California Earthquake Authority (CEA), a privately funded, publicly managed, not-for-profit PGE to provide the earthquake cover written when a CEA participating insurer's home-insurance customer accepts that insurer's mandatory earthquake-insurance offer.

Insurers pay a charge to participate in the CEA and then remain liable for a significant part of CEA earthquake losses. Participation in the CEA is not mandatory for insurers. Neither is it a mandatory purchase for renters or homeowners, who can buy a home-insurance policy without taking up earthquake cover at all. However, where an offer of CEA cover is taken up, CEA receives premiums which, by law, must be based on rates that reflect all actual costs of providing the selected insurance: actuarially sound rates. Currently, 80% of the insurance market participates in the CEA, while about 20% of residential earthquake insurance in California is still provided through the private market.

The CEA solved the 1994 Northridge-related supply problem of obtaining residential insurance in California, since it

directly enabled CEA participating insurers to come back to the market. CEA participating insurers could now provide the mandatory offer of earthquake cover, without having to be exposed to the full expense of providing the cover themselves. Residents could now buy home-insurance policies that enabled them to meet insurance requirements for new home-purchase mortgages. In this way, the very specific protection gap of *home insurance* was bridged. Yet the long-standing issue of an earthquake protection gap in California was unresolved. Even before the Northridge earthquake State-wide residential earthquake take-up was only some 25%. Despite the CEA's best efforts, only about 11% of households with home insurance in California today actually take up earthquake insurance.

Despite concerted efforts to communicate to California residents the risks that are associated with earthquakes, the CEA has remained largely defined by its initial remit. It lacks effective powers to solve the low take-up of earthquake insurance itself and has not encouraged or proposed legislative changes such as mandatory take-up.

Evolving gaps and evolving PGEs. PGEs such as the CEA or Pool Re were set up as an emergency response to a specific local protection gap, sometimes, like in CEA's case, connected to but different from the catastrophe gap; sudden contraction in the supply of (re)insurance for a specific peril in a specific region, threatening key aspects of economic life.

While PGEs such as CEA and Pool Re are often successful in solving the specific problem they were set up to address, they typically have to evolve, as the related protection gaps emerge and change over time. For example, as shown in the CEA case study, the CEA solved the supply problem of homeowner insurance in California but did not solve problem of earthquake under-insurance – a related, but ongoing protection gap. Terrorism PGEs around the world have also faced a change in the nature of their protection gap, as terrorism itself has evolved from 'conventional' terrorism (such as bombs), to what is termed CBRN (chemical, biological, radiological and nuclear attack), to the increasing threat of cyberterrorism¹⁰ and the rise of small-scale attacks on citizens. These unmodeled and potentially catastrophic new risks have also been under-insured by the market, so terrorism PGEs have had to evolve in order maintain (re)insurance supply.

Solving a temporary supply disruption or an evolving protection gap? PGEs established to meet Objective 1 aim to provide capital for a sudden gap in cover, in which *existing* demand for insurance is not being met. The PGE's remit may (or may not, as in the case study of the CEA) be additionally intended to *increase* demand for insurance, or to grow protection in under-insured areas or for under-insured perils. Such a remit would imply a longer-term project rather than simply fixing the supply disruption.

Furthermore, supply disruption may be temporary: for instance, as modelling improves, or the risk is reduced, it is possible that supply returns to the market. Alternatively, the gap in cover

may evolve, to require new cover which is also in short supply (as in the case of terrorism). Either eventuality poses questions in relation to the long-term future of the PGE. Should the remit be limited to fixing the initial supply disruption, after which the PGE should wind down? Or should the remit have the flexibility to evolve alongside the protection gap itself?

2.3 OBJECTIVE 2: MITIGATE THE THREAT OF UNAFFORDABLE INSURANCE IN MATURE MARKETS

The combination of more frequent extreme weather events, high levels of urbanization in weather-exposed areas, and increasingly sophisticated risk modelling able to pinpoint risks at an ever-higher level of detail¹¹ has resulted in a growing number of insureds in mature insurance markets falling into the "high-risk" category. Insurance products which are priced to reflect this high risk may 'price out' potential policyholders.

The protection gap created by unaffordable insurance is a social problem. In the aftermath of disaster, for instance, social inequality is widened between those who were covered, and those who were not. Furthermore, the under-insured parts of society in high-risk areas may not be able to recover financially, unless recovery is met from the public purse. The public purse is, of course, not a neutral pot of money, but rather represents subsidization of the under-insured indirectly by taxpayers. Thus, while pricing constitutes a critical market mechanism, it also carries considerable *social* implications.

Yet market pricing should also ensure that insurance companies remain solvent and continue to play their role in absorbing society's risk. As the Northridge earthquake in California indicates, if insurers are not adequately compensated for the policies they provide, they risk financial collapse when losses need to be paid. Clearly, robust insurers that can pay claims are critical to the protection of their policyholders – another social implication of pricing.

It is therefore important to address this problem effectively from both a market and social perspective. This explains why governments sometimes attempt to solve the problem by establishing PGEs that make insurance products affordable to those in high-risk areas. *“Repeated exposure to risk means that the insurance products become unaffordable to citizens and consumers in developed economies, and so governments step in with different kinds of mechanisms to suppress pricing or spread pricing in such a way that disadvantaged citizens in high risk areas can continue to get insurance.”*

(Inter-governmental stakeholder)

Lower prices for those at high risk may be counteracted by spreading the true cost of the highest risk cover across the wider pool of insureds. This may involve a range of mechanisms from mandatory insurance for all citizens to levies on lower-risk policies. Examples of such PGEs are Flood Re in the UK, the Earthquake Commission in New Zealand (EQC) and CCR in France, which latter, as a multi-peril PGE, can underpin insurance provision in highly-exposed areas across a range of risks.

PGEs that operate with this remit face the substantial challenge of not unwittingly creating larger problems.

1. **Suppressing market signals about high-risk areas:**

Increasing prices reflects high risk areas and gives an important market signal about the growing exposure to a particular peril in these areas. Suppressing such signals, by smoothing the price to make insurance affordable and available, does not discourage people from living in such areas where the frequency and severity of weather events is growing. Nor does it incentivize citizens and governments to increase resilience of the natural and built environment.

To counteract this problem, PGEs need to be part of an integrated solution to the problem of highly-exposed risk. This should include access to policy tools that enhance resilience, and discourage unsustainable behaviours. Examples are policies requiring properties that suffer repeated losses to be constructed in more resilient ways – such as building houses on stilts in flood areas – in order not to be excluded from the scheme. Flood Re in the UK goes further, excluding properties built after 2009 from the scheme to discourage subsidization of new developments in flood-prone areas.

2. **Affordable insurance unconditionally?** High-risk policyholders that can benefit from a PGE may range across a wide socio-economic spectrum. At one end of the spectrum are people of low socio-economic means, who do not have the capacity to move to safer places or afford high premiums. At the other end are those who have the socio-economic means, but who by choice live in desirable but highly risk-exposed areas, such as sea- and river-fronts. Cross-subsidization of both types of policyholders may not be an equally desirable social objective.¹² The potential for social and financial inequities and the related social and political discontent should be strongly considered when establishing PGEs schemes.

Evolving gaps and evolving PGEs. In general, PGEs established as a response to the threat of unaffordable premiums for high-risk policy holders do address this protection gap, as there are specific mechanisms available to make insurance more affordable (see Section 3.1.2). In addition, where accompanied by mandatory insurance legislation, they can go a long way towards ensuring that all citizens receive at least some cover from catastrophes to which a country is particularly prone. This has been a particular success of the EQC.

These PGEs also face a challenge to keep up with evolving protection gaps. They need to be watchful about unintended social/political consequences of their actions that may impact upon the protection gap; for example avoid distorting incentives so that the resilience of the natural and built environment in risk-prone areas is not compromised. Such actions might lead the protection gap to widen in new and initially unexpected directions.

2.4 OBJECTIVE 3: INCREASE THE FINANCIAL VIABILITY OF SOVEREIGN STATES WITH FRAGILE ECONOMIES

PGEs are established to protect sovereigns in fragile economies that have high exposure to natural catastrophe, and where there is little insurance penetration. These PGEs, as shown by the following example of the Africa Risk Capacity (ARC), typically introduce insurance products designed to provide a rapid injection of capital in the immediate aftermath of a disaster, rather than to support reconstruction. These products are innovative in addressing a particular protection gap; the gap between a need for a rapid humanitarian response, such as providing food, clean water, or shelter after a disaster, and the capability of a sovereign in a low-income economy to meet those costs.

Mauritania is impacted by drought on a frequent basis. It was among the first countries to purchase an insurance policy from ARC for an estimated premium of \$1,394,000 for a total cover of \$9,000,000 for the agricultural season from July through November 2014. The product worked. After a very poor rainy season, Mauritania received a payout of approximately \$6,326,000 in January 2015. They were able to use the rapid payment to alleviate a humanitarian crisis, providing 50,000 households with 50 kilograms of rice and 4 litres of oil each over 4 months (April – July 2015). The timeliness of the payout had a positive impact; protecting livelihoods, and also prevented migration and the distressed sale of livestock.¹³

Countries like Mauritania are at risk of severe economic damage because of the combination of extreme and frequent weather events, low levels of resilience and increasingly high levels of public debt. This has resulted in two protection gaps in low-penetration insurance markets with fragile economies.³ First, there is the disaster liquidity gap: the lack of capital in the immediate aftermath of disaster to provide essential services whilst awaiting the arrival of humanitarian aid. Second there is the reconstruction gap: the lack of capital to pay for properties and infrastructure to be rebuilt. It is inevitable in such countries that the funds for reconstruction after a disaster will need to come from international aid.¹⁴ However, at the point of catastrophe, immediate disaster relief is a priority requiring relatively small funds - and that cover can be a viable and affordable product for a PGE to support.

Governments, inter-governmental organizations such as the World Bank, and, increasingly, aid organizations are therefore turning to various forms of disaster-liquidity insurance for low-income countries. Some of these efforts have resulted in the establishment of PGEs, including both multi-country risk pools such as the African Risk Capacity (ARC), the Caribbean Catastrophe Risk Insurance Facility (CCRIF) and the Pacific Catastrophe Risk Insurance Company (PCRIC); and single-country entities, such as FONDEN in Mexico. In all of these PGEs, sovereign states pay a premium to purchase insurance products that are backed up with market capital, and which will provide an injection of capital immediately after a catastrophic event.

The insured is the state, not private citizens or businesses; and the state may use the payout for any post-disaster requirements, such as petrol for generators, payment of the civil service, or the relocation of citizens. The knowledge that their budget is protected in this way enables sovereigns to plan for disaster in advance,¹⁵ while the immediate timing of the payment at the point of the crisis is considered to reduce the longer-term humanitarian impact of the disaster.¹⁶

Evolving gaps and evolving PGEs. The PGEs operating in this area were set up with a very specific remit, focused on a particular protection gap afflicting sovereign states rather than private citizens or businesses, and providing capital liquidity rather than funding post-disaster rebuilding.¹ The countries involved often have little technical expertise in assessing vulnerability and exposure, and poor data availability – factors which relate to low insurance penetration (for more details see Section 4). These factors point PGEs towards a development trajectory, with a direct emphasis on developing knowledge and ability to model the peril; developing the ability to prepare for it financially; and improving national resilience. As risk-modelling capabilities and financial literacy evolve in such contexts, a sovereign generally improves its ability to identify other insurable types of risk. PGEs play a key role in helping their country members understand both the protection gap itself, and how insurance-based products can incentivize the growth of financial and physical resilience to disasters.

Objectives for PGEs:

1. Resolve disruption in (re)insurance supply in mature markets;
2. Mitigate the threat of unaffordable insurance in mature markets;
3. Increase the financial viability of sovereign states with fragile economies.

Evolution of PGEs and protection gaps:

- PGEs should evolve their remit and operating mechanisms in parallel with the evolving nature of the protection gap that they are addressing

2.5 BEYOND MARKETS: PGES' ROLES IN FRAMING THE PROTECTION GAP DEBATE AND IN BUILDING EXPERTISE

The previous sections have provided an analysis of PGEs' roles in marrying socio-political interests with market mechanisms to bridge particular localised protection gaps. Their role includes enabling the market to continue to trade in particularly volatile or uncertain risks; suppressing price for high-risk insureds; and developing new markets and products, as well as establishing the conditions for the market to grow in economies with low insurance penetration.

PGEs' roles in addressing the protection gap, however, goes beyond their direct market effects, to encompass the following effects on risk framing and developing expertise.

Framing effect. PGEs come about through considerable work from a range of *stakeholders*, all of which have *different objectives and interests* in addressing a protection gap. Indeed, as we showed at the start of this Section, the establishment of any PGE will be an 'uneasy truce' at a moment in time between parties. Because of the process through which they are established, PGEs have a central position with direct ties to these multiple stakeholders. They thus become a critical point of interdependence between stakeholders.¹⁷

As the effects of shifting population distributions, climate change, and rising inequality change the nature of exposure,¹¹ the interests and objectives of stakeholders' shift. Being at the nexus of the stakeholders, PGEs become a centre for debate or informed dialogue amongst them. PGEs, therefore, become critical actors in framing an evolving understanding of the protection gap, such as what risks remain under-insured, how they might be addressed, and who should be responsible.

As a result, even where they have been established as a temporary solution, PGEs tend to persist. For example, Pool Re, initially established to cover the risk of bomb blasts in the city of London, has, as explained above, been part of the evolving cover for new types of terrorist risks. As they align with the interests of different stakeholders over time they continue to evolve and to be part of the way that the protection gap is identified and defined within society.

Expertise effect. PGEs need to trade risk that is either not insured, or would be priced out of affordability, according to the existing technical expertise in the market. A new understanding is needed in order to find a rationale on which to trade - and PGEs must therefore develop new technical expertise, or find and co-ordinate existing expertise which may not have been available to the market. For instance, as part of its initial remit, Flood Re needed to quantify the potential number of properties at severe risk of flood in the UK. This entailed combining existing technical expertise about UK flood peril from different parties including insurers, public databases, modelling companies and the Environment Agency.

In another example, part of the mission of the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) is to develop new technical expertise in understanding the earthquake and cyclone peril in the Pacific Ocean and quantify the potential loss from these perils for its sovereign-state members.

“We had hazard data for small local areas. What we didn't have was nationwide hazard information and exposure data. The data that countries and inter-governmental organizations had wasn't sufficient to do the work. Initial modelling showed that the data [even when combined] wasn't robust enough to explain the actual losses. That really made the push to look at how could we improve the data collection and modelling for the Pacific.” (PGE stakeholder)

PGEs have an incentive and indeed, a unique position in filling a knowledge gap that often accompanies a protection gap. However, these activities have consequences for the

¹ One exception is FONDEN, which also purchases a reinsurance product from the global market to cover the costs of reconstructing infrastructure.

competitive dynamics of insurance markets. Technical expertise can be a source of competitive advantage for market players, since the ability to quantify and price risk is central to the ability to trade it. For example, private sector (re)insurers regard their modelling capability, and technical expertise in trading risk as one way in which they are better able to price risk and so, outperform their competitors. This has led to the development of a market in which data and models are usually owned and licensed within the private sector. In contrast, a PGE builds or expands a body of technical expertise with a view to trade risk that is under-insured or uninsured and hence not, initially at least, within the market. Its remit and interests are not necessarily profit-oriented, but aimed at increasing the spread of insurance for financial protection as a social good. Such interests might be served by promoting an open-sharing approach for its modelling capability in order to promote wider risk cover and enable more parties to bridge the protection gap.¹⁸

In these ways, PGEs can address barriers to knowledge sharing, overcome knowledge deficits and develop a 'pre-competitive' space for technical expertise. However, they can also generate tensions between the open and proprietary nature of that technical expertise.

PGEs effects go beyond their direct effect on markets:

1. **Framing effect:** by being at the nexus of multiple stakeholders, PGEs have a generative role in framing the debate and evolving understandings about how to address the protection gap.
2. **Expertise effect:** PGEs generate new knowledge, and often make it publicly available as a social good. This might alter the distribution of expertise in the market, as well as the incentives for the development of expertise across the various stakeholders.

SECTION 3. In the presence of a mature insurance market: Market dynamics

PGEs typically show considerable variation in governance structures (e.g. public, private, partnership), risks covered (e.g. single peril or multi-peril), type of risk solution (e.g. product used) and their funding model (e.g. policy holders' premiums, public or private levy).^{7,8,19} Indeed, these distinctions are often so particular to the point of origin and the national political economy that we may ask: what can we learn from the study of PGEs, and what can they learn from each other?

We have found that PGEs have important common underlying principles on how they respond, strategically, to the protection gap. When PGEs operate in developed economies (Objectives 1 & 2 in Section 2), they must sit alongside the established (re) insurance market. This raises critical strategic issues:

- Types of market intervention: how they share risk with the existing market players
- Positions in the value chain: where they sit within the value chain for risk transfer

Classification of PGEs by their strategic choices

Types of market intervention:

- Removing risk
- Redistributing risk
- Combining risk removal and risk redistribution

Positions in the value chain:

- Insurer PGE
- Reinsurer PGE
- Market Capture PGE

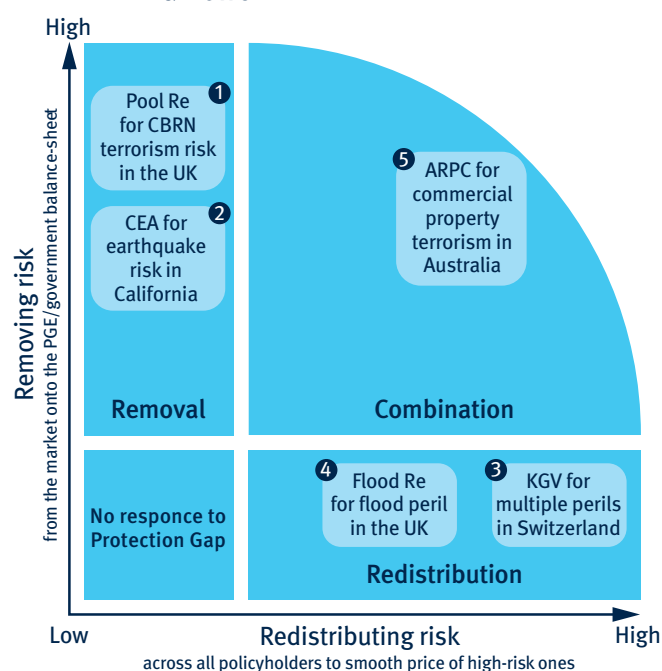
3.1 PROTECTION GAP STRATEGIC RESPONSE FRAMEWORK: TYPES OF MARKET INTERVENTIONS

Our research study shows that PGEs emphasize primarily either 1) removing risk, or 2) redistributing risk as their key means of market intervention (see Figure 3.1).

3.1.1 Removing risk

This risk refers to a market intervention in which risk is removed from the market onto the balance sheet of the PGE or the Government (vertical axis, Figure 3.1). This is particularly likely for risk that is seen as too volatile or extreme for the market to take, such as the threat of what is termed non-conventional or chemical, biological, radiological or nuclear (CBRN) terrorism, where the potential losses are beyond

Figure 3.1. Protection Gap Strategic Response Framework



- 1 Remove all risk from the market to the PGE government
- 2 Remove risk to the PGE and return only some to the market (e.g. through reinsurance or insurers retention)
- 3 Redistribute all of the risk across all the policy holders
- 4 Redistribute some of the risk across all policy holders
- 5 Remove risk from the market to the PGE/government and redistribute across all policy holders

the capacity or risk appetite of the market. A high position on this dimension would represent a PGE fully removing the risk of CBRN terrorism from the market. In this scenario, insurance companies may accept premiums from insureds for CBRN terrorism risk, so ensuring policies can still be issued. However, they then pass the entire percentage of that premium associated with CBRN terrorism risk to the PGE. The PGE can then provide the cover because it has access to some government guarantee (limited or unlimited) to pay for losses.ⁱⁱ

While the extreme position on this dimension is removing the risk fully from the market, responses may also vary along the continuum, by removing only some of the most extreme risk. For example, a PGE might remove a 'top layer' of risk as defined by market signals such as high price, or withdrawal of insurance supply, while risk below a certain threshold is retained by primary insurers in the usual way.

ⁱⁱ While the specific policy by which the risk is removed may indicate some future levying of higher premiums on the insurance market and policyholders to recover some future government costs, the actual mechanism is to remove the risk altogether in the first instance.

Risk removal to a PGE is an effective way to maintain supply, particularly in the face of sudden market withdrawal from extreme and highly volatile risk (see Objective 1 in Section 2). When there is no market appetite to provide cover, and yet there remains commercial demand for an insurance product such as nuclear terrorism cover, removing that most volatile risk allows market operations on less volatile risk to be restored, bringing back stability and security in a market.

Challenges. The issue of what and how much risk to remove from the market is fraught with challenges. We draw attention to two unintended consequences that emerge when removing risk from the market:

1. **Weakening risk appetite of the market:** PGEs that operate through risk removal are often set up to address an urgent crisis of undersupply. Under time pressure to find a solution, stakeholders tend to transfer all of the risk related to the specific peril to the PGE – even when some of the risk could still be traded by the market, at least when market conditions stabilize. However, without a deliberate policy to progressively return at least some of the risk to the market, the market might lose its appetite for that risk. Not trading the risk for a long time, can result in the market no longer having the necessary expertise and being reluctant to make the investment to develop it.

However, insurance markets exist to trade in risk. Exposure to risk helps them sharpen their knowledge, technical expertise and innovation for such risk. Removal of some risks (e.g. terrorism) or parts of such risks (e.g. particular flood-prone areas) may dull this competitive edge of the market for this specific peril. *“I think the insurance industry has grown a little bit fat and lazy when it comes to [specified risk] because they’ve always seen it as [PGE’s] remit ... They just basically said well I can sleep at night, I’m not taking that risk.”* (PGE stakeholder).

2. **Skewing PGEs/ Governments to higher expected losses:** If the PGE removes only the most volatile risk, allowing the market to continue trading by ‘cherry-picking’ the ‘easier’ or more profitable forms of risk, the PGE is essentially set up to absorb the problem of adverse selection in the insurance market. That is, the PGE takes the small body of highly exposed risk that does not yield sufficient volume or price to be profitable for the industry to trade.

However, if the PGE takes only the highly volatile or extreme risk, but does not also have access to the wider body of risk, with which to diversify its own exposure, then it has a portfolio skewed to higher expected losses that will be removed to the PGE and ultimately government balance sheet. This means that the taxpayer, through the government’s balance-sheet, will cover these higher expected losses for a) the purposes of allowing a market to continue to trade; and b) the protection of only a small, most exposed sector of society. Risk removal models thus raise critical questions about market subsidization and social fairness.

These two challenges are a trade-off, since keeping all the risk within the PGE can dampen market appetite, whilst leaving some risk with the market can skew government exposure. Nonetheless, risk removal remains a key strategic response by which PGEs can address a protection gap, whilst still allowing the market to function. It can be an immediate response to a sudden supply failure (see Objective 1), after which PGEs can seek to scale down their position on the vertical axis in Figure 3.1, gradually returning more risk to the market as the market problem rebalances.

3.1.2 Redistributing risk

This refers to taking the risk of loss by a relatively small group of highly-exposed policyholders and redistribute it across the wider pool of variably-exposed policyholders (horizontal axis, Figure 3.1). It is typically used in situations where risk-reflexive pricing makes insurance unaffordable for policyholders in highly-exposed areas (see Objective 2 in Section 2).

In this model, low-risk policyholders pay a slightly higher premium than what would truly reflect their risk, in order to subsidize an affordable premium for those who are highly exposed to risk. The PGE, typically formed as a pool, takes the premiums from all policyholders and uses the resultant revenue to redistribute and smooth pricing across all policyholders.

Redistribution as a strategic response essentially uses the PGE to restore traditional models of insurance. Historically, insurance losses were less predictable, modelled in coarser detail, and so pricing could not accurately reflect the risk on a case-by-case basis. Rather, the premiums of the many, widely distributed across possible exposures, covered the losses of the few. Today, however, the plethora and granularity of available data on risk exposure, combined with improvements in risk modelling in mature insurance markets,²⁰ has eroded these traditional ‘risk-sharing’ models of insurance. Properties that are most exposed to loss can be pinpointed and their policyholders charged individual premiums that more accurately reflect their specific risks.

While such models better specify risk, they do not necessarily address the protection gap. Rather, as noted in Objective 2, Section 2, they may widen it as some highly-exposed policyholders fall out of the pool of insureds. *“But improved models for whom? We can identify an individual property and apply rating factors. Are we doing that to provide more cover? Why are we doing that?”* (Industry stakeholder).

PGEs that adopt the strategic response of redistributing risk attempt to ameliorate these ‘improvements’ in risk-reflexive pricing by artificially creating a wide pool of insureds, in which the premiums of the many can continue to cover the extreme losses of the few. However, they can only do so with some government legislation, typically supported by an underlying notion of collectivism in the underpinning national culture, that enables a levy on lower-risk properties to subsidize higher-risk properties. Effectively the Government must legislate for a social objective to take some precedence over market objectives.

Challenges. Risk redistribution via a PGE is effective at counteracting the problems of highly-exposed actors falling out of the insurance nest. It can support high collective insurance coverage in a particular country or region, essentially bridging the underlying protection gap. However, it also comes with the following challenges.

1. **Growth of high-exposure areas.** Risk redistribution is predicated on a model of a large number of insureds, in which only a few are highly exposed. Take the example of flooding. We know that climate change and/or growing urbanization increases exposure to natural disasters such as flooding. This can result in very large or expensive areas being repeatedly flooded. In such a situation, the premiums of the many can no longer necessarily outweigh the losses of the few.
2. **Redistribution shifts focus away from risk mitigation.** In addition, redistributing risk breaks the market chain of risk, reward and responsibility. Insurance risk models send a strong price signal that specific risk-prone areas are only viable to trade if rewarded with a high premium. However, the redistribution strategy can induce moral hazard in which those at the highest risk of repeated loss are not incentivised to reduce their risk, or change risky behaviours (for example, through structural changes to their property to mitigate the effects of flood), since they do not bear the full costs of their exposure.

More broadly, the market signal of high prices can be seen as the prompt to improve risk mitigation in risk-prone areas, for instance through changes in planning permission to require improved methods of building in highly-exposed areas (see Section 5). Thus, bridging the protection gap through risk redistribution can not only suppress the price signal, but also direct attention away from risk mitigation as another means of reducing the protection gap. In these ways, risk redistribution can, in the long-term, exacerbate the very problem it was established to solve.

3.1.3 Combination of risk removal and redistribution

Removing and redistributing risk are not necessarily either/or responses. As indicated by Figure 3.1, PGEs can combine risk removal and risk redistribution, albeit not necessarily in equal measures, or on the same elements of risk. Rather they may take an approach where they remove some elements of risk and redistribute others. Often such changes occur in an evolutionary way. A PGE may initially be established to solve, for example, the problem of lack of supply for a very volatile risk, through a strategic removal response. Once supply begins to return, it might also employ some redistribution of risk.

To better understand this strategic response, we present the case study of the Australian Reinsurance Pool Corporation (ARPC) – a PGE that uses this combination approach.

The case of ARPC: Evolving strategic responses to address a supply failure

The ARPC was formed in 2003 to address the limited capital supply for terrorism risk globally following the 2001 terrorist attacks on the World Trade Centre. Coming relatively late in the formation of such pools, the Australian government and the insurance industry were able to examine and learn from many existing PGEs. Initially, the Terrorism Insurance Act was established, which addressed the problem of insurance supply by over-riding any terrorism exclusions in contracts of insurance covering ‘eligible’ property (as defined in the Act), requiring the insurance industry to pay insured policyholders for losses on eligible property if the Australian government declared a particular incident as a terrorist act. To this extent, terrorist insurance was thus mandatory for all insured policyholders because an insurance company would find themselves paying for terrorist losses by default, following a declared terrorist act, even if they did not deliberately offer such cover for eligible property.

At the same time, the ARPC was set up with a remit to respond strategically by *removing the risk* of paying for terrorism losses in eligible policies from the insurance industry. Insurers pay ARPC a premium based on three broad tiers of risk, from highest premium in central city locations, to suburban, to lowest premium in rural areas. In return, they are given full removal of terrorism risk, since the ARPC, operating as a reinsurance company, would pay all the claims beyond the insurers’ retentions to a limited liability of \$10 billion AUD. ARPC would meet these payments through its own capital reserve, the additional reinsurance it bought in global reinsurance markets as a retrocession product, and thereafter, from the government balance sheet, which guarantee the Australian government provides ARPC for a fee.

While it is voluntary for insurance companies to purchase terrorism treaty reinsurance from ARPC, if they do choose to do so, they must transfer the risk for all eligible policies within their portfolio. Given the legislative situation in which they are liable for commercial property losses arising from terrorist attack, almost all of the insurance companies in Australia have taken up the option to transfer their terrorism risk to the ARPC. This approach thus not only uses risk removal as a strategic response but, because insurance companies are required to transfer the risk across all of their eligible policies in Australia, was also a risk redistribution strategic response. Specifically, those at low risk of terrorism loss cross-subsidized the highest threats, resulting in a diversified pool of insured commercial risk across higher and lower threats around the country.

The ARPC was set up with a remit to remain relevant to problems of market supply through a three-year legislative review process. At these reviews, the ARPC has consistently evolved to both widen the definition of which properties might be defined as eligible under the Act. For example, at the 2015 review the definition of commercial use of a

property was expanded to include mixed-use residential and commercial buildings in which at least 20% of the property has a commercial use and all buildings with a sum insured value of \$50 million or more.

At the same time, ARPC has scaled down the level of risk removal, by pushing insurers to retain more of the risk of terrorism losses on their own balance sheet to a specified threshold that is aggregated across the industry. This amount of retention has grown progressively from an initial threshold of \$150 million AUD to \$200 million, as an aggregated industry loss, from July 2018. The maximum retention for individual insurance companies has increased from \$10 million AUD to \$12.5 million AUD.

In scaling down risk removal, the ARPC is thus working to address the problem of industry supply, by working with the primary insurance industry to help them supply some terrorism insurance from their own balance sheets. At the same time, because ARPC buys reinsurance cover itself, it has brought reinsurance capital to the market, further addressing the problem of capital supply. Yet the government balance sheet remains available for losses above the industry appetite to supply capital.

Hence, a combination of risk removal and risk redistribution, evolving within a legislative framework of three-year reviews have ensured that the ARPC continues to evolve in consultation with its stakeholders in government and industry, and the wider needs of Australian society.

PGEs typically start with a removal or a redistribution approach in response to any particular type of protection gap. For instance, a PGE might fully remove a risk after a market shock when supply fails, but then gradually return risk to the market as the market's understanding and appetite return. Or a PGE might introduce risk redistribution in highly risk prone areas, but then gradually reduce risk redistribution as risk mitigation efforts in such areas progressively make insurance premiums affordable again.

Ideally, PGEs would have flexibility along both axes of Figure 3.1. They should be able to scale up removal after a major shock in which insurance industry supply in a particular region or on a particular peril is disrupted. Conversely, they should be able to scale up redistribution where overall capacity within a region is robust, despite some highly-exposed pockets of risk.

A combination approach is potentially very efficient for PGEs that have a portfolio of different types of risks. Multi-peril PGEs, such as CCR, can take different approaches to perils, emphasising risk removal on some risks and risk redistribution on others, according to the available modelling capability and market appetite for each risk.

Challenges. The main challenge for the combination approach is how to move between the axes of Figure 3.1 – usually from a starting position wholly on either the removal or redistribution axis. Critically, there needs to be a highly-flexible approach to the role and remit of the PGE. A combination approach,

particularly one in which removal and redistribution on any particular risk may be scaled up or down, necessitates an adaptable and even nimble approach to legislation and governance, in which multi-party dialogue between stakeholders remains open.

3.1.4 Summary: evolving remit or mission creep?

As Figure 3.1 suggests, risk removal and risk redistribution are different strategic responses that a PGE may take to the management of a specifically identified local protection gap. However, they should not be seen as static positions. There is no 'ideal type' of strategic response. Rather, as the nature of the protection gap, and the interdependencies between the key stakeholders evolves, the strategic response of a PGE needs to evolve to meet the multiple demands upon it.

While PGEs are well placed to develop new responses as risk evolves, they also need to be at the heart of continuously-evolving legislation and multi-party dialogue to manage the multiple different interests involved in bridging the protection gap. Hence, strategic responses are not simply technical issues about approaches to risk transfer. Rather, a key feature of PGEs is the need for high competencies in managing the social and political economy within which approaches to risk transfer need to evolve. In particular, PGEs need to balance tensions between demands for an evolving remit and fears that this may lead to "mission creep" that distorts the competitive market.

3.2 MARKET EFFECT: STRATEGIC POSITIONS IN THE VALUE CHAIN

To bring market solutions to socio-politically defined problems, PGEs intervene in the traditional value chain for risk transfer (see Figure 3.2). We now explain three possible strategic positions that they may occupy. These positions are archetypes, meaning that they illustrate general characteristics of occupying that space in the value chain. The reality of any particular PGE, as explained in our case examples, may differ slightly from the archetype. We address the implications of each archetype in terms of competitive effects, challenges, and what that type is 'Best For'.

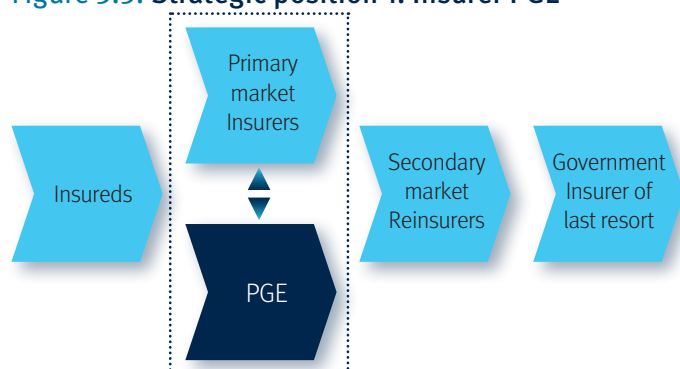
Figure 3.2. Value chain for risk transfer



3.2.1 Strategic position 1: The 'Insurer' PGE

PGEs can act as an insurer operating in the primary market to provide policies on a particular risk that is no longer covered by the market (Objective 1); or one for which cover has become unaffordable for those highly exposed to the risk (Objective 2). As shown in Figure 3.3, this means that they provide insurance policies directly to insureds in return for a premium. They also buy reinsurance from the private market to cover their risk exposure.

Figure 3.3. Strategic position 1: Insurer PGE



Examples of the Insurer PGE archetype are EQC, CEA, and NFIP. This position is typically taken by PGEs offering homeowner policies and has two main strategic implications:

Co-opetition in distribution. Typically, Insurer PGEs develop their own insurance policies on the risk they deal with and offer them to policyholders via traditional insurers. Homeowners often buy their insurance as a ‘bundled’ product that covers them from the risk of fire, flood, or earthquake, alongside other perils. Such policies provide a catch-all of potential risks and, usually, provide the necessary protection of assets to underpin a homeowner’s mortgage. When an Insurer PGE, like CEA in California, intervenes in the value chain to bridge a local protection gap, then a proportion of the homeowners’ insurance cover, namely earthquake cover in California, can be provided through the PGE.

There are situations, as in California with earthquake, when the particular cover for this peril can still be provided by traditional insurers or they can choose to attach CEA’s cover to their homeowners’ insurance product. Policyholders then select whether they buy the PGE cover, the private market cover, or, if purchasing cover is not mandatory, do not buy any policy for that particular peril. However, in other situations the cover for a peril is provided exclusively by the PGE. This means that the Insurer PGE essentially replaces traditional insurers for this particular cover. For example, the New Zealand Earthquake Commission (EQC) provides the earthquake component of all homeowner insurance policies to a particular threshold and receives a percentage of the premium charged on those policies.

This position in the value chain involves collaboration between insurers and the Insurer PGE. The insurer can continue to provide comprehensive cover through a bundled product to policyholders, with the help of the PGE that takes some risk, usually the most volatile, or most exposed. At the same time, there is also an element of indirect competition as they both occupy the same position in the value chain and the PGE provides a product for which the private market might otherwise develop risk appetite to supply. This mixing of collaboration and competition is usually known as co-opetition.

Risk-reward-responsibility effects. While distribution via insurance companies is efficient, a potential problem arises. Since insurers don’t take the risk, don’t get the premium

(reward) and also don’t pay the claims (responsibility) for the proportion of the policy that is provided by the Insurer PGE, they are not incentivised to compete to sell more of the cover, and thus ensure take-up of the PGE’s percentage of the policy.

In addition, after an event, a key feature of the insurance value chain is that capital flows to the insurers to pay claims. One of the key functions of primary insurers is to assess damage in order to manage the effective payment of claims for which they are responsible. However, again, unless there is a specific mandated requirement for primary insurers to assess loss, in order for the PGE to pay claims, or the PGEs develop their own apparatus for loss adjustment and payment of claims, the direct chain of responsibility for accurate risk assessment and distribution of payments is also disrupted.

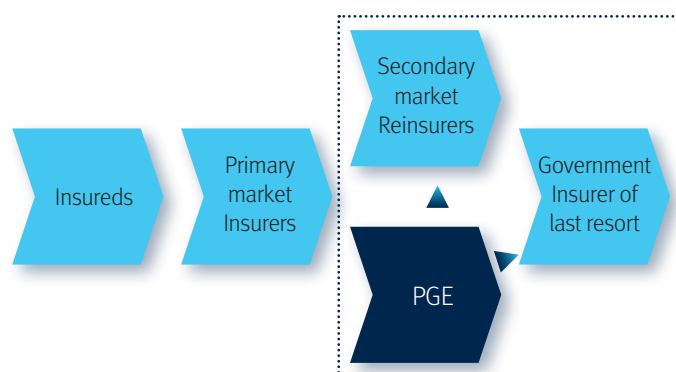
While not insurmountable, both elements indicate how Insurer PGEs affect the relationship between risk, reward and responsibility.

Best For. The Insurer PGE archetype is best for ensuring personal lines cover to citizens where a region is heavily exposed to a key peril, such as earthquake or windstorm. It can ensure that all members of a society have access to homeowner cover that could otherwise be unaffordable for some. It may be particularly effective for the risk redistribution strategic response explained in Section 3.1, especially where cover is either mandatory, or required by lending institutions in order for policyholders to obtain a mortgage.

3.2.2 Strategic Position 2: The ‘Reinsurer’ PGE

PGEs can act as a reinsurer operating in the secondary market. In this scenario, insurers operate as normal in the market, providing insurance products. However, they then transfer that proportion of risk specifically identified as a protection gap, such as the risk of flood or terrorism, to the PGE. In the event of a loss, the PGE provides the capital to pay the claims against the insurance policies for that particular proportion of the risk. Some examples of this archetype are Flood Re in the UK, ARPC in Australia, and CCR in France.

Figure 3.4. Strategic position 2: Reinsurer PGE



This position in the value chain has the following strategic implications:

Preserving the primary market. The Reinsurer PGE intervenes in the value chain to preserve the ability of the primary market to trade in two ways:

1. It can address a supply failure in the secondary market (see Objective 1) by removing risk from the market (Section 3.1.1) to the PGE. The Reinsurer PGE provides the necessary reinsurance capital that the primary market needs to continue trading if the traditional secondary market withdraws capital after a shock, or has insufficient capacity for the scale of the risk. The Reinsurer PGE may itself buy a retrocession product from the reinsurance market, as indicated in Figure 3.4 by the presence of the secondary market in the chain; and/or it may have access to a government balance sheet to underpin its own exposure (e.g. Pool Re).
2. When insurance premiums become unaffordable (see Objective 2) the Reinsurer PGE can act as a price-smoothing mechanism by redistributing risk (Section 3.1.2).
 - a. The Reinsurer PGE may act as the ‘transformer’ of price differences, where it takes all of the personal lines risk from the primary market, acting as the dominant reinsurer. It essentially smooths the reinsurance price by pooling all risks, of high and low exposure, for a nation, endeavouring to ensure the overall reinsurance premium received is sufficient to cover the overall national exposure. In doing so, it is able to offer lower reinsurance premiums to the primary market, since it needs only to cover its own diversified exposure, without concern for profit, or higher premiums to offset the potential volatility of any one primary insurer. It thus enables primary insurers to also smooth their own pricing of personal lines in highly-exposed areas because they can transfer such risk at a lower price to the Reinsurer PGE (e.g. CCR).
 - b. Alternatively, only the most highly-exposed risk may be transferred from insurers to the PGE. In this scenario, insurers usually charge a below-market price that is affordable for policyholders. These premiums, for this highly-exposed risk, are passed on to the PGE, which is then liable for the claims against that risk. To afford the payout for those claims, the PGE has to receive a subsidy from insurers, levied on all policyholders, that becomes its capital reserve to cover the high risk of loss in the PGE portfolio (e.g. Flood Re in the UK). Here, the Reinsurer PGE operates a risk-sharing mechanism between its own balance sheet and the primary market through the levy, but can also use other forms of risk transfer mechanism, such as buying a retrocession product and/or transferring risk to the Government, to manage its own exposure.

In all cases, the primary market is enabled to continue trading in risk, whilst being able to transfer that proportion of risk, which comprises the basis of an identified protection gap, to a Reinsurer PGE as the secondary market. The introduction of a Reinsurer PGE, providing ample reinsurance cover for less attractive (or new) risks, can also enable primary insurers to obtain new business that will expand the market. This means that insurers can underwrite new policies, which as a result can narrow the local protection gap.

Competitive effects in the secondary market. The Reinsurer PGE has access to a pool of primary risk that might otherwise be transferred to reinsurers, particularly as their appetite for that risk evolves. If reinsurers have appetite but are restricted from accessing primary market risk, because it all goes to the PGE, it may be unclear whether the PGE necessarily offers the best price, since the effects of competition in driving down price will be restricted. Thus, regulatory oversight is needed to ensure that the PGE is not acting as a monopoly for primary market risk that is anti-competitive to the secondary market, or that drives up prices.

One way this can be managed is if the Reinsurer PGE acts as an aggregator for individual highly-exposed primary market risk, and then transfers part of this risk to the secondary market. As with Flood Re in the UK, the secondary market can both directly access flood risk from primary insurers and also access flood risk from the PGE.

Best For. As discussed in Section 3.1, PGEs can scale up or down their strategic responses of risk removal and risk redistribution, in line with the changing nature of the protection gap. While such strategic flexibility necessitates a skilful coordination of the interdependencies among stakeholders, who may have conflicting interests, the Reinsurer PGE can be an effective archetype for responding to fluctuations in (re)insurance capital, because of its position between the primary and secondary market.

For instance, after a market shock caused by a big catastrophe, there may be a shortage of reinsurance supply in the market. At this point, the Reinsurer PGE can facilitate risk removal by scaling up to take more risk from the primary market, which it can hold, or pass directly to the government balance sheet following shortage of supply. At other times, when primary and/or secondary markets recover their risk appetites, the Reinsurance PGE can scale down its own share, effectively increasing primary market retention and passing more risk to the secondary market (e.g. ARPC or Pool Re). In this way it can enhance risk redistribution across the entire value chain.

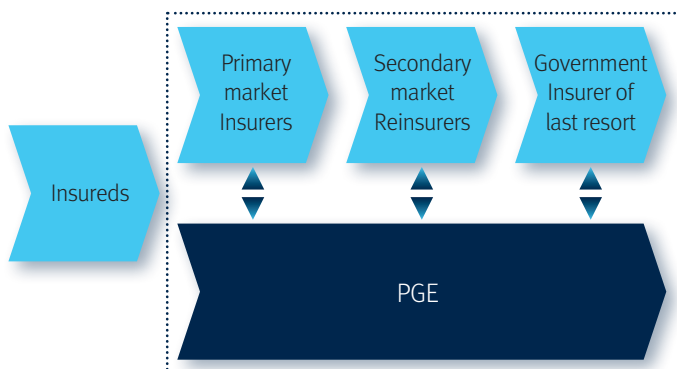
3.2.3 Strategic Position 3: The ‘Market Capture’ PGE

This type of PGE ‘captures’ risk throughout the value chain, operating in both the primary insurer and the secondary reinsurer spaces, and also accessing the government balance sheet. It can act as a primary insurer for all, or at least most, risks in a country, either alongside traditional insurers as an additional product, or by ‘co-insuring’ on existing products with the primary market insurers, to support the market’s ability to provide cover to and pay claims.

Because the PGE holds all premium transferred over many risks on a national level, it has a highly diversified portfolio that enables it to optimize its capital reserves.²¹ Essentially premium generated across the portfolio can pay for losses in one part of the portfolio. Hence, the Market Capture PGE does not necessarily need to purchase reinsurance but can choose instead to act as its own reinsurer, due to the benefit of a diverse portfolio of risks that lowers the overall exposure to losses. This type of PGE is typically a public-sector organization with access to the government backstop to secure its balance

sheet above the capital reserves it can amass through its privileged access to the primary market.

Figure 3.5. Strategic position 3: Market Capture PGE



This archetype has the following strategic implications:

Comprehensive national protection. This type of strategic response can be very effective when a consistent national approach exists to provide the most comprehensive cover to all citizens at an affordable price. This presupposes that most citizens are insured, typically through some mandatory form of cover, and that any private sector insurance companies are co-opted into sharing cover with the public-sector PGE. This way, the Market Capture PGE enables the risk redistribution element of protection at the primary level, whilst enabling risk removal from the private-sector elements of the market at the secondary level.

In effect, this is a means of mutualizing risk cover on a national level to address the protection gap, albeit not necessarily by transferring it to a market.²² In such situations, the mutualization acts as a price-smoothing mechanism, which may lower overall cost of cover to individual policyholders.²²

Crowding out private sector provision of catastrophe insurance. The strength of this strategic response in providing comprehensive national cover may also bring about unintended effects, primarily in deterring private sector insurers from offering products in the catastrophic-risk market. This occurs in two ways.

1. **The primary market** may lose its competitive or market interests. We refer to this effect of this type of PGE strategy as ‘market capture’ with a nod to the concept of ‘regulatory capture’.²³ When market parties operate in a context where the Market Capture PGE is dominant, they can end up relying on the PGE to take the majority of volatile risk, lose or never develop expertise in trading that risk, and therefore lose appetite for such risks. Indeed, the market players may see this as in their own best interests to protect their balance sheets. This might happen even where there are governance structures in place to ensure that the PGE responds to changes in risk appetite in the industry, and even where the two parties may feel they have independently negotiated their positions. While, as noted above, this may have benefits, the flipside is

that it dampens the risk appetite and competitive edge of market players in ways that may stifle market-based innovation. For example, primary level players do not have to worry about calculating the risk-reward-responsibility relationship in measuring their exposure, pricing policies, and purchasing risk transfer. The risk and responsibility of paying for that risk is carried anyway by the national provider. They are therefore not incentivized to improve their risk modelling and pricing mechanisms in order to gain a competitive edge.

2. **A national barrier to competition at the secondary market level exists.** The Market Capture PGE does not need to access reinsurance, due to its comprehensive access to wide diversification, underpinned by a government guarantee. At the same time, the international reinsurance market cannot offer cover directly to the primary market, because the primary market trades solely with the nationally-owned PGE. While this is beneficial from the perspective that the cost of buying reinsurance is avoided, it also hinders the inflow of capital from global markets to pay for national losses.

Best For. The Market Capture PGE effectively nationalizes the insurance market. It is the best for a country wishing to use insurance-based mechanisms to provide comprehensive cover for its citizens, and to control the pricing of that cover. It is thus effective where cover is largely compulsory and where the primary aim of the PGE is to bridge the protection gap by ensuring that citizens have the maximum access to widespread cover. It is particularly suitable for political economies and historical contexts in which there is a nationalised approach to public goods and facilities.

An example of the Market Capture PGE is the Spanish Consorcio de Compensación de Seguros (CCS). CCS is a public business entity with assets separate from those of the State. It has provided insurance for a comprehensive set of catastrophic risks, including earthquake, flooding and terrorism, to both private citizens and businesses for several decades. CCS insurance is provided automatically on the back of regular insurance policies, and financed with a geographically-flat “surcharge” calculated on the basis of the capital insured and type of policy (residential homes, offices, shops, etc.). The premium is collected via the insurance companies that provide the policy. While it is not compulsory to have these “extraordinary” risks covered with CCS, the surcharge is still due once a regular insurance policy is set up. This system has enabled Spain to reach a high level of penetration of catastrophe insurance.²⁴ Apart from the fact that all policies are sold by private insurance companies, collaboration with primary industry players is ensured, as CCS’ 12-member Board includes six high-level executives of private insurance companies. This board structure aims to ensure that CCS only takes up the risks that the market is not willing to cover, and indeed there appears to be little interest in expanding into catastrophic risk in the Spanish insurance market.

BEST FOR strategic positions in the value chain**Insurer PGE**

Best for ensuring cover to citizens in a region or country heavily exposed to a peril. It can effectively use risk redistribution as a strategic response especially where cover is mandatory, or insurance penetration is high.

Reinsurer PGE

Best for responding to fluctuations in (re)insurance capital supply for a peril. It can effectively move between risk removal and risk redistribution or combine both responses.

Market Capture PGE

Best for a country that aims to provide comprehensive insurance cover for its citizens at a controlled price. Suitable for contexts with a nationalised approach to public goods and facilities.

is seen as critical to the ability to solve the protection gap, in collaboration with government initiatives, it is important that these markets are maintained. At the same time, as we suggest in our examples of risk redistribution, the intervention of PGEs can have unintended social consequences that might even exacerbate inequality. Hence, none of the strategic responses we discuss, or the positions in the value chain are necessarily right or best for PGEs. Rather, each response and each archetype represent specific ways of managing a localised protection gap that is itself evolving. Critically, therefore, ongoing dialogue and cooperation between state and market parties will be important to allow social and market interests to evolve in tandem.

3.3 SUMMARY

In section 3.1, we have shown the strategic responses of risk removal and risk redistribution through which PGEs use market mechanisms of risk transfer to address the socio-political objectives for which they have been established. At the same time, as we show in Section 3.2, such market-based solutions intervene in the natural functioning of a market in ways that may have unintended consequences for the market. Hence, there will often be tensions between market and socio-political interests, particularly as PGEs endeavour to evolve alongside the evolving protection gap.

If the co-opting of robust and healthy (re)insurance markets

SECTION 4. Protection for sovereigns: Insurance as a disaster liquidity product

One of the objectives that PGEs are set up to address is the desire to protect sovereign states with fragile economies that are highly exposed to natural catastrophe, where there is little insurance penetration (see Objective 3 in Section 2). Such PGEs address a different protection gap from those found in mature insurance markets. Specifically, they are not attempting to fund reconstruction for private citizens and businesses after damage and loss. Here, the gap lies between a need for a rapid humanitarian response after a disaster and the capability of a sovereign to meet those costs. The sovereign is the ‘insured’, taking responsibility for the nation’s risk, and the level of its cover through the PGE.

The resulting insurance products are not designed, at least initially, to supply the funds necessary for governments to fully rebuild critical infrastructure such as roads, water and sewage systems, hospitals, and schools. Instead, payouts from these products enable governments to keep running in the aftermath of a disaster and provide key disaster relief functions,^{15,16,17} particularly in the critical period between disaster striking and international aid arriving. Because of this, they are sometimes referred to as disaster liquidity products, which term we use in this report.

These PGEs are organizational vehicles aiming to:

- a) quantify (through catastrophe modelling¹⁷ and strategic planning) the level of disaster relief funding which might be needed after future catastrophes;
- b) transfer some risk for such outlay from the government budget to a capital market.

In this way, they provide sovereigns with autonomy over at least some of their own disaster response, so reducing their reliance on aid. 🗣️*What we’ve had in the past in terms of a natural disasters, was a heavy reliance on development partners coming in with aid to assist us in recovery and to help us work through rebuilding. We looked at this and decided that we need to do something ourselves in terms of preparedness.* 🗣️ (Government stakeholder)

Both the PGEs formed, and the relation they address between risk and payout, differ from those in mature insurance markets, as we now discuss.

4.1 CALCULATING INSURANCE AS DISASTER LIQUIDITY

Historically, the idea of fulfilling a need for disaster liquidity via insurance was new, and needed an innovative solution. That solution was found by adapting the financial instrument known as a Catastrophe (CAT) bond, which was already well-known

to insurance markets. The key point of this type of product for the purposes of this report, is the parametric basis for modelling risk and triggering payment. Products that work on a parametric basis disburse payment not on the basis of actual losses, but when a particular parameter (for instance, wind speed in certain locations, or total rainfall, or modelled losses) or index of parameters reaches a determined threshold (see Glossary).

This structure allows insurance products to overcome the limited data available on exposure, vulnerability, and historic losses in countries which require disaster liquidity.²⁵ These disadvantages make it very difficult to estimate risk and create insurance products for reconstruction of individual buildings or facilities. Indeed, traditional insurance penetration in such countries is low.

However, disaster liquidity does not need models which can estimate detailed damage and loss to property. Instead, it needs to relate the probability and the severity of a particular disaster occurring in a specific region (such as a hurricane at Category 5 passing through the island of Barbados), with the *overall* potential damage to, and human consequences for that region, and the operations needed to restore civil society. In such models, the parameters would be the hurricane Category (5), and the direct ‘hit’ on a particular area in Barbados. On the basis of the models, estimates can be made for the funding needed by the sovereign government to take effective action. Triggers can then be established that enable a payout of a particular size if a hurricane does occur at that wind speed in a set of agreed geographical locations, as declared by an independent third party.

A key function of disaster-liquidity PGEs is therefore to develop the necessary modelling capability to relate the risk of different levels of disaster to the level of funding which might be necessary to keep Government and society functioning.

All parametric products entail the risk of the parameters or modelled losses not providing an accurate reflection of the gravity of the disaster (so called ‘basis risk’). Hence these products have often evolved from an initial binary trigger – in which a single specified level of severity must be reached to release the entire amount of capital. With such a binary trigger, if a disaster comes in at just under the severity of the parameters, there would be no payout despite significant need for emergency government expenditure. This situation can undermine a sovereign’s confidence in a product. Increasingly, therefore, there are staggered threshold triggers that enable partial payments at different levels of agreed severity.

4.2 PGES IN RELATION TO SOCIAL AND MARKET STAKEHOLDERS

Disaster-liquidity PGEs are typically an outcome of the collaboration and technical support between:

- one or more sovereign states;
- one or more development organizations, such as the World Bank;
- donor organizations, such as DFID in the UK;
- scientific and modelling organizations.

The resultant PGE may be the initiative of a single sovereign, such as FONDEN in Mexico,²⁶ or, increasingly, multi-sovereign risk pools, such as CCRIF (see case study), ARC (with a potential membership of all African nations), or PCRAFI (providing disaster risk modelling and transfer to Pacific Island countries). When multiple sovereigns develop a risk pool,¹⁴ they benefit from greater risk diversification and also enhance their purchasing power in global markets. As indicated in the case study of the CCRIF, it is critical that sufficient sovereigns remain members of the pool, to ensure this diversification and critical mass. Negotiating their ongoing purchase of cover can thus be a source of tension during the annual renewals between PGEs and their members.

The history of CCRIF: The Caribbean multi-sovereign risk pool

In 2004 Hurricane Ivan devastated Grenada and caused heavy damage in other areas such as Jamaica and the Cayman Islands. Recognising that they were all highly exposed to similar hazards such as tropical cyclones and earthquakes, the twenty countries of the Caribbean Community (CARICOM) decided to approach the World Bank for help to manage their disaster risk. Under the technical leadership of the World Bank, a multi-sovereign risk pool, the Caribbean Catastrophe Risk Insurance Facility (CCRIF), was proposed to transfer some of the risk of disaster into global reinsurance markets. Collectively, each of these relatively small countries would benefit from shared technical expertise, diversification across their member states, and increased reinsurance purchasing power.

Proprietary insurance models for the region were sparse, so the pool first needed to develop data and modelling capabilities to help members quantify their risk. A Japanese Government grant helped provide scientific expertise which came up with a novel proposal: to provide disaster liquidity insurance products based on parametric triggers, through which member countries could gain an injection of capital to manage their cash flow in the immediate aftermath of disaster.

With such a novel solution the process of establishing a coalition of member countries and donors involved intense outreach, communication and preparation, including two international conferences. As a result, operating capital was provided by contributions to a Multi-Donor Trust Fund (MDTF) from the Governments of Canada, the UK, France, Ireland and Bermuda; from the European Union, the World Bank, and

the Caribbean Development Bank, and through membership fees paid by participating governments.

CCRIF thus formed in 2007 as the world's first multi-sovereign risk pool providing parametric insurance. In fact, in its first year, the new products demonstrated their value with Saint Lucia and Dominica receiving payouts totalling almost US\$1 million after an earthquake in November. The next year Turks and Caicos Islands received a US\$6.3 million payment after the impacts of Hurricane Ike.

Since then CCRIF has not been static. There have been active efforts to retain and gain members, in part by developing an increased range of products, such as excess rainfall, all of which required additional data and modelling. In 2014 CCRIF was restructured into a segregated portfolio company (SPC) to facilitate an expansion of the CCRIF membership base the next year. Through partnership, CCRIF started offering earthquake, tropical cyclone and excess rainfall policies to Central American governments.

The expansion required additional funding. In 2014, another MDTF was established by the World Bank to support the development of CCRIF SPC's new products for current and potential members, and facilitate the entry for Central American countries and additional Caribbean countries. The MDTF currently channels funds from various donors, including: the governments of Canada, the United States, Germany, and the European Union. In 2017, the Caribbean Development Bank, with resources provided by Mexico, provided funding for enhanced insurance coverage to the Bank's Borrowing Member Countries.

Today CCRIF has 16 member countries from the Caribbean and 1 from Central America. As of May 2018, CCRIF has issued total payouts of US\$130 million to 13 member countries, all within 14 days of disaster. During the annual policy renewal negotiations with member governments, CCRIF works actively to help members understand their risk, provide a business case to support them in finding the necessary financial allocation in their budgets to continue buying risk transfer products, and reassure them that CCRIF continues to remain relevant to members' needs through continuous evolution.

CCRIF soon will be introducing three new products; for drought, agriculture and fisheries. It is also discussing the feasibility of introducing parametric insurance in other sectors that are adversely impacted by disasters and where insurance is not always easily accessible on a timely basis. Product ideas discussed cover other industries, such as tourism, and public utilities such as power and telecoms. Through such efforts CCRIF can both broaden the risk pool and increase its diversity, and, more importantly, evolve to meet the needs of a wider range of insureds.

The market players to whom the risk is transferred are typically global reinsurers, not aid or non-profit organizations. They price and trade risk for profit and issue payouts on the basis of commercially agreed market triggers. However, during the establishment of the PGE, other parties such as development

and donor organizations may operate on a different basis that is not strictly commercial.

1. Most technical modelling of financial products is done on a proprietary or market basis, with the expectation to recoup the costs of developing the models from either trading products or licensing those models to others to trade products. However, in the case of developing economies, the rate of insurance penetration is too low to justify development of risk models on a strictly commercial basis. Rather, donors or development organizations may pay for the development of the technical infrastructure that the PGE then draws upon to generate products.
2. The ultimate intention is for sovereigns to pay their own premiums, as part of taking responsibility for their own disaster response. However, in exceptional cases, such as the Caribbean Development Bank's payments of Haiti's premiums for membership of the CCRIF, donors may pay the premiums for some sovereigns, enabling them to participate in the risk-transfer product. Sometimes these payments are on a sliding scale, decreasing each year as the sovereign assumes greater understanding of both the product, and command of their resources to pay their own premiums.

As these points suggest, such PGEs bring together an especially complex set of parties with both market and social objectives. In particular, donors and development organizations, with their social mission, play a key role in establishing these PGEs and enabling the transfer of sovereign risk to financial markets. However, an important feature of these schemes is that they enable a path through which countries become increasingly able to access financial markets, self-fund, and expand their insurance cover.

4.3 BENEFITS OF DISASTER LIQUIDITY PRODUCTS

While these disaster liquidity products are different in aim and scope from traditional catastrophe insurance products, they have certain advantages for countries with emerging insurance markets, which allow them to play an important role in recovery from catastrophe. The main advantages include:

1. **Financial protection.** These products, with their limited scope, have smaller premiums (and payouts) than traditional insurance products, and are therefore more affordable.
2. **Rapid payout.** Payouts from these products generally fall far below the cost of the devastation actually experienced by a country. However, their effect is considered amplified because of the rapidity of payment. Cash flow in the immediate aftermath of disaster can provide services that prevent the humanitarian crisis from escalating.²⁷ For example, in a drought, the provision of food to people within their communities can prevent migration and the development of a refugee crisis. Similarly, the provision of clean water and shelter after a hurricane can prevent the development of illness that escalates the crisis. Hence, it is not simply the size of the payment, but its timing in the disaster response that is critical. *“I remember when we saw the payment from CCRIF after the earthquake, it was*

very quick... The President declared a state of emergency and so we put the money in an emergency budget. Then the Government could use this money to respond.”
(Government stakeholder)

3. The introduction of these products generates new knowledge and expertise. Data access and collection improves, resulting in stronger modelling capability. This can have positive effects in two ways:

a. **Growth of insurance.** Governments and other public organizations gradually develop a deeper understanding of how these products work and are educated on the benefits of insurance-based risk transfer mechanisms. The inflow of data and modelling capability can work for the mutual benefit of stakeholders' social and market objectives. It can expand the appetite of governments to increase their risk cover and of market players to provide capital for such cover in these regions. For instance, CCRIF, after 10 years in operation, it is introducing additional disaster products such as for excess rainfall, and additional insurance products such as for fisheries,²⁸ in response to the needs of its member countries. *“Here people were not very financially literate about it ... but I think the work we are doing is very important for all the other stakeholders that are now interested in this specific market because we kind of opened the door to it.”*
(PGE stakeholder). The establishment of insurance products for disaster liquidity may also stimulate the progressive development of insurance products for reconstruction of national infrastructure, as and when countries can afford to purchase such cover.

b. **Empowerment over disaster response.** As data and modelling expertise improve, governments can better understand their vulnerability from potential disasters and so improve disaster mitigation and resilience. For example, they can gain a better understanding of the risk they are carrying and its impact on their budgets, enabling better financial planning for catastrophic risk.

“Thanks to [the PGE] we now have exact figures. Knowing that three years ago there was [a disaster] and it cost you this, but if you had insurance it would have cost you this ... When you have those figures, it is really clear to explain to a Minister that you can better plan for your finances ... then you realize that OK, yes, maybe we should consider [insurance] going forward.”
(PGE stakeholder)

These products can also enable governments to take more responsibility for and have more control over their response to disasters – for instance, by formulating costed contingency plans – and reduce their reliance on international aid organizations. *“The fact that it is the [sovereigns] that initiated the creation of [this PGE] is also a big signal that [this region of the world] now wants to take that issue into their own hands and not just wait for the solution to come from outside.”*
(PGE stakeholder)

In general, PGEs aimed at disaster liquidity have proved a successful marriage of social and market objectives. Participants from the insurance markets benefit because a new market is made accessible, and because modelling techniques are expanded; governments and other social agents learn to achieve social objectives via market mechanisms, which can leverage their resources.

4.4 ENABLING CONDITIONS FOR SUCCESS

The disaster liquidity products being developed by PGEs must also overcome some challenges to realize their many positive effects. Key enabling conditions include:

1. Their aim should be clearly communicated, so that they do not engender misplaced expectations about the nature and extent of the cover provided. This is critical as misunderstanding about what these products can do (finance disaster response with a specified amount in a specified time period) and cannot do (finance property reconstruction) can lead to backlashes that might reduce trust in the product and reduce future levels of insurance protection.
“So at first I was not a fan. But then I spent time getting more acquainted with the product, how it works, the trigger, understanding the trigger. And at that point I recognised that like any other business, they are selling a product, and really and truly the failure was at the level of governments not spending enough time to appreciate the product and what it can or cannot do for them.”
 (Government stakeholder)
2. Improving the metrics for modelled losses, pricing and triggers for payments is also vital to increase sovereigns' confidence in their ability to use these products as part of the ex-ante preparation for disaster. Better modelling also helps in attracting market players to invest in creating their own products to transfer these types of risks into the capital market.
3. Adherence to market signals is a vital principle in promoting market confidence. In the long term it will enable the market to make the fullest contribution to the social development objective – that of giving sovereigns autonomy over their own affairs.

In the shorter term, and more particularly in the early stages of model and product development, market interests to stick to the modelled triggers may conflict with the social development interests to provide relief. For example, in the case of Malawi, triggers were not met per the contract agreement placed by the government but conditions on the ground demonstrated a clear case of a drought event (with this discrepancy driven largely by some of the modelling customisation assumptions).²⁹ Being proactive about investigating such situations and finding technical solutions grounded in the models and methodological triggering approach are critical, as well as the flexibility to accompany such learning process in these countries.

For developing countries, where insurance is seen as a luxury in extremely fiscally constrained circumstances, simply sticking to contracts that may be incompatible with the development mandate of PGEs could prove counter productive. Indeed, embedding market principles and developing financial capabilities, gives confidence to market-players and empowers sovereign states to manage their own risk. Likewise, the flexibility to accommodate the required learning process among multiple parties with different interests is an ongoing challenge for these PGEs, necessitating multi-party dialogue and flexibility.

4. The success of disaster liquidity products as tools to address the protection gap depends on the governments' ability to spend the money rapidly and effectively. Effectiveness of these products is likely to be enhanced where governments are accountable for the use of payouts to their citizens and sponsors.

“One of the biggest problems is the lack of accountability at national level in terms of how these payouts are used. Visibly you are unable to link payouts in to the recovery and early reconstruction phases or in serving as any sort of mechanism for reducing risk, going back to this argument about how insurance can drive risk reduction. Because there's no accountability around how it does that.”
 (Government stakeholder)

Efforts to promote accountability involve developing and reporting on contingency plans for the use of resources, as a condition of payment (e.g. ARC), or may involve more voluntary forms of reporting (e.g. CCRIF, PCRAFI). For example, ARC members are first required to provide contingency plans showing how beneficiaries will be targeted before they can access insurance and second are subject to process and financial audits when they receive a payout in order to ensure efficient and targeted spent of the money. This ex ante approach is innovative in linking accountability for the use of public funding for insurance with the targeted delivery of relief to the most vulnerable.

5. Most multi-sovereign PGEs act as a risk-pooling mechanism. To be effective as a source of capital protection, they need to have a large enough member base, and these members need to be retained over a number of years. This ensures diversification across geographic regions and perils, improving the pools' own capital optimization and ability to pay for member losses, and also their purchasing power. Hence, as indicated in the CCRIF case, efforts need to focus on building members' common purposes for remaining with the PGE.

A PGE which attends to the conditions outlined above, in its remit or its evolution, should enjoy the confidence of sovereign states, their citizens and wider stakeholders that government money is well placed in purchasing risk transfer products, and that the PGE itself meets the various market, humanitarian, and political objectives of the different parties.

Road map to success for PGEs' disaster liquidity products

- Effective communication about the product as immediate relief post-disaster, rather than as more large-scale reconstruction
- Continuous improvement of the modelling for product development and metrics that trigger payment
- Supporting effective and accountable use of funds to alleviate hardship post disaster
- Ensuring effective pooling through diversification and retention of members

4.5 SUMMARY

Overall, the establishment of PGEs and disaster liquidity products in the context of low-income countries or those with low insurance penetration redefines the protection gap. Such schemes redefine who or what may be insured, extending the ability of insurance to protect against disaster to sovereigns for the purposes of providing cash flow to manage disaster response. Disaster liquidity products were therefore

a significant innovation in the treatment of under-insurance: disaster relief and humanitarian crisis had not previously been considered areas in which ex-ante market mechanisms might be deployed. But their creation has prompted new ways of looking at the protection gap debate. For instance, some donations to poor countries which might previously have gone directly into government expenditure are now used to buy disaster liquidity cover, or to provide operating capital for PGEs to support countries to buy their own disaster liquidity cover, so leveraging the donation.

Certainly, PGEs of this sort are growing both in their regional spread with new multi-sovereign PGEs being considered and existing PGEs growing their membership, and in terms of the range of cover offered. At the same time, these types of products are being applied to a wider range of gaps, as evidenced by the recent development of the World Health Organization (WHO) catastrophe bond for pandemics.

SECTION 5. Bridging and reducing the protection gap: PGEs' role in resilience

Disaster resilience is the ability of individuals, communities, organizations and states to survive, adapt to, and recover from catastrophic events; and to adapt their structures and behaviours to reduce the potential damage from future perils.^{30,31} There is an important relationship between PGEs as providers of insurance to those who might otherwise be un-insured, and the disaster resilience of a society. One aspect of this relationship can be improved financial resilience, where insurance provides the capital to support recovery. Such initiatives help bridge the protection gap by providing financial solutions. However, if financial solutions lead purely to reconstruction of what was destroyed, they leave the underlying vulnerability unchanged. Given the importance of social as well as market objectives, reducing the gap by reducing vulnerability through more resilient forms of building can also help to fulfil the social objectives of PGEs. One way that PGEs can support both bridging and reducing the gap is through their effects in generating technical knowledge for identifying, measuring and better preparing for risk.

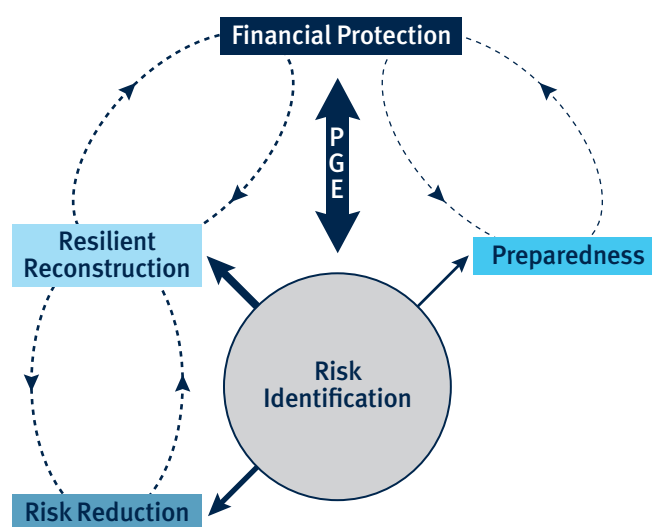
Paradoxically, PGEs, with some exceptions, are not in a position to influence resilience measures directly. Rather, governments are generally the central agents in improving resilience. Through their many sub-entities at both national and local levels, they have the legislative power to drive resilience through tools such as environmental policies, land-use planning, building codes and standards, defensive infrastructure, and disaster relief. Hence, PGEs must work with and through their interdependent stakeholders, particularly government, in supporting the relationship between insurance and resilience.

We present a *Protection Gap Entities (PGEs) Resilience Framework*, adapted from the World Bank 5 pillars framework,³² to show how PGEs, through their effects in increasing insurance cover, can also support key aspects of resilience.

PGEs are put in place specifically to increase the financial resilience of both insurance markets to shock (Objective 1 in Section 2) and policyholders and governments to large and/or frequent disasters (Objectives 2&3 in Section 2). This function is indicated in Figure 5.1 by the thick arrow to **financial protection**. However, **risk identification** is central to managing the various elements of disaster resilience, since society cannot prepare for, mitigate against, or arrange financial protection from risks that are not identified. We position PGEs, via their role in supporting the insurance-based financing of disaster, as one critical mechanism for

enhancing risk identification. Of course, there are other ways to promote risk identification. For instance, public organizations and technologists may use open data and open software tools to identify the risks posed by natural disasters³³ and humanitarian organizations may work with local communities to map vulnerable areas³⁴. However, because of their role in supporting insurance against disaster, PGEs are especially well-positioned to enhance risk identification; and thereafter, PGEs have some unique characteristics that enable them to play a potentially pivotal role.

Figure 5.1. PGE Resilience Framework³²



5.1 PGEs' ROLE IN RISK IDENTIFICATION

Risk identification refers to building the capacity to identify, assess and analyse risk, typically as a technical capability supporting the quantification of risk.³⁵ The insurance industry, in collaboration with natural and environmental scientists, follows a specified risk-identification process to enable the transfer of risk within the value chain: from modelling the hazard; assessing the vulnerability of a particular region to that hazard; then calculating the exposure of property and citizens to that hazard, and the potential loss arising from a severe occurrence of the hazard. As a result, it can price cover based on the probability and severity of a loss.

Data and model generation. Since the early 1990s, there have been significant developments in catastrophe modelling, largely driven by advances in the availability of computing power and data, and by the commercial needs of the (re) insurance industry to price and trade in risk.

Where such data and modelling capabilities are lacking, as in emerging markets (see Section 4), or in relation to new forms of risk such as terrorism, PGEs are critical catalysts in establishing data for risk identification. PGEs can be particularly effective in promoting risk identification and making it relevant to government policy, because they construct a direct link between risk identification and financial solutions that may act as complementary or substitutive forms of funding for governments. The search for a financial solution drives the coordination of existing data and models and the development of new ones.

Even in mature insurance markets where data exists, PGEs often have a key role in identifying the most exposed areas of risk, because they can collect, refine and recombine existing modelling and data analytics that were generated for purposes outside the insurance industry, such as environmental projects. For example, Flood Re, at its inception drew upon a wide range of data from the insurance industry but also the UK Environment Agency to identify those properties most likely to be at risk. Hence, PGEs promote the collection of data and identification of what may otherwise have been over-looked or unmodeled risk.

Information transfer for social and market objectives.

While pricing risk may be specific to its transfer, other aspects of insurance industry risk identification can have wide application. In particular they support the estimation of aggregate losses in particular regions, as a basis for various government initiatives. As they are not-for-profit organizations, PGEs do not need to make such modelled information proprietary but can provide it as a ‘public good’ to other parties. *“It would be a shame to just collect this data for insurance and not make it accessible for other uses. So it was good to identify other data formats that [the modelling company] was willing to share that wouldn’t actually jeopardise any proprietary uses.”* (PGE stakeholder)

PGEs can therefore be a valuable two-way conduit for information between the insurance market and society. Disparate data gathered in social, environmental or population-based projects can be used to improve insurance modelling. Once available, insurance modelling increases the ability to identify and understand risk, both in general terms and in terms of economic consequences. Identifying risk can provide the motivation and information necessary to increase risk mitigation and disaster resilience. Indeed, the insurance industry is involved with efforts to improve and share ‘pre-competitive’ risk-modelling data in several countries.³⁶

Creating an ecosystem. In promoting risk identification, PGEs stimulate the development of an ecosystem, comprising professionals from aid, science, development, policy, commercial (re)insurance, and government ministries, for producing information that underpins all forms of disaster resilience. Interaction across this ecosystem creates at least two major spill-over effects:

1. Better understanding of the hazard and the associated vulnerability allows governments to better assess the economic costs of disasters and how they impact the

budget of different ministries, as this quote on the role of terrorism PGEs indicates:

“There is nowhere in government where they are looking at these terrorist events in terms of economic loss. They will look at those terrorist events as terrorist acts, they will be looking at them from an operational and a political perspective ... but they won’t be looking at those events as something that will cost them a lot of money. And there’s a role for [PGE] I think to conduct that kind of research on government’s behalf... it would then be able to inform government; ‘Look, if we’d had a similar attack in [our country], the consequential loss [from loss of tourism, disruption to transport etc] would have been X billion and [PGE] doesn’t cover that’.” (Government stakeholder)

2. Improved risk identification also supports the design of new financial products (whether provided by PGEs themselves or not) that may complement and extend the relief provided by insurance-based products. An example is forecast-based financing (FbF) as a technique to fill gaps in humanitarian aid. It uses the science of weather and climate to anticipate possible impacts in risk-prone areas and to mobilize resources automatically *before* an event.³⁷ Such forecasting can also support insurance triggers. For example, satellite data can now be used to forecast drought based on levels of green-ness, and so to put in place humanitarian strategies before catastrophe occurs.³⁸

In these ways, PGEs can have a direct effect on the relationship between risk identification and financial resilience in the face of potential disaster.

5.2 PGES ROLE IN RISK REDUCTION AND RESILIENT RECONSTRUCTION

Insurance can enhance resilience by providing incentives for behaviours that either reduce risk or improve resilient reconstruction. Examples might be the implementation of risk reduction measures such as levee banks and drainage systems that change the built environment, or improved building codes for reconstruction after disasters.³⁹ In improving risk identification, PGEs can also indirectly influence these areas even so that they rarely have direct responsibility for implementing physical and behavioural resilience measures.

Under pure market conditions, a property highly exposed to risk would find it difficult to get affordable cover; this would dampen the market for high-risk property (since mortgage conditions typically require insurance cover), and thereby discourage building in high-risk areas or with insufficient risk mitigation features. Such a situation could motivate risk reduction behaviours both in policyholders, who may build to different structural codes in order to improve the insurability of their properties, and in planning authorities, in terms of where to build and what mitigation features to include. However, as developed economies already have significant property that has been built to varying structural codes in highly-exposed areas, such pure market conditions do not exist.

Incentivizing risk reduction. PGEs ameliorate some of these legacy effects by providing financial support to properties and regions that do not have inbuilt risk reduction features. PGEs

can still incentivize better risk reduction behaviours going forward. For instance, in the UK, properties eligible for the Flood Re scheme had to be built prior to January 2009. This was to ensure that the PGE was not incentivizing development of new buildings in flood prone areas. Flood Re's mandate also includes promoting flood management action through the use of data to support decision-making by Government, the Devolved Administrations, Local Authorities and others, including the Environment Agency and the Committee on Climate Change.⁴⁰

Placed between governments and markets, PGEs are well-equipped to coordinate resilience action on both fronts. The insurance industry might have loss data and/or the technical expertise to identify and calculate high risk areas and consult on efficient ways of resilient rebuilding; but only governments can introduce and enforce policy-making such as land-use planning and building codes. However, our results show that while PGEs sit at the nexus of various stakeholders within governments and markets, they typically lack the formal power to introduce and impose the uptake of risk-reduction measures. Usually their remit is limited to providing consultation on resilience and attempting to influence the various stakeholders based on their position in the risk transfer value chain. In Figure 5.1 therefore, we depict the link from the PGE's role in risk identification to risk reduction as relatively weak.

Nonetheless, PGEs coordinate multiple sectors (e.g. insurance, resilience, governments) and disciplines (natural, financial, social science), enabling knowledge-sharing and capacity-building. They are increasingly eager to provide information on risk mitigation to improve risk reduction behaviours. For example, the ARPC terrorism pool in Australia has identified some key structural features, such as bollards that limit the positioning of explosives near key points in buildings. As such features will reduce the risk of certain terrorism activities, the PGE is offering premium discounts for companies that install such measures. Price is thus used as a means to incentivize behavioural change.

Other PGEs, notably the CEA, have invested heavily in understanding how reconstruction of legacy properties can be linked to mitigation of loss from earthquake damage. Their risk identification activities have enabled them to understand how to retrofit structural adaptations to existing at-risk properties, prior to an event, so as to limit the damage caused by earthquake. As part of their statutory requirements, they use this information to actively support risk reduction by offering retrofit packages that take advantage of tax discounts and that can even be cost neutral for the homeowner.

Constraints around PGE influence over risk reduction.

Despite this, evidence from post-flood reconstruction grants in the UK⁴¹ and retrofit packages in California⁴², shows that uptake appears to be low. The reasons are various, ranging from difficulties in communicating and distributing reconstruction grants, to poor understanding by policyholders of the potential risks of damage, to concerns over the cost, timing and inconvenience of reconstruction.

Such findings indicate the difficulty for PGEs in implementing risk reduction measures, and *ex ante* retrofitting in particular, without legislative support. However, these same measures can be used in resilient reconstruction, where the PGE pays the claim on the proviso that rebuilding follows specific reconstruction codes. PGEs that provide insurance cover to highly-exposed properties may have a more direct influence over resilient reconstruction, particularly where the payment of claims may be linked to enforceable structural codes for rebuilding. In Figure 5.1 we therefore indicate this influence on resilient reconstruction by a relatively thick arrow.

5.3 PGES ROLE IN DISASTER PREPAREDNESS

The link to disaster preparedness is the weakest link shown in Figure 5.1. Financial protection, risk reduction and resilient reconstruction can all be tied together through risk identification in a logical virtuous cycle, in which better-constructed properties that reduce risk are more affordable to protect financially, whilst financial protection enables more resilient reconstruction post-disaster that subsequently reduces risk. Nonetheless, as explained in section 5.3, this is not easy for a PGE to influence directly. Disaster preparedness, involving early warning systems and contingency planning,³⁵ is even more remote from PGE influence. A PGE may have the data to indicate the likelihood of loss, and so to support understanding of how to prepare for it, but may not have the remit to encourage such preparedness.

Some PGEs, however, are set up with a remit to build links from risk identification to disaster preparedness. ARC is a case in point. A key feature of the way ARC inducts its member states is to take them through a process of risk modelling, which is used to develop early warning systems of impending disaster, and to undertake contingency planning for how specifically, they will use any payouts to address the disaster, prior to taking out the risk financing component of membership.⁴³

The establishment of such risk preparedness procedures in ARC is helped by the fact that most of the scheme deals with drought, a slow-onset disaster in which the impact can be observed, and systems put in place as the disaster worsens. In addition, the payments are intended to support food security, for which, again, there can be contingency planning in advance. Preparedness for other types of peril, where onset is more rapid, may be different. Nonetheless, some early warning systems to support, at the least, evacuation in the path of a hurricane, and other similar measures, may be spillover benefits from the risk modelling and identification promoted by PGEs.

5.4 SUMMARY

The primary purpose of a PGE is financial protection of those who are potentially under-insured. We might describe this extension of the reach of insurance as *bridging* the protection gap, and the role of the PGE as increasing *financial* resilience. However, for a society to solve the protection gap, increasing financial resilience is not generally enough. In high-risk areas particularly, it is essential to reduce risk, and thereby reduce the protection gap, which means that other aspects

of resilience – resilient reconstruction, risk reduction and preparedness – are essential (see Figure 5.1).

We have shown that PGEs have a key role in risk identification, and thus they can influence or enable these other aspects of resilience. Increasing the uptake of resilience measures has an impact on the social goal of reducing the protection gap. In addition, it can reduce the frequency and severity of loss, which means that PGEs will have to pay lower claims, decreasing the financial impact on their balance sheet.

To enhance PGEs' role in resilience, we suggest:

- **Build formal power in resilience:** Being identified as independent, and being a centre of risk expertise, places PGEs in a unique position regarding resilience. However, they usually lack the formal power to enable the uptake of resilience measures and are restricted to, at best, an advisory role. For instance, Flood Re is doing research to understand how to incentivize the uptake of resilience measures, but without formal powers, it can only cooperate with the insurance industry and the government to promote its position in risk reduction.⁴⁴ Potential ways to increase formal power could be to give PGEs a mandate to enforce resilient reconstruction after a disaster or to financially incentivize citizens to take risk reduction measures. CCS for instance can request resilience measures to be taken in order to continue to provide cover.
- **Enhance useful links with(in) government:** PGEs can be public or private organizations or public-private partnership organizations. They are either part of the government or at least collaborate directly with governmental departments. Even the PGEs that are private organizations have a strong public purpose. PGEs hold information and develop technical expertise that is critical for central and local governments in supporting resilience initiatives. For instance, in both FONDEN and CCR, the data used for risk modelling to develop (re)insurance products is integrated with the data used for disaster management. By linking government departments involved with planning for disaster, planning for infrastructure and financial planning, PGEs can help build a more comprehensive approach to resilience. Formal channels of communication and collaboration between PGEs and parts of the government that have powers over these different aspects of resilience should be strengthened.
- **Evolve remit but avoid mission creep:** A PGE is developed to address a specified protection gap by invoking a market mechanism. PGEs may be a means of coordinating the different interdependencies involved in resilience, but their specific expertise is in providing insurance-based measures, rather than initiating resilience measures. Expanding PGE's remit in resilience should avoid mission creep, losing focus and bloating their role. We suggested that PGEs need to evolve over time alongside their stakeholders and their local protection gap. However, PGEs should be alert not to change their mission unintentionally in ways that may neglect a continuing necessity to provide affordable financial protection, when commercial markets cannot supply it.

SECTION 6. Protection Gap Entities or Stopgap Entities?

The previous sections have shown that PGEs are usually set up with objectives related to a specific and local protection gap. These objectives fall into three main categories, (i) addressing a sudden disruption in the supply of (re)insurance; (ii) ensuring that a portion of the currently insured population that is classified as ‘high-risk’ is not priced out of the market; and (iii) ensuring the financial viability of governments in the aftermath of catastrophic events in countries with low insurance penetration (see Section 2). These objectives emerge in the aftermath of major catastrophic events that promote political engagement and influence opinion in civil society.

They thus form the basis of a remit around which stakeholders with diverse and sometimes conflicting interests can agree to join forces in setting up the PGE. Crucially, those interests may lean more towards market objectives, or towards social objectives; they may prioritise bridging the gap or reducing it; and tensions between such interests will need to be managed. The need to forge consensus in a short period of time to address a crisis means that a PGE’s remit is often tightly constructed around the objective leading to its establishment. In such cases, PGEs, as initially set up, can provide only partial solutions to the protection gap.

Paradoxically, while the PGE’s activities may contribute to a wider, deeper and more refined understanding of the protection gap (see Section 5), their institutional set-up can significantly constrain any evolution to address either the underlying reasons for the gap or changing circumstances. Indeed, stakeholder attention, particularly political attention, moves on so that there is typically little will to address change until after another disaster exposes a new protection gap.

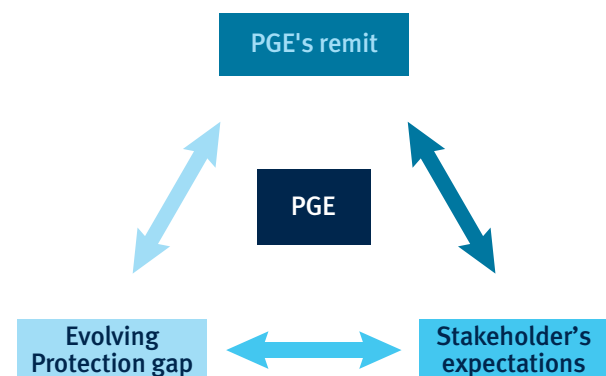
In fact, a ‘stopgap’ character is often built into PGEs and their remits from the very beginning. Narrow and rigid remits can create problematic situations in which stakeholders assume the threat of a particular disaster has been covered (because the remit has been ‘ticked’), leading to criticisms of the PGE when it is unable to respond to losses that were never in its scope. However, stakeholders might reasonably expect that the PGE is there to address the protection gap, rather than a shopping list of objectives related to a narrow part of it. From this point of view, PGEs should be able to modify their remit to continue to address the gap.

An opposing point of view holds that complex organizations have a well-documented tendency to “mission creep” – the expansion of the organization beyond its expertise or usefulness. For this reason, many PGEs are explicitly set up

to be temporary: “We’re a government agency and we’re a temporary organization because we were created as a short-term stopgap measure for market failure. So we actually have a social purpose for existing and we’re not a private sector, for profit or private interest organization.” (PGE stakeholder).

These tensions around flexibility or mission creep, around an evolving gap or a fixed purpose, must in fact be constantly monitored and managed by all PGEs. The PGE’s remit, the stakeholders’ expectations, and the evolving protection gap exist in a dynamic balance, as we depict in Figure 6.1. Particular problems in managing this balance occur when there are mismatched understandings between parties to this balancing act, as we now explore.

Figure 6.1. PGE Evolution Framework



6.1 MISMATCH 1: PGE REMIT DOES NOT MATCH STAKEHOLDERS' EXPECTATIONS

Stakeholders may see a PGE as inadequate even when it fulfilled its remit. For instance, since its inception in 2007, CCRIF has clearly performed extremely well to its remit, making payouts totalling US\$130 million to 13 member governments; all within 14 days of the event.⁴⁵ Following Hurricane Irma in 2017, CCRIF issued payouts to 6 member governments within 14 days of the event. Nonetheless, as one country member explained to us, while praising the efficiency with which they received their payout:

“It is a drop in a bucket in terms of the actual loss... The payout for the impact of Hurricane Irma was just over 6 million. It helps because Irma was major. We just had a damage and loss assessment putting the bill around 338 million, so for us that’s just over 100% percent of GDP” (Government stakeholder)

Such cases exemplify what we call the Expectations mismatch. Disaster-liquidity PGEs (as discussed in Section 4) are *not* intended to address the protection gap for reconstruction in such countries – but stakeholders may expect them to do so.

Disaster-liquidity PGEs generally seem to perform as intended, and with good leverage for the premium paid. Yet they can have only the most marginal of effects in closing the far larger protection gaps for reconstruction which are associated with the same disasters. Furthermore, their existence may distract from other ways of addressing the immensity of the reconstruction protection gap, if stakeholders have unrealistic expectations of them.

“They have seen sovereign risk pools in my view as a silver bullet, and so they do not invest in other means of reducing risk and exposure and they do not invest in other areas of financing that gap that you speak of after an event. ... You know, when you look at the catastrophic events and you go to the donor community to have these donor conferences, when you look at the losses versus what is raised even in these donor conferences, it's less than one tenth of the losses. So it means there is a significant financing gap for recovery and reconstruction.” (Inter-governmental stakeholder)

The problem is that in highly-exposed countries with fragile economies, it is difficult to think of any self-funded insurance solution that could enable a country's full reconstruction after recurrent disasters that cause losses of the order of magnitude of their entire GDP.

This Expectations mismatch is not only a problem in emerging insurance markets, but can also occur in mature markets. For example, a terrorist attack, in which a truck drives into crowds of people in a tourist area, may cause no property damage. If the remit of the PGE is to cover only property damage caused by terrorism attack, no payments would be made. But this truck attack may cause significant loss of life and will probably have a huge economic impact on tourism, due to cancellations and last-minute changes by travellers concerned about the threat of terrorism. The non-cover of these financial losses does not make the PGE unsuccessful, since they were not relevant to its remit. Yet, *ex-post*, some stakeholders, not to mention the public, may expect that this ‘should’ have been the remit of the PGE.

Tackling the mismatch: *There are two key ways to deal with an Expectations' mismatch:*

1. **Communicating remit and success:** It is critical for PGEs to communicate their remit clearly to stakeholders. The fact that the PGE deals with ‘the protection gap’ can be confusing as that term is quite abstract. PGEs are formal organizations that have a set of specific goals to achieve in relation to a specific protection gap and a specific risk, rather than a mission to close the *global* protection gap. Thus, PGEs need to define what constitutes success in terms of their remit, so that stakeholders can evaluate them based on this predefined set of objectives.
2. **Building other forms of resilience.** PGEs, while performing many valuable functions, are not a silver bullet. Rather, they should be seen as a critical mechanism

for financial and physical resilience (see Section 5), by showing the feasibility and effectiveness of insurance products and helping build the expertise around them. PGEs support financial resilience (that is, protection from financial loss), which in turn can lead to other resilience features such as resilient reconstruction, preparedness and risk reduction (Figure 5.1).

6.2 MISMATCH 2: WHEN ADDRESSING ONE PROBLEM CREATES ANOTHER

While PGEs provide an initial solution to an identified protection gap, these solutions can have unintended consequences. One such consequence is moral hazard. This is the situation in which policyholders can engage in risky behaviour knowing that other parties (insurers and/or government) will incur the cost. Specifically, as explained in Section 3.1.2, PGEs, by paying for losses, may unintentionally reduce the incentive to engage in risk mitigation, both by policyholders and more widely by planning authorities. Indeed, after repeated events in flood prone areas, leading to the rebuilding of highly exposed properties on more than one occasion, the National Flood Insurance Program (NFIP) in the USA has come under attack for precisely this issue, with the criticism that “*it is subsidized floodplain development*”.⁴⁶

This problem is exacerbated by a risk redistribution strategy (Section 3.1), in which the PGE adopts a pooling mechanism, so that low-risk areas cross-subsidize the higher-risk areas. When the actual risk of living on a floodplain or an earthquake fault-line is not reflected in the premium, then policyholders have little incentive to engage in risk mitigation strategies that would lower the cost of their premiums, or the cost of rebuilding. As time goes on, and flood or earthquake strikes repeatedly, the costs of a risk-redistribution response rise to pay for repeated high losses, increasing the expense to others in the pool.

Tackling the mismatch: *Co-evolving financial and physical resilience measures.* As highlighted in Section 3, while increasing the affordability of cover for policyholders, PGEs can affect the risk-reward-responsibility balance. Removing responsibility for high risks from policyholders may have unintended consequences for those policyholders' behaviours. The issue of subsidizing insurance policies has been analysed extensively in the debate on equity vs efficiency – where the overall welfare benefits resulting from universal protection in a society are weighed against the overall costs for society of moral hazard. This literature has generated proposals on how to combine policy instruments such as tax incentives or building regulations to address the problem.^{47,48,49}

In Section 5.3 we have considered the issue by placing PGEs and insurance within the broader landscape of resilience. We discussed how PGEs can play a critical role in coordinating the different interventions necessary for financial resilience through market measures, and physical resilience through public policies for risk reduction and resilient reconstruction. This is a critical area in which the remit of PGEs might need to be expanded to match the changing nature of the protection gap and the expectations of stakeholders.

6.3 MISMATCH 3: PGE (IR)RELEVANCE IN THE FACE OF AN EVOLVING GAP

PGEs are set up to deal with a local protection gap at a specific moment in time. However, protection gaps evolve, so that the original gap that the PGE was set up to address might become less relevant; or while it remains important, other gaps of equal significance may emerge over time.

One example is terrorism risk, which has evolved significantly since the origin of most terrorism PGEs. For example, the threat of sophisticated, highly-coordinated, severe events like 9/11 may be ever-present. However, increasingly terrorist events are ‘lone wolf’ attacks with less catastrophic impact,⁵⁰ using familiar, accessible objects, such as cars and knives, as weapons. Many of the financial impacts of such attacks, such as the business interruption caused by site closure after an attack, the loss of revenue from diminished footfall, or indeed, the capacity to pay for loss of life, may not be covered by PGEs established to cover catastrophic damage to commercial property. Thus, a swathe of uninsured risk emerges, demonstrating the evolution in the protection gap and, post-disaster, the emergence of stakeholder interests and expectations where the risk is not addressed within the remit of the PGE.⁵¹ Quite simply, even if it goes beyond their initial remit, PGEs need to remain relevant to the evolving protection gap, as this will be expected of them in case of future disasters.

On the other hand, PGEs that can influence the closure of a protection gap may also need to co-evolve – into obsolescence. For example, while flood risk has increased significantly over the last decades it can be significantly reduced if risk resilience (Section 5) is taken seriously. Measures that promote resilient reconstruction, risk reduction and preparedness, alongside financial protection (PGEs Resilience Framework; Figure 5.1) can have a real impact on reducing the protection gap. Essentially, if the protection gap that a PGE was set up to address is not significant anymore, the PGE itself may become redundant.

Tackling the mismatch: *Evolving policy dialogue, with regular review.* Our research study shows that the response to this situation can vary significantly. A first strategy is to adapt the remit of the PGE, as political or societal awareness of evolving threats emerges. For example, as awareness of terrorism threat has grown, most terrorism PGEs have evolved from offering ‘conventional’ terrorism cover for fire and explosion to also offering non-conventional cover for chemical, biological, radiological and nuclear (CBRN) threats. In this way, the dynamic balance illustrated in Figure 6.1 is preserved as stakeholder interest, protection gap, and PGE remit co-evolve.

Often this process of adaptation is precipitated by a crisis, similar to the process leading to the initial establishment of PGEs. For instance, some PGEs operating in the terrorism area originated only in the wake of 9/11, such as ARPC in Australia; elsewhere many existing terrorism PGEs responded by expanding their remit to include new categories of CBRN risk. Such changes of remit can better be brought about through regular policy or legislative review of the PGE. That is, through foresight and planning, rather than being forced upon the PGE in the aftermath of a new disaster.

Another strategy is to give PGEs a limited lease of life. This is done in the assumption that the problem as perceived today is temporary and that the PGE will, by its termination date, have stimulated sufficient market development to close the gap. For instance, the recently established Flood Re in the UK has been set up with a specific remit to ‘solve’ the problem for which it originated and then dissolve over a 25-year period. While such deadlines may simply demonstrate that the PGE has not, in fact, solved the protection gap, or may call into question what other gaps have arisen, the termination date should generate a point of dialogue about the role and remit of the PGE.

6.4 SUMMARY

The mismatches detailed in this Section are indicative of the inherent tensions that exist when the PGEs’ remit, the interests of stakeholders and the protection gap are evolving in parallel (Figure 6.1). It would be wrong to understand potential mismatches as fundamental problems that need to be fixed. Rather, these are naturally-occurring tensions that would always exist at the nexus of competing demands upon PGEs, which they would have to mediate.

By actively managing these mismatches, PGEs can powerfully frame both the way we understand risk in society, and the role of governments, markets and wider stakeholders in managing that risk. Although different stakeholders will always have different interests in the potential solutions, more use can be made of PGEs, not solely as temporary stopgap solutions to initial problems but also as spaces in which to host an ongoing dialogue about a growing problem.

SECTION 7. Conclusion. Learning from PGE experiences: A call-to-arms

This report has provided an impetus for learning across regions and sectors, about the nature, characteristics and activities of Protection Gap Entities (PGEs); those organizations and initiatives set up in collaboration between States and markets to bring financial solutions to the socio-economic problems caused by the increasing prevalence of natural and man-made catastrophes. PGEs, while in many ways heterogeneous, are set up with the objective to transform uninsured risk into insurance-based products that can be transferred onto government balance sheets or into global financial markets in order to provide capital for recovery following a disaster. This report has developed the following findings:

PGEs classification. Beyond their widely recognized sources of variation, PGEs may be usefully grouped according to their common features:

1. PGEs are partial and temporary solutions to a specific and local protection gap – rather than entities set up to tackle the overall problem of underinsurance against disasters. Specifically, we have shown that PGEs are often set up in response to major crises that push stakeholders with different market and social interests to collaborate in tackling one of three objectives:

Objective 1: Resolve disruption in (re)insurance supply in mature markets;

Objective 2: Mitigate the threat of unaffordable insurance in mature markets;

Objective 3: Increase the financial viability of sovereign states with fragile economies.

2. PGEs tackle these objectives by adopting different positions in our Protection Gap Strategic Response Framework, in terms of their choices on:
 - a. how they share risk with existing market players - removing versus redistributing risk;
 - b. what position they occupy in the value chain for risk transfer - Insurer PGE, Reinsurer PGE or Market Capture PGE.

Each of these choices brings advantages and disadvantages.

3. PGEs in sovereign states with fragile economies that are highly exposed to natural catastrophe, where there is little insurance penetration, develop disaster liquidity products as immediate relief post-disaster, rather than as more large-scale reconstruction

PGEs functions. Beyond their function in providing financial solutions, because of their unique position at the nexus of a diverse set of stakeholders, PGEs perform a range of other critical functions that are being increasingly recognized as important:

1. They act as the locus in which a conversation about the evolving nature of the protection gap can take place, thereby contributing to framing the debate and policy initiatives connected to the protection gap.
2. They play an important role in fostering the development of knowledge about perils and how they affect specific areas that were not previously tackled by markets; and in changing the dynamics of knowledge distribution and ownership.
3. They facilitate risk identification and contribute to making it more policy relevant to Government, by providing better knowledge about perils and by linking this knowledge to the availability of additional financial resources in case of disasters.

In doing so, our PGE Resilience Framework outlines the important spillover effects that PGE's have in informing and improving society's resilience to disasters.

PGE challenges. PGEs face significant challenges, as demonstrated by our PGE Evolution Framework, to:

1. Balance the competing demands of different stakeholders, both in terms of balancing social and market objectives.
2. Support the more vulnerable portions of society without undermining long term resilience by distorting incentives and providing grounds for moral hazard.
3. Adapt their remit so that it matches the evolving characteristics of the protection gap but also avoid mission creep and loss of effectiveness.
4. Manage stakeholders' expectations, so that they are not perceived as silver bullets to the problem of the protection gap, displacing other forms of risk management and reduction, particularly those related to resilience.

This report is by no means a final word on the complex and challenging issue of the protection gap. Rather, it has provided some new insights about PGEs from which to continue the dialogue of how it may be better addressed in different contexts by multiple stakeholders.

This report should be considered as “call to arms” to learn from, and make better use of those already established PGEs, in order to better address the increasing threat of natural and manmade catastrophic disaster, and the growing protection gap.

Appendix

METHODOLOGY

This report presents the full results from a qualitative research study, looking at Protection Gap Entities (PGEs) around the world.

Dataset. The data for this global research study of PGEs includes:

- in-depth interviews of key stakeholders within and around PGEs (305 interviews with 359 participants);
- 64 ethnographic observations within a sample of PGEs;
- participant-observation at 20 key conferences, workshops, and meetings, as well as 7 social events;
- more than 9,500 pages of documentary data such as annual reports, press releases and media articles.

Methodological approach. This research study incorporates global breadth and variation in cases. We studied PGEs in different countries, employing different governance structures and covering different types of risk. We adopted a multi-stakeholder approach to all cases, accessing data with various stakeholders from both the public and private sector.

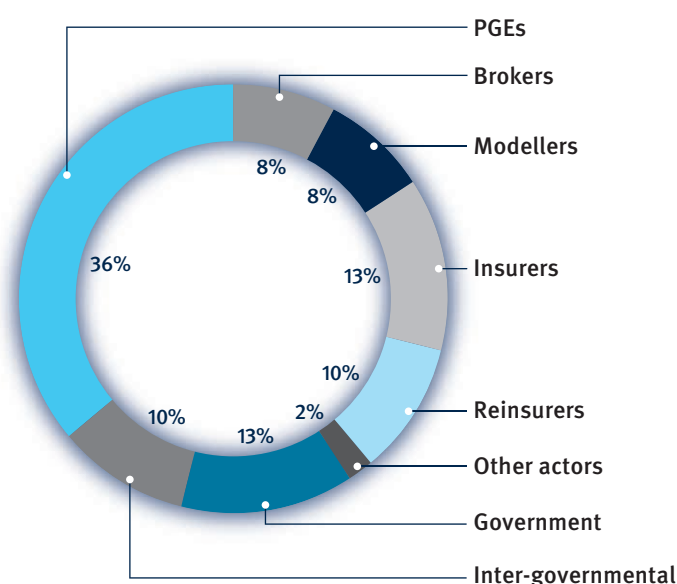
Global breadth. We have collected primary data for 13 PGEs and their stakeholders across 23 countries spanning the globe. In addition, our dataset includes PGEs from both developing and developed economies. This captures different understandings of the protection gap and variation in the solutions developed.

Variation. We selected the 13 PGEs purposively to include variation. First, the PGEs represented different governance structures. In particular, the selected PGEs range from public to private to partnership entities. Second, the selected PGEs covered different types of risk, ranging from flood to earthquake, tropical cyclone, drought, excess rainfall, and terrorism. In addition, some were mono-risk, covering only one peril, while others covered multiple perils. While we maintain confidentiality over our cases, those participants happy to be named are listed on the back page of this report.

Multi-stakeholder approach: As well as global breadth this research study focused on developing a holistic, polyvocal understanding of PGEs. The study informants consist of:

- the PGEs;
- insurance market players such as insurers, reinsurers, modellers and brokers;
- government actors such as ministers, governmental departments and government-based organizations;
- intergovernmental organizations such as the World Bank and OECD;
- other key protection gap actors such as independent consultants and resilience teams.

The focus was thus not on any particular organization but on developing a holistic understanding of the particular local solutions to the protection gap via a multi-stakeholder approach.



We thank the PGEs and their stakeholders for the generosity and transparency that has made the analysis in this report possible. Our engagement with these participants is ongoing as we continue to explore the issues outlined in this report.

GLOSSARY

ARC (African Risk Capacity) was established in 2012 as a Specialised Agency of the African Union (AU), with 18 Member States that signed the Establishment Agreement initially, which has grown to 33 Member States in 2018. ARC aims to provide insurance products that help protect food security in the face of extreme weather events, such as drought.

ARPC (Australian Risk Pool Corporation) is a corporate Commonwealth entity established in 2003 and provides insurance cover against terrorism in Australia.

CBRN Chemical, Biological, Radiological and Nuclear terrorism perils.

CEA (California Earthquake Authority) is a not-for-profit, publicly managed, privately funded entity established in 1996 and provides insurance cover against earthquake in California, US.

CCR (Caisse Centrale de Reassurance) is a public-sector reinsurer established in 1946 and provides insurers operating in France with multi-peril coverage against natural catastrophes and other risks.

CCRIF SPC (Caribbean Catastrophe Risk Insurance Facility) is an entity established in 2007 that provides insurance cover for hurricane, earthquake and excess rainfall to its, as in 2018, 16 Caribbean government-members and one Central American government member.

CCS (Consortio de Compensación de Seguros - Insurance Compensation Consortium) is a state-owned entity established in 1941 that provides insurance cover for natural and terrorism disasters in Spain.

Crowding out effect is a phenomenon discussed in economics in which rising public sector spending drives down or even eliminates private sector spending.

Disaster liquidity is the short-term liquidity necessary in the aftermath of disasters to start recovery efforts while maintaining essential government service.

EQC (Earthquake Commission) is a public entity established in 1945 that provides insurance to residential property owners against earthquake and associated perils such as natural landslip, volcanic eruption, and hydrothermal activity in New Zealand.

Exposure refers to the inventory of elements such as citizens, infrastructure, housing, production capacities and other tangible human assets in an area in which hazardous events may occur. Measures of exposure can include the number of citizens or types of assets in an area.

Financial protection is the financial resilience of governments, private sector and citizens through insurance-based mechanisms.

Flood Re is an insurance pool established in 2016 to provide insurance cover against flood in the UK.

FONDEN (Fondo de Desastres Naturales - Natural Disasters Fund) is a public entity established in 1996 that provides insurance cover to the Mexican States and the Federal Agencies against natural disasters.

GAREAT (Gestion de l'Assurance et de la Réassurance des risques Attentats et actes de Terrorisme – Management of the Insurance and Reinsurance of Risks of Terrorist Attacks and Acts of Terrorism) is a private-public partnership established in 2002 that provides reinsurance cover against terrorism in France.

Hazard is the condition that can cause a disaster such as a hurricane or a tsunami.

Market capture a term that we use to reference the concept of 'regulatory capture', in which a state organization set up to regulate a market in the interests of citizens, ends up instead adopting the point of view of the market and so serving its interests. The market capture PGE can have the opposite issue, in which market parties operating in a context where the PGE is highly dominant, can end up assuming that their interests are best met through the PGE, so dampening their own risk appetite.

Modelled loss is the loss estimated through an insurance catastrophe model on the basis of the parameters of the event (e.g. wind speed). The event parameters are fed into a catastrophe model to calculate the modelled loss.

Parametric insurance is a type of insurance that uses a parameter or an index of parameters of the catastrophic event as triggers for issuing a payout. Such insurance products may combine a mix of triggers from indemnity to industry loss, to the occurrence of specific parameters of a peril, such as wind speeds within a specified zone. Such products can also be linked to modelled losses (as opposed to actual claims for losses), triggering a payment when losses exceed a particular threshold. However, they do not have to be linked specifically to claims for property loss.

Peril is the direct cause of loss such as flood or earthquake.

Pool Re is a reinsurance pool established in 1993 to provide reinsurance cover against terrorism in the UK.

Risk is the possibility of loss.

PCRAFI (Pacific Catastrophe Risk Assessment and Financing Initiative) is an entity established in 2016 to provide the Pacific Island Countries (PICs) with climate- and disaster-related insurance.

Protection gap (global) is the gap between the insured and actual economic losses caused by large-scale catastrophic events. It refers to a global problem, affecting all countries, and referring to the whole uninsured population.

Protection gap (local) refers to specific manifestations of underinsurance in a particular region, such as lack of terrorism cover for city-centre business districts; insufficient emergency capital reserves in developing economies to maintain essential services after natural disaster; or unaffordable premiums for homeowners in highly exposed flood plains, or in earthquake-prone regions.

Protection Gap Entity (PGE) is the entity that brings together different market and non-market stakeholders in an effort to address the protection gap by transforming uninsured risk into insurance-based products that can be transferred onto government balance sheets or into global financial markets in order to provide capital for recovery following a disaster.

Preparedness is the development of early warning systems, support of emergency measures and contingency planning to prepare for disasters.

Resilient reconstruction is the ex-post reconstruction of property and the built environment for quicker, more resilient disaster recovery.

Risk mitigation refers to taking ex-ante action to reduce the adverse effects of disasters.

Risk identification is building the capacity to identify, assess and analyse risk, typically as a technical capability supporting the quantification of risk assessments and risk communication.

Risk reduction is the reduction of risks in society by implementing structural and non-structural measures in policy and investment.

Vulnerability refers to the propensity of exposed elements such as individuals, a community, and assets to suffer adverse effects of hazardous events.

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Participating PGEs

We gratefully acknowledge the generous participation of different stakeholders from the 13 PGEs on which we collected primary data for this report. Those PGEs that have agreed to be named are listed below. Their acknowledgement does not indicate any endorsement of this report, and all analyses, findings and errors therein remain our own.

- ARC (African Risk Capacity)
- ARPC (Australian Risk Pool Corporation)
- CEA (California Earthquake Authority)
- CCR (Caisse Centrale de Reassurance)
- CCRIF SPC (Caribbean Catastrophe Risk Insurance Facility)
- CCS (Consortio de Compensación de Seguros)
- Flood Re
- GAREAT (Gestion de l'Assurance et de la Réassurance des risques Attentats et actes de Terrorisme)
- Pool Re

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In 2002, the School was renamed Sir John Cass Business School following a generous donation towards the development of its new Bunhill Row premises.

Sir John Cass's Foundation

Sir John Cass's Foundation has supported education in London since the 18th century and takes its name from its founder, Sir John Cass, who established a school in Aldgate in 1710. Born in the City of London in 1661, Sir John served as an MP for the City and was knighted in 1713.



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