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## **Report: Financial Risk Management of Public Assets Against Natural Disasters in APEC Economies**

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## Volume I: **Draft** Main Report

# Financial Risk Management of Public Assets against Natural Disasters in APEC Economies

World Bank Technical Contribution to the APEC Finance Ministers' Process

**October 2017**

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## **ACKNOWLEDGMENTS**

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This report builds on the operational framework for disaster risk financing and insurance developed by the World Bank and on a series of case studies that informed the synthesis analysis and that will be part of the final version of this report. It complements a separate report jointly prepared by the World Bank and the Organisation for Economic Co-operation and Development (OECD) on managing disaster-related contingent liabilities in public finance frameworks.

The project was carried out by the World Bank's Disaster Risk Financing and Insurance Program (DRFIP), a joint partnership between the World Bank's Finance and Markets Global Practice and the Global Facility for Disaster Reduction and Recovery (GFDRR). The team was co-led by Olivier Mahul and Hang Thu Vu and included Hideaki Hamada, Benedikt Signer, Martin Luis Alton, Felix Lung, Jose Angel Villalobos, Cinthya Aramayo, and Rui Xu, all from the DRFIP.

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## ABBREVIATIONS

AEL	annual expected loss
AP	Pacific Alliance
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
CAF	Andean Development Corporation
CAT DDO	Catastrophe Deferred Drawdown Option
CDEM	Civil Defence Emergency Management
CERC	Contingent Emergency Response Components
CCF	Contingent Credit Facility
DFAA	Disaster Financial Assistance Arrangements
DRFIP	Disaster Risk Financing and Insurance Program
DPL	Development Policy Loan
ERM	enterprise risk management
FEMA	Federal Emergency Management Agency
FONDEN	Natural Disaster Fund
FNGRD	National Fund for Disaster Risk Management
GDP	gross domestic product
GFDRR	Global Facility for Disaster Reduction and Recovery
GSIS	Government Service Insurance System
IBRD	International Bank for Reconstruction and Development
IDB	Inter-American Development Bank
IDA	International Development Association
IMAP	Investment Management and Asset Performance
IMF	International Monetary Fund
IRM	Immediate Response Mechanism
MDB	multilateral development bank
MOF	Ministry of Finance
NDRRA	Natural Disaster Relief and Recovery Arrangements
NDRRMF	National Disaster Risk Reduction and Management Fund
OECD	Organisation for Economic Co-operation and Development
PFI	private finance initiative
PML	probable maximum loss
QGIF	Queensland Government Insurance Fund
RFI	Rapid Financing Instrument
RCF	Rapid Credit Facility
R-FONDEN	Riesgo-FONDEN (FONDEN Risk)
SECO	Swiss State Secretariat for Economic Affairs
SOE	state-owned enterprise
UNISDR	United Nations Office for Disaster Risk Reduction

## OVERVIEW

**In recent years, natural disasters have become more frequent, severe, and economically costly in the Asia-Pacific Economic Cooperation (APEC) region.** During 1997–2016, natural catastrophes claimed more than 450,000 lives in APEC member economies, affected more than 2.5 billion people, and inflicted over US\$2 trillion worth of economic losses<sup>1</sup>—less than 30 percent of which are estimated to have been insured<sup>2</sup>. The growing trend in losses is expected to continue for a variety of reasons, including growing urbanization, environmental degradation, and climate change.

**The impact of natural disasters on public assets is one of the major sources of fiscal vulnerability in APEC economies.** Public asset damage and losses are estimated to account for around 10–20 percent of total damage and losses from natural disasters in APEC economies, and can amount to 70 percent in exceptional cases.<sup>3</sup> The impact of disasters on lifeline infrastructure has often been felt profoundly by populations and businesses in the APEC region. Since 2010, the total value of fixed assets within a group of six selected APEC economies has grown on average by more than 4 percent annually, underlining the importance of strengthening the management of associated fiscal risks.<sup>4</sup>

**APEC economies under review<sup>5</sup> have established a range of legal and institutional frameworks for the financing of disaster-related government expenditure for rehabilitation and reconstruction of public assets.** While Mexico, Peru, and the Philippines have adopted explicit disaster risk finance strategies, other APEC economies rely on a varied set of rules and procedures for financing disaster-related public expenditures for public assets, often codified in laws and regulations. The ministry of finance (MOF) usually takes the lead in financial risk management of public assets, as this task closely relates to the broader management of contingent liabilities from disasters and fiscal risks.

**Post-disaster financing of public assets is an integral part of comprehensive fiscal risk management and disaster risk management frameworks in APEC economies.** Effective risk management requires clear accountability and responsibility for all involved agencies, both on the fiscal and disaster management sides, as well as strong central coordination and effective integration of risk mitigation and risk financing measures.

**Primary responsibility for the financial management of public assets against natural disasters lies with the assets' owners or managers, which are devolved from the central level in all APEC economies reviewed for this report.** Central governments or states are often responsible for adopting the appropriate disaster risk financing solutions for the public assets they own or manage. Cost-sharing arrangements for public asset rehabilitation and reconstruction were found in 9 of the 11 reviewed APEC economies. Of these, Australia, Mexico, and the United States have structured their arrangements in a way that explicitly links central government financial assistance to proactive risk mitigation measures and appropriate risk transfer mechanisms by recipients of central government funds.

<sup>1</sup> Data are from EM-DAT: The Emergency Events Database - Université catholique de Louvain (UCL) - CRED, D. Guha-Sapir - [www.emdat.be](http://www.emdat.be), Brussels, Belgium.

<sup>2</sup> Estimation was based on data from the insurance industry.

<sup>3</sup> Estimation was based on a limited number of observations where data were available.

<sup>4</sup> The six economies are Australia, Canada, Japan, Republic of Korea, Mexico, and the United States. The growth rate was calculated using data for produced, nonfinancial assets, including fixed assets, inventory, and valuables, from the OECD.Stat database, <http://stats.oecd.org> (accessed September 2, 2017).

<sup>5</sup> APEC member economies under review include Australia, Canada, Chinese Taipei, Indonesia, Japan, Mexico, New Zealand, Peru, the Philippines, the US, Vietnam.



**Few economies reported systematic assessment of their disaster-related contingent liability arising from public assets.** For various reasons, comprehensive fiscal risk assessments are often not conducted: required data are not collected or accessible; awareness is low; analytical tools are lacking; or limited knowledge of an appropriate risk assessment methodology impedes governments from working in this area. Challenges related to data for financial risk management were identified across economies and include data availability, quality, usability, consistency, and accessibility, as well as a lack of coordination among relevant institutions. In all reviewed economies, either the MOF or a line ministry or agency collects data for a few types of public assets, including public buildings and some infrastructures. However, information on public assets is often incomplete, and data on historical loss and damage, on historical expenditure for asset rehabilitation and reconstruction, and on insurance coverage of public assets are limited.

**All APEC economies under review take risk mitigation measures for public assets.** Risk reduction has been mainstreamed into the legislation of many APEC economies as part of a holistic approach to disaster risk management and fiscal risk management. Risk mitigation measures in APEC economies include land use planning, enforcement of resilient building codes, retrofitting and construction of infrastructures to reduce the severity of disaster risks.

**APEC economies often rely on budgetary funds to finance rehabilitation and reconstruction of public assets following natural disasters.** These include funds from contingency budgets, dedicated disaster reserves, and budget (re)allocations. However, experience from catastrophic events in APEC economies shows that such budgetary mechanisms are often insufficient to cover the large funding needs of the post-disaster recovery and reconstruction phases, when governments often have to finance the recovery and reconstruction of public assets and some private assets (e.g., houses of low-income households).

**Insurance of public assets is legally compulsory in five respondent economies, although penetration is often low.** Indemnity-based insurance solutions are used in all reviewed economies, while parametric insurance is used by some governments, including in Mexico and the Philippines. More commonly insured assets include public buildings and certain public infrastructures such as some transport or water works. In several economies, there were constraints on local appetite for and capacity to establish traditional insurance arrangements for some public assets; contributing factors included the small size of the portfolio of insurable assets, data limitations, poor loss experience, and cost associated with loss adjustment procedures and claim settlement following a disaster, among others. Parametric insurance or other innovative risk transfer instruments such as catastrophe bonds (CAT bonds) have been used in Mexico and the Philippines. Domestic pooling of public assets in six APEC economies and centralized procurement in Colombia have helped to achieve efficiency gains.

**Raising public debt and levying temporary taxes are sometimes used to finance post-disaster reconstruction of public assets, especially after major disasters.** These instruments have been used by a limited number of APEC governments following extreme events. They can unlock significant post-disaster funding, as shown by the experiences of Japan and New Zealand in issuing bonds following (respectively) the Great East Japan Earthquake and the Canterbury Earthquakes, and by the experience of Australia in raising income tax following the Queensland floods in 2011.

**Developing fund execution mechanisms linked to ex ante contingency planning for public asset rehabilitation and reconstruction is an important step in ensuring effective response.** Mexico and Japan have made notable progress in this regard. These systems are put in place to ensure that re-

sources reach beneficiaries in a timely, transparent, and accountable fashion. They require effective administrative and legal systems for the appropriation and execution of budgetary funds, insurance distribution and settlement (often through private channels), and public asset rehabilitation and reconstruction programs.

**Several APEC economies reported that limited technical capacity and financial resources hamper the development and implementation of strategies for financial risk management of public assets.**

Other reported challenges include underdeveloped domestic catastrophe insurance markets and lack of an adequate legal and regulatory framework for innovative risk transfer instruments.

Table O.1 below summarizes the policies and practices in place in APEC economies for the financial risk management of public assets against natural disasters.

**Table O.1. Policies and Practices on Financial Risk Management of Public Assets against Natural Disasters in APEC Economies: Summary Table**

		Australia	Canada	Chinese Taipei	Indonesia	Japan	Mexico	New Zealand	Peru	Philippines	United States	Vietnam	Colombia
Legal, institutional framework	Key laws, regulations governing financial risk management of public assets	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Comprehensive financial protection strategy against natural disasters						✓		✓	✓			✓
	- Including for financing public asset rehabilitation and reconstruction						✓			✓			✓
	Explicit post-disaster cost-sharing arrangement between central and local levels for public assets	✓	✓	✓	✓	✓	✓	✓			✓	✓	
Pre-disaster risk assessment	Systematic assessment of total disaster-related contingent liability for public assets	✓					✓					✓	
	Use of probabilistic cat risk modeling	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Centralized database of public assets	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Systematic and comprehensive contingency planning	✓	✓	✓		✓		✓			✓		
Financing risk reduction	Financing risk reduction	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Capital expenditure/investments	✓	✓	✓		✓	✓	✓		✓		✓	
	Recurrent budget	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓
	Integrate disaster risk into land use planning	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓
	Retrofitting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Resilience building code	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
	Building disaster mitigation infrastructures	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Financing residual risk	Dedicated disaster reserve, including for public asset rehabilitation and reconstruction		✓	✓	✓		✓	✓		✓	✓	✓	✓
	Recurrent budget line for public asset rehabilitation and reconstruction		✓	✓		✓			✓		✓	✓	
	General contingency budget		✓	✓	✓	✓	✓		✓			✓	✓
	Contingent line(s) of credit								✓	✓			✓
	Use of insurance	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Disaster insurance of public assets compulsory	✓					✓		✓	✓		✓	✓
	Centralized procurement for public asset insurance												✓
	Disaster risk pooling (domestic)	✓			✓		✓	✓		✓	✓		
	Issued catastrophe bonds						✓				✓		
	Budget reallocation/appropriation	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓
	Public borrowing			✓		✓		✓		✓			✓
Post-disaster tax increases	✓				✓							✓	
Post-disaster tax breaks				✓							✓		
Post-disaster	Tracking of post-disaster expenses for public asset rehabilitation and reconstruction	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓

*Note:* The table is based on APEC economies' responses to World Bank Group questionnaire, 2017, and multiple sources. Blank cells denote that the practice is not in place or information is not available to the authors.

## Recommendations for APEC Economies

The APEC finance ministers could promote a set of priority policy actions to strengthen financial resilience of public assets against natural disasters. Specifically, the APEC finance ministers could promote activities that support the following areas:

- 1. Develop strategies for the financial risk management of public assets against natural disasters.** Such strategies could include a mix of financial instruments for emergency repair and rehabilitation of public assets, such as budgetary instruments, contingent credit, and catastrophe risk transfer. They would also include post-disaster financial measures such as post-disaster borrowing or indemnity insurance for reconstruction of public assets. They should be linked to and even enhance the strategies for maintenance of high-quality and resilient public assets.
- 2. Fully integrate the financial risk management of public assets into the fiscal risk management framework.** The impact of natural disasters on public assets is a major source of contingent liabilities for governments and therefore could be integrated within a holistic fiscal risk management framework. Under this approach, contingent liabilities would be identified, quantified, and integrated into fiscal risk statements and disclosed.
- 3. Promote catastrophe risk insurance of public assets through public-private partnerships.** Governments could develop legal and institutional frameworks that foster sound and innovative catastrophe risk insurance solutions, thus facilitating risk pooling or centralized insurance procurement to achieve greater efficiency gains and encouraging the private sector to develop innovative insurance solutions. Through public-private partnerships, the private sector can bring capital, technical expertise, and innovative financial solutions to de-risk public sector balance sheets from natural disasters.
- 4. Improve risk data to inform management of fiscal impacts of natural disasters on public assets.** APEC economies could enhance their collection, management, and analysis of relevant disaster-related data on public assets. Specifically, they could improve baseline data, historical loss information, and expenditure data through standardized data management systems. This action not only contributes to advancing the financial resilience agenda in member economies but also to raising their readiness in fulfilling their ongoing (and possibly future) commitments to the monitoring and reporting of disaster preparedness under the United Nations' Sendai Framework for Disaster Risk Reduction 2015-2030.
- 5. Develop contingency plans for public asset rehabilitation and reconstruction linked to financial risk management strategies of public assets against natural disasters.** Such plans would define clear roles and responsibilities for stakeholders and thereby enhance the efficiency of the rehabilitation and reconstruction process.

The APEC finance ministers could develop a work program structured around the priority actions identified above to specify how economies would support specific activities. Efforts under the program could be supported by further knowledge exchange and experience sharing among APEC economies.

## INTRODUCTION

**Enhancing the financial resilience of Asia-Pacific Economic Cooperation (APEC) economies against natural disasters is a key policy objective put forward by APEC leaders in recent years.** In 2015, APEC economies approved the Cebu Action Plan, which has one pillar dedicated to enhancing the financial resilience of APEC economies, mainly through disaster risk finance and insurance mechanisms. In February 2017 in Nha Trang, Vietnam, APEC finance deputies highlighted the importance of strengthening financial resilience against disasters in the region. They called on APEC member economies to continue cooperating and exchanging knowledge and experience on disaster risk finance policies and financial risk management of public assets against natural disasters.

**Prepared at the request of the Ministry of Finance of Vietnam as Chair of the 2017 APEC Finance Ministers' Process and the APEC Working Group on Disaster Risk Financing and Insurance, this report is part of a collaborative effort to document policies and practices in the financial management of public assets against natural disasters** in APEC member economies and select economies outside APEC. It aims to facilitate learning and exchange among government financial decision makers and practitioners and to help APEC economies identify opportunities for further exchange and collaboration toward a more actionable agenda beyond APEC 2017. The expression “public assets” in this report refers to physical public assets, including public buildings, infrastructure, fixed structures, and contents; “disasters” refers to natural hazard events that have significant impact on public assets.

**This report builds on the work undertaken by APEC and international organizations** such as the World Bank, the Organisation for Economic Co-operation and Development (OECD), the Asian Development Bank, and the United Nations Office for Disaster Risk Reduction (UNISDR) in previous APEC presidencies as well as in other fora such as the G20, ASEAN (Association of Southeast Asian Nations), and ASEAN+3. It was prepared by the World Bank's Disaster Risk Financing and Insurance Program (DRFIP) in close collaboration with the Ministry of Finance of Vietnam as Chair of the 2017 APEC Finance Ministers' Process, the APEC Secretariat, and the APEC Working Group on Disaster Risk Financing and Insurance. It draws on the inputs and responses provided through an APEC/World Bank survey questionnaire on financial risk management of public assets against natural disasters circulated to member economies.

**The report complements two other reports prepared at the request of the APEC Finance Ministers' Process:** the report on managing disaster-related contingent liabilities, prepared by the World Bank and the OECD; and the report on improving public asset and insurance data for disaster risk financing and insurance solutions, prepared by the World Bank. These two reports explore their respective topics in depth and should be read in conjunction with this report for a more comprehensive picture of the state of disaster risk finance in APEC economies.

**This report is organized into three volumes. Volume 1: Main Report** takes stock of policies and experiences in financial management of public assets against natural disasters across APEC economies. It highlights good practices, provides options for consideration by policy makers, and includes a check list for financial officials and practitioners suggesting how to approach the financial management of public assets against natural disasters. **Volume 2** provides a series of case studies from member economies that participated in the APEC/World Bank survey. These offer insights into each economy's approach to financial risk management. Through another series of case studies, **Volume 3** shares experience and insight from the private sector in enterprise risk management (ERM) applied to infrastructure.

**APEC economies and Colombia were invited to complete a questionnaire on their respective financial risk management of public assets against natural disasters.** Responses were received from 11 APEC economies—Australia, Canada, Chinese Taipei, Indonesia, Japan, Mexico, New Zealand, Peru, the Philippines, the United States, and Vietnam—and from Colombia.

**The rest of this volume is structured in three chapters.** Chapter 1 provides background on natural disasters in the region and discusses the relevance of financial risk management for public assets. It also summarizes general principles for disaster-related fiscal risk management. Chapter 2 presents the approaches and good practices for financial management of public assets against natural disasters adopted by APEC economies. Taking into account lessons learned from existing practices on financial management of public assets, Chapter 3 recommends a set of priority actions that APEC economies could consider to strengthen the financial management of public assets against natural disasters.

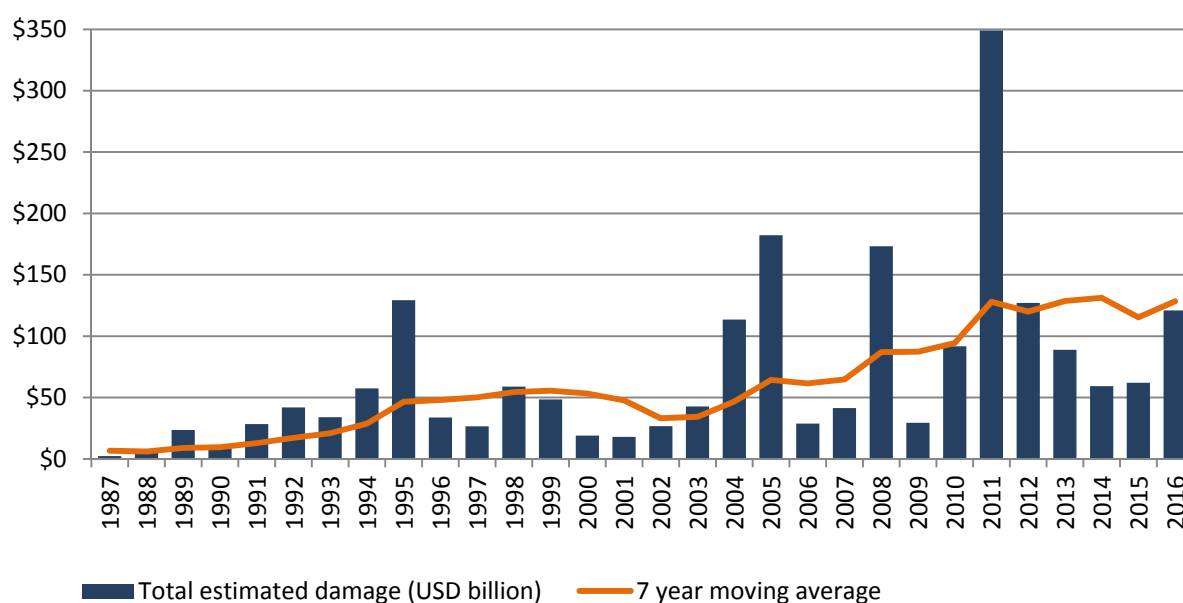
## CHAPTER 1. MANAGING THE FINANCIAL IMPACT OF DISASTER RISKS

### 1.1. NATURAL DIASSTERS IN APEC ECONOMIES

#### Natural Disasters: A Common Challenge for APEC Economies

APEC economies have been facing an increase in the frequency, severity, and economic cost of natural disasters in recent years.<sup>6</sup> Together, APEC member economies produce more than half of the global gross domestic product (GDP) and make up more than half of the world's population,<sup>7</sup> yet they experience more than 75 percent of total disaster-related losses worldwide. In 2011, the highest global loss year on record with losses of US\$364 billion, APEC economies suffered 96 percent of the loss. During 1997–2016, natural catastrophes claimed more than 450,000 lives in APEC states, affected more than 2.5 billion people, and inflicted over US\$2 trillion in economic losses.<sup>8</sup> Over the past 40 years, disaster-related annual expected losses across APEC members have steadily climbed, from the low billions in the 1970s and 1980s to tens of billions in the 1990s and hundreds of billions in the new millennium (see figure 1.1). This trend in losses is expected to continue for a variety of reasons, including growing urbanization, environmental degradation, and climate change.

Figure 1.1. Total Estimated Damage from Natural Disasters across APEC Economies, 1987–2016



Source: EM-DAT: The Emergency Events Database - Université catholique de Louvain (UCL) - CRED, D. Guha-Sapir - [www.emdat.be](http://www.emdat.be), Brussels, Belgium.

**Key hazards in the region include storms, earthquakes, floods, and tsunami; however, hazards and their impacts are unevenly distributed across economies and subregions.** Total events recorded in

<sup>6</sup> APEC member economies include Australia; Brunei Darussalam; Canada; Chile; People's Republic of China; Hong Kong, China; Indonesia; Japan; Republic of Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; the Philippines; Russia; Singapore; Chinese Taipei; Thailand; the United States; and Vietnam.

<sup>7</sup> Data are from the World Development Indicators Database; and from World Bank, <https://data.worldbank.org/indicator/SP.POP.TOTL>.

<sup>8</sup> Data are from EM-DAT: The Emergency Events Database - Université catholique de Louvain (UCL) - CRED, D. Guha-Sapir - [www.emdat.be](http://www.emdat.be), Brussels, Belgium.

APEC economies exceeded 2,700 over the 1997–2016 period. During that time, among all events that occurred in the APEC region, a plurality were storms (33 percent), followed by floods (29 percent), earthquakes (9 percent), and tsunami (1 percent). During this period,

- The greatest number of storms was experienced by the United States, China, and the Philippines (62 percent).
- Floods were mostly experienced in China, Indonesia, the Philippines, and the United States (59 percent of all floods).
- The greatest number of earthquakes was experienced in China, Indonesia, and Japan (69 percent of all earthquakes).
- Storms inflicted 42 percent of all damages sustained from natural disasters in APEC economies, followed by floods at 17 percent and tsunami at 15 percent.
- In absolute terms, storms inflicted the greatest damage in the United States (72 percent of all damages), followed by China (11 percent) and Japan (6 percent).
- Floods caused the greatest damage in China (54 percent), Thailand (14 percent), and the United States (12 percent).
- Tsunami hit Japan the hardest by far (causing 84 percent of all damages), followed by Chile (12 percent).<sup>9</sup>

These patterns suggest the potential for risk diversification by risk carriers in the region, although pursuing this possibility will require more in-depth study of hazards and economies' exposures over a significant time period.

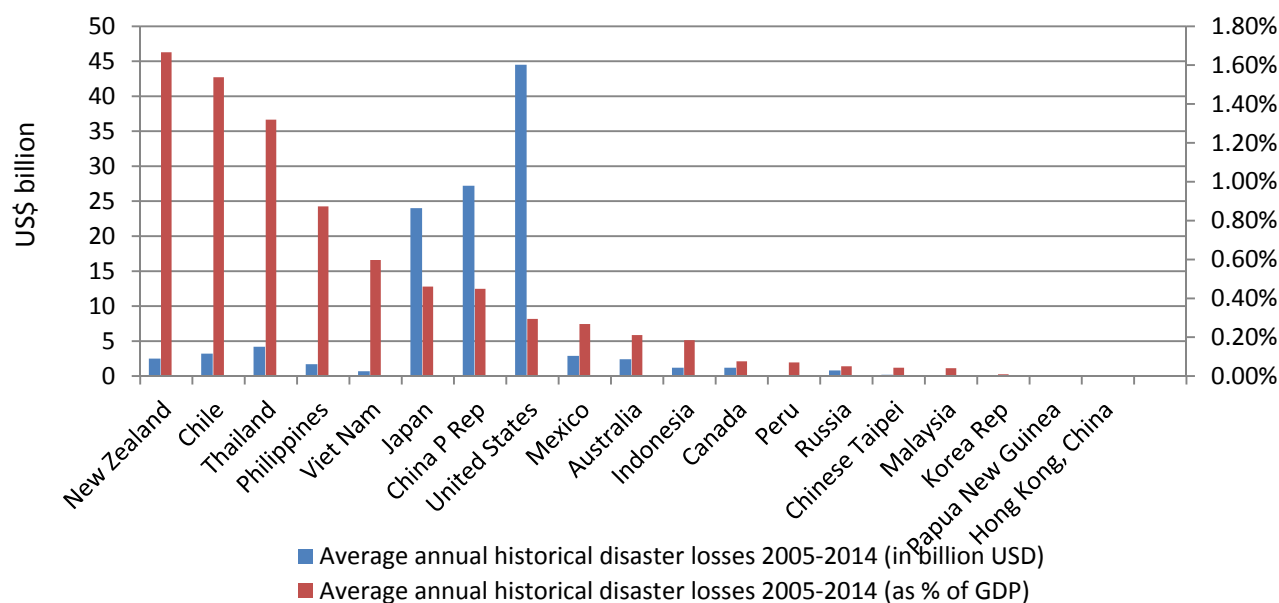
**Hazard impacts are more deeply felt in emerging economies that are less able to prepare for disasters.** Advanced economies are generally better able to reduce vulnerability—e.g., through enforcement of building codes or retrofitting of lifeline infrastructure; they are also better able to absorb shocks, in part due to better access to the insurance and capital markets for post-event financing. Disasters often have devastating impacts on rapidly urbanizing emerging economies—where the greater share of the APEC population currently resides and where the asset base at risk is growing, both because financial protection mechanisms are underdeveloped and because upgrades in regulations (e.g., building codes, resilience standards) and the implementation of risk mitigation measures do not keep pace with construction of new infrastructures and assets. See figure 1.2 and table 1.1.

**Figure 1.2. Average Annual Historical Disaster Losses in APEC Economies, in US\$ and as a Percentage of GDP, 2005–14**

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<sup>9</sup> Calculations based on data from EM-DAT: The Emergency Events Database - Université catholique de Louvain (UCL) - CRED, D. Guha-Sapir - [www.emdat.be](http://www.emdat.be), Brussels, Belgium; storms include tropical cyclones, extra-tropical storms, and convective storms; floods include flash floods, coastal floods, and riverine floods.





Source: EM-DAT Database; The Emergency Events Database – Universite cathorique de Louvain (UCL) – CRED, D. Guha-Sapir – [www.emdat.be](http://www.emdat.be), Brussels, Belgium; World Development Indicators Database.

Table 1.1. Selected Major Natural Disasters in APEC Economies, 2001–15

Year	Event	Economy	Estimated direct loss (US\$ billion)	Economic loss as % GDP	Insured direct loss (US\$ billion)
2011	Earthquake	Japan	210	4	30
2008	Earthquake	China	150	3.3	0.14
2005	Hurricane (Katrina)	United States	125	1	46
2011	Floods	Thailand	46.5	1.1	12
2012	Hurricane (Sandy)	United States	50	0.3	—
2008	Hurricane (Ike)	United States	30	0.2	15
2010	Earthquake	Chile	30	15	8
2004	Earthquake	Japan	28	0.6	0.76
2011	Earthquake	New Zealand	20	16	10
2010–11	Flood	Australia	7	<1	2.5
2007	Pisco Earthquake	Peru	3.9	1.24	—
2010	Hurricane (Karl)	Mexico	3.9	0.4	0.15
2013	Typhoon (Yolanda/Haiyan)	Philippines	10	3.7	0.7
2004	Tsunami	Indonesia	4.5	1.75	0.5
2012	Typhoon (Bopha)	Philippines	0.9	0.4	—
2009	Typhoon (Ondoy/Ketsana)	Vietnam	0.8	0.8	—
2015	Drought	Papua New Guinea	0.06	0.4	—
2012	Flood	Papua New Guinea	0.03	0.2	—

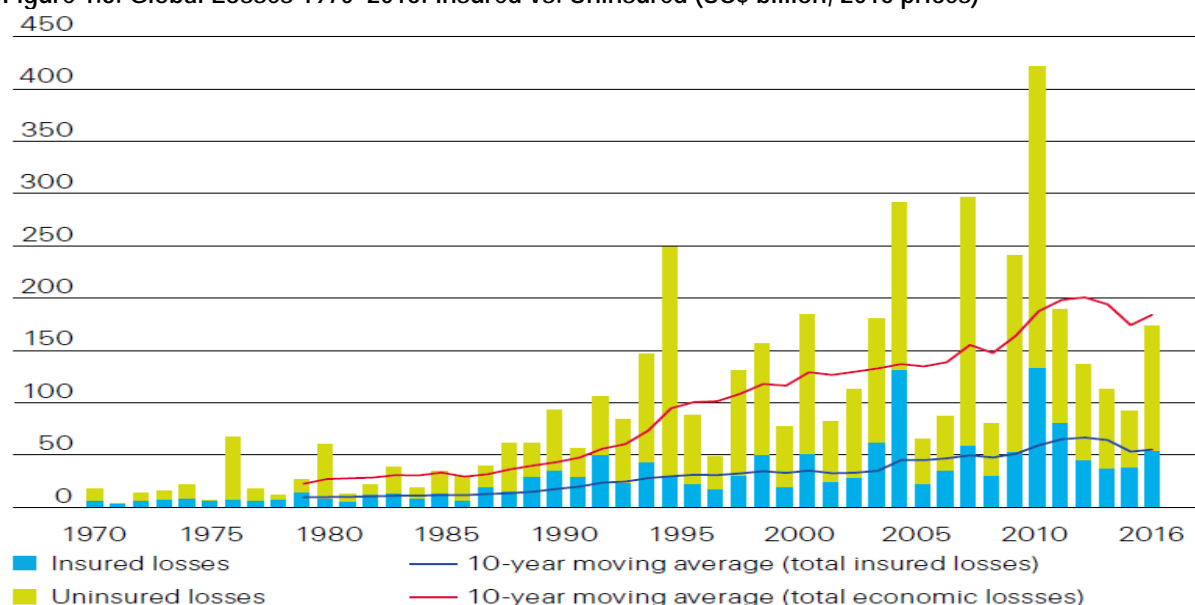
Source: World Bank DRFIP, using data from multiple sources.

Note: — = not available.

**Disasters can have a significant impact on the fiscal balance by changing both government expenditure and revenue.** Governments often face increases in expenditure following a disaster because they must pay for the costs of emergency relief and response in the short term and recovery and recon-

struction in the medium and long-term, while fiscal revenues may decline as economic activity declines due to disruptions. For a sample of 81 middle- and upper-income economies worldwide, Melecky and Raddatz (2011) find that disasters tend to raise expenditures by about 15 percent and to lower revenues by 10 percent, resulting in an increase in budget deficits by 25 percent from initial levels. In economies with well-developed non-life insurance markets, where a significant portion of economic losses from natural disasters is absorbed by the private sector, real losses tend to be smaller and there is less expansion in fiscal deficits. For example, in 2010, nearly 75 percent of natural disaster losses in North America were shouldered by insurers. Meanwhile, the economic impact of natural disasters on developing economies is exacerbated by comparatively low rates of non-life insurance penetration. In lower-income economies, the rising costs of natural disasters are borne principally by governments and households (see figure 1.3).

Figure 1.3. Global Losses 1970–2016: Insured vs. Uninsured (US\$ billion, 2016 prices)



Source: Swiss Re Institute 2017.

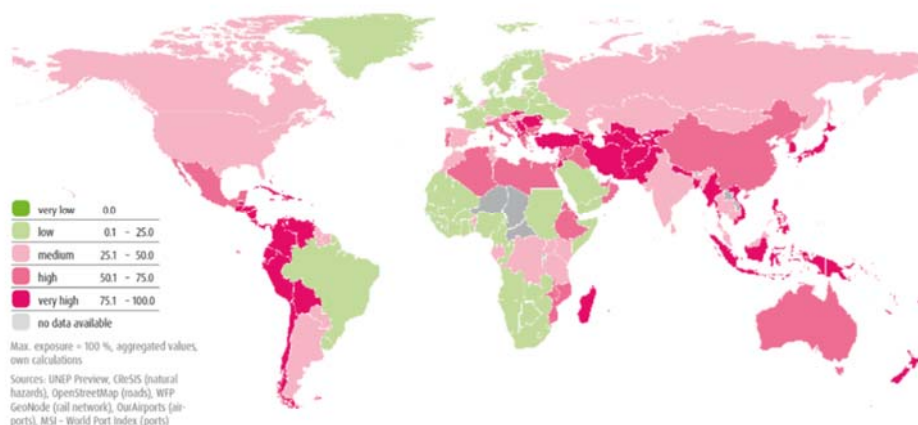
### Impact of Natural Disasters on Public Assets

**The impact of natural disasters on public assets is one of the major sources of fiscal vulnerability in APEC economies, affecting as it does both revenues and expenditure.** By damaging public assets, natural disasters strain public finances in two ways: (1) they necessitate increased government expenditure to fund recovery and long-term reconstruction of direct physical damage to public assets and infrastructures, and (2) they decrease economic activity that depends on the damaged/destroyed assets, and consequently lead to reduced tax revenues and other sources of government revenue such as natural resource royalties or user fees.

**Critical public infrastructure is often exposed to natural hazards.** Urbanization increases the siting of public infrastructure such as airports in coastal, delta, or river areas and hence makes it more susceptible to flooding and cyclones (Garschagen et al. 2016). Figure 1.4 shows the exposure of major

transport infrastructure to the hazards of earthquakes, cyclones, floods, and sea-level rise (considered under the World Risk Index 2016<sup>10</sup>) and demonstrates high exposure due to long coastlines.

**Figure 1.4. Share of Transport Infrastructure Exposed to Natural Hazards**



Source: Garschagen et al. 2016.

Note: Transport infrastructure includes roads, rail network, airports, and ports.

**Disclaimer:**  
The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

**The impact of natural disasters on public assets, particularly on lifeline infrastructure, is often felt profoundly by populations and businesses.** Schooling and health services can be interrupted; in China in 2008, for example, the Sichuan Earthquake damaged or destroyed 7,444 schools and 11,028 health facilities (World Bank 2012a). Storms and floods can interrupt access to villages and cities, sometimes for days. Interruptions to commuting and the delivery of intermediate goods can lead to production losses. Inventories to protect production against climate-induced supply irregularities bind up significant amounts of business capital. In the future, extreme weather events induced through climate change are expected to occur more frequently and will thus disrupt infrastructure-dependent public services more often.

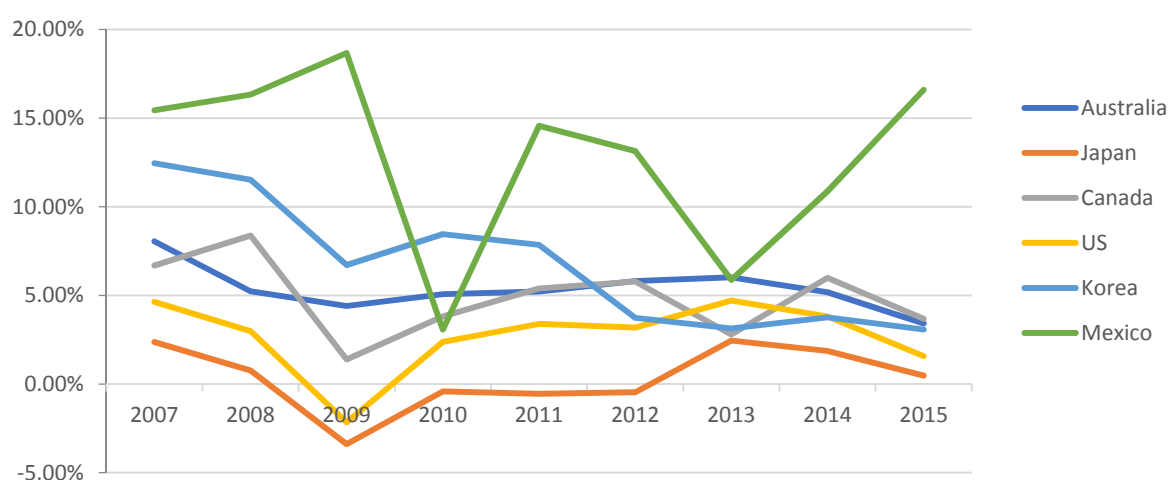
**The impact of natural disasters on local public infrastructure can also be felt at the regional level, if supply chains across APEC are affected.** As APEC economies become increasingly open and interconnected, cross-economy public infrastructure should be considered as an integrated network. “Network effects” (Economides 1996) involve potential benefits from interconnectedness (of trade, transportation, logistics, manufacturing, and local and regional growth and development) as well as critical interdependences that, if broken, could dramatically disrupt a regional economy. For example, in 2011, the inundation of industrial parks and manufacturing facilities in Thailand caused significant disruptions to the world’s industrial productions.<sup>11</sup>

<sup>10</sup> The World Risk Index is an index calculated with 28 individual indicators that rates the disaster risk for 171 economies for five natural hazards. See Garschagen et al. (2016).

<sup>11</sup> The United Nations Office for Disaster Risk Reduction (UNISDR 2012) estimated that Thailand’s 2011 flood reduced the world’s industrial production by 2.5 percent. Japanese automakers and electronics manufacturers were hit hard because Thailand was an important part of their global supply chain. Although lifeline infrastructure and the transportation system had damages of B 57.4 billion, which was lower than the damage in the manufacturing sector (B 1,007 billion) (World Bank 2012d), the damage and loss in the lifeline and transport systems could have negatively affected the manufacturing sector (Haraguchi and Lal 2015). The simulation conducted by Miles and Chang (2003) indicates that the recovery period for businesses significantly benefits from pre-disaster mitigation measures directed at lifeline systems and post-disaster restoration of transportation systems.

**Managing the public asset–related fiscal impact of natural disasters will become increasingly important as the value of public assets grows and disasters intensify due to climate change.** In recent years, the value of public assets has increased in many APEC economies (see figure 1.5); the recent past also illustrates the high fiscal costs entailed by the effect of disasters on public assets. For example, in **Colombia** in 2010–11, a severe La Niña season caused heavy damage to public buildings, of which only a few were properly insured. While replacement costs were estimated at US\$89 billion, only US\$400 million was collected from insurance policies. Primary and secondary roads also suffered damages of US\$1.7 billion. With better financial protection in place, much of the subsequent reconstruction cost to government could have been avoided (World Bank 2013).

**Figure 1.5. Growth of Nonfinancial Assets on Governments' Balance Sheets**



Source: Organisation for Economic Co-operation and Development, OECD.Stat, <http://stats.oecd.org/> (accessed September 2, 2017).

Note: Data are for produced, nonfinancial assets, including fixed assets, inventory, and valuables.

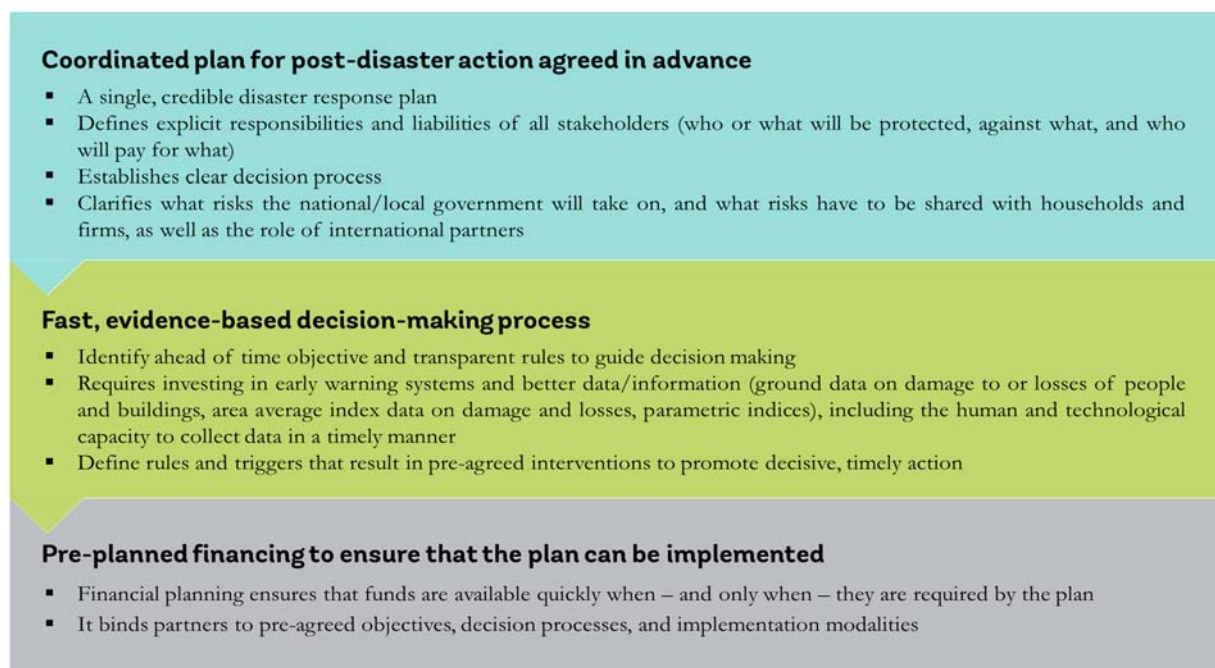
**Financial planning for post-disaster public asset rehabilitation and reconstruction can also avoid unnecessary delays.** Public asset rehabilitation and reconstruction typically is started only a few months after the occurrence of a natural disaster. Although this period can be used to organize funding arrangements, funds are not always available in time. For example, in the **Philippines** in October 2009, the Congress passed a resolution authorizing the use of unprogrammed funds of up to ₱12 billion (US\$266 million) for the response to Typhoons Ondoy (Ketsana) and Pepeng (Parma). However, one year later, the Department of Budget and Management had allocated only 2.8 percent of that amount.<sup>12</sup> Moreover, Hallegatte, Hourcade, and Dumas (2007) suggest that the negative impacts of disasters on GDP are much higher in economies where public (and private) reconstruction resources are limited and where reconstruction is thus spread over a number of years.

<sup>12</sup> Senate of the Philippines, “Privilege Speech: One Year After: Ondoy's Wake-Up Call Remains Unheeded” (press release), September 27, 2010, [http://www.senate.gov.ph/press\\_release/2010/0927\\_legarda3.asp](http://www.senate.gov.ph/press_release/2010/0927_legarda3.asp).

## 1.2. PRINCIPLES OF FINANCIAL PROTECTION AGAINST NATURAL DISASTERS

General principles for financial protection against natural disasters are outlined in this section and briefly summarized in figure 1.6.<sup>13</sup>

**Figure 1.6. The Elements of an Effective Approach to Disaster Preparedness and Crisis Response**



*Source:* World Bank 2017a.

### Coordinated Plan for Post-Disaster Action Agreed in Advance

**A pre-agreed coordination plan for post-disaster action is needed to ensure an effective and efficient response and recovery.** This approach requires all stakeholders to work together before disasters happen to establish a credible plan that clearly defines the responsibilities of all actors and explains the decision-making process. By explicitly defining who or what will be protected, against what, and who will pay for what, such a plan clarifies what risks the central or local government will take on and what risks have to be shared with lower-level governments, households, and firms.

Financial resources for post-disaster response and recovery also need to be planned in advance, including how they will be included in the central and local governments' budget, how they will be disbursed and executed, and how they will be delivered to end beneficiaries in a rapid, efficient, and transparent manner.

### Fast, Evidence-Based Decision-Making Process

**A fast, evidence-based decision-making process is required to avoid costly delays.** Such a decision-making process requires appropriate information and early identification of objective and transparent rules. Clear rules and triggers tied to pre-agreed steps will facilitate decisive, timely action and limit the number of decisions that stakeholders must make when a disaster occurs.

The data driving these decisions need to strike the right balance among cost, speed, and accuracy and must be resistant to manipulation. Such data will depend on pre-disaster investments in the risk in-

<sup>13</sup> This chapter builds on World Bank (2014, 2017a).

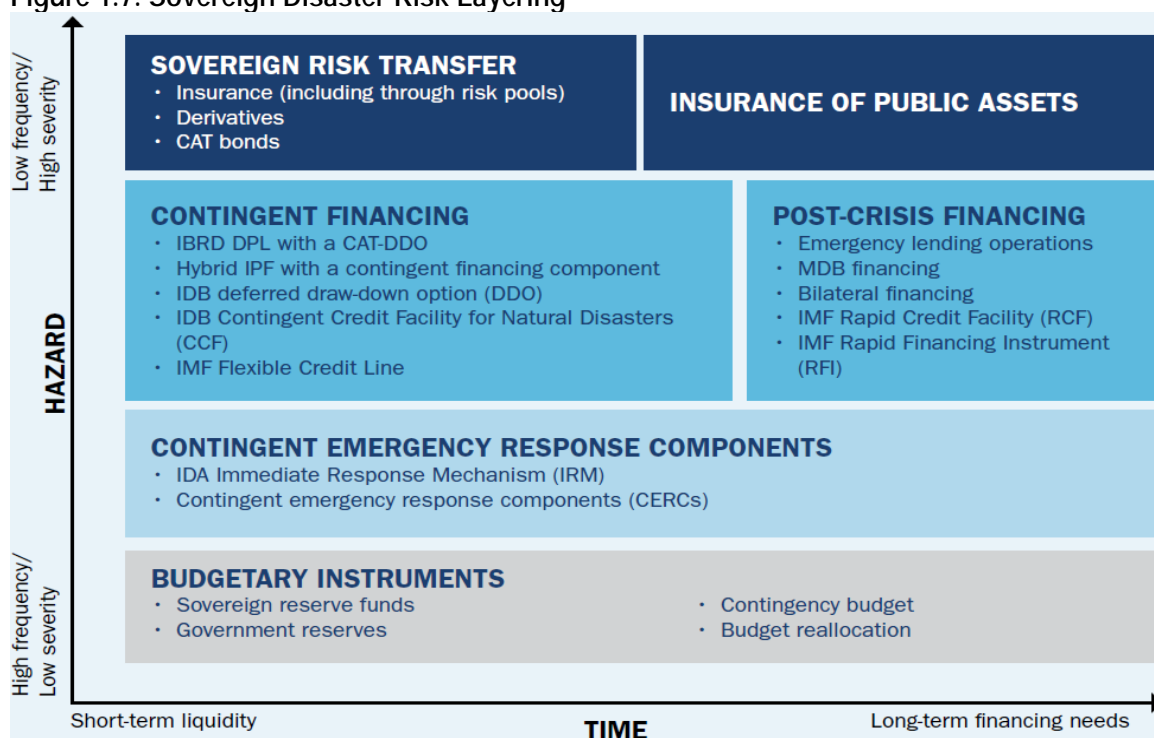
formation system, and in the human and technological capacity to implement the system. For public assets, two types of data are particularly useful for triggering post-disaster action: individual damage and loss data of public infrastructure and parametric indexes.

### Ex Ante Financial Planning for Disaster Response

**Financial planning, the third key element for effective disaster response, should follow a layered approach.** This approach (represented schematically in figure 1.7 and explained below) prioritizes the most cost-effective solution for different layers of risk and ensures that the most expensive instruments are used only for the extreme events that rarely occur.

- *Low-risk layer.* Frequent low-impact events could be financed primarily through risk retention mechanisms in the form of a disaster fund, a dedicated budget line, or a contingency budget. If needed, some minor in-year budget reallocations could also be used.
- *Medium-risk layer.* Medium-scale, less frequent events could be financed through contingent facilities that are typically provided by international financial institutions. Pre-agreed contingent credit arrangements allow governments to access liquidity quickly after a disaster.
- *High-risk layer.* The financial risk for extreme events that occur infrequently could be transferred to the international capital and reinsurance market using insurance, catastrophe derivatives, or catastrophe bonds. Risk transfer solutions tend to be relatively expensive but can unlock large amounts of funding when they are needed most.

Figure 1.7. Sovereign Disaster Risk Layering



Source: World Bank 2017a.

Note: IBRD = International Bank for Reconstruction and Development; DPL = Development Policy Loan; CAT DDO = Catastrophe Deferred Drawdown Option; IPF = investment project financing; IDB = Inter-American Development Bank; IMF = International Monetary Fund; MDB = multilateral development bank; IDA = International Development Association.

**Financing instruments can be categorized into those that are procured after disaster strikes (ex post) and those that are pre-arranged (ex ante).** The characteristics of the instruments vary—they



may be faster or slower to activate, and generate greater or lesser volumes of funding. Each case is different and requires a different combination of instruments to optimize the financing strategy. Table 1.2 briefly describes various instruments used by 12 respondent economies.

**Ex ante financial instruments are most suited to cover the large costs of reconstructing public assets after extreme events, while ex post instruments can finance quick rehabilitation of lifeline infrastructures.** Given the large funding it can unlock for comparatively small premium payments, risk transfer tends to be the most cost-effective solution for the most costly and devastating disasters. Risk transfer solutions can also ensure that funding is available in time, for example through parametric triggers; otherwise, if funding is unavailable, reconstruction works may be delayed.

**Table 1.2. Overview of Risk Financing Instruments**

	Instrument	Characteristics	Used by
Ex Ante Instruments	Dedicated disaster reserve/budget	Most APEC economies have established some type of reserve funded through the regular budget. Such reserves are governed by legislation in their respective financial management acts and vary in size and complexity.	Canada, Chinese Taipei, Indonesia, Japan, Mexico, New Zealand, Peru, the Philippines, the United States, Vietnam, Colombia
	General contingency budget	While not exclusively designed for post-disaster expenditures, contingency budgets can provide a timely source of limited cash. Just as for in-year budget reallocations, the amount of money available from the contingency budget will vary depending on the time of the fiscal year.	Canada, Chinese Taipei, Indonesia, Japan, Mexico, Peru, Vietnam, Colombia
	Contingent credit	These pre-agreed credit arrangements that unlock money upon occurrence of a specified event, e.g., a disaster, are typically offered by international financial institutions, including the World Bank, the Asian Development Bank, the Inter-American Development Bank, and the International Monetary Fund.	Peru, the Philippines, Colombia
	Risk transfer	Through risk transfer instruments, risks can be assumed by a third party. Risk transfer replaces an incidental large fiscal cost—in case of a disaster—with continuous smaller premium payments. Different instruments can be used, including insurance of public assets, derivative contracts, and catastrophe bonds.	All
Ex Post Instruments	Budget reallocation	This instrument can provide large amounts of disaster response funding by redistributing funds from other programs. However, reallocation often requires complex approval processes and can thus take time to operationalize; and the amount of money available for reallocation can vary depending on when disaster strikes, as it may be easier for the government to reallocate funds at the beginning or the end of the fiscal year.	Australia, Chinese Taipei, Indonesia, Japan, Mexico, New Zealand, Peru, the Philippines, Vietnam, Colombia
	Public borrowing	Issuing bonds or taking advantage of a loan can be a source of substantial funding for the recovery and reconstruction phases. This approach often has significant costs, however, and economies must be aware of their existing debt levels, the strong technical capacity required to manage them, and the fact that credit solutions take a relatively long time to realize.	Chinese Taipei, Japan, New Zealand, the Philippines, Colombia
	Post-disaster tax increase	A temporary tax increase can generate large amounts of funding. It requires significant administrative capacity; tends to be politically unpopular; can weigh on citizens' finances, which may already be strained due to the disaster; and can take a relatively long time to be approved and even longer to be collected.	Australia, Japan

	Post-disaster tax break	This instrument will cause government revenue to dip in the short term, but by encouraging recovery may imply a net increase in government revenue over the longer term. Typically targeted at supporting recovery of the private sector and citizens, it is less suited to support the rehabilitation and reconstruction of public assets.	Indonesia, Vietnam
	External donor assistance	This instrument can be substantial and is sometimes the most important funding source. Yet there is always an element of uncertainty about how much will be provided, what will be provided, and when it will be provided.	Indonesia, Peru, Philippine, Vietnam, Colombia

*Note:* The table summarizes information about the 12 economies reviewed for this report.



## CHAPTER 2. FINANCIAL MANAGEMENT OF PUBLIC ASSETS AGAINST NATURAL DISASTERS: REVIEW OF EXPERIENCE IN APEC ECONOMIES

### 2.1. OVERALL FRAMEWORK

APEC economies have adopted a broad range of policies and practices in financial risk management of public assets against natural disasters. Table 2.1 provides an overview of policies and practices in place in 11 APEC economies and Colombia.

**Table 2.1. Policies and Practices on Financial Risk Management of Public Assets in APEC Economies: Summary Table**

		Australia	Canada	Chinese Taipei	Indonesia	Japan	Mexico	New Zealand	Peru	Philippines	United States	Vietnam	Colombia
Legal, institutional framework	Key laws, regulations governing financial risk management of public assets	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	National financial protection strategy against natural disasters						✓		✓	✓			✓
	- Including for financing public asset rehabilitation and reconstruction						✓			✓			✓
	Dedicated fiscal risk management unit including for disaster risk within Ministry of Finance	✓			✓	✓	✓	✓	✓	✓	✓		✓
	Explicit post-disaster cost-sharing arrangement between central and local levels	✓	✓	✓	✓	✓	✓	✓			✓	✓	
	- Includes incentive for risk mitigation and proactive risk financing	✓					✓				✓		
Pre-disaster risk assessment	Systematic assessment of total disaster-related contingent liability for public assets	✓					✓					✓	
	Fiscal risk statement: Inclusion of disaster risk	✓					✓	✓		✓			✓
	- Explicit reference to disaster related contingent liabilities from public assets	✓					✓	✓		✓			
	Use of probabilistic cat risk modeling	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Centralized database of public assets	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
	- Coverage of lifeline assets	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
	- Georeferenced	✓	✓			✓	✓						✓
	- Includes information on asset risk exposure			✓			✓	✓				✓	✓
	- Includes loss/damage data	✓											
	- Information on asset insurance status												✓
	Risk ranking/layering	✓		✓			✓		✓	✓	✓		✓
Systematic and comprehensive contingency planning	✓	✓	✓	✓	✓		✓			✓			
Financing risk reduction	Plan for making public assets more resilient	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Integrate disaster risk into budgetary allocations for risk reduction/maintenance spending	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Financing risk reduction	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Capital expenditure/investments	✓	✓	✓		✓	✓	✓		✓		✓	
	Recurrent budget	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓

	Integrate disaster risk into land use planning	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	
	Retrofitting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Resilience building code	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	
	Building disaster mitigation infrastructures	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Financing residual risk	Dedicated disaster reserve, including, for public asset rehabilitation and reconstruction		✓	✓	✓		✓	✓		✓	✓	✓	✓	
	Recurrent budget line for public asset rehabilitation and reconstruction		✓	✓		✓			✓		✓	✓		
	General contingency budget		✓	✓	✓	✓	✓		✓			✓	✓	
	Contingent line(s) of credit								✓	✓			✓	
	Use of insurance	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Disaster insurance of public assets compulsory	✓					✓		✓	✓		✓	✓	
	Standardized disaster insurance policies for public assets	✓	✓		✓		✓	✓		✓			✓	
	Centralized procurement for public asset insurance													✓
	Disaster risk pooling	✓			✓		✓	✓			✓	✓		
	- Domestic	✓			✓		✓	✓			✓	✓		
	- International													
	Issued catastrophe bonds						✓					✓		
	Budget reallocation/appropriation	✓			✓	✓	✓	✓	✓	✓			✓	✓
	Public borrowing				✓		✓		✓		✓			✓
Post-disaster tax increases	✓				✓								✓	
Post-disaster tax breaks					✓							✓		
Post-disaster	Tracking of post-disaster expenses for public asset rehabilitation and reconstruction	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	

*Note:* The table is based on APEC economies' responses to World Bank Group questionnaire, 2017, and multiple sources. Blank cells denote that the practice is not in place or information is not available to the authors.

### Legal and Institutional Framework

**APEC economies have varied legal and institutional frameworks for the financial management of disaster-related risks to public assets.** Most commonly, frameworks include laws and regulations on public asset management, fiscal management, disaster risk management, risk transfer markets, and public financial management of fund disbursements and tracking of disaster-related expenditures for public assets. This report does not analyze the adequacy and depth of the laws and regulations.

**Some APEC economies have adopted and have started to implement explicit financial protection ("disaster risk financing") strategies.** A full comparative review of general disaster risk financing practices in APEC economies has been undertaken by the OECD (2013), which is why such a review is not repeated here. However, it is worth highlighting the experience of **Mexico** (box 2.1) and the fact that the **Philippines** (box 2.2) and **Peru** have recently adopted financial protection strategies.

#### Box 2.1. Learning from APEC Economies

##### FONDEN, the National Disaster Fund of Mexico

Founded in 1996, the Fondo de Desastres Naturales (FONDEN) is a financial vehicle through which the Federal Government of Mexico allocates budget ex ante for post-disaster relief, rehabilitation, and reconstruction of public infrastructure such as roads, hospitals, and schools.

For the reconstruction of public assets, FONDEN operates on insurance principles: a transparent damage

reporting system, clear rules for how funds are disbursed, a clear plan for how money is spent, and a credible monitoring system for expenditures. It thereby provides a rules-based framework that coordinates the post-disaster activities of the federal, state, and municipal governments and the private sector.

The disbursement rules for public assets are clear: the fund pays for 100 percent of the post-disaster rehabilitation and reconstruction cost of federal public assets and 50 percent of the cost of local assets.

FONDEN has a layered financial risk management strategy. The bottom layer of risk amounts to up to US\$1 billion. This layer of risk is financed with FONDEN's annual budget appropriation (by law, FONDEN and its related funds receive no less than 0.4 percent of the annual budget, around US\$800 million, including any uncommitted funds in the FONDEN Trust from the previous fiscal year) and, if necessary, with an exceptional additional federal budget allocation of approximately US\$200 million. For higher risk layers, FONDEN has concluded a US\$400 million indemnity insurance contract on the whole FONDEN portfolio and placed a catastrophe bond worth up to US\$360 million in August 2017.

By facilitating faster reconstruction of infrastructure assets, FONDEN has contributed to increasing local post-disaster economic activity by 2–4 percent on average (De Janvry, del Valle, and Sadoulet 2016).

*Sources:* World Bank 2012b; World Bank, "World Bank Bonds to Provide \$360 Million in Catastrophe Protection for Mexico," August 4, 2017, <http://treasury.worldbank.org/cmd/htm/World-Bank-Bonds-Provide-360-Million-in-Catastrophe-Protection-for-Mexico.html>.

### Box 2.2. Learning from APEC Economies The Disaster Risk Financing Strategy of the Philippines

Through the national financial protection strategy adopted by the Department of Finance in 2015, the Philippines pursues an integrated financial risk management strategy at the national, subnational, and local levels.

The Philippines operates national and local disaster funds that provide government agencies and subnational governments with funding for relief, recovery, reconstruction, and risk reduction in response to natural and man-made disasters.

To cover the higher risk layers, the Philippines uses contingent credit and risk transfer mechanisms. In 2011, the Philippines became the first economy in the region to obtain disaster-related contingent credit through a US\$500 million Catastrophe Deferred Drawdown Option (CAT DDO) with the World Bank. The contingent credit was fully drawn down in the same year and was renewed in full for 2015–18.

In August 2017, the government launched a new insurance program, under which the Government Service Insurance System (GSIS), a government-owned insurance agency, provides the government and the 25 participating provinces with catastrophe risk insurance. The World Bank acted as an intermediary to transfer GSIS's risk to a panel of international reinsurers selected through a competitive bidding process.

*Sources:* Government of the Republic of the Philippines 2014; World Bank 2017b.

**Ministries of finance (MOFs) have a leading role in the financial risk management of public assets against natural disasters, given their capacity, their remit to ensure fiscal stability, and their location at the nexus of various policy areas.** Successful financial planning for disasters requires identifying and quantifying disaster-related contingent liabilities associated with public assets, and then incorporating these into fiscal frameworks. For example, it is possible to assess the risk to debt sustainability or to meeting fiscal rules arising from the costs of public assets damaged by a disaster. As already discussed, financial strategies can then be developed to reduce such risks in a cost-effective way.

**Effective financial risk management of public assets requires seamless interinstitutional coordination.** While the MOF has a central role, coordination with other agencies and stakeholders is very important to ensure that all principles of a coordinated and effective disaster response are adhered to (see section 1.2), and particularly to ensure that funds flow where and when they are needed most. Besides the policy areas of the MOF and entities owning or operating public assets (i.e., ministries of health, transport, education; subnational governments), the agencies responsible for disaster risk management play an important role. Furthermore, agencies involved in financial sector regulation—a significant policy objective in some economies—are key stakeholders given the importance of strengthening risk transfer markets for financial protection.

**Several APEC economies have a fiscal risk management unit within the MOF that is responsible for disaster-related fiscal risk management.** For example, **Peru** set up a dedicated fiscal risk management unit within its MOF in 2011. Its key tasks include the identification, quantification, disclosure, and management of disaster-related fiscal risks. In **Indonesia**, the Directorate of Financial Risk Management under the MOF was established to deal with the state’s financial risks, including from natural disasters. In **Japan** and the **United States**, disaster-related fiscal risk is managed by their respective budget planning entities. And in **New Zealand**, the Investment Management and Asset Performance (IMAP) team was established within Treasury in 2014 to oversee state-owned property and improve investment management and asset performance, including through financial risk management.

**The private sector has an important role to play in managing disaster-related risks.** With vast capabilities in risk management and data analytics as well as financial capacity for risk bearing, the private sector—including (re)insurers, banks, and investors—can support governments through public-private partnerships, particularly by helping economies to understand risks and transfer them to markets. The private sector can assume risk through insurance companies, which are subject to regulatory requirements on capital adequacy to ensure solvency against large losses, and which must therefore maintain sufficient capital. By the end of 2016, global reinsurance capital reached US\$595 billion, the highest level ever.<sup>14</sup> In addition, (re)insurance with the capital markets significantly increases the private sector’s ability to assume and diversify catastrophe risk and to de-risk public sector entities, including public assets and infrastructures. Although the growth of this new form of reinsurance capital has been fast, it still represents less than 20 percent of total reinsurance capital. With total assets under management by the global pension fund industry estimated at US\$30 trillion, the emergence of alternative risk transfer solutions presents a unique opportunity for institutional investors to put their capital in financial instruments that have low correlation, while also increasing the potential to bear new insurance risks (Actuaries Institute’s NDWG 2016). The private sector can also help governments better understand the risks they face by transferring its unique technical expertise, including analytical tools, products, and methodologies.

### **Post-Disaster Financing of Public Asset Rehabilitation and Reconstruction**

**In most respondent economies, responsibility for the maintenance of public assets, including in relation to natural disasters, is typically aligned with ownership or management of public assets.**<sup>15</sup>

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<sup>14</sup> Ernst and Young, “Global Insurance Trend Analysis 2016,” [http://www.ey.com/Publication/vwLUAssets/ey-global-insurance-trends-analysis-2016/\\$File/ey-global-insurance-trends-analysis-2016.pdf](http://www.ey.com/Publication/vwLUAssets/ey-global-insurance-trends-analysis-2016/$File/ey-global-insurance-trends-analysis-2016.pdf).

<sup>15</sup> It is worth noting that ownership structures for public assets can vary across economies and can be found at both central and local levels. In Australia, for example, most public assets are sub-nationally owned. In New Zealand, on the other hand,

With public assets owned and managed at both central and local levels, central and local governments are primarily responsible for financing rehabilitation and reconstruction of their respective public assets following natural disasters.

**Cost-sharing arrangements between central and local governments for post-disaster funding of public assets were found in nine APEC economies.** These arrangements establish rules for financial support from the central government to local governments when the latter are overwhelmed by the funding needs for public asset rehabilitation and reconstruction after disasters. Cost-sharing formulas vary across economies. In **Vietnam**, provincial governments may resort to funding from the central government only if they have exhausted all their lawful funds planned for disasters; however, there is no explicit formula for cost sharing under these circumstances. In **Canada**, municipal, provincial, and territorial governments are responsible for the first response to the majority of emergencies. When disasters are beyond their capacity or the impact of the event spans more than one jurisdiction, they may call on the federal government for financial assistance from several programs, including the Disaster Financial Assistance Arrangements (DFAA), which provide guidelines on expenses eligible for federal cost sharing. Box 2.3 describes cost-sharing arrangements in Canada, Australia, and Mexico. For further details on disaster-related cost-sharing arrangements for public assets in APEC economies, see annex 2.

**Box 2.3. Learning from APEC Economies  
The Cost-Sharing Challenge**

In **Canada**, under the Disaster Financial Assistance Arrangements (DFAA), the federal government assumes an increasing share of the post-disaster costs incurred by provinces and territories. Based on the formula, the DFAA can pay up to 90 percent of the costs, including those for public asset rehabilitation and reconstruction (table B2.4.1).

**Table B2.3.1. Cost-Sharing Formula for January 1, 2017, to December 31, 2017**

Provincial expense thresholds (per capita)	Government of Canada share (%)
First Can\$3.07	0
Next Can\$6.15	50
Next Can\$6.15	75
Remainder	90

Source: Government of Canada 2017.

In **Australia**, funding through the Natural Disaster Relief and Recovery Arrangements (NDRRA) is based on losses net of each state's insurance and on financial year definition. State governments are responsible up to a particular cost threshold, which is defined as a percentage of the state's total general government sector revenue and grants in the financial year two years prior to the financial year during which the disaster occurred. The first threshold is 0.225 percent of the state's total revenues as defined, and the second threshold is 1.75 times the first threshold (table B2.3.2). Funding can be provided either in the form of a financial reimbursement or as an advance payment. Advance payments are generally made only in response to significant and extremely damaging natural disasters, where the cost is likely to be greater than the state can manage in the immediate to short term.

**Table B2.3.2. Australian Government Rates of Assistance to States for Disaster Expenditure for Public Assets**

	Rate of assistance (%)
Under state's first threshold	0%

the central government owns and manages a wide array of public assets such as schools, hospitals, national roads, and power production plants.

Between first and second threshold	50% of Category B expenditure
Exceeding state's second threshold	Up to 75% of Category B expenditure

Source: Australian Government 2017.

Note: Assistance under Category B helps state and local governments restore essential public assets and conduct "counter-disaster operations." Small businesses, primary producers, nonprofit organizations, and needy individuals are also assisted under this category through concessional loans, subsidies, or grants.

In **Mexico**, FONDEN resources finance 100 percent of the reconstruction costs for federal assets and 50 percent of costs for local assets, insured or uninsured, after the first disaster. The formula is shown in table B2.3.3.

**Table B2.3.3. FONDEN's Financing of Insured and Uninsured Federal and State Assets**

	Insured federal asset	Insured local asset	Uninsured federal asset	Uninsured local asset
First disaster	100%	50%	100%	50%
Second disaster	100%	50%	50%	25%
Third and subsequent disasters	100%	50%	0%	0%

Source: World Bank 2012b.

**Cost-sharing arrangements covering public assets that create incentives for subnational governments to mitigate and transfer risk were found only in Australia, Mexico and the US.** In **Australia**, before being granted access to funds under NDRRA, states must have risk mitigation measures in place and have reasonably adequate capital or access to capital to fund infrastructure losses (Attorney-General's Department 2017). They must also submit independent assessments of their insurance arrangements, including those for public assets, to the Department of Finance and Deregulation at least every three years. In **Mexico**, FONDEN's cost-sharing rules limit repeat eligibility for its resources in order to encourage risk reduction. Federal agencies are responsible for the design, contracting, and supervision of all rehabilitation and reconstruction works. Local governments are responsible for remaining reconstruction needs, using their own resources or drawing on a line of credit from the Reconstruction Fund for Local Entities.

**Another contingent liability for governments is the potential assistance to state-owned enterprises and public-private partnerships.**<sup>16</sup> In **Japan**, the Cabinet Office guideline on risk sharing for private finance initiative (PFI) projects recommends that when developing a PFI contract, the parties should agree on how to share costs incurred due to disasters. The PFI contracts for Sendai Airport, for example, indicate that the government bears the risk from disasters and that the private operator must buy insurance. However, if disaster-related costs exceed the insured amount, the government assumes responsibility for the rest so that private operators can continue to operate. In **Vietnam**, the Corporate Income Tax Law 2008, the Revised Corporate Income Tax Law 2013, and associated decrees and circulars<sup>17</sup> allow for tax breaks, including exemptions, reductions, and deferred payment

<sup>16</sup> Also included here are other types of contractual arrangements through which public services and/or infrastructures are provided by entities outside of the central government.

<sup>17</sup> See Decree No. 218/2013/NĐ-CP, Decree No. 12/2015/NĐ-CP, and Ministry of Finance Circular No. 96/2015/TT-BTC on the corporate income tax.

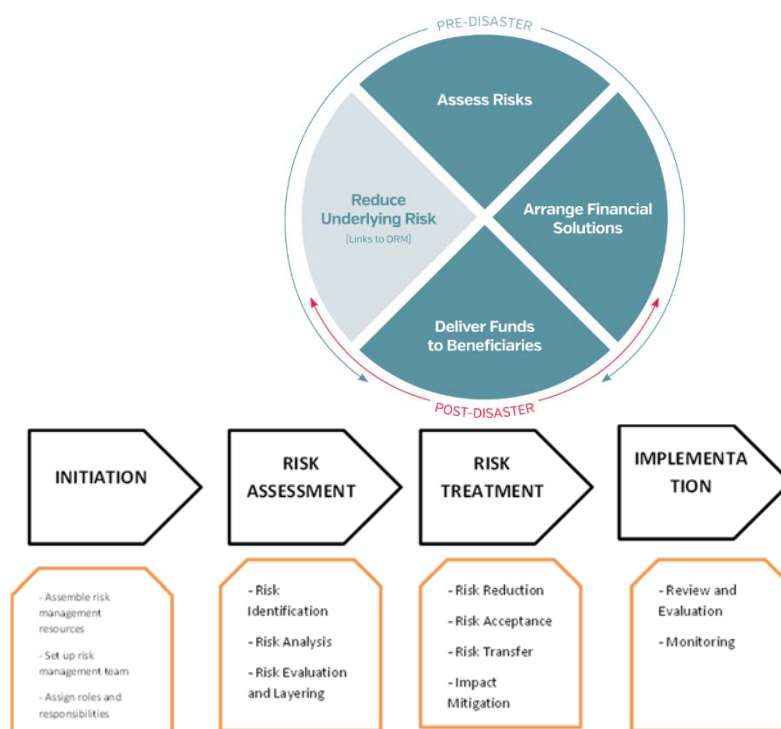
of corporate income tax, when assets of manufacturers and businesses (including state-owned enterprises) suffer disaster-related physical damage or other direct impacts.<sup>18</sup>

### Operational Framework for Financial Management of Disaster-Related Risks to Public Assets

**Financial risk management frameworks, guidelines, and processes for public assets have been developed in some APEC economies.** Australia’s Department of Finance and its Treasury have developed the Commonwealth Risk Management Policy and frameworks for various risks, including natural disasters. The Commonwealth government also requires states to adopt risk management policies and strategies, including for financial management of public assets. The ISO 31000 standards have been widely adopted across federal and state governments in Australia. In 2015, the Risk Policy and Crown Balance Sheet team within the New Zealand Treasury introduced the Crown Asset and Liability Management (CALM) framework. CALM is new tool for developing and maintaining prudent and robust risk management principles and disciplines across the comprehensive balance sheet. This tool has been used to assess the contingent liability that the Crown faces from realistic natural disaster scenarios.

**Various elements of the operational framework for risk management of public assets (see figure 2.1) have been adopted in APEC economies.** The framework builds on the World Bank’s operational framework for disaster risk financing and insurance and on practices in both the public and private sector in risk management of public assets. A check-list for self-assessment which constitutes necessary steps based on these practices for financial risk management of public assets against natural disasters is provided in annex 1.

**Figure 2.1. Toward a Comprehensive Operational Framework for Financial Risk Management of Public Assets against Natural Disasters**



<sup>18</sup> The tax amount, deferred payment, and tax fines overdue are calculated up to the date of the natural disaster occurrence and must not exceed the value of physical damage minus the taxpayer’s recoverable.





## 2.2. DISASTER RISK ASSESSMENT OF PUBLIC ASSETS

### Risk Identification and Quantification of Disaster-Related Contingent Liabilities Arising from Public Assets

**Understanding the government's disaster-related contingent liabilities arising from public assets is a key prerequisite to design an effective financial protection strategy.** Disaster-related financial risk assessments of public assets estimate the cost of disasters arising from public asset damage by assessing the nature and extent of risk from different hazards, and they evaluate public assets' vulnerability and exposure. Such assessments, together with clearly defined cost-sharing rules for reconstructing public assets, allow governments to better understand their disaster-related contingent liability arising from public assets.

**Statistical analysis of historical loss data and probabilistic catastrophe risk models are employed in all the economies under review to assess contingent liabilities.** Analysis of historical loss and damage data as well as past expenditures on rehabilitation and reconstruction can help to estimate the cost of recurrent events, but does not account for the possibility of the most extreme events occurring. For example, the **Philippines** did not experience major disaster-related losses between 1996 and 2012, but in 2013 it was hit by Typhoon Haiyan, one of the most devastating tropical cyclones on record and—with at least 6,300 victims—one of the deadliest ever known in the Philippines. Probabilistic catastrophe modeling can estimate the impact of infrequent events regardless of recent occurrence. In the APEC area, this method is most relevant for earthquakes and storms. Floods, on the other hand, though common in the region, are typically too complex to be adequately modeled. Box 2.4 presents an exemplary approach for the assessment of contingent liabilities arising from public assets.

**Several APEC economies do not know the size of their disaster-related contingent liabilities arising from public assets.** Of 12 economies that responded to the questionnaire for this report, only four economies conducted systematic assessment of their total disaster-related contingent liability arising from public assets. Of these four, only **Mexico** and the **United States** assess disaster-related contingent liabilities from public assets using probabilistic catastrophe risk models. The other two, **Colombia** and **Vietnam**, have assessed their contingent liabilities for public assets with the support of external actors (UNISDR and the World Bank) but do not systematically assess them internally. In **Australia**, both the federal and the state governments regularly assess post-disaster public expenditures to serve as a baseline for future spending in case of extreme events. However, no specific evaluation of the disaster-related contingent liability arising from public assets is conducted.

#### Box 2.4. Quantifying the Impact of Natural Disasters on Public Assets

Assessing contingent liabilities for public assets involves three basic steps:

- Probabilistic catastrophe risk modeling is used to estimate disaster-related total annual expected loss (AEL) and probable maximum loss (PML). The AEL is an expression of the long-term average annual loss. The PML represents the expected loss based on likelihood of occurrence, such as the 1-in-100-year loss or the 1-in-200-year loss.
- Historical disaster damage and losses to public assets are evaluated, as is government spending on public asset rehabilitation and reconstruction during past disasters.
- Observed historical ratios of total damage to fiscal cost for public asset rehabilitation and recovery are applied to AEL and PML for different disaster scenarios to approximate the disaster-related contingent liabilities for public assets.

This approach has important limitations:

- *The ratio of total past damage to historical post-disaster expenditure for public asset recovery can vary significantly.* Determining factors include the scale of the event, as the public share in post-disaster expenditure may rise significantly with growing disaster severity; the level of domestic and international media coverage; the availability of funding; and political opportunism.
- *Historical data on post-disaster expenditure for public assets can be scarce.* Given the infrequent nature of major natural disasters and the specific nature of the required data, records on former disaster-related expenditure for public asset rehabilitation may be limited and insufficient to serve as the basis for authoritative extrapolations. For example, New Zealand currently does not hold a single comprehensive database of economic losses or fiscal impacts from past disasters.
- *Data on damage and losses should be treated with caution.* Damage and loss assessments can be incomplete and subject to inaccuracies.

To address these limitations, proxies should be developed for the ratio of post-disaster expenditure for public asset rehabilitation and reconstruction to AEL or PML, on an individual economy, hazard, and hazard severity basis.

Source: World Bank 2012c.

**Access to probabilistic catastrophe risk models varies among APEC governments.** Among survey respondents, **Australia, Canada, Chinese Taipei, Japan, Mexico, New Zealand,** and the **United States** use probabilistic modeling to assess the impact of a wide array of disaster risks. However, only the United States and Mexico use the obtained data to specifically assess disaster-related contingent liabilities. **Australia** uses the probabilistic catastrophe risk modeling services of an insurance broker. **Colombia, Peru, the Philippines,** and **Vietnam** have had access to probabilistic modeling in the past through the World Bank, but this has not been institutionalized. Most of the models that have been used by governments were developed by the private sector for the insurance industry. Catastrophe risk models require highly specialized expertise and significant investment in capacity to run and maintain, and governments should consider the costs and benefits of developing their own model versus outsourcing to the private sector. See box 2.5 and 2.6.

#### Box 2.5. Probabilistic Catastrophe Risk Modeling

Probabilistic catastrophe risk models are detailed computer simulations of natural disaster scenarios used to quantify loss that could be sustained from them. They were developed by the insurance industry to assess the risk faced by certain assets and to price insurance contracts. Even today, such models are mostly tailored for private sector needs. However, they are increasingly being used by governments that wish to understand better how future disasters could impact them and what the associated economic and fiscal cost would be.

The key elements of a typical probabilistic catastrophe risk model are these:

- *Hazard module.* Analyzes the frequency and severity of potential disasters at different locations. This is done by analyzing historical data on frequency and severity, including through scientific studies.
- *Exposure model.* Provides a georeferenced database of assets at risk, including their relevant attributes (e.g., construction type, number of stories). This is used to assess an area's vulnerability, captured through vulnerability functions.
- *Loss module.* Uses data from the hazard and exposure modules to calculate different risk metrics such as the AEL and PML for different disaster scenarios (return periods).

Source: World Bank 2012c.

**Box 2.6. Learning from APEC Economies****R-FONDEN: Catastrophe Risk Modeling for Public Assets in Mexico**

The Mexican MOF has developed a probabilistic catastrophe risk model called R-FONDEN for its national disaster fund, FONDEN. It analyzes four perils (earthquake, flood, tropical cyclone, and storm surge) for infrastructure in key sectors (roads and bridges, hospitals, schools, hydraulic infrastructure, and low-income housing) at national, state, and substate levels.

R-FONDEN takes as input a detailed exposure database (including details of buildings, roads, and other public assets) and produces as outputs risk metrics, including AEL and PML. The MOF uses the model together with actuarial analyses of historical loss data to monitor the disaster risk exposure of FONDEN's portfolio and to design disaster risk transfer strategies.

R-FONDEN was developed in three steps:

1. *Data gathering.* The required database was prepared, including hazard information, an asset inventory with the key variables (such as building characteristics) required for evaluating vulnerability and loss of infrastructure, and historical loss data to complement simulated data.
2. *Catastrophe risk modeling.* The government, working with the Universidad Nacional Autónoma de México (UNAM), developed hazard models for earthquakes, tropical cyclones, and floods, and vulnerability functions for all types of infrastructure. In conjunction with the exposure database, this enabled the government of Mexico to carry out deterministic and probabilistic risk modeling used to inform financial analysis of probable disaster loss.
3. *Financial analysis.* Finally, the government carried out actuarial analysis of the simulated risk data and historical losses to develop and fine-tune the federal disaster risk financing strategy for public infrastructure—including both risk retention and risk transfer. This step also included the development of a decision support tool to facilitate this process in the future.

Source: World Bank 2012b.

### Data as the Essential Challenge for Successful Analysis

**Collecting and analyzing relevant data is critical to understanding potential disaster risk impacts on government finance.** The lack of data is one of the key challenges facing APEC in devising financial solutions for disasters. In 2016, APEC economies asked the World Bank to undertake a study of public asset, insurance, and related loss databases to shed light on the availability of relevant data in APEC economies and identify good data practices for risk financing purposes. The report at hand should be read in conjunction with the report on data practices. Key issues identified there include data availability, quality, usability, consistency, and access, along with institutional coordination.

**To enable financial planning for natural disasters, recording specific data relating to public assets should be a high priority for governments.** The types of data to be recorded include the following:

- *Public asset disaster exposure data.* These offer a full picture of which public assets exist, who owns them, their value and replacement value, and their location. Engineering data on specific building types, number of floors, and similar elements are also desirable.
- *Public asset historical damage and loss data.* These offer information on former disaster-related damage to public assets.
- *Public asset insurance policy and insured loss data.* These indicate which insurance contracts have been concluded for which public assets, including details on insurance policies and historical loss/claims.
- *Hazard and vulnerability data.* These geological, hydrometeorological, and vulnerability data make it possible to better understand the course and impact of natural disasters. They are

normally required for modeling and mapping tools, which often depend on expert advice. In most cases these data are held by technical agencies or line ministries, but access to them is not always available.

**While many APEC governments already collect and record various types of needed data, the overall picture is mixed.** All respondent economies kept a central register of some public assets either in the MOF or in a line ministry or a local government. However, these databases were mostly not established for financial risk management but rather for asset maintenance, budget planning, accounting, and similar purposes. In most cases, the MOFs manage the centralized registries for assets that fall under their jurisdictions, for example public buildings and some infrastructures, including transport. Across respondent economies, there are large differences in the coverage, availability, accessibility, usability, characteristics, and management of data for financial risk management purposes. For example, only a few economies (**Australia, Canada, Japan, Mexico**) reported that their databases were georeferenced. Some governments reported registering their public assets but not recording their risk exposure (e.g., **Canada, Peru**). Many databases do not capture all public assets in the respective economy (e.g., **United States, Vietnam**). Asset valuation also differs across economies; a few economies such as **Vietnam** follow book accounting systems, while others such as **New Zealand** adopt internationally accepted accounting practices. It seems that only the **Queensland Treasury**, one of the Australian respondents, registers replacement value in its database. The absence of this information in other economies presents a major limitation for risk analysis.

**APEC governments could consider keeping public asset databases that are centralized, complete, and georeferenced, and that include information on risk exposure, insurance status, and historical damage and losses:**

- *Centralized.* A central database could be kept by the MOF. Data other than those kept by the MOF are often housed in local governments and technical agencies or line ministry agencies; but without coordination by the MOF, assessing disaster risk and disaster-related contingent liabilities cannot be successful. See box 2.8 for the example of Vietnam’s institutional coordination of data management.
- *Complete.* The central database could comprise all public assets whose post-disaster rehabilitation and reconstruction would—partly or in full—be financed by the central government. Ideally, it would also include public assets whose replacement could result in fiscal cost to the central government (cars, computers, etc.) and in most cases should also include subnational assets in light of the cost-sharing arrangements in place.
- *Georeferenced.* To make it possible to match potential disasters with exposed infrastructure and evaluate associated risks, the exact location of public assets should be recorded.
- *Informative about asset exposure.* The attributes determining the level of vulnerability of a given public asset should be recorded. These include, for example, a building’s construction type and number of stories. Using vulnerability functions, these can be turned into potential disaster impacts in the modeled scenarios. See box 2.7 on the example of Mexico.
- *Informative about insurance status.* The government could have a catalog of the insurance policies of public assets, both current and recently lapsed. This information is important both to assess possible options for improving the terms and conditions of the insurance policies and to determine associated disaster-related contingent liabilities (since potential insurance payouts could lower the required fiscal contribution significantly).
- *Historical damages and losses.* Historical damages and losses should be recorded, as should related historical public expenditure data. In some cases, historical loss and damage data are housed in different ministries or agencies.

**Box 2.7. Learning from APEC Economies**  
**Mexico's National Risk Atlas**

The government of **Mexico** maintains a National Risk Atlas that includes information on a broad range of public and private assets, including infrastructure related to low-income housing, highways/roads, hydraulics/hydro-agriculture/waterways and lagoons, sports, education, electrical, military, naval, fishing, health sector, federal tourism, urban solid waste disposal, coastal areas, natural protected areas, forestry, and historical, artistic, or archaeological monuments.

For each asset, the georeferenced database includes spatial information (GIS), hazard maps, maps showing susceptibility to hillside instability or other phenomena where applicable, exposure and vulnerability data, risk maps, and risk scenarios. The atlas is updated every five years.

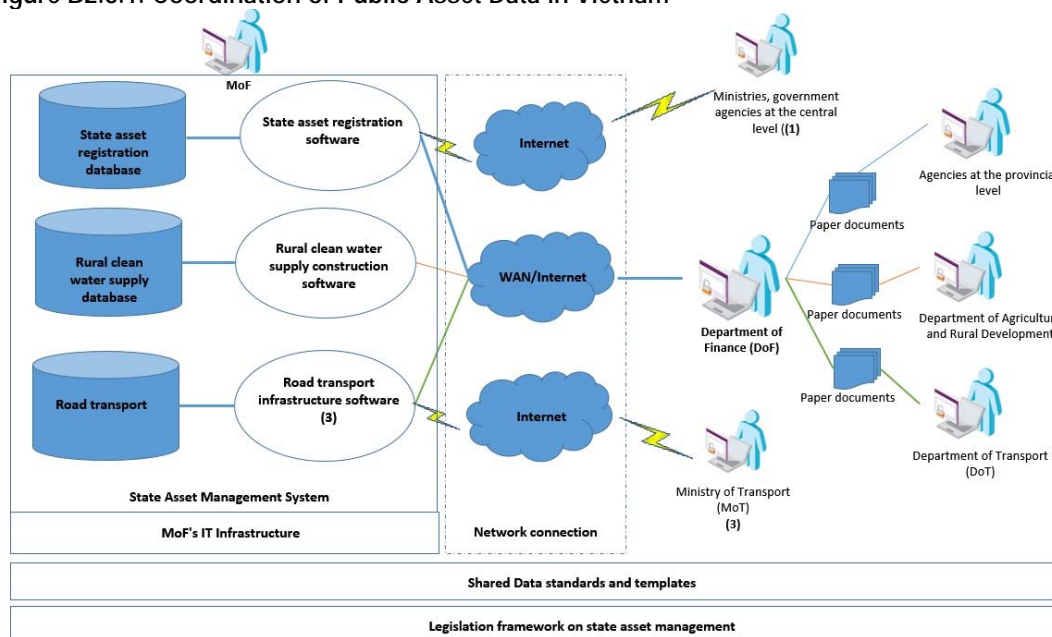
Used for probabilistic modeling, the information from the database feeds directly into Mexico's analysis of disaster-related contingent liabilities.

*Source:* Government of Mexico, response to APEC/World Bank questionnaire, 2017.

**Box 2.8. Learning from APEC Economies**  
**Vietnam: Overcoming Institutional Coordination Challenges in Data Collection**

In **Vietnam**, the Public Assets Management Law requires government agencies to coordinate with and report public assets data to the central database held by the MOF. The data are used for budget planning, allocation, and accounting of assets. Vietnam's approach is shown in figure B2.8.1.

**Figure B2.8.1. Coordination of Public Asset Data in Vietnam**



*Source:* Vietnam Law on Public Assets Management 2008, 2017.

## 2.3. DISASTER RISK FINANCING OF PUBLIC ASSETS

### Financing Disaster Risk Reduction<sup>19</sup>

**Natural disaster risk reduction, including for public assets, has been mainstreamed into the legislation of many APEC economies.** In **Vietnam**, the Law for Natural Disaster Prevention and Control requires that risk reduction be integrated into various public investments. In **New Zealand**, disaster risk reduction is reflected in four core acts, including the Resource Management Act 1991, Civil Defence Emergency Management (CDEM) Act 2002, Building Act 2004, and Local Government Act 2002 (IFRC and UNDP 2014; LGNZ 2014). In **Australia**, the NDRRA requires that states establish risk mitigation strategies and measures before being eligible to receive assistance from the Australian government for public asset recovery and reconstruction. In **Japan**, the government has heavily invested in natural disaster risk mitigation and reduction: the Japanese central government invests in disaster prevention more than it spends on disaster reconstruction year by year, excluding the cost of reconstruction for great earthquakes (like the Great Hanshin-Awaji Earthquake and the Great East Japan Earthquake) (Japan Cabinet Office 2016).

**Some APEC economies emphasize that both risk reduction and risk financing are integral parts of a comprehensive disaster risk management agenda.** This understanding is reflected in the disaster risk finance strategies of the **Philippines**, **Peru**, and **Colombia** and the FONDEN strategy of **Mexico**. As elaborated in section 2.2, risk identification and assessment are essential to inform the development of risk reduction and financial strategies; they enable the efficient allocation of resources and critical funding for risk reduction before an event and enable response, recovery, and reconstruction after an event.

**Risk mitigation is financed by a mix of capital and recurrent government expenditure in APEC economies**, particularly where structural measures are concerned. In **Australia**, The Australian government spends about \$A 50 million annually for funding pre-disaster risk mitigation, mainly through the National Partnership on Natural Disaster Resilience, which provides \$A 26.1 million annually to states and territories to fund disaster resilience programs.<sup>20</sup> Between 2009-10 and 2012-13, the central government spent around \$115 million, while matched spending of states was at least \$110 million under this agreement (Australian Government Productivity Commission 2014). In 2015-16 and 2016-17 the budgets of the central government on the NPANDR was \$13.4 million and \$52.2 million respectively.<sup>21</sup> In **Vietnam**, the government allocates both capital and recurrent expenditures for risk mitigation activities.

**Risk reduction planning is required in several APEC economies.** In **Vietnam**, risk reduction has been required in all legal documents governing investment planning and regional, local, and sectoral development planning. In **Canada**, the 2014 budget earmarked Can\$200 million over five years for the National Disaster Mitigation Program. The bulk of this amount—Can\$183 million—is a cost-sharing contribution allowing provinces and territories to invest in disaster risk mitigation measures such as

<sup>19</sup> Based on available information, this section documents the disaster risk reduction measures and practices in economies under review and does not offer detailed analysis of the implementation of these measures.

<sup>20</sup> Australian Government, Attorney General's Department, <https://www.ag.gov.au/EmergencyManagement/Resilience-funding/Natural-Disaster-Resilience-Program/Pages/default.aspx>, and Actuaries Institute's NDWG 2016

<sup>21</sup> Australian Government, "Budget 2016–17. Part 2: Payments for Specific Purposes," [http://budget.gov.au/2016-17/content/bp3/html/bp3\\_03\\_part\\_2h.htm](http://budget.gov.au/2016-17/content/bp3/html/bp3_03_part_2h.htm).



risk assessments, flood mapping, and risk mitigation planning. The remaining Can\$17 million is invested in the disaster risk information repository.<sup>22</sup>

**Many APEC economies consider land use planning, including zoning of new development and relocation of properties, a good practice for ex ante risk reduction.** In Australia, most councils involved in approval of zoning rules and development recognize that zoning is an important measure for reducing disaster risks, and they incorporate disaster risk into their zoning and development approval process (Actuaries Institute’s NDWG 2016).

**Building standards are critical to reduce natural disaster damage for new properties.** Under New Zealand’s Building Act 2004, a territorial authority must refuse consent for building work if the land is subject to one or more natural hazards or if the hazard’s adverse effects on the land or other property are likely to be worsened as a result of the building work. The act also requires new buildings to meet the performance requirements of the Building Code, which are designed to protect against certain hazards and specifically seek to increase buildings’ resilience to earthquakes (LGNZ 2014).

**Several APEC economies practice retrofitting of existing properties to improve their resilience to hazards.** In Japan, critical infrastructure—for example, main roads and railroads—has been prioritized for seismic reinforcement. As of 2014, over 80 percent of emergency transport roads and bridges were earthquake resilient and secure for the passage of emergency vehicles involved in evacuation, rescue, and relief in the aftermath of an earthquake. Recognizing the vulnerability of the aging infrastructure, the central government has developed and implemented the Basic Plan for Life Extension of Infrastructure to strengthen the cycle of construction, maintenance, renewal, and repair (World Bank and GFDRR 2016).

**Constructing infrastructure to reduce the frequency and severity of individual perils is a common practice among APEC economies.** In Australia, for example, key infrastructure developed and used to reduce the frequency and severity of disasters includes dams and levees to prevent floods, and seawalls to protect against storm surge and limit erosion and coastal flooding caused by tides and waves (Actuaries Institute’s NDWG 2016).

### Financing the Residual Risk

**To rehabilitate and reconstruct public assets, APEC governments can access different funding sources depending on funding needs, cost and benefits of funding sources, and required speed of access and disbursement.** There is no one-size-fits-all formula for funding mobilization. The risk-layering matrix (described in section 1.2) was developed to inform an optimal mix of financing instruments where the timing, size, and cost of funding are considered. Table 2.2 shows a range of instruments employed by APEC economies and indicative time for access and size.

**Table 2.2. Instruments for Financing Public Asset Reconstruction in Select APEC Economies and Colombia**

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<sup>22</sup> Public Safety Canada, “Canada’s National Disaster Mitigation Program,” <https://www.publicsafety.gc.ca/cnt/mrgnc-mngmnt/dsstr-prvntn-mtgtn/ndmp/index-en.aspx>.

Public assets' residual risk treatment through risk financing	Indicative disbursement (months)	Size of funds	Australia	Canada	Chinese Taipei	Indonesia	Japan	Mexico	New Zealand	Peru	Philippines	United States	Vietnam	Colombia
<b>Ex ante</b>														
General budget contingency	0–2	Small		✓	✓	✓	✓	✓		✓			✓	✓
Dedicated disaster re-serve/budget	0–1	Small		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Contingent credit	0–1	Medium								✓	✓			✓
Parametric insurance	1–2	Large						✓			✓			
Indemnity insurance	1–2	Large	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CAT bond	2–6	Large						✓				✓		
<b>Ex post</b>														
Temporary tax increase	12–124	Large	✓				✓							
Budget reallocation	0–12	Small	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓
Public borrowing	3–9	Medium to large			✓		✓		✓		✓			✓
Donor assistance	4–9	Uncertain				✓				✓	✓		✓	✓

Source: Based on Ghesquiere and Mahul 2010; APEC economies' responses to World Bank Group questionnaire, 2017; multiple sources.

### Ex Post Financing Approaches

#### Box 2.9. Takeaways for Using Ex Post Financing Instruments to Finance the Rehabilitation and Reconstruction of Public Assets

- Ex post instruments such as public borrowing can be used for financing public asset rehabilitation and reconstruction following a large-scale disaster, as they can unlock great funding volumes. They should be complemented by short-term liquidity instruments if there is a need for quick rehabilitation of lifeline infrastructure during the emergency response phase.
- Governments should, however, be aware of the challenges of these instruments, including the required technical and administrative capacity and access to capital markets.
- Ex post instruments tend not to be sufficient or cost-effective if they alone are relied on.

**As rehabilitation and reconstruction of infrastructure (including public assets) typically fall into the tail end of the disaster response and require substantial funding, ex post financing can sometimes be a suitable approach.** Funds for the rehabilitation and reconstruction of public assets are usually required comparatively late in the disaster response: setting up reconstruction programs can take up to six months or even longer, given the need for planning and project procurement. Large reconstruction programs can also take multiple years to complete, with a large share of the payment due only at the end. Using ex post financing may avoid the opportunity costs entailed in holding ex ante reserves in anticipation of their eventual use. This option could be appropriate for an economy that has fiscal flexibility for reallocation and has ready access to debt capital markets.

**In-year budget reallocations and budget appropriations are commonly used in the economies under review.** In Japan, supplementary budgets can be passed when reconstruction expenditure needs exceed funds available through budget reallocation. For example, in the case of the Kumamoto Earthquake in April 2016, a supplementary budget of US\$7,780 million was passed. Following the Great East Japan Earthquake, three supplementary budgets were passed in the 2011 fiscal year; these



were partially financed through reductions in subsidies to families with children under three years old and pay cuts for government staff of 7.8 percent on average in fiscal years 2012 and 2013. However, this budget reallocation contributed only 5.4 percent of the total central government spending on the event for the first two years (Sato and Boudreau 2014). In **New Zealand**, the Public Finance Act allows the minister of finance to authorize expenses or capital expenditures to meet an emergency, which must subsequently be confirmed by an appropriation by Parliament. In **Vietnam**, the State Budget Law 2015 allows for budget reallocations to finance medium- and long-term reconstruction and allows for advancing budget to subnational governments where their contingency budgets and other lawful funds have been exhausted.

**A few APEC economies also used temporary tax increases for financing post-disaster reconstruction of public assets.** Tax increases can unlock significant post-disaster funding but can take a relatively long time to materialize. However, since the rehabilitation and reconstruction of infrastructure typically take months to start and can take years to finish (with a large share of the reconstruction contracts due at the end), tax increases may be effective elements of a post-disaster financing strategy for public assets. For example, the government of **Australia** charged middle- and higher-income taxpayers a flood levy in 2011–12 to help finance the reconstruction efforts after the January 2011 Queensland floods. The levy amounted to 0.5 percent for the income share between \$A 50,001 and \$A 100,000 and to 1 percent for the share above. The revenue met almost a third of the total \$A 5.6 billion (US\$5.1 billion) public reconstruction bill.<sup>23</sup> Similarly, in **Colombia**, following floods and heavy rainfall in 2010 that caused total damage of up to US\$5.2 billion, the government lowered the threshold for paying wealth tax from Col\$3 billion to Col\$1 billion. The government thereby expected to generate an additional Col\$3.3 trillion (US\$1.6 billion) in tax receipts for recovery purposes.<sup>24</sup> Similar temporary tax increases were imposed following the 1985 Armero volcanic eruption and the 1999 Eje Cafetero Earthquake.

**Raising debt has been used by a limited number of governments.** After the Great East **Japan** Earthquake, most of the estimated reconstruction cost was financed by the issuance of reconstruction bonds. Over US\$140 billion was raised in fiscal years 2011 and 2012, of which about 25–30 percent was sold to retail investors. Some of these bonds are “reconstruction supporters’ bonds” that promote financial support and solidarity from the Japanese public. They offer the lowest possible interest rate for Japanese government bonds (0.05 percent) for three years before converting to standard Japanese government bond rates (Sato and Boudreau 2014). In **New Zealand**, much of the funding used after the Canterbury Earthquakes came from the issuance of additional Crown debt to predominantly wholesale investors. However, the level of public indebtedness needs to be considered in case of borrowing. One of the reasons that New Zealand could borrow significantly to finance the reconstruction cost after the Canterbury Earthquakes was that net government debt was relatively low at the time (13.6 percent of GDP in 2010). The Canterbury Earthquakes, in conjunction with the response to the global financial crisis, increased the net core Crown debt by around 20 percent of GDP.<sup>25</sup>

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<sup>23</sup> Department of the Prime Minister and Cabinet, “Rebuilding after the Floods” (media release), January 27, 2011, <http://pmtranscripts.pmc.gov.au/release/transcript-17631>.

<sup>24</sup> Colombia Reports, “Colombia to Hike Taxes 1.6B to Finance Flood Recovery,” December 30, 2010, <https://colombiareports.com/colombia-to-hike-taxes-16-bln-to-finance-flood-recovery/>.

<sup>25</sup> Net core Crown debt represents gross sovereign issued debt less core Crown financial assets excluding advances and financial assets held by the New Zealand Superannuation Fund.

*Dedicated Government Disaster Reserves***Box 2.10. Takeaways for Disaster Reserve Financing for Public Assets**

Disaster reserves are most cost-effective when financing the lower-risk layer and recurrent events. They should

- Have clearly defined, complementary objectives, avoiding overlap and conflicts of competency.
- Have pre-defined sources of funds and envisaged size of funding. Ideally, dedicated budget lines and inclusion in the budget law ensure the sustained funding of reserves.
- Be managed by the MOF (usually in coordination with the national disaster management agency).
- Have clearly defined payout criteria. Clear definitions of payout events help avoid depletion and misallocation of funds.
- Pre-define the use of funds. The narrower the definition of the use of funds, the easier and more effective their allocation.
- Foster cooperation between central and local governments. Distributing funds via local governments leverages regional expertise and may be the best arrangement.

**In their function as cash reserves, national disaster funds are most cost-effective for financing recurrent disaster-related losses.** A reserve is designed to maintain a certain volume of response funds that can be disbursed easily in case of a disaster. Given the significant opportunity cost of such a risk retention approach, it is mostly suited to finance the lower levels (higher frequency, lower impact) of disaster risk.

**The simplest versions of disaster reserves are a dedicated budget line or the general contingency budget.** Such a budget line can either be dedicated to post-disaster funding exclusively or be a general contingency budget that may be used for disaster-related funding but also other unforeseen government expenditures. The key advantage of thus earmarking some funds in the budget lies in the simplicity and flexibility of the approach. As an example, the government of **Japan** uses both dedicated and general reserves: it maintains an annual budget allocation for disaster recovery of about ¥73 billion (US\$658 million), from which it finances its contributions to subnational governments' recovery and reconstruction efforts, as mandated by the national cost-sharing formula. In addition, if necessary, it can also draw funds amounting to ¥350 billion (US\$3.1 billion) for disaster recovery from the annual contingency reserve in the general budget.<sup>26</sup>

**Another common approach is to structure a disaster reserve as a trust to take advantage of the clear rules that can be used to govern it.** The fund thus comprises an off-budget financial account that amasses resources earmarked for disaster response subject to disbursement rules and is administered by a designated financial manager. The main advantage of such a fund is that it can have elaborate operating procedures. In this way, (1) fast, reliable, and accountable disbursement of funds can be ensured, with clear payout criteria helping to avoid depletion and misallocation of funds; (2) the use of funds can be pre-defined to facilitate their allocation and avoid offloading of ministries' day-to-day activities into projects financed by the fund; and (3) a more effective governance framework can be established, including for example reliance on subnational governments' regional expertise to help in the distribution of funds.

**When considering ownership and management of the disaster reserve fund, a strong role for the MOF is the natural choice.** Disaster reserve funds require competence in disaster risk management as well as public financial management. Ministries of finance have expertise in the latter, and therefore

<sup>26</sup> Japan Ministry of Finance, "Budget," <http://www.mof.go.jp/english/budget/budget/index.html>.

a strong role to play in the fund’s management. In addition, the MOF often manages the government’s wider disaster risk financing strategy; its leadership in reserve fund management would support and build on this agenda.

#### Box 2.11. Learning from APEC Economies Government Disaster Reserves

- In **Mexico**, the national disaster fund FONDEN is a good example of how the rules of a fund can enhance the efficiency of the whole disaster response system. See box 2.1 for details.
- In the **Philippines**, the National Disaster Risk Reduction and Management Fund (NDRRMF) is a line item in the national budget that provides national government agencies and local governments with funding for risk reduction, relief, recovery, and reconstruction after natural and man-made disasters. Some 30 percent of NDRRMF funds are embedded within nine national government agencies as Quick Response Funds that can be used immediately for emergency relief, including for public asset works. The remaining 70 percent of NDRRMF funds can be accessed if approved by the president and are used after disasters that occurred within that budget year or the preceding year. NDRRMF funds can also be used to pay insurance premiums for coverage of public assets, particularly at the local government level.
- In **Colombia**, a National Fund for Disaster Risk Management (FNDR) is part of the Ministry of Finance’s Disaster Risk Financing Strategy. Financed through budget allocations, it serves as the first layer of risk retention for the government but still requires operationalization. Its funds are also used for infrastructure rehabilitation and reconstruction works.

#### *Contingent Credit*

**Contingent credit tends to be cost-effective for the middle layers of disaster risk.** Contingent credit is a loan whose conditions, such as size, interest, grace period, and payback period, have been pre-negotiated. The loan sum, however, is disbursed only after the agreed event occurs (e.g., a storm). Typically, for the time that the principal is not withdrawn, contingent lines of credit are subject to a small annual commitment charge. Contingent credit complements the other risk instruments—on one end, risk retention instruments such as disaster reserves for frequent, less severe natural disasters, for which post-disaster resources are best kept in an account for rapid disbursement; on the other end, risk transfer instruments that are expensive to maintain but can unlock the largest funding volume in case of rare but severe events.

The government of **Peru** has entered a series of contingent credit arrangements with various international financial institutions; the loans’ maximum value is US\$3.75 billion. Creditors include the Andean Development Corporation (CAF)—Development Bank of Latin America (2013, US\$300 million), the Inter-American Development Bank (2013 and 2015, totaling US\$600 million), the Japan International Cooperation Agency (2014, US\$100 million), and the World Bank (2013, 2015, and 2016, totaling US\$2.75 billion). Driven by the risk of a great earthquake in Lima, they complement the primary fiscal responsibility of central and local public managers for public asset rehabilitation and reconstruction, as well as resources from the Contingency Reserve and Fiscal Stabilization Fund.

In **Colombia**, the government has concluded two contingent lines of credit with the World Bank (each a Catastrophe Deferred Drawdown Option, or CAT DDO), totaling US\$400 million. They are meant to cover the middle layer of disaster risk funding, once resources from the FNDR are exhausted.

In the **Philippines**, the government concluded a CAT DDO with the World Bank totaling US\$500 million in 2011 and drew down the full amount in the same year. A second CAT DDO, again of a maximum US\$500 million, was secured with the World Bank in 2015 and has not yet been utilized.

#### *Sovereign Insurance and Other Risk Transfer*

**Among the survey respondents, some economies employ risk transfer solutions at the central or local level.** The government of **Mexico** uses indemnity insurance and a catastrophe bond to secure the upper risk layers of its disaster fund FONDEN. It has subscribed to a US\$400 million indemnity insurance contract on the whole FONDEN portfolio to cover the layer immediately above the US\$1 billion that it retains through budget allocations (World Bank 2012b).

**Alternative capital or risk transfer instruments have been employed in just a few economies.** In 2009, the government of **Mexico** and the World Bank launched the MultiCat Program, a platform for issuing catastrophe bonds for earthquakes, floods, hurricanes, and other wind storms. Structurally, it is a special purpose vehicle that underwrites parametric insurance with governments or public bodies and then issues catastrophe bonds to finance the risk it takes on. It thereby facilitates access to international insurance markets for interested governments of middle-income and developing economies and lowers insurance premium costs by pooling multiple perils and regions. In 2017, the World Bank issued catastrophe bonds that will provide Mexico with financial protection of up to \$360 million against losses from earthquakes and tropical cyclones. The bonds were issued under the World Bank's Capital at Risk Notes Program, created in 2014, in three different structures to provide coverage against three types of disasters: earthquakes, Atlantic tropical cyclones, and Pacific tropical cyclones. If a natural disaster occurs that is eligible for coverage, some or all of the bond proceeds will be made available to FONDEN (World Bank 2012b; World Bank 2017c). In the **United States**, the New York Metropolitan Transportation Authority (MTA) issued a US\$125 million [MetroCat Re Ltd. \(Series 2017-1\)](#) CAT bond, the second since the first issuance of a US\$200 million CAT bond in 2013, to provide the state-run MTA's captive insurer with parametric storm surge and earthquake reinsurance protection<sup>27</sup>. In **Australia**, there have been several attempts by (re)insurance companies to transfer some of the disaster risks to alternative markets, but with limited success; this result is due to competitive pricing from traditional insurance markets and concerns around assessing the solvency capital calculations and therefore potential difficulties in getting regulatory approval (Actuaries Institute's NDWG 2016).

**There are also regional innovative approaches to risk pooling in APEC economies.** The Pacific Alliance (AP) economies (Chile, Colombia, Mexico, and Peru) are analyzing the issuance of a joint CAT bond. With support from the World Bank and Swiss Cooperation, the modeling firm AIR Worldwide carried out the quantification and modeling of seismic risk. The study will increase AP economies' technical capability to make informed decisions about the potential benefits of transferring risk to financial markets, considering both the fiscal and budgetary aspects of each AP economy. The CAT bond will provide financial relief, help economies respond quickly to a disaster occurrence (specifically earthquakes), and complement other financial instruments as emergency funds and contingent

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<sup>27</sup> <http://www.artemis.bm/blog/2017/05/02/new-york-mta-targets-125m-parametric-metrocat-re-2017-1-cat-bond/>

credit lines. The initial results of the study show that the joint issuance by the four economies may reduce the costs of transferring risk to financial markets by more than 50 percent.<sup>28</sup>

## 2.4 IMPROVING DISASTER RISK INSURANCE OF PUBLIC ASSETS

### Box 2.12. Takeaways for Disaster Insurance of Public Assets

- Insuring public assets can be an effective way to finance their rehabilitation or reconstruction after less frequent, severe natural disasters.
- As a rough guide, governments could undertake five activities to structure and improve the quality of an insurance program for public assets:
  1. Assess the legal environment and institutional capabilities for public asset insurance.
  2. Assess the risk information infrastructure.
  3. Assess the local insurance market.
  4. Standardize terms and conditions of insurance policies.
  5. Insure a portfolio of public assets.
- Evaluating and concluding disaster insurance for public assets requires significant technical expertise. The government can support public asset managers by offering technical assistance or by standardizing insurance terms for all public asset insurance contracts.
- Governments could explore ways to pool the risk of their public assets across different perils. This can be done by approaching the insurance market through a central institution or establishing a collective framework agreement for all public asset insurance contracts.

**Insurance can be used to obtain the sizable volume of funding needed for the expensive rehabilitation and reconstruction of public infrastructures.** Insurance tends to be a cost-effective approach to financing the highest (least frequent, most severe) layers of risk. In **Australia**, insurance losses from natural disasters exceeded \$21 billion over the period 1970 to 2013 (in nominal terms), of which 80 percent was attributed to only 10 percent of the disaster events (Productivity Commission 2014). It is important to keep in mind that insurance is no panacea—lower and middle layers of risk tend to be financed most cost-effectively via other risk financing instruments. But the use of insurance contributes to greater discipline and transparency in disaster risk financing, since public agents need to understand and prepare before committing funds for premium payment and also have to establish transparent rules for payout before entering into contractual agreement with insurers. In addition, insurance can send a price signal through its premium about the quality of public assets when risk information is adequately reflected, and therefore can create incentives for better-quality infrastructure (see box 2.13).

### Box 2.13. Learning from APEC Economies

#### The Premium Rates That Signal the Risks: Examples from Australia

- A \$16 million flood levee was built in Charleville, Queensland. In response, Suncorp Group reduced average annual premiums for building and contents by \$400.
- Recent mitigation works were undertaken in St. George, Queensland, that include a \$6 million flood levee, house raising, and land swaps. Average premium on an existing policy was reported to decrease by about 15 percent, and decreased by \$270 for a new building policy.

*Source:* Productivity Commission 2014.

<sup>28</sup> Publimetro, “La Alianza del Pacífico se asocia con el Banco Mundial para preparar un posible Bono Catastrófico,” August 21, 2017, <https://www.publimetro.cl/cl/noticias/2017/08/21/la-alianza-del-pacifico-se-asocia-banco-mundial-preparar-posible-bono-catastrofico.html>.

**Insurance of public assets is compulsory by law in four APEC economies and Colombia, but the degree of compulsion varies and data on insurance uptake is limited.** It is compulsory for those managing assets (e.g., government agencies, subnational governments, ministries) in **Colombia, Peru,** and the **Philippines**. In **Vietnam**, insurance is compulsory for certain types of public assets as required by legislation. Some APEC economies require public asset owners to evaluate available disaster risk management options to determine the most appropriate one: in **Australia**, states must assess available insurance options on a cost-benefit basis, and in **New Zealand**, government agencies are mandated by law to systematically assess all risk management options available to them, including insurance. Finally, some APEC economies leave financial risk management of public assets to the respective managers, who decide whether or not to protect them with disaster insurance. This approach is taken in **Canada, Chinese Taipei,** and the **United States**.

**Indemnity insurance is being used by all the studied economies, while parametric insurance has been used only in Mexico and the Philippines.** Commonly insured assets include public buildings and some subset of public infrastructures. For some public assets, it was found that appetite for, capacity of, and affordability of traditional insurance arrangements were limited in several economies, due in part to lack of economy of scale, data limitations, poor loss experience, and time and labor required for post-disaster loss adjustment and claim settlement. In **Australia**, a significant gap remains for insurance of road assets because there is insufficient risk appetite and capacity for traditional insurance arrangements for roads, as well as limited data on claims history (Department of Finance and Deregulation 2012). In **New Zealand**, industry capacity in loss adjustment and claim handling in traditional insurance arrangements has been severely tested given the massive claims volumes following disasters. In **Vietnam**, catastrophe risk insurance for public assets is often offered as part of a package because there is not enough critical mass and capacity to underwrite the risk as a standalone. In some economies, including **Vietnam** and **Thailand**, some reinsurers have put event limits on proportional treaties or provided treaties that exclude natural catastrophe perils, which significantly impede the domestic capacity in taking on these risks. **Parametric insurance** and other innovative risk transfer instruments such as **catastrophe bonds** emerge as potential alternative solutions. Catastrophe bonds have been utilized by several APEC economies, including **Mexico** and the **United States**.

Based on the experience of APEC economies and international best practice, a number of activities could help structure and improve the quality of insurance for public assets. These are described in the subsections below.

### Assessment of the Legal Environment and Institutional Capabilities

This activity should address the following questions:

- *Are public entities legally able to purchase insurance contracts?* For example, the government of **Indonesia** had to pass a new government regulation (PP 45/2013) in 2013 to explicitly allow its MOF to purchase insurance with funds allocated in the national budget.
- *Is disaster insurance compulsory for public assets, and do public managers comply with this requirement?* Even when disaster insurance is compulsory for public assets, this does not mean that all public assets are reliably insured (see box 2.14). Changes to the system may be required to achieve the desired insurance coverage.

<p><b>Box 2.14. Learning from APEC Economies</b>  <b>Compliance with Regulations: How Many Public Assets Are Actually Insured?</b></p>
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- In **Colombia**, a review of compulsory disaster insurance cover of public buildings undertaken by the World Bank in 2012 showed that most public buildings were underinsured (Campos et al. 2012).
- In the **Philippines**, public asset insurance is compulsory for local governments; but according to government estimates in 2014, local government properties were mostly not insured against disasters (about 70 percent) or were underinsured (on average 15–20 percent of their replacement value) (Government of the Republic of the Philippines 2014).
- In **Peru**, although catastrophe risk insurance is compulsory for all public assets at all levels of government, the regulations also state that compliance may be subject to an entity's priorities and budget availability, leading to incomplete overall coverage (Government of Peru, response to APEC/World Bank questionnaire, 2017).

- *Do public managers have the technical capacity to evaluate, purchase, and manage disaster insurance contracts, including handling of claims?* This question is particularly pertinent for economies in which public asset insurance is compulsory, but is also relevant for those where disaster insurance is a voluntary mechanism for responsible public managers. For example, the World Bank's 2012 review of public building insurance in **Colombia** (Campos et al. 2012) found that while many public institutions were compelled by law to buy disaster insurance for the assets under their administration, the majority did not have an appropriate risk management unit at their disposal. One solution to this problem is to pool insurance across public entities by purchasing it via a capable central manager; this is the solution undertaken by Colombia. Other solutions are to establish standardized insurance purchasing guidelines (also undertaken by Colombia) or to provide technical assistance through the central government (undertaken by Mexico; see box 2.15).
- *Is there a national or institutional policy on risk management or on purchasing insurance products for public assets that public managers need to adhere to?* Standardizing risk management practices and insurance policies can fill potential gaps in technical capacities among the public managers and ensure that the most cost-effective insurance solution is attained.

### Assessment of All Public Assets and Their Insurance Policies

**As indicated above, the central government should have a catalog of public asset insurance policies in place.** This will enable both better assessment of contingent liabilities and better evaluation of potential improvements to the established terms and conditions.

### Assessment of the Local Insurance Market

**Governments should attempt to understand whether the local insurance market is equipped to handle property catastrophe risk insurance.** This includes an analysis not only of insurers but also of other market participants, including intermediaries (brokers, agents, third-party administrators), loss adjusters, and reinsurers.

**Important questions include whether there is sufficient appetite for disaster risk insurance, sufficient capacity in the market, sufficient competition among insurers, and a sufficient regulatory and supervisory framework in place—or whether a government-owned entity should insure public assets against disasters.** Not all risks are amenable to private insurance, and not all markets have sufficient capital and technical capacity to provide catastrophe risk insurance. Supporting competition among insurers is important as it helps to promote consumer-oriented insurance policy pricing and terms and conditions. Beyond the market situation among private insurers, the role of state insurers in public asset insurance against natural disasters should also be evaluated. Generally, market-based solutions are preferable, where possible. For example, in the **Philippines**, local governments are obliged to purchase insurance for public assets from the government-owned insurer GSIS. The lack of competition and key role of a public entity have led to numerous inefficiencies, including lack of in-

surance and widespread underinsurance. As the law fails to specify what assets need to be insured and against what perils, local governments often insure as little as possible and do not insure against disaster risk. In addition, the relevant law governing reinsurance procurement does not match international standards, making procurement slow and impeding negotiations with reinsurers (Government of the Republic of the Philippines 2014).

**In some cases, however, a government-owned insurer can play a role that is hard to find in the commercial insurance markets.** For flood risk, for example, which tends to be very difficult to model and is thus expensive to insure, a government-owned insurer can take on a greater risk at a lower price. One example of this is the National Flood Insurance Program in the **United States**, which is operated by the Federal Emergency Management Agency (FEMA).<sup>29</sup>

**Further key aspects of insurance market assessment include the state of insurance products, insurers' technical capabilities, insurers' dependence on international reinsurers, and the regulatory system.** Among others, the following questions should be considered:

- Do the locally available insurance products provide for disaster insurance needs for public assets? How strong are the technical capabilities of local insurance market participants?
- How dependent are local insurers on international reinsurers with regard to disaster coverage?
- Is a strong regulatory system for insurance market participants in place?
- Are local insurers sufficiently capitalized to absorb potentially large disaster shocks?

### **Standardization of Insurance Policy Terms and Conditions**

**For all public asset insurance against natural disasters, terms and conditions should be standardized and based on international best practice.** Using the most up-to-date insurance policy wording and providing the most relevant and accurate underwriting information to insurers can help reduce the uncertainty of insurance companies and thereby allow for better terms and conditions or reduce the price.

**Many governments have therefore introduced insurance guidelines or offer technical assistance to public managers buying insurance.** Among the respondents, for example, **Australia, Canada, Indonesia, Mexico, New Zealand, and the Philippines**, all report having issued insurance guidelines to standardize insurance cover. The government of **Mexico** also actively supports local governments in obtaining the appropriate public asset insurance cover. See box 2.15.

**Box 2.15. Learning from APEC Economies  
Technical Assistance by Mexico's Ministry of Finance for Subnational Governments Seeking to Procure Public Asset Insurance**

The Risk Analysis Division of the Directorate of Insurance, Securities, and Pensions within Mexico's MOF supports local governments in securing the appropriate protection for their respective public assets. It does so through a mix of measures:

- It advises local governments on the analysis and selection of the model required for risk transfer.
- It proposes the models for the acquisition of insurance and financial instruments for risk management, seeking best conditions (price, quality, financing, etc.).
- It issues insurance guidelines for asset insurance at the local level, i.e., (1) develops insurance pro-

<sup>29</sup> See FEMA, "The National Flood Insurance Program," <https://www.fema.gov/national-flood-insurance-program>.



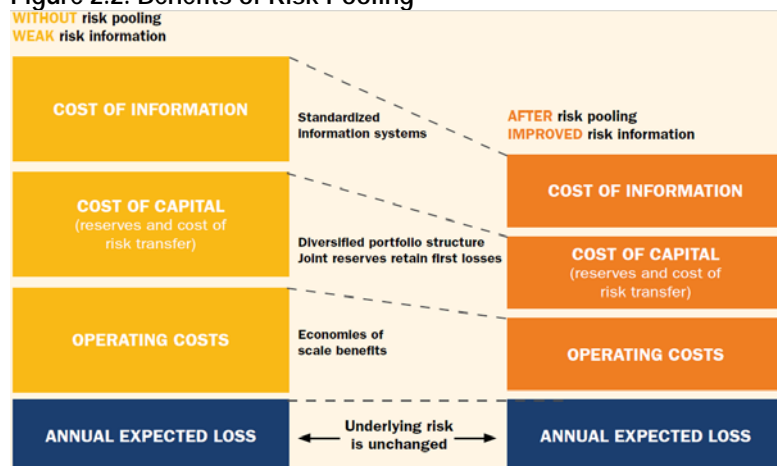
grams, (2) develops manuals for purchasing insurance, (3) establishes maximum retention levels for local governments, and (4) defines the claims process.

*Source:* Government of Mexico, response to APEC/World Bank questionnaire, 2017.

### **Insuring a Portfolio of Public Assets**

**It is more cost-effective to insure different public assets together than to insure each asset on its own.** By aggregating risk into larger, more diversified portfolios, risk pooling can help reduce the cost of insurance policies (World Bank 2014). The benefits of risk pooling are illustrated in figure 2.2.

Figure 2.2. Benefits of Risk Pooling



Source: World Bank 2014.

Note: The size of the boxes is not meant to be proportional to each component's actual contribution to the insurance premium.

**Insuring various public assets and disaster risks together tends to be more cost-effective, and should be reflected in how the insurance sector is approached.** The options for governments include (1) a centralized strategy, whereby one institution coordinates the procurement of the insurance across all public entities; (2) a collective approach, which uses a framework agreement to set out standardized terms and conditions; or (3) the creation of a facility dedicated to the insurance of the governments' assets. See box 2.16.

#### Box 2.16. Learning from APEC Economies Insurance of Public Assets

- In **Australia**, the **Queensland Government Insurance Fund (QGIF)** is a captive insurance pool under Queensland Treasury that covers all state government budget-dependent agencies. Excepting roads, it covers all the physical assets that the covered entity owns (or is responsible for) against declared natural disasters. Bridges and tunnels are not covered by QGIF but are covered under its reinsurance policy with sub-limits. QGIF charges risk-based premiums to agencies to collect sufficient contributions to fund the following year's expected claims (net of any reinsurance recoveries), reinsurance costs, and other administrative expenses. It retains \$A 20 million for a single risk loss or \$A 50 million for an event (multiple risk) loss and provides unlimited reinstatements at no additional cost. Currently, QGIF has purchased \$A 1.43 billion of property catastrophe cover. The retention and limits selected were based on advice from the QGIF reinsurance advisor, which in turn was based on modeling of the QGIF portfolio, among other things. Modeling approaches included third-party natural hazard vendor models and statistical-based loss models using historical claims experience. Catastrophe modeling indicated that the limit of cover purchased by QGIF is in excess of the estimated 1-in-250-year event loss. QGIF also maintains a centralized georeferenced database for all state government assets, which is updated every year (Queensland Treasury, response to APEC/World Bank questionnaire, 2017; Queensland Treasury 2012).
- In **Colombia**, the government decided in 2012 to pursue a collective approach to purchasing insurance in order to pool risk and further lower insurance premiums. National insurance guidelines and objectives were developed for improving the level and quality of the insurance of public assets in the event of natural disasters. The main recommendations are these: Specify relevant information required by (re)insurers to execute an appropriate underwriting process (e.g., location of buildings); organize and protect data of insurance policies by updating the insurance policies database; and ensure that robust risk management procedures are in place, for example by establishing a contingency plan. As of December 2016, public assets are insured collectively under the umbrella of a framework agreement (Government of Colombia 2012; Government of Colombia, response to APEC/World Bank questionnaire, 2017).
- In the **Philippines**, the government worked with the World Bank to develop a catastrophe risk insur-

ance program for local governments. International market-standard catastrophe risk models for tropical cyclone and earthquake form the basis of a modeled loss trigger. In July 2017, the program was placed to provide the Philippine peso equivalent of US\$206 million in coverage against losses from major typhoons and earthquakes to national government assets and to 25 participating provinces against losses from major typhoons. Insurance payouts are made when pre-defined parametric triggers are met (World Bank 2017b).

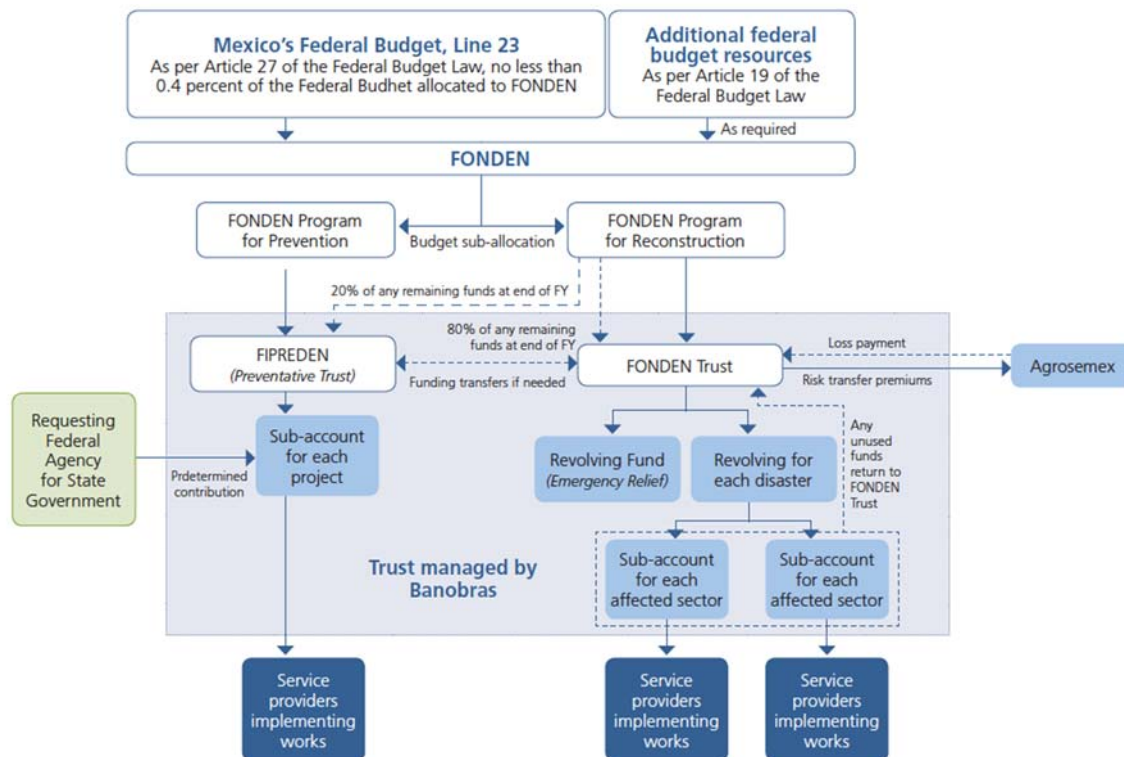
## 2.5. EXECUTING POST-DISASTER RESOURCES

### Post-Disaster Budget Execution, Reporting, Monitoring, and Evaluation

**Resources for rehabilitation and reconstruction of public assets should reach beneficiaries in a timely, transparent, and accountable fashion.** This often requires governments to put in place effective administrative and legal systems and well-organized processes to execute and deliver funds from the government budget or insurance payout. Many economies lack the dedicated mechanisms, experience, and expertise needed to effectively allocate, disburse, and monitor recovery and reconstruction funds following disasters. If officials are aware of emergency procedures and rules for public procurement well in advance and can apply the right process at the right time, costly delays to the reconstruction process can be avoided. Part of the challenge in implementing a sovereign disaster risk financing and insurance strategy, including setting up budget execution systems to address specific post-disaster challenges, is that doing so requires strong collaboration between the MOF and the public entity tasked with spending the money, such as local governments or public infrastructure maintenance agencies (World Bank 2014).

**Some economies in APEC have developed fund execution mechanisms for public asset rehabilitation and reconstruction.** For example, **Japan** has a fast process allowing local governments to access national subsidies after disasters. Once a disaster occurs, local governments report their infrastructure damage to the line ministries, usually within 10 days of occurrence, and request a national subsidy for recovery works. Upon receipt of the application and within two months of the disaster, the line ministry assesses the damages in the field and examines the subsidy request. MOF also sends a budget examiner from the local MOF offices to the disaster-affected area to observe damage assessment and approve the subsidy jointly with the line ministry. To ensure quick rehabilitation, local governments can begin implementing their work immediately after the disaster occurs, even before applying for the subsidy (Sagara and Ishiwatari 2013). In **Mexico**, the government established a post-disaster loss-reporting mechanism and a process for financial flows managed by its Natural Disaster Fund (FONDEN), which lets affected states access timely payments directly from FONDEN, reducing time-consuming coordination problems (see figure 2.3).

Figure 2.3. FONDEN’s Resource Allocation Process



Source: Authors, from FONDEN (2011).

Source: World Bank 2012b.

### Contingency Planning

**Contingency planning helps governments define clear roles and responsibilities for post-disaster actors and thereby enhance the rehabilitation and reconstruction process.** It can also help minimize disruptions and instability in the supply markets for reconstruction of public assets. Empirical studies of the aftermath of the 2004 and 2005 Florida hurricanes suggest that the surge in demand for reconstruction and repair along with supply shortages—in qualified workers, carrying capacities of reconstruction materials, and so on—pushes up prices for reconstruction (up to 60 percent in some regions) after an extreme event (Hallegatte 2007, 2009; Kopp, Block, and Block, and Iimi 2013).

**Only a few economies in APEC put in place pre-disaster procurement arrangements.** In Japan, the local governments and the local offices of the central government can arrange pre-disaster agreements with private companies or local industry associations to ensure that relief and recovery work begins promptly in the aftermath of disasters. The agreement covers information sharing, emergency inspections, debris removal, and disaster recovery. These companies are required to begin post-disaster activities upon request from the government even before a contract to cover the costs is drawn up. As an incentive, participation in the pre-disaster arrangements is positively evaluated as a contribution to local communities whenever the relevant offices conduct a comprehensive evaluation of competitive procurement.

**Within the broader APEC forum, there are opportunities for creating synergies with other initiatives working on related disaster contingency planning issues as part of the broader disaster and crisis management framework.** For example, possible collaboration can be explored with the APEC Human Resources Development Working Group; this would link disaster risk financing strategies and labor supply preparedness strategies for disaster recovery and reconstruction of public assets. Given the

economies' interconnectedness and interdependence, cooperation can also be explored with the Transportation Working Group and the Emergency Preparedness Working Group to promote financial protection of critical infrastructure toward supply chain resilience.

## **2.6. IMPLEMENTATION CHALLENGES**

A few challenges were reported by some member economies in implementing financial risk management of public assets against natural disasters. Among the key challenges identified were **lack of technical expertise and capacity** in all stages of the risk management process. The most pressing challenge identified was in data collection, database development, and deployment of sophisticated analytical tools such as risk models. **Institutional coordination** was also found to be a challenge, given the complex multi-sectoral nature of the work, especially in data collection and risk assessment. Another reported challenge was **insufficient market capacity**, found in some economies that lack sufficient appetite for catastrophe risk insurance, as well as financial and technical capacity to underwrite catastrophe risks, data for proper risk assessment, and disaster risk regulatory and supervisory capacity. In some cases, the **lack of an adequate legal and institutional framework** for the development and implementation of market-based risk transfer instruments, along with an underdeveloped risk culture, has not been conducive to risk transfer products.

## CHAPTER 3. RECOMMENDATIONS AND LOOKING AHEAD

The governments of APEC economies have made significant progress in developing and implementing policies for financial risk management of public assets.

Moving forward, APEC finance ministers could promote a set of priority policy actions to strengthen financial resilience of public assets against natural disasters. Specifically, the APEC finance ministers could promote activities that support the following areas:

- 1. Develop strategies for the financial risk management of public assets against natural disasters.** Such strategies could include a mix of financial instruments for emergency repair and rehabilitation of public assets, such as budgetary instruments, contingent credit, and catastrophe risk transfer. They would also include post-disaster financial measures such as post-disaster borrowing or indemnity insurance for reconstruction of public assets. They should be linked to and even enhance the strategies for maintenance of high-quality and resilient public assets.
- 2. Fully integrate the financial management of public assets into the fiscal risk management framework.** The impact of natural disasters on public assets is a major source of contingent liabilities for governments and therefore could be integrated within a holistic fiscal risk management framework. Under this approach, contingent liabilities could be identified, quantified, and integrated into fiscal risk statements and disclosed.
- 3. Promote catastrophe risk insurance of public assets through public-private partnerships.** Governments could develop legal and institutional frameworks that foster sound and innovative catastrophe risk insurance solutions, thus facilitating risk pooling or centralized insurance procurement to achieve greater efficiency gains and encouraging the private sector to develop innovative insurance solutions. Through public-private partnerships, the private sector can bring capital, technical expertise, and innovative financial solutions to de-risk public sector balance sheets from natural disasters.
- 4. Improve risk data to inform management of fiscal impacts of natural disasters on public assets.** APEC economies could enhance their collection, management, and analysis of relevant disaster-related data on public assets. Specifically, they could improve baseline data, historical loss information, and expenditure data through standardized data management systems. This action not only contributes to advancing the financial resilience agenda in member economies but also to raising their readiness in fulfilling their ongoing (and possibly future) commitments to the monitoring and reporting of disaster preparedness under the United Nations' Sendai Framework for Disaster Risk Reduction 2015-2030.
- 5. Develop contingency plans for public asset rehabilitation and reconstruction linked to financial risk management strategies.** Contingency plans should enable governments to rapidly assess damages, allocate and disburse funding, and rehabilitate or rebuild damaged assets. Such plans could define clear roles and responsibilities for stakeholders and thereby enhance the efficiency of the rehabilitation and reconstruction process.

The APEC finance ministers could develop a work program structured around the priority actions identified above to specify how economies would support specific activities. Efforts under the program could be supported by further knowledge exchange and experience sharing among APEC economies.



## ANNEX 1. CHECK LIST FOR SELF-ASSESSING FINANCIAL RISK MANAGEMENT OF PUBLIC ASSETS

- Stage 1      **Initiation**
- Assemble risk management resources
  - Set up risk management team, appoint team leader, and assign responsibilities
  - Define key objectives
  - Define key elements to structure risk analysis
- Stage 2      **Risk Analysis**
- Identify risk
- Prepare a comprehensive list of risks
  - Define each risk and key assumptions
  - Define risk appetite
- Assess risk likelihoods and consequences
- Assemble data on risks and their consequences
  - Assess risk likelihoods
    - Qualitative assessments
    - Quantitative assessments
  - Assess risk impacts
- Stage 3      **Risk Evaluation and Rating/Layering**
- Layer risks to reflect impacts and likelihood
  - Discard/accept minor risks
  - Identify risk for risk treatment planning
- Stage 4      **Risk Response and Treatment Planning**
- Identify feasible responses for each major risk
  - Select risk response measures
    - Risk reduction/prevention
    - Risk acceptance/retention
    - Risk transfer including insurance
    - Impact mitigation including contingency planning
- Stage 5      **Reporting**
- Summarize and collate risk actions and measures
- Stage 6      **Risk Management Implementation**
- Implement risk response measures and actions
  - Monitor implementation
  - Review and evaluate performance on a periodic basis



## ANNEX 2. DISASTER COST-SHARING ARRANGEMENTS BETWEEN CENTRAL AND LOCAL GOVERNMENTS FOR REHABILITATION AND RECONSTRUCTION OF PUBLIC ASSETS IN APEC ECONOMIES

Economy	Program	Cost-sharing formula	Eligibility	Note
Australia	Natural Disaster Relief and Recovery Arrangements (NDRRA)	<p>The government of Australia rate of assistance:</p> <ul style="list-style-type: none"> <li>Under state's 1st threshold: <b>0%</b></li> <li>Between 1st and 2nd threshold: <b>50%</b> of Category B expenditure<sup>a</sup></li> <li>Exceeding state's second threshold: Up to <b>75%</b> of Category B expenditure</li> </ul> <p>State governments are responsible for the rest.</p> <ul style="list-style-type: none"> <li><b>1st threshold:</b> 0.225% of the state's total general government sector revenue and grants in the financial year two years prior to the financial year during which the disaster occurred</li> <li><b>2nd threshold:</b> 1.75 times the first threshold</li> </ul>	<p><b>Essential public assets:</b> The scope of the essential public assets must be proposed by the states and agreed by Attorney General's Department as a necessary part of a state's infrastructure and integral to the normal functioning of a community (e.g., roads, bridges, and schools).</p> <p><b>States must have</b></p> <ul style="list-style-type: none"> <li>Risk mitigation strategies in place.</li> <li>Reasonably adequate capital or access to capital to fund liabilities or infrastructure losses in place.</li> <li>Independent assessments of their insurance arrangements undertaken by an independent and appropriate specialist, to be reported to the Department of Finance and Deregulation at intervals of no greater than 3 years apart.</li> </ul>	<ul style="list-style-type: none"> <li>Funding aims to aid the restoration of public infrastructure, to support relief and recovery measures delivered by the states in response to eligible disasters,<sup>b</sup> and to complement other state-based strategies, such as insurance and natural disaster mitigation planning and implementation.</li> <li>NDRRA's funding is based on losses net of each state's insurance.</li> <li>The absence of meeting conditionality results in decrease in financial assistance by 10 percent.</li> </ul>
Canada	Disaster Financial Assistance Arrangements (DFAA)	<p>The government of Canada share, based on the provincial expense thresholds (per capita):</p> <ul style="list-style-type: none"> <li>First Can\$3.07: <b>0%</b></li> <li>Next Can\$6.15: <b>50%</b></li> <li>Next Can\$6.15: <b>75%</b></li> <li>Remainder: <b>90%</b></li> </ul>	<p>Eligible expenses include</p> <ul style="list-style-type: none"> <li>Recovery or replacement of provincial and territorial assets, evacuation operations, and replacement or repair of basic essential personal property of individuals, small businesses, and farmsteads</li> <li>Expenses beyond provincial/territorial capacity or when the nature of the events spans more than one jurisdiction</li> </ul>	<ul style="list-style-type: none"> <li>The current annual budget appropriation to DFAA is approximately Can\$100 million.</li> <li>DFAA provides guidelines on expenses eligible for federal cost sharing.</li> </ul>
Chinese Taipei	Regulation of Budget Appropriation from Central Government to Local Governments for Major Natural Disaster Rescue	No explicit formula.	<ul style="list-style-type: none"> <li>Local governments' existing disaster preparation budget is not sufficient to meet their needs.</li> </ul>	<ul style="list-style-type: none"> <li>Once local governments apply to the Executive Yuan for budget assistance with post-disaster reconstruction, the Public Construction Commission convenes the relevant agencies from the central government to organize an ad hoc review</li> </ul>

				committee to handle the applications, and the review results are reported to the Executive Yuan for approval.
Japan	<b>Act on National Treasury's Sharing of Expenses for Projects to Recover Public Civil Engineering Works Damaged by Disaster (1951)</b>	<p>Central government bears <b>at most 98.3%</b> of the recovery costs of infrastructure assets in the aftermath of natural disasters.</p> <ul style="list-style-type: none"> <li>The central government covers <b>two-thirds of the recovery cost</b>, and the local governments cover one-third.</li> <li>If the local government issues a bond to finance its cost, <b>95% of the interest and redemption of the bond</b> can be covered by the central government.</li> </ul>	<ul style="list-style-type: none"> <li>The formula is applied to infrastructure assets managed not only by the local governments but also by the central government, under the notion that local governments should share the burden due to the benefit they receive from the infrastructure.</li> <li>Where extremely negligent maintenance and management causes the damage, local governments are ineligible for the subsidies.</li> </ul>	<ul style="list-style-type: none"> <li>The dedicated annual reserve for this activity is around ¥73 billion (US\$730 million). The amount is determined on a yearly basis as part of the annual budget.</li> <li>The fund is managed mainly by Ministry of Land, Infrastructure, Transport and Tourism, though other line ministries, such as the Ministry of Agriculture, Forestry and Fisheries, are also involved.</li> </ul>
Mexico	<b>FONDEN</b>	<ul style="list-style-type: none"> <li><b>For insured federal assets</b>, resources finance <b>100%</b> of the reconstruction cost.</li> <li><b>For insured local assets</b>, resources finance <b>50%</b> of the reconstruction cost.</li> </ul> <p><b>When assets are not insured</b>, reconstruction costs are financed as follows:</p> <p>Federal assets</p> <ul style="list-style-type: none"> <li>1st disaster: <b>100%</b></li> <li>2nd disaster: <b>50%</b></li> <li>≥ 3rd disaster: <b>0%</b></li> </ul> <p>Local assets</p> <ul style="list-style-type: none"> <li>1st disaster: <b>50%</b></li> <li>2nd disaster: <b>25%</b></li> <li>≥ 3rd disaster: <b>0%</b></li> </ul>	<ul style="list-style-type: none"> <li>The affected federal or state agencies must demonstrate that the reconstruction needs exceed the financial capacity within their natural disaster management programs and present a specific request detailing the extent of the damage and estimated cost of reconstruction.</li> </ul>	<ul style="list-style-type: none"> <li>Federal agencies are responsible for the design, contracting, and supervision of all rehabilitation and reconstruction works using their own operating procedures.</li> <li>FONDEN does not provide direct support to municipalities. State governments, however, have traditionally applied for FONDEN resources to restore municipal assets and assisted municipalities with the execution of these resources.</li> <li>Local governments are responsible for remaining reconstruction needs, using their own resources or drawing on a line of credit from the Reconstruction Fund for Local Entities.</li> </ul>
New Zealand	<b>Disaster Relief Funding</b>	<p><b>Central government reimburses 60%</b> of the combined eligible costs (response and essential infrastructure costs), above the following thresholds:</p> <ul style="list-style-type: none"> <li>0.0075% of the net capital value of the city council, district council, or unitary authority involved</li> <li>0.002% of the net capital value of unitary authorities where the assets in question are of a type that ordinarily is managed</li> </ul>	<p><b>Essential infrastructure recovery</b> repairs that may be claimed include</p> <ul style="list-style-type: none"> <li>Repair or recovery of essential infrastructure assets such as water, storm water, electrical, sewerage, and gas facilities</li> <li>Repair or recovery of river management systems whose damage causes major community disruption and continuing risk to life</li> </ul> <p>Road and bridge repair cost may be subsidized</p>	

		<p>by regional councils</p> <ul style="list-style-type: none"> <li>• 0.002% of net capital value in the case of regional councils.</li> </ul>	<p>by New Zealand Transport Agency. Subsidy rates differ between local governments.</p>	
United States	Disaster Relief Fund (DRF)	<p><b>No explicit formula.</b> FEMA draws on the fund to finance.</p>	<p>Funds finance eligible response and recovery efforts following major domestic disasters or events that prove too expensive for state budgets, such as</p> <ul style="list-style-type: none"> <li>• The repair and restoration of qualifying disaster-damaged public infrastructure</li> <li>• Emergency protection and other eligible services to states, territories, tribal lands, and local areas</li> </ul>	
	Public Assistance Program after Emergency Declarations (Stafford Act)	<ul style="list-style-type: none"> <li>• The federal share is not less than <b>75%</b> percent of the eligible costs.</li> <li>• If actual federal obligations, excluding administrative costs, meet or exceed a qualifying threshold, FEMA may recommend an increase up to <b>90%</b>.</li> <li>• Maximum amount of assistance for a single emergency is <b>\$5 million</b>. The president reports to Congress if this amount is exceeded.</li> </ul>	<p>Eligible activities:</p> <ul style="list-style-type: none"> <li>• Debris removal</li> <li>• Repair, replacement, or restoration of disaster-damaged publicly owned facilities</li> </ul>	<p>The president can declare an emergency for any occasion or instance when the president determines federal assistance is needed.</p>
	Public Assistance Program after Major Disaster Declarations (Stafford Act)	<ul style="list-style-type: none"> <li>• The federal share is not less than <b>75%</b> of the eligible costs.</li> <li>• If actual federal obligations, excluding administrative costs, meet or exceed a qualifying threshold, FEMA may recommend an increase up to <b>90%</b>.</li> </ul>	<p>Eligible activities:</p> <ul style="list-style-type: none"> <li>• Debris removal</li> <li>• Emergency protective measures</li> <li>• Roads and bridges</li> <li>• Water control facilities</li> <li>• Buildings and equipment</li> <li>• Utilities</li> <li>• Parks; recreational and other facilities</li> </ul>	<p>The president can declare a major disaster for any natural event that the president determines has caused damage of such severity that it is beyond the combined capabilities of state and local governments to respond.</p>
Vietnam	State Budget Law and Decision 01/2016/QĐ-TTg	<p><b>No explicit formula.</b> Decisions on the rate of financial support are at the discretion of the prime minister.</p>	<p>To be eligible, subnational governments</p> <ul style="list-style-type: none"> <li>• Must have exhausted all their lawful funds planned for disasters</li> <li>• Must be reliant on central budget transfer</li> <li>• Must have revenue sharing of less than 50%</li> </ul>	<p>Financial support is for repair and recovery of public buildings, disaster prevention and control works, transport, telecommunications, irrigation, water, energy, schools, health facilities, and lifeline infrastructures that were damaged by disasters.</p>

- a. Assistance under Category B helps state and local governments restore essential public assets and conduct “counter-disaster operations.” Small businesses, primary producers, nonprofit organizations, and needy individuals are also assisted under this category through concessional loans, subsidies, or grants.
- b. An eligible disaster is defined as a natural disaster or terrorist act for which a coordinated multiagency response was required and for which state expenditure exceeds the small-disaster criterion. Attorney-General’s Department 2017.

*Source:* APEC economies’ responses to World Bank Group questionnaire, 2017; Australian Government. 2017; Government of Canada. 2017; Japan MLIT; World Bank, 2012b; New Zealand Government. 2015; FEMA. 2017.

## GLOSSARY

average expected loss (AEL)	Expected loss per year when averaged over a very long period (for example, 1,000 years). Computationally, AEL is the summation of products of event losses and event occurrence probabilities for all stochastic events in a loss model.
catastrophe (CAT) bond	A high-yielding, insurance-linked security providing for payment of interest and/or principal to be suspended or cancelled in the event of a specified catastrophe, such as an earthquake of a certain magnitude within a predefined geographical area.
contingent liability	Possible obligation that can be confirmed only by the occurrence or not of one or more uncertain future events that are beyond the full control of the public entity.
emergency	State of damage to life, property, and the environment as a result of a natural or human-induced phenomenon that alters the normal progress of activities in the affected area.
ex ante risk management	Action taken prior to a potential risk event. Making preparations before a disaster helps avoid inefficient and hasty coping decisions. If ex ante strategies are not in place, governments will resort to short-term coping strategies that have no significant benefit in the long run.
ex post risk management	Risk management strategies that are developed in reaction to an event, without prior planning. Although ex post strategies have a role to play in a risk management program, risk management mechanisms can be more effective when introduced ex ante.
exposure	The amount (sum insured) exposed to the insured peril(s) at any one time.
georeference	To establish something's location in terms of map projections or a coordinate system (e.g., the position of an aerial photograph within a map or the geographical coordinates of a physical asset).
hazard	Potentially harmful natural or human-induced phenomenon that can occur in a specific location with certain intensity and within a definite period of time or at a given frequency.
indemnity	The amount payable by the insurer to the insured, in the form of cash, repair, replacement, or reinstatement, in the event of an insured loss. This amount is measured by the extent of the insured's pecuniary loss. It is set at a figure equal to but not more than the actual value of the objects insured just before the loss, subject to the adequacy of the sum insured.
insurance	A financial mechanism that aims to reduce the uncertainty of loss by pooling a large number of uncertainties so that the burden of loss is distributed. Generally, policyholders pay a contribution to a fund, in the form of a premium, commensurate with the risk they introduce. The insurer uses these funds to pay the losses (indemnities) suffered by any of the insured.  Traditional indemnity-based insurance contracts pay claims based on an assessment of the damage suffered by the insured.
loss exceedance probability—PML (probable)	Annual probability that a given amount of loss will be exceeded. The exceedance probability is based on the minimum loss that could occur

maximum loss) curves	with a given annual probability. The level of loss associated with an exceedance probability is called probable maximum loss (PML). Technically, a PML is a percentile of the loss distribution.
parametric (or indexed) insurance	Non-indemnity insurance that makes payouts based on an index or parameter established in the contract.
probabilistic catastrophe risk model	A detailed computer simulation of natural disaster scenarios to quantify loss that could be sustained from them. These models were developed by the insurance industry to assess the risk of certain assets and to price insurance contracts. Today, such models are mostly tailored for private sector needs. However, they are increasingly being used by governments that wish to understand better how future disasters could impact them and what the associated economic and fiscal cost would be.
public assets	Physical public assets, including public buildings, infrastructure, fixed structures, and contents.
reinsurance	Insurance contract under which a reinsurance company insures an insurance company's portfolio of policies (reinsurance treaty) or an individual policy (facultative contract).
risk financing	The process of managing risk and the consequences of residual risk through products such as insurance contracts, CAT bonds, reinsurance, or options.
risk layering	The process of separating risk into tiers that allow for more efficient financing and management of risks.

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