PHILIPPINE CITY DISASTER INSURANCE POOL

RATIONALE AND DESIGN

DECEMBER 2018

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The cover design depicts a city which is financially resilient to disasters, with readily available resources to support rapid post-disaster recovery including through insurance. Graphic illustration by Lowil Fred Espada.

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Abbreviations

ADB	Asian Development Bank
ARC	African Risk Capacity
CCRIF	Caribbean Catastrophe Risk Insurance Facility
COA	Commission on Audit
GSIS	Government Service Insurance System
JMA	Japan Meteorological Agency
LDRRMC	Local Disaster Risk Reduction and Management Council
LDRRMF	Local Disaster Risk Reduction and Management Fund
NDRRMF	National Disaster Risk Reduction and Management Fund
PCDIP	Philippine City Disaster Insurance Pool
PCRIC	Pacific Catastrophe Risk Insurance Company
₱	Philippine peso
QRF	Quick Response Fund
RMS	Risk Management Solutions
STF	Special Trust Fund
USGS	United States Geological Survey

Acknowledgments

This report summarizes the analysis and research undertaken under Output 5 of the Technical Assistance on Enhanced Use of Disaster Risk Information for Decision Making in Southeast Asia.[1] Output 5 focused on the design of a city government disaster insurance pool for the Philippines. It was implemented under the overall guidance of Charlotte Benson, Principal Disaster Risk Management Specialist, Sustainable Development and Climate Change Department (SDCC), Asian Development Bank (ADB).

ADB engaged a consortium of leading national and international experts to design the insurance pool. Led by risk modeling firm Risk Management Solutions, the project team included geospatial specialists from Earthquake and Megacities Initiative, economic experts from Vivid Economics, and insurance experts from reinsurance broker Willis Towers Watson. The consortium was represented by Stephen Moss (consultant team lead), Fouad Bendimerad, Theresa Lederer, Arnaud Castéran, Sophie Hannah, David Simmons, Simon Young, Swenja Surminski, Oliver Walker, Aditi Sahni, and Shahbano Soomro as international consultants; and Vida Chiong, Mark Edwin Tupas, Violeta Seva, Albertito Kalagayan, Jose Mari Daclan, Catherine Madamba, Francisco Tavora, Cyndi Ignacio, Bernadette Dimmog, and Precious Zara as national consultants. Two additional consultants, Tuga Alaskary and Faisal Abdul, provided direct support to ADB in the design of the pool, including extensive outreach activities with city governments participating in the pool design. The contributions of the full team of consultants in developing a technically robust, practical, and sustainable pool is gratefully acknowledged.

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[1] ADB. 2015. *Technical Assistance for Enhanced Use of Disaster Risk Information for Decision Making in Southeast Asia*. Manila.

Thanks are also extended to other national government agencies that provided inputs and advice including the Department of Social Welfare and Development, Department of Budget and Management, Office of Civil Defense, Department of the Interior and Local Government, Department of Science and Technology (particularly Philippine Institute of Volcanology and Seismology and Philippine Atmospheric, Geophysical, and Astronomical Services Administration), National Mapping and Resource Information Authority, Philippine Statistics Authority, Government Service Insurance System, National Economic and Development Authority, Department of Health, Department of Education, Department of Public Works and Highways, and Metropolitan Manila Development Authority.

ADB is indebted to the many government officials from the 10 cities that participated in the pool design–Bacolod City, Baguio City, Butuan City, Caloocan City, Dagupan City, Davao City, Iloilo City, Marikina City, Paranaque City, and Quezon City. City government officials from Angeles City, Cavite City, Iriga City, Tacloban City, Tagatay City, and Trece Martires City also cooperated with the project team. All city governments and the League of Cities of the Philippines are thanked for their kind cooperation and provision of data and critical insights, as well as their generous time and hospitality.

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EXECUTIVE SUMMARY

The Philippines is located in one of the world's most disaster-prone regions. Positioned on the Pacific Ring of Fire and within the Western North Pacific basin, it is exposed to earthquakes, volcanic eruptions, and severe typhoons. The country also experiences floods, droughts, and landslides.

The Government of the Philippines has undertaken a number of steps in recent years to enhance disaster resilience. These have included initiatives both to reduce risk and to strengthen preparedness for potential events. The Philippines has emerged, in particular, as a leading nation among emerging economies in Asia with regard to its approach to financial preparedness for disasters. As part of its efforts, the government formulated a Disaster Risk Financing and Insurance Strategy in 2015. This strategy provides a framework for enhancing financial resilience at national, local, and individual levels.[2]

Philippine cities typically face particularly high disaster risk, reflecting the concentration of people, assets, infrastructure, and economic activities in urban areas. City governments also shoulder a high level of responsibility for disaster risk management and associated costs. As a result, there are mandated budgeting mechanisms in place for cities to allocate financing for disaster risk management through their Local Disaster Risk Reduction and Management Funds. Nevertheless, cities often face significant challenges in securing adequate resources for post-disaster operations, including rapid access to funding to support early recovery efforts such as the restoration of critical infrastructure, delivery of services, and support of livelihoods. Delays in early recovery increase the impact of disasters on local and national economies, as well as on the economic and social welfare of those affected.

The Philippine City Disaster Insurance Pool (PCDIP) has been developed to address this need for rapid access to early recovery financing. As such, PCDIP directly supports the second (local) of the 3 tiers of disaster risk financing under the government's 2015 Disaster Risk Financing and Insurance Strategy. The Philippine Department of Finance has led the design of PCDIP, with technical assistance from the Asian Development Bank.[3]

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2 Republic of the Philippines. 2015. Disaster Risk Financing and Insurance Strategy. Manila.
3 ADB. 2015. *Technical Assistance for Enhanced Use of Disaster Risk Information for Decision Making in Southeast Asia*. Manila. Funded by the Government of Canada through the Integrated Disaster Risk Management Fund administered by ADB.

This report presents the approach taken to develop PCDIP and the proposed structure and workings of the pool.

Design Approach

Ten cities participated in the design of the pool. Their selection was based on a range of factors including disaster risk, demographic and economic size, geographic location, data availability, and disaster risk management governance. The relative scale of government and public facilities, and thus of potential post-disaster levels of expenditure, was also considered. Two cities from each of Luzon, Visayas, and Mindanao were selected, together with 4 cities from Metro Manila. The selected cities were Bacolod City, Baguio City, Butuan City, Caloocan City, Dagupan City, Davao City, Iloilo City, Marikina City, Parañaque City, and Quezon City. Once implemented, the pool is expected to expand to cover additional cities.

To support the optimal design of PCDIP, these cities were engaged in a number of activities:

- **Exposure data collection**. To inform an understanding of the disaster risks faced by each city and potential post-disaster financing requirements, an exposure dataset of public and private "vertical assets" was developed with the support of each city, describing all buildings within the city boundaries but excluding roads, railways, and underground infrastructure. This database was used as an input to the Risk Management Solutions (RMS) Philippine earthquake and typhoon risk models to quantify the level of risk faced by each city.

- **Needs assessment**. Existing disaster risk financing arrangements in each city were mapped and combined with outputs of the risk models to determine levels of additional financial support required by each city to meet early recovery spending needs following earthquakes and typhoons of varying severities.

- **Capacity building**. Two national workshops were held to inform the design of PCDIP and secure feedback on the proposed structure. A three-part capacity development program was also provided to each city to secure a deeper understanding of disaster risk financing and enable city officials to make informed decisions on participation in PCDIP.

Key PCDIP Design Features

PCDIP is intended to provide rapid post-disaster financing for early recovery in a cost-efficient manner. A parametric insurance pool was identified as the best solution to achieve this. Parametric insurance payouts are determined based on the physical features of a natural hazard event, such as wind speed for typhoons or ground shaking for earthquakes, rather than on actual losses suffered by a policyholder. The parameters most closely correlated to actual losses are chosen for these indices. Verification of the parameters driving payouts is provided by reputable independent scientific agencies, which make physical parameter data publicly available very shortly after a disaster occurs. This approach means that payouts can be expected within a few weeks of qualifying disaster events, as they avoid the lengthy loss assessment required by traditional "indemnity" insurance.

PCDIP will offer parametric insurance cover against typhoons and earthquakes in its first phase. It is expected that flood cover will also be offered once existing data and modeling challenges have been addressed. Parametric indices will be calculated individually for each city, based on spectral acceleration (a measure of ground motion[4]) for earthquake cover and on 3-second peak wind gusts (a measure of wind speed) for typhoon. These physical parameters will be measured at the center of each barangay and weighted according to the proportion of the relevant city's assets located in that barangay.

PCDIP payouts will be made within 15 business days of the occurrence of an event. These rapid payouts will complement existing post-disaster financing arrangements, such as indemnity insurance purchased through the Government Service Insurance System (GSIS), which is targeted at longer-term financing needs during the post-disaster reconstruction phase.

The parametric cover will be offered through a risk pooling arrangement. A disaster insurance pool is a structure under which participating entities, in this case city governments, collectively buy insurance through a single platform. The pool essentially operates as an insurance company acting for the benefit of the insured cities. Insurance pools reduce the price of premiums in several ways:

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[4] Spectral acceleration measures the acceleration experienced by an object (typically a building) during an earthquake due to movement of the ground.

- **Diversification**. A pool combines risk across multiple regions and types and levels of severity of natural hazard, reducing the variability (often termed volatility) of total losses experienced by the group as a whole and so leading to greater stability in the group's funding requirements, reduced capitalization and reinsurance (insurance purchased by an insurance company) costs, and therefore lower insurance premiums.

- **Economies of scale**. All insurance products have inherent costs associated with their setup and their ongoing administration which cities can share by grouping together. These costs include licensing, structuring, setup, administrative, claims management, data and modeling, regulatory and other statutory compliance costs.

- **Profit retention**. Profits made by a pool during years with fewer disasters can be retained within the pool, rather than being paid to shareholders of a commercial company.

The success of parametric disaster insurance pools has been demonstrated at a sovereign level through facilities in the Caribbean,[5] the Pacific islands,[6] and Africa.[7] Each of these provides payouts to its pool members upon the occurrence of a disaster of a predetermined size and has demonstrated its ability to operate on a financially stable basis.

Selecting PCDIP Coverage

Cities will purchase insurance cover based on the type(s) of hazard they want to insure against, the frequency and scale of payouts they would like to receive, and the funding available for premium payments. The premiums paid by each city will be based on the level of risk which that city individually brings to the pool. There will be no cross-subsidization of premiums among participating cities.

Unutilized annual transfers from cities' quick response funds to special trust funds could provide a source of premium funding and increase the cost-effectiveness of those resources relative to the current practice of accruing resources in special trust funds for use in the event of a disaster. Using part of those resources for PCDIP premiums would leverage or increase the post-disaster funding available to cities in the event of typhoons and earthquakes that trigger insurance payouts.

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[5] Caribbean Catastrophe Risk Insurance Facility. https://www.ccrif.org/
[6] Pacific Catastrophe Risk Insurance Company. http://pcrafi.spc.int/
[7] African Risk Capacity. http://www.africanriskcapacity.org/

Pool Financing and Capitalization

PCDIP has been carefully structured to ensure that city governments can afford premiums (via flexibility in choosing their cover), that the pool is able to honor payouts in a timely manner, and that the pool is financially sustainable over the long term. Payouts will be funded by a combination of pool capital, initially established through seed capital, and reinsurance protection purchased from the domestic and international markets. The initial pool capital will be provided by the government, which is expected to secure a sovereign loan from ADB for this purpose. This will be supplemented by retained profits should PCDIP benefit from years of low disaster loss. The level of reinsurance purchased each year will be driven by the level of risk transferred to the pool by the cities, available capital in the pool, the price of reinsurance from traditional reinsurance and/or capital markets and, crucially, the level of protection required by PCDIP.

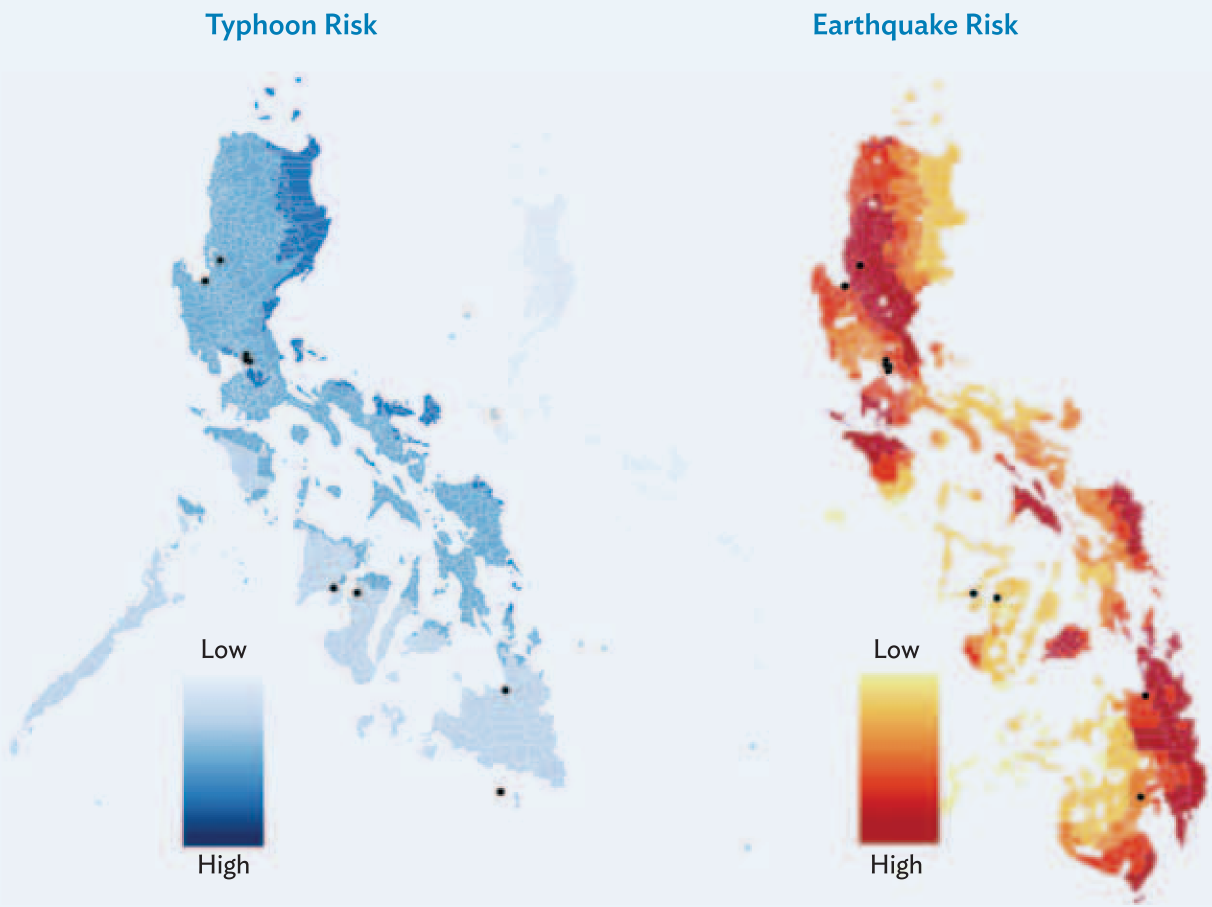
1| INTRODUCTION

The Philippines' position on the Pacific Ring of Fire and within the western North Pacific basin exposes it to the severe effects of both earthquakes and severe typhoons (Figure 1). Recent events causing significant damage and loss in the Philippines include the Surigao Earthquake in 2017, the Bohol Earthquake in 2013, Typhoon Haiyan (Yolanda) in 2013, Typhoon Bopha (Pablo) in 2012, and Typhoon Ketsana (Ondoy) in 2009.

City governments typically face particularly high disaster risk, reflecting the concentration of people, assets, infrastructure, and economic activities in urban areas in the Philippines. Cities also face significant challenges in securing adequate resources for timely post-disaster recovery and reconstruction, thereby accentuating the indirect economic and social impacts of direct physical losses.

The Government of the Philippines has undertaken a number of steps to enhance its disaster resilience, including through the passage of the comprehensive Philippine Disaster Risk Reduction and Management Act of 2010 (RA 10121) addressing all aspects of disaster risk management and the approval of the National Disaster Risk Reduction and Management Plan 2011-2028, as well as through a range of disaster risk reduction and preparedness projects.

Figure 1 : Overview of Disaster Risk in the Philippines



Source: Risk Management Solutions, 2018.

Figure 2 : Framework for Disaster Risk Financing in the Philippines

National level: Improve the financing of post-disaster emergency response, recovery, and reconstruction needs.

Local level: Provide local governments with funds for post-disaster recovery and reconstruction efforts.

Individual level: Empower poor and vulnerable households and owners of small and medium-sized enterprises to quickly restore their livelihoods after a disaster.

Source: Republic of the Philippines. 2015. *Disaster Risk Financing and Insurance Strategy*. Manila.

The Philippines has emerged, in particular, as a leading nation among emerging economies in Asia with regard to its approach to financial preparedness for disasters. In 2015, the government formulated a Disaster Risk Financing and Insurance Strategy, positioning existing measures within a broad framework and outlining additional measures to further enhance its resilience. This strategy delineates 3 tiers of instruments to enhance financial resilience, focusing on national government, local government, and individuals (Figure 2).

This report presents a proposed disaster insurance pool to support city governments, focusing on the second tier of the strategy. A disaster insurance pool is a structure under which participating entities, in this case city governments, collectively buy insurance through a single platform. The pool essentially operates as an insurance company acting for the benefit of the insured cities.

In this case the pool, referred to as the Philippine City Disaster Insurance Pool (PCDIP), would complement existing indemnity insurance cover for public assets already provided by the Philippine Government Service Insurance System (GSIS), offering a parametric insurance scheme which would provide rapid and cost-efficient financing in the aftermath of a disaster. Indemnity insurance provides payouts (compensation) in accordance with the actual losses suffered by a policyholder. Payouts under parametric insurance are determined based on physical features of the natural hazard event experienced (e.g., wind speed or earthquake magnitude) rather than actual losses suffered by the policyholder.

PCDIP is intended to (i) help reduce the cost of premiums by diversifying risk and supporting the first layer of loss via pool reserves, in turn reducing the amount of reinsurance required to protect the pool; (ii) share administrative costs associated with the creation and management of the pool, further reducing premium costs; and (iii) allow for cross-learning of experience among participating cities. The pool has been designed to offer insurance cover against tropical cyclones and earthquakes, with the expectation that cover against floods will be added once existing data and modeling limitations have been addressed.

Ten cities participated in the design of the pool. Participation was objectively determined based on a range of factors including disaster risk, demographic and economic size, geographic location, data availability, and disaster risk management governance. The relative scale of government and public facilities, and thus of potential post-disaster levels of expenditure, was also taken into account. Two cities from each of Luzon, Visayas, and Mindanao were selected, together with 4 cities from Metro Manila. The selected cities were Bacolod City, Baguio City, Butuan City, Caloocan City, Dagupan City, Davao City, Iloilo City, Marikina City, Paranaque City, and Quezon City. Once implemented, the pool is expected to expand to cover additional cities.

This report provides further details on the steps taken in developing the pool, focusing on the assessment of city disaster risk (Section 2); a review of existing disaster risk financing arrangements, and related needs (Section 3); development of the technical, legal/regulatory, and administrative structure of the pool (Section 4); premium pricing (Section 5); and pool benefits (Section 6). Final concluding remarks are provided in Section 7.

2| ASSESSING CITY DISASTER RISK

Purpose of risk modeling

Risk modeling is central to the development of any disaster risk financing instrument, including insurance products. It plays a key role at several stages in the development of a parametric disaster insurance pool:

- **Initial risk assessment.** Risk modeling is required to quantify the underlying disaster risk to a city and express it in monetary terms.
- **Trigger structuring.** Risk modeling is required to assess the level of financing needed to meet post-disaster relief, early recovery and reconstruction spending needs, and to design disaster risk financing instruments, such as parametric insurance structures, which provide cost-efficient funding to meet these needs.
- **Pricing.** Risk modeling is required to calculate fair premium prices, based on actual levels of risk faced.

Most frequent causes of loss, such as the risk from car accidents or thefts, can generally be reliably estimated based on historical data. For more severe—and typically less frequent—events like typhoons or earthquakes, however, their historical record is typically too short to adequately capture the full range of risks from these events. Just because an earthquake has not happened in a certain location or with a certain magnitude within the available historical record, does not guarantee that such earthquake will not happen in the future. The 2013 Bohol Earthquake, which occurred on a previously unknown fault line, was a devastating demonstration of this in recent Philippine history.

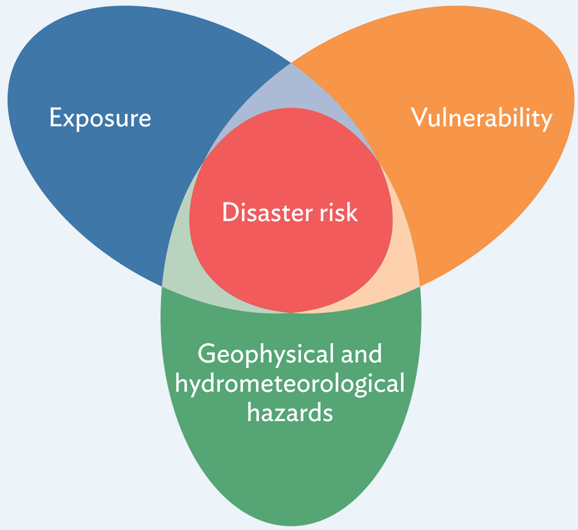
In the case of such severe, infrequent events, an assessment based on a robust risk model is required to capture the full range of potential impacts. Risk models combine latest scientific knowledge on natural hazards, such as typhoons and earthquakes, with their historical record in order to achieve a more complete view of the risk these hazards pose.

Modeling approach

Framework for Modeling Physical Asset Damage

A disaster is caused by 3 factors in combination: the occurrence of a natural hazard event, the presence of asset exposure (such as buildings and other infrastructure) in the affected region, and vulnerability of that exposure to damage from that event (Figure 3). As such, risk modeling requires a series of steps to determine (i) the types of natural hazard that could occur in a particular location (in this case, particular cities) and levels of frequency at different levels of intensity; (ii) the physical characteristics of those hazard events (e.g., wind speed, storm surge, and ground shaking); (iii) the physical assets exposed to those hazards; and (iv) the degree of vulnerability of those physical assets to hazard events of varying levels of intensity and physical characteristics. These factors come together in a final, fifth stage to determine the scale of physical losses, expressed in monetary terms, that can be expected to occur at different levels of frequency.

Figure 3 : The Three Components of Disaster Risk



Source: Asian Development Bank.

The risk modeling undertaken to assess disaster risk for the 10 cities participating in the design of PCDIP was based on the Risk Management Solutions (RMS) Philippine earthquake and typhoon models (Box 1 and Box 2). Both models are based on the modeling steps outlined above and described in further detail below. These modeling steps are widely used by modern catastrophe models to quantify risk from severe events. Recognizing the broad range of typhoon and earthquake risk across the Philippines, the 2 models enable the assessment of individual city risk profiles and comparison of risk between cities and types of natural hazard.

Box 1 : The Risk Management Solutions Southeast Asia Earthquake Model

The Risk Management Solutions Southeast Asia Earthquake Model captures earthquake risk across Southeast Asia, including the Philippines. The current model (released in 2017) assesses damages caused by ground shaking, landslides and liquefaction. It calculates losses from both well-known faults (such as the Manila and Philippine Trench systems), and less identifiable background seismicity which still has the potential to cause damage.

The model applies established ground motion equations, which link key high-level parameters of an earthquake (such as its location and magnitude) and local characteristics (distance from the epicenter and soil conditions) to quantify ground shaking at specific locations. The ground shaking information at each location is overlaid with vulnerability and exposure information to determine the loss each simulated event causes to a specific asset. The vulnerability information used by the model takes account of the characteristics of each asset (e.g. structure, occupancy, age), as well as local construction practices and building regulations.

Source: Risk Management Solutions, 2018.

Box 2 : The Risk Management Solutions Philippines Typhoon and Inland Flood Model

The current Risk Management Solutions Philippines Typhoon and Inland Flood Model (released in 2018) assesses damages caused by typhoon-related wind, flood, and storm surge, and by seasonal and monsoon flood events.

The wind hazard characteristics of simulated events contained in the model were validated against data from the Philippine Atmospheric Geophysical and Astronomical Services Administration to ensure that expert local knowledge and experience is reflected in the model.

Similar to the earthquake model, the typhoon model applies wind field equations to quantify the wind and surge hazard experienced by specific locations based on their local topography and bathymetry. The resulting hazard level at each location is then overlaid with vulnerability and exposure information to assess the damage and losses to a given set of assets of interest. The vulnerability information has been developed based on a detailed assessment of local design codes, wind maps and construction practices, damage data from historical events, and insights gained from damage inspections after Typhoon Haiyan (Yolanda) in 2013.

Source: Risk Management Solutions, 2018.

1. **Defining possible types and frequencies of hazard.** Thousands of hypothetical events for a given natural hazard, such as earthquakes or typhoons, are simulated based on the latest scientific understanding of these hazards. For example, the RMS Philippine Typhoon and Inland Flood Model contains over 180,000 simulated typhoon events. Unlike historical typhoons, these simulated events are not intended to reflect specific events that have occurred in the past. Instead, they have been created to represent the range of possible severities of typhoon events which could potentially impact the Philippines in the future.

2. **Determining physical (hazard) characteristics.** Each simulated event will impact a certain geographical area with different physical characteristics. These characteristics are expressed in terms of event-specific hazard measurements. For example, the impact of a typhoon event is measured in terms of its wind speed, storm surge, and flood depth hazards; and the hazard used to measure the impact of an earthquake event is its ground motion. The model generates the hazard characteristics of each simulated events across all locations impacted by that event.

3. **Identifying impacted assets.** A risk model requires information about the assets that would be impacted by potential hazard events. This information is typically captured in an exposure database which contains information on the type, location, reconstruction cost, and building characteristics of each asset. During the modeling process, the locations of the assets included in the exposure database is overlaid with the stored hazard information on each simulated event. Through this process, the level of hazard (for example, wind speed or ground motion) experienced by each asset in the exposure database can be determined for every simulated event.

Box 3 : Development of Exposure Databases for the Philippine City Disaster Insurance Pool

Databases containing comprehensive information about the location, characteristics (occupancy, construction type, height), and reconstruction cost of public and private buildings in each of the 10 cities participating in the design of the Philippine City Disaster Insurance Pool were developed. Data were drawn from relevant city departments, national government agencies and existing studies and reports, and supplemented by open-source data. Information was extracted using geographic information systems techniques and converted to align with the required content and format of the exposure databases. These "vertical" datasets were initially developed at a building-footprint level and then aggregated up to the barangay level for use in the analyses. Quality assurance and validation processes were carried out, including consultations with city officials and stakeholders, cross-referencing of collated data with open source data, as well as aerial and satellite imagery.

Source: Asian Development Bank.

In order to assess the risk from typhoon and earthquake events to the 10 cities participating in the design of PCDIP, a bespoke exposure database was developed for each city (Box 3).[8]

4. **Assessing asset vulnerability to experienced hazard levels.** Vulnerability is the relationship between hazard (e.g. wind speed) and damage (e.g. 30% damage to a building structure). The vulnerability of an asset is dependent on its physical characteristics, such as building material and height, and can vary by natural hazard: for example, a building could be more vulnerable to typhoons than to earthquakes. The models store vulnerability information for thousands of asset types. During the modeling process, the models select the vulnerability information appropriate for each of the assets contained in the exposure database used for the modeling and use this information to calculate the level of damage caused by each simulated event for all assets impacted by the event.

5. **Calculating financial loss.** In the final step, the level of damage that a simulated event of a particular intensity causes to an asset is converted into a financial loss, based on the total value of the asset. For example, if a 30% damage level is calculated for an asset with a value of ₱1,000, the resulting financial loss is ₱300. For each simulated event, losses are then aggregated across all assets included in the analysis. Finally, different levels of losses are assigned different likelihoods or probabilities. For a given level of loss, its likelihood (often expressed as a return period, Box 4) depends on how many simulated events reach this level of loss. Typically, larger, more severe events have a lower likelihood than smaller, less severe events.

For the purpose of designing PCDIP, a final stage in the disaster risk modeling work was required to adjust the post-disaster cost data to reflect the early recovery costs faced by local government.

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8 Assets were broken down into the following occupancy types: single family res/duplex, multi-family residential, light commercial, commercial, office buildings and hotels, industrial, institutional – government, institutional – education primary and secondary, institutional – education tertiary, institutional – health, institutional – religious, institutional – emergency response services, leisure and sports, informal settlements, and agriculture. Data on "horizontal" infrastructure such as roads, bridges, or drainage systems was not collected. Data from the Disaster Risk and Exposure Assessment for Mitigation program (a program of the Department of Science and Technology being implemented by the University of the Philippines), the National Mapping and Resource Information Authority, and the Philippine Institute of Volcanology and Seismology were included.

Box 4 : The Concept of Return Periods: Measuring the Likelihood of Disaster Risk

The likelihood with which different level of loss can be expected to occur is frequently measured using the concept of return periods. A loss with a return period of 100 years, for example, can be expected to be exceeded once every 100 years, on average. Conversely, the likelihood of exceeding this loss level within any given year is 1-in-100 or 1%. This 1% probability is commonly called occurrence exceedance probability (OEP) and describes the probability with which an event with a loss above a pre-defined threshold can be expected to occur in any given year, on average.

This concept of a loss amount at a given return period (or OEP) is sometimes also referred to as "probable maximum loss" (PML), with a subscript denoting the return period for that loss (for example, the expected loss at 1-in-100-year return period would be denoted PML_{100}).

Source: Asian Development Bank.

Estimating Post-Disaster Financing Needs to be Met by PCDIP

In quantifying losses as a basis for designing PCDIP, it was finally necessary to determine the post-disaster financing needs that the pool would be designed to address. Cities in the Philippines face a range of post-disaster financing needs including for:

- Disaster relief activities
- Early recovery activities
- Support for the recovery of livelihoods and reconstruction of homes
- Reconstruction of city-owned buildings and infrastructure, and
- Compensation for losses in city revenue

A parallel review of post-disaster financing resources that was also undertaken to inform the design of PCDIP (Section 3) identified a clear need for an additional financing instrument to meet near-term liquidity for early recovery activities in the weeks and months after an event in a timely and efficient manner. As such, the risk assessment focused on quantifying funding requirements faced by cities for early recovery activities.

Early recovery costs for the cities were estimated as a percentage of the modeled physical damage. This approach is based on the key assumption that the more severe and widespread the damage to physical assets, the greater the costs of early recovery. Previous research associated with other sovereign and sub-sovereign pools has estimated the typical cost of early recovery to be 15%-25% of the physical asset damage, depending on the natural hazard and existing disaster risk management mechanisms. Prior applications within the Philippines have used a factor of 16% for earthquake events, and 23% for typhoon events.[9] For consistency, these same factors have been used to estimate the short-term liquidity needed to address early recovery costs in this project.

[9] Government of the Philippines, Department of the Interior and Local Government and Department of Budget and Management. 2017. Updated Guidelines on the Appropriation and Utilization of the Twenty Percent (20%) of the Annual Internal Revenue Allotment (IRA) for Development Projects. Joint Memorandum Circular No. 2017-1. June 30, 2017. Manila.

However, it is important to note that the relationship between physical damage and early recovery costs is inherently uncertain and can vary significantly across different geographies and individual events affecting the same location. The proportion is also heavily reliant upon the speed with which these funds are delivered, with delayed disbursement typically leading to higher costs. As such, the aforementioned factors of 16% and 23% are not intended to provide a precise quantification of early recovery costs. Instead, they are intended to provide a realistic estimate of the order of magnitude of early recovery costs that cities can expect to incur in the aftermath of an earthquake or typhoon.

City-level risk profiles

Disaster risk profiles were developed for the following natural hazards for each of the 10 cities participating in the design of PCDIP:

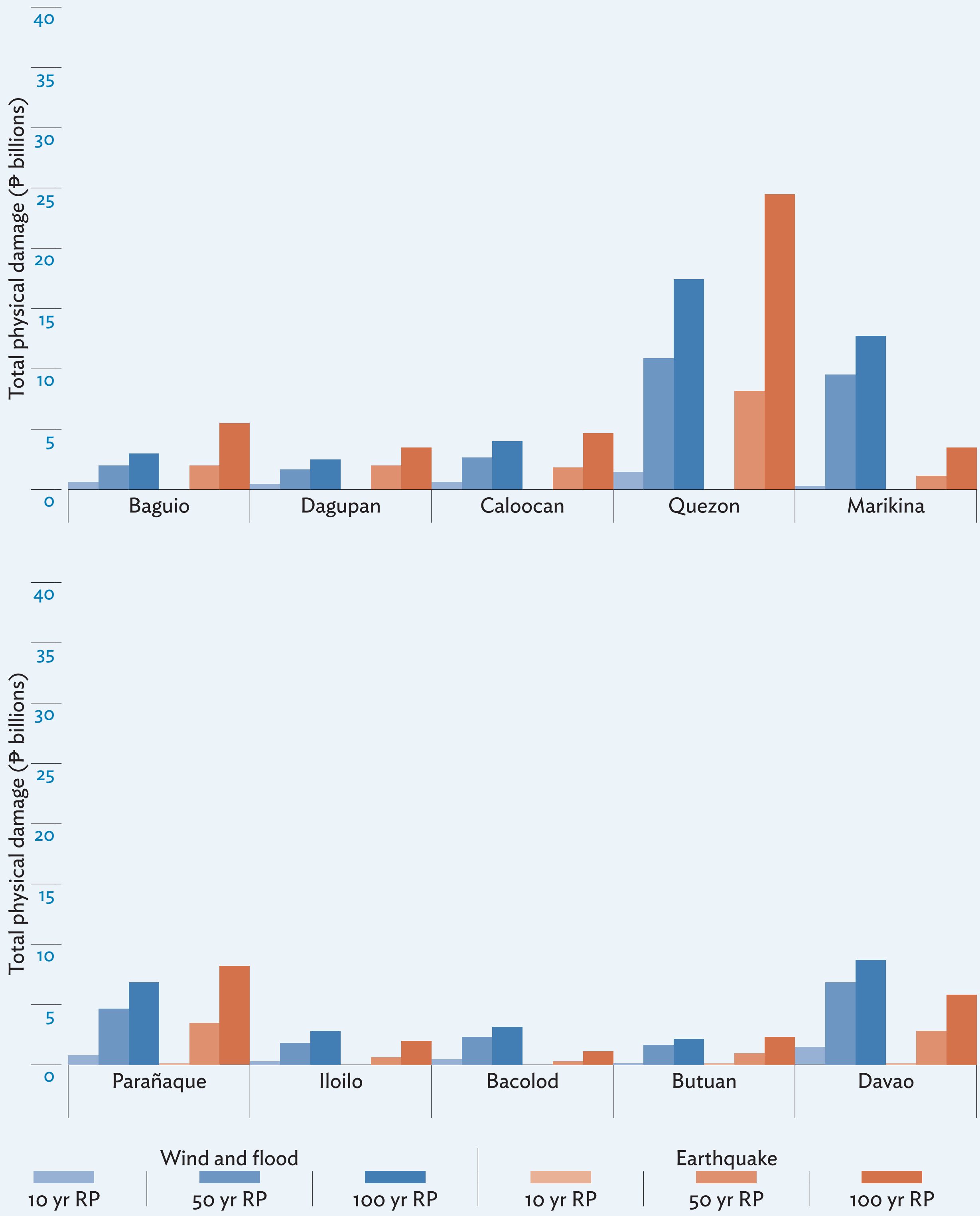
- "Earthquake" modeled losses, estimating the impact of earthquake ground shaking, landslide, and liquefaction.
- "Typhoon (wind)" modeled losses, estimating the impact of extreme winds during typhoons, without considering any additional damage caused by rainfall-induced flooding or coastal storm surge during typhoon events.
- "Typhoon (flood+surge)" modeled losses, estimating the impact of rainfall-induced flooding and coastal storm surge during typhoon events.
- "Combined" modeled losses, estimating the impact of all of the above hazards, i.e. earthquake, typhoon (wind) and typhoon (flood+surge).

Expected losses from physical asset damage across each city are summarized in Figure 4, which indicate the expected physical asset damage for each city in the event of 1-in-10, 1-in-50, and 1-in-100 year earthquakes and typhoons (wind+flood+surge). Both typhoon and earthquake risk vary significantly across the Philippines. Unsurprisingly, therefore, each city has a different risk profile and earthquakes pose a greater risk to some cities while typhoons pose a greater risk to others.

It should be noted that the expected losses shown in Figure 4 reflect the total physical asset damage across all (public and private) assets within a city, as captured in the exposure databases developed under the project. In practice, city governments would be expected to only fund a moderate share of the costs arising from damages to these assets, most notably the costs of repairing or reconstructing assets which are owned by the cities themselves. However, the total physical asset damage across a city can be used to estimate the scale of funding required for early recovery efforts, as described above.

Figures 5 show these estimated early recovery costs for 1-in-10, 1-in-50, and 1-in-100 year events. In these figures, estimated costs from earthquakes and typhoons have been combined to show the total estimated early recovery costs for each city across these 2 hazards.

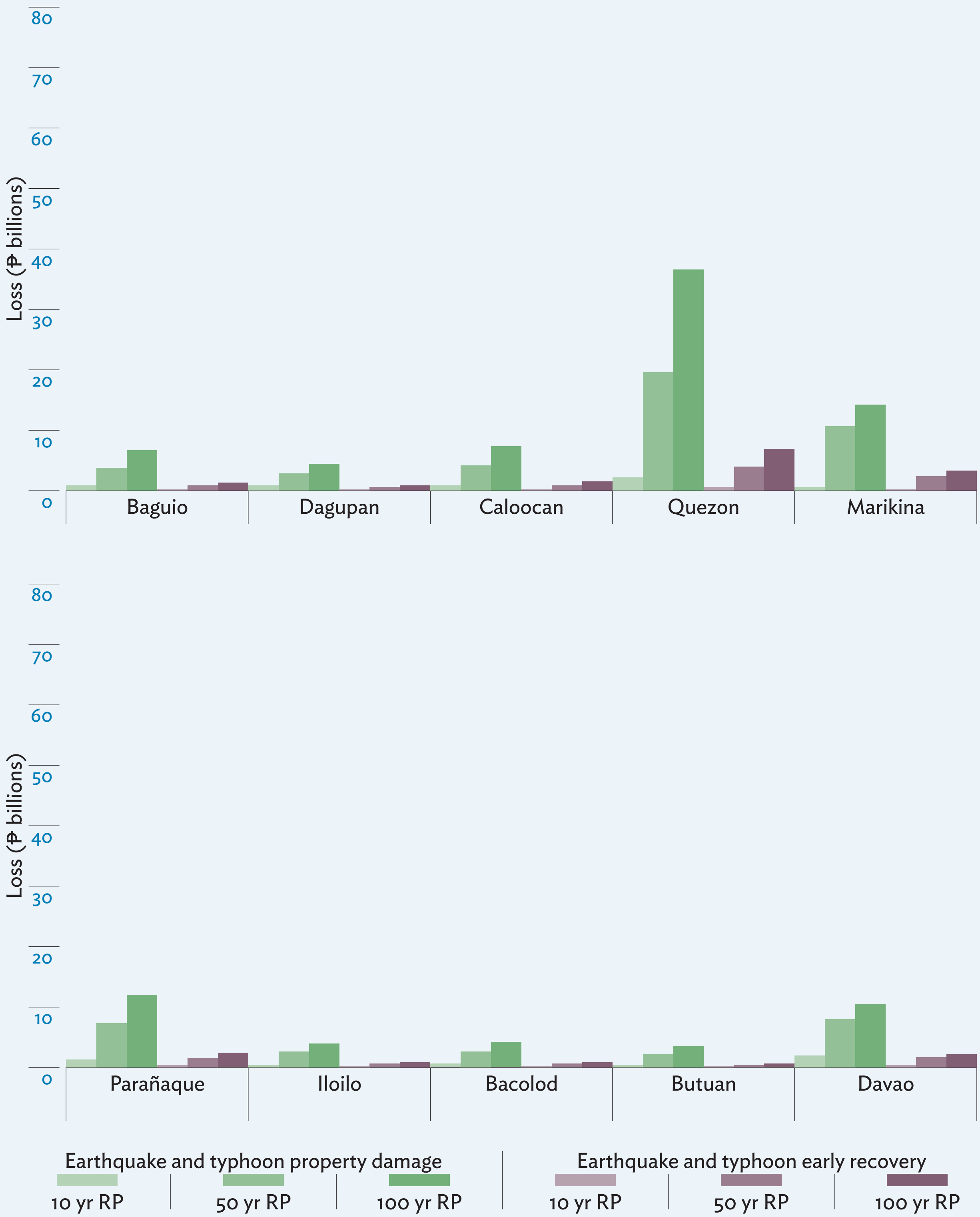
Figure 4 : Modeled Physical Asset Damage by Hazard and City at the 10-Year, 50-Year, and 100-Year Return Period



₱ - Philippine peso, RP - Return period.

Source: Asian Development Bank.

Figure 5 : Total Modeled Physical Asset Damage and Early Recovery Costs by City at the 10-Year, 50-Year, and 100-Year Return Period



₱ - Philippine peso, RP - Return period.

Source: Asian Development Bank.

In combination with the review of existing disaster risk financing resources presented in Section 3, these risk profiles can be used to guide cities in choosing the level of additional disaster financing that they might obtain through a PCDIP policy and in allocating such coverage between different natural hazards (Section 4).

It is important to note that the funding need from flood has been assessed as part of the risk analysis and is an important disaster risk financing consideration for many cities in the Philippines. However, flood cover has not built into the initial design of PCDIP due to the limited availability of suitable real-time event parameter data to support flood coverage (Section 4). In particular, further work has to be done to identify a reliable data source for granular, timely information on flood and precipitation levels during a flood event. It is expected that flood cover will also be offered once existing data and modeling limitations have been addressed.

3| EXISTING CITY GOVERNMENT POST-DISASTER FINANCING ARRANGEMENTS, AND NEEDS

City governments in the Philippines use a range of instruments to finance post-disaster relief, early recovery, and reconstruction activities. These instruments and the supporting institutional framework are outlined in this chapter and outstanding city financing needs identified, focusing on levels of financing required for early recovery.

Overview of existing instruments and actors

Existing disaster risk financing instruments available to city governments in the Philippines involve a mixture of arrangements put in place in anticipation of potential disaster events (sometimes referred to as ex ante instruments) and sources of financing turned to after an event (sometimes referred to as ex post instruments). These are summarized in Figure 6.

Use of disaster risk financing by city government

Local Ex Ante Instruments – Before the Event

The Local Disaster Risk Reduction and Management Fund (LDRRMF) is the principal source of funding for all types of disaster-related spending under city government control. LDRRMFs were established by the Philippine Disaster Risk Reduction and Management Act of 2010. Each city is mandated to allocate no less than 5% of the estimated revenue from regular sources to be allocated as follows:

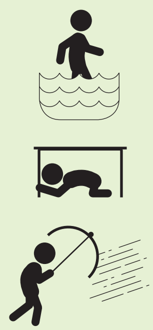
- **Quick Response Fund (QRF).** 30% of the annual LDRRMF should be allocated to the QRF for post-disaster financial liquidity. Resources from the QRF are available upon the declaration of a state of calamity at a local (city or higher) or national level by the relevant body.
- **Mitigation Fund.** 70% of the annual LDRRMF should be allocated to the mitigation fund for use in disaster prevention, mitigation, preparedness, response, rehabilitation, and recovery projects identified in a city's local disaster risk reduction and management plan and integrated in its annual investment program.
- **Special Trust Fund (STF).** unspent balances of the LDRRMF at the end of a budget year accrue to a special trust fund for use within 5 years for the sole purpose of disaster risk reduction and management activities of the Local Disaster Risk Reduction and Management Council (LDRRMC). Any amount not utilized within 5 years reverts to the city's general fund for social services purposes.

The LDRRMF is governed by the LDRRMC and administered by the Local Disaster Risk Reduction and Management Office. The LDRRMC guides the city's disaster risk management actions and is responsible for reviewing and planning for expenditure at the local level as well as for declaring local states of calamity.

Government Service Insurance System (GSIS) is a government-owned and controlled insurance provider. Cities are required by law to insure their assets against "fire, earthquake, storm, or other casualty" with GSIS. As of March 2017, 88% of all cities were insured with GSIS.[10] Premiums for GSIS insurance are

[10] Government of the Philippines, General Service Insurance System. 2017. *Presentation on Traditional Fire Insurance with Catastrophe Cover and Parametric Insurance.* Manila.

Figure 6 : Overview of Local and National Disaster Risk Financing Strategy

		National government DRF		Local government DRF
Actors		**NDRRMC** leads national DRF strategy and wider DRRM activities **OCD** implementation arm of NDRRMC, primarily coordinates DRRM actors **OP** approves finance and, in severe events, establishes new actors **DoF** strategic oversight of DRF strategy **NEDA** coordinates reconstruction activities **GSIS** government owned insurance corporation		**LDRRMC** strategic body that plans DRF strategy at the local level **LDRRMO** implementation arm of LDRRMC **RDRRMC** coordinates local DRF strategies of LDRRMCs
Instruments	Ex ante	**NDRRMC** national fund **Insurance** indemnity based through GSIS as well as parametric (PPIP) **Catastrophic swap** to reinsure parametric insurance scheme **Contingent scheme** from World Bank	2010 National Disaster Risk Reduction Management Act allows LGUs access to resources from NDDRMF. Allocations depend on relative financing need of an LGU	**LDRRMC** local fund **DRF** annual allocation for post-disaster relief **QRF special trust fund** unexpended LDRRMF allocation **Municipal Development Fund** local fund for long-term development projects **Insurance** indemnity based through GSIS as well as parametric (PPIP) **NDRRMC** national fund
	Ex post	**Budget allocation** **Tax increases** for infrastructure users/business **Deficit financing** **International assistance** from international donors		**LGU transfer** between LDRRMCs **Tax increases** for infrastructure users/business **Deficit financing** **International assistance** from international donors

DoF - Department of Finance, DRF - disaster risk financing, DRRM - Disaster Risk Reduction Management, GSIS - Government Service Insurance System, LDRRMC - Local Disaster Risk Reduction and Management Council, LDRRMF - Local Disaster Risk Reduction and Management Fund, LDRRMO - Local Disaster Risk Reduction and Management Office, LGU - Local government unit, NDRRMC - National Disaster Risk Reduction and Management Council, NDRRMF - National Disaster Risk Reduction Management Fund, NEDA - National Economic and Development Authority, OCD - Office of Civil Defense, OP - Office of the President, PPIP - Provincial Parametric Insurance Program, QRF - Quick Response Fund, RDRRMC - Regional Disaster Risk Reduction and Management Council.

Source: Asian Development Bank.

funded by each city's general services department (from their annual investment plan) and payouts are received on an indemnity basis to match the monetary value of damage to insured assets.

Local Ex Post Instruments – After the Event

Cities can turn to several potential sources of financing in the aftermath of a disaster to provide additional resources for the relief, early recovery and reconstruction:

- **Budget reallocations.** Cities can reallocate funding from other budget lines to meet post-disaster needs within as little as a few weeks of an event, with in-kind reallocations of human resources and heavy equipment happening near immediately. However, the magnitude of funding available from budget reallocations is limited by prior commitments. As set out below, probable reductions in city government tax revenues after a disaster and city borrowing limits further constrain the likely scope for budget reallocations and make it an uncertain source of financing. One potentially significant source of budgetary reallocations is the development fund, toward which cities are required to allocate at least 20% of their annual internal revenue allotment. Although it is not intended as a disaster risk financing instrument, cities can consider drawing upon the development fund following a disaster should the LDRRMF prove inadequate. However, the process of reprioritizing development fund resources toward post-disaster spending can take a number of months.

- **Taxation.** Cities can raise taxes on real estate and local businesses and/or increase fees to service users following a disaster. In practice, though, these options have never apparently been pursued in the Philippines in the aftermath of a disaster and, instead, discretionary tax cuts have sometimes been offered to stimulate economic recovery. For example, Marikina City reduced real estate taxes by 50% for 5 years following Typhoon Ondoy in 2009.

- **Deficit financing.** Cities can borrow from private banks and national government as well as potentially international development partners following a disaster, subject to borrowing constraints set by the Department of Finance. Cities estimate the whole process from commencement of application to receipt of funds takes approximately 6 months.

- **City transfers:** LDRRMCs can transfer QRF funds to disaster-affected cities upon approval of their Sanggunian.[11] Cities with stronger financing capacity have been known to make such transfers to disaster-affected cities. Richer cities do not expect to be recipients of such funding though.[12]

- **Drawdown of general reserves.** Some cities (e.g., Quezon City) maintain general reserves that, while not specifically intended as sources of post-disaster financing, may be used for this purpose.

- **National Disaster Risk Reduction Management Fund (NDRRMF) transfers.** Cities can access the NDRRMF's mitigation fund for recovery and reconstruction projects upon approval by the Office of the President. To be eligible, cities must have exhausted their internal resources and have requests reviewed and endorsed by the Office of Civil Defense and National Disaster Risk Reduction Management Council. This process has been known to take between a few months to years. Cities may also access support funded through the NDRRMF's quick response fund, which can be deployed rapidly but mostly takes the form of in-kind support rather than cash transfers. In

[11] Legislatures of city governments with legislative and quasi-judicial powers.
[12] World Bank. 2017. *Philippines: Lessons learned from Yolanda*. Washington, DC.

general, national funding is limited and prioritizes lower-class LGUs as well as humanitarian relief, rather than early recovery needs.

- **International assistance.** Cities can access ad hoc funding from international development partners (channeled via the national government) and nongovernment organizations (NGOs). Although uncertain, funding from donors and NGOs can be made available rapidly for the relief phase.

Table 1 provides a summary assessment of these instruments highlighting the key characteristics of speed, certainty, and level of financing. It is based on a review of published literature, survey responses from the 10 cities participating in the design of PCDIP and interviews with officials from local and national governments. There is some variation between the availability of different instruments between the cities, reflecting differences in administrative systems, and cities' available capacity to use deficit financing within their borrowing limits.

Table 1 : Assessment of Instruments

Instrument	Spending authority	Speed of disbursement	Certainty of availability	Level of Financing
Stockpiles of relief goods	City	Immediate	High	Varies between cities
City Quick Response Fund	City	Immediate	High	1.5% city budget per year, accumulated for up to five years
Budget reallocation	City	1–2 weeks for an emergency reallocation; months for longer term reallocations	Medium	Limited by costs to other services of reallocation
National Quick Response Fund	National government agencies	Weeks	Low	Shared with low-income cities
Development partner (including nongovernmental organizations)	Development partner	Days for humanitarian support; months for other disaster risk financing	Low	Indeterminate
Government Service Insurance System	City	>6 months	High	As per insurance contract
National Disaster Risk Reduction and Management Fund – other	Office of Civil Defense	>7 months	Medium	Shared with other local governments needing long-term support
Borrowing	City	>9 months	High	Limited to 20% of budget

Source: Asian Development Bank.

Together, the above ex ante and ex post instruments provide some financing disaster relief, early recovery and reconstruction efforts at the city level. However, challenges remain, in particular with respect to the timely availability of financing to support critical early recovery efforts.

While city governments recognize the need to allocate budgetary resources for disaster relief, early recovery and reconstruction prior to a disaster, they also lack the technical basis to determine appropriate allocations. The development of technical capacity and tools to quantify likely post-disaster expenditure needs would enable city governments to enhance their financial planning for disasters and ensure that their associated budgets, in particular their LDRRMFs, are sufficient.

Funding needs at the city level

PCDIP seeks to help meet outstanding rapid funding needs faced by cities during the relief and early recovery phases following earthquakes and typhoons which are not covered by existing local resources. For the purpose of designing this pool, these needs were estimated as the total cost of relief and early recovery plus estimated losses in property tax revenues as a consequence of disasters less the rapid financing available to cities (Figure 7). Available rapid financing was assumed to comprise of the annual QRF, the current balance in the STF, and a 10% reallocation of the city's overall budget. Based on discussions with the cities, a 10% budget reallocation is considered the maximum level that could be easily achieved and is approximately equal in size to each city's development fund.[13]

Figure 7 : Definition of City Funding Need

Source: Asian Development Bank.

This definition of funding needs excludes long-term reconstruction costs, which are expected to be met through other mechanisms such as GSIS insurance cover, post-disaster budget reallocations and support from national government. The funding needs according to this definition were estimated for the 10 cities participating in the design of PCDIP. The analysis indicated that the cities face significant funding needs following major disasters, even allowing for emergency reallocation of funding from other budget lines:

[13] Cities are obliged to allocate at least 20% of their annual Internal Revenue Allotment to the development fund. For the 10 cities that are participating in the initial design of PCDIP, the development fund amounts to around 10% of city revenue (from internal revenue allotment and local sources, e.g., revenues from real property and business taxes).

Earthquake funding needs

- For the 10 cities combined, the sum of their 1-in-50 year loss (i.e., the total combined loss occurring with a 2% probability of occurrence each year) would exceed ₱15 billion.
- For the 10 cities combined, the sum of their 1-in-150 year loss (i.e., with a 0.67% probability of occurrence each year) would exceed ₱50 billion.
- There is significant variation in funding need relative to total city budget across the cities. A 1-in-100 earthquake loss (i.e., with a 1% chance of occurrence each year) would be equivalent to an estimated 130% of the city's annual budget for Dagupan, but only 17% for Bacolod.
- There is also significant variation in the impact on cities' tax receipts, with Quezon City seeing a reduction of 5% from a 1-in-100 earthquake event compared to 20% for Butuan and Dagupan.

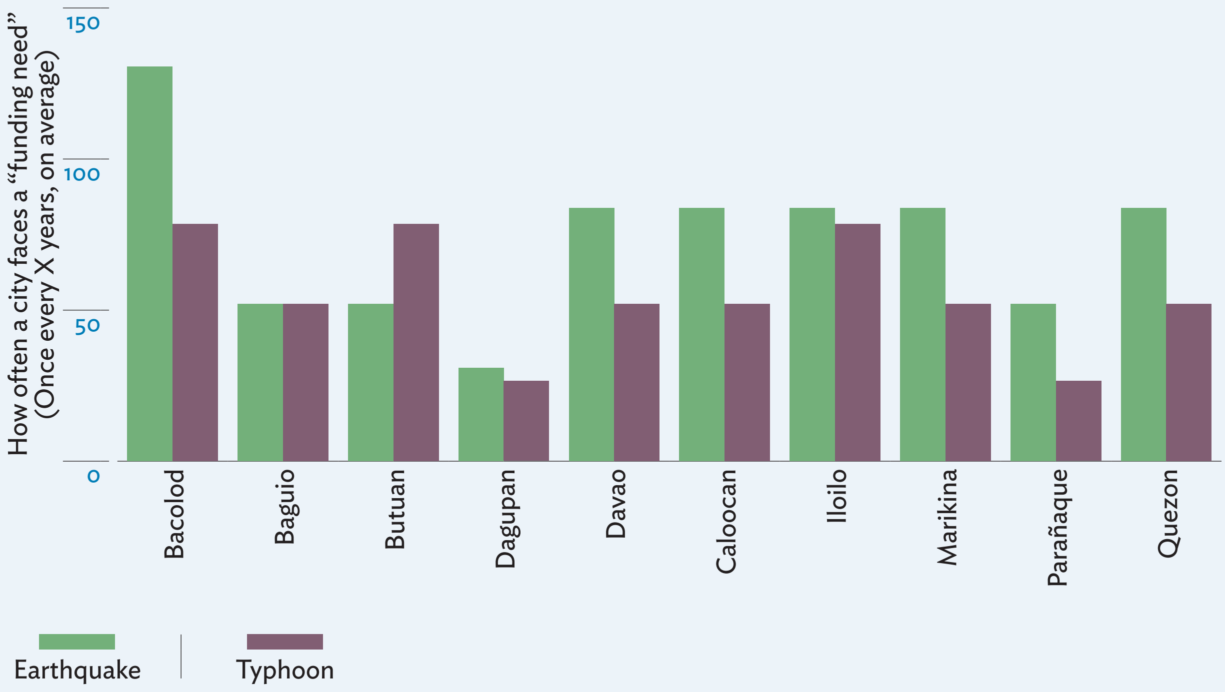
Typhoon funding needs

- For the 10 cities combined, the sum of their 1-in-10 year loss would exceed ₱2 billion.
- For the 10 cities combined, the sum of their 1-in-100 year loss would exceed ₱35 billion.
- Again, there is significant variation in impact between cities. A 1-in-50 typhoon loss (i.e., with a 2% chance of occurrence each year) would be equivalent to an estimated 68% of the city's annual budget for Baguio, but only 13% for Butuan.
- Similarly, Quezon City would experience a 1% reduction in tax receipts from a 1-in-50 typhoon event, but Dagupan City would experience a 6% reduction.

The frequency with which each of the 10 cities would experience a funding need is further indicated in Figure 8. For earthquake, Dagupan, Paranaque, Butuan, and Baguio cities have the largest relative funding needs with available rapid funding exhausted as a result of a 1-in-30 to 1-in-50 year earthquake event. For typhoon, Dagupan and Paranaque have the highest relative funding needs, with available rapid funding exhausted as a consequence of a 1-in-25 typhoon event.

The review of existing disaster risk financing arrangements reveals an opportunity to address post-disaster financing needs through a parametric disaster insurance pool. Current city arrangements provide funding to meet immediate relief needs, with national arrangements, GSIS and NDRRMF, providing funds in the later reconstruction phases. Funding sources for the early recovery phase are less clear, with an absence of assured, timely funding acting as a barrier for detailed planning. A parametric disaster insurance pool like PCDIP would pay out rapidly after an event triggers and thus ensure this funding is in place during the early recovery phase.

Figure 8 : Cities' Funding Needs for Earthquake and Typhoon



Source: Asian Development Bank.

4| POOL STRUCTURING

The design of an insurance pool must be tailored to meet its specific purpose. PCDIP is intended to address an identified need for rapid availability of financing to support early recovery activities in the weeks and months immediately after a disaster (Section 3). As outlined in this section, this purpose was reflected in the selection of the form of insurance that PCDIP would offer, in this case parametric insurance, and the specific trigger design proposed to determine when payouts will be made. An appropriate legal and administrative structure is also outlined to ensure the smooth and sustainable running of the pool.

Selection of the form of insurance

Disaster insurance can generally provide coverage in 2 different forms – on an indemnity or a parametric basis:

- **Indemnity insurance.** Traditional insurance contracts are contracts of indemnity. Indemnity insurance provides payouts (compensation) in accordance with the actual losses suffered by a policyholder. If an item is damaged by one of the types of natural hazard covered by its insurance policy, the damage is assessed by a loss adjustor and the policyholder then receives funds, known as a payout, to repair or replace the damaged item. The greater the damage, the higher the payout. In the Philippines context, a typical example of indemnity insurance is the cover GSIS offers for government assets, including city-owned property. For insurers to be able to offer indemnity insurance, the intended policyholder must share detailed information on the assets covered under the policy in order to enable the insurer to assess and price the risk to those assets. As the damage assessment process for an indemnity policy can be complex, it can potentially take many weeks, and in some cases many years, for the policyholder to receive a payout. Once the payout is received, it can typically only be used to repair or replace the specific assets insured under the insurance policy and cannot be "diverted" to support other post-disaster needs.

- **Parametric insurance.** Payouts under parametric insurance are determined based on the physical features of the natural hazard event experienced (e.g., wind speed or earthquake magnitude) rather than actual losses suffered by a policyholder. The physical features that will trigger a payout are pre-agreed, for instance, the occurrence of an earthquake in a particular location and exceeding a particular level of intensity. As no loss adjustment is required, payouts can be made very quickly, and the basis for determining the level of payout is extremely transparent. Payouts can also generally be used for any purpose and are not tied to the restoration of a specific, named asset. However, these benefits have to be weighed up against so-called "basis-risk," which is the difference between the actual loss experienced by a policyholder and the payouts received. For example, a parametric earthquake cover could be defined to trigger if an earthquake of given magnitude occurs within a given distance from a city. However, there is a possibility that an earthquake which meets these criteria (and therefore triggers a payout) does not cause significant loss in that city. Conversely, a different earthquake which fails to meet the magnitude or distance criteria could cause notable losses to the city but would not result in a payout. Basis risk can be minimized by a carefully designed parametric trigger design and a well-structured implementation.

Indemnity and parametric insurance products can both be secured as part of a comprehensive disaster risk financing strategy. Parametric insurance cover can provide rapid liquidity to support early recovery efforts immediately after an event. Indemnity insurance cover can fund medium- and long-term reconstruction.

PCDIP is intended to address the need to strengthen the rapid availability of financing to support early recovery activities in the weeks and months immediately after an event (Section 3). Parametric insurance was therefore selected as the form of insurance which would be offered by PCDIP.

Overview and validation of proposed trigger structure

Application of parametric insurance requires the development of a trigger structure to determine when payouts will be made. This structure is based on the physical hazard parameters of an event, as already noted. The development of a trigger structure typically addresses common key elements of a parametric insurance coverage, as described below in the context of PCDIP.

Which events are covered?

The initial design of PCDIP proposes parametric insurance coverage for earthquake and typhoon events. While flooding is a key driver of damage and financial loss in the Philippines, insurance cover will not be offered through PCDIP in the first few years of operation due to the lack of immediately available flood data from which to construct a robust parametric trigger. It is intended to add flood cover at a future stage.

What physical parameters of an event are used to determine payouts?

The proposed trigger structure uses spectral acceleration (a measurement of ground motion), to determine PCDIP payouts from earthquakes and 3-second peak gust (a measurement of wind speed), to determine PCDIP payouts from typhoons. Both hazard parameters have a strong correlation with the physical damage caused by the respective events: the higher the level of spectral acceleration or 3-second peak gusts during an earthquake or typhoon event, the generally higher the level of physical damage.

How is information on the physical parameters of an event obtained after an event?

Following an event, reliable data on the selected event characteristics—spectral acceleration for earthquakes, and 3-second peak gusts for typhoons—will be collected from an appropriate data source. This data source has to be an independent, reputable data provider which reports the required data in a consistent and timely manner and, in the context of PCDIP, across the Philippines. These criteria were used to review the suitability of event parameter data published by various agencies for the Philippines to support PCDIP parametric triggers. The United States Geological Survey (USGS) and Japan Meteorological Agency (JMA) were selected as reporting agencies for earthquake and typhoon respectively.

USGS is the only provider of real-time ground motion data in the Philippines and provides detailed spectral acceleration data within hours following an earthquake. This made it a natural choice for the proposed parametric index trigger.

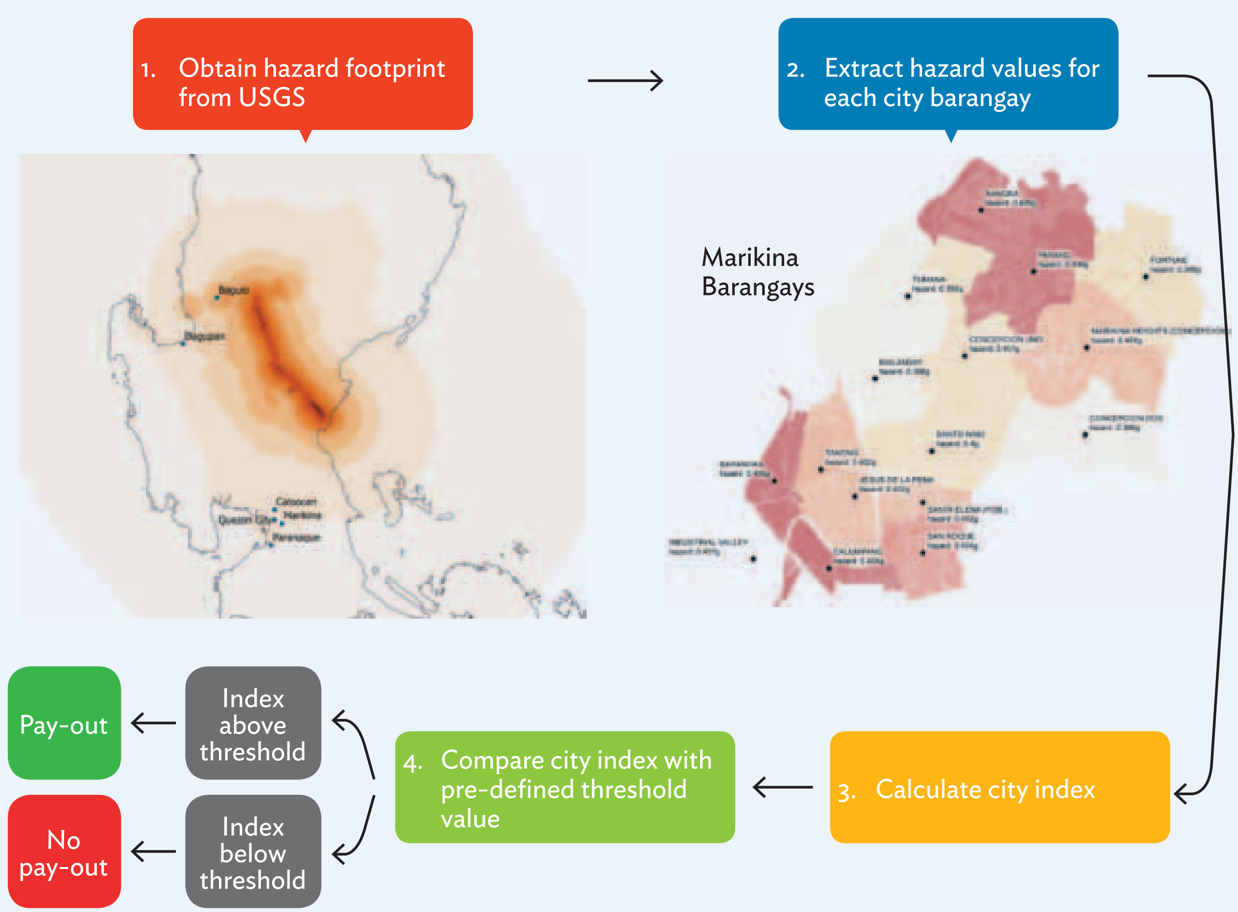
JMA reports real-time typhoon track data, including location, speed, central pressure, size, and direction of a storm on a 6-hourly basis. It does not directly report 3-second peak gust values; however, these peak gust values can be derived based on the storm data reported by JMA and well-established and validated windfield modeling techniques. Specifically for PCDIP, the RMS windfield model will be used to convert JMA storm data into 3-second peak gust values based on these techniques.

There are many precedents for the use of both USGS and JMA data products within the international reinsurance markets and this is expected to help ensure efficient and cost-effective endorsement of the PCDIP earthquake and typhoon triggers by these markets.

How are physical parameters converted into financial payouts?

When an earthquake or typhoon impacts the Philippines, the applicable physical event parameters (spectral acceleration for earthquakes, and 3-second peak gusts for typhoons) will be obtained from USGS or JMA for each barangay in the affected cities and weighted by the share of the relevant city's assets in each barangay. These barangay-level parameters will be used to calculate an average ground shaking or wind speed index for each city impacted by the event (Figure 9). This average is typically referred to as the city's "index value." It is calculated by an independent advisor, the so-called "calculation agent" of the insurance policy.

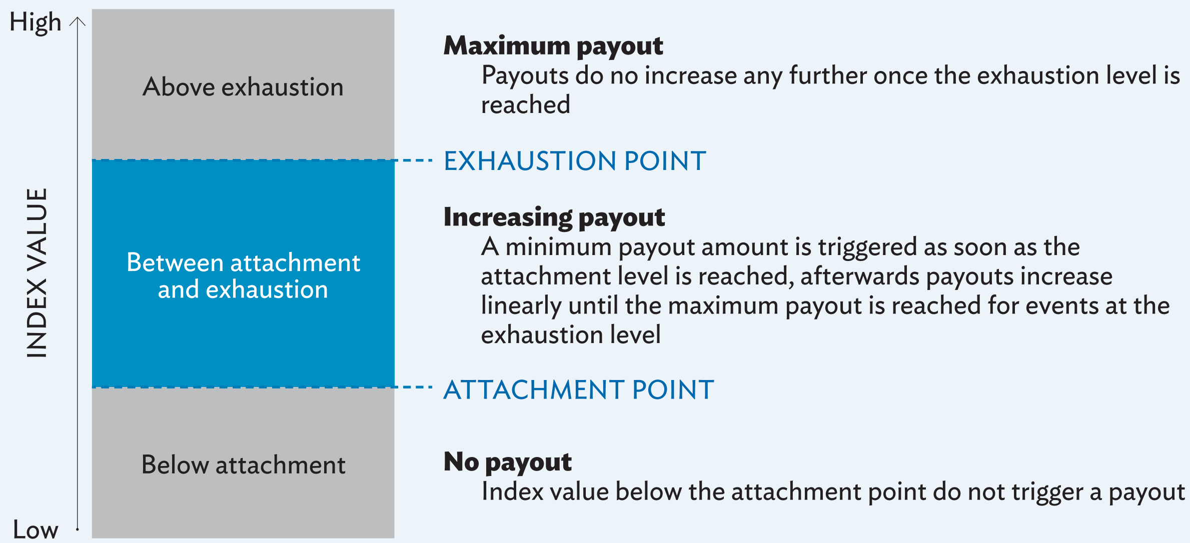
Figure 9: Proposed Parametric Payout Calculation Process for Earthquakes



USGS - United States Geological Survey.
Source: Asian Development Bank.

The level of payout will be determined by comparing the index value for an event to 2 pre-defined index thresholds which are specified in the insurance policy for each city and natural hazard – a lower bound (the so-called attachment point) and an upper bound (the so-called exhaustion point) (Figure 10).

Figure 10 : Payout Levels Based on a Parametric Index



Source: Asian Development Bank.

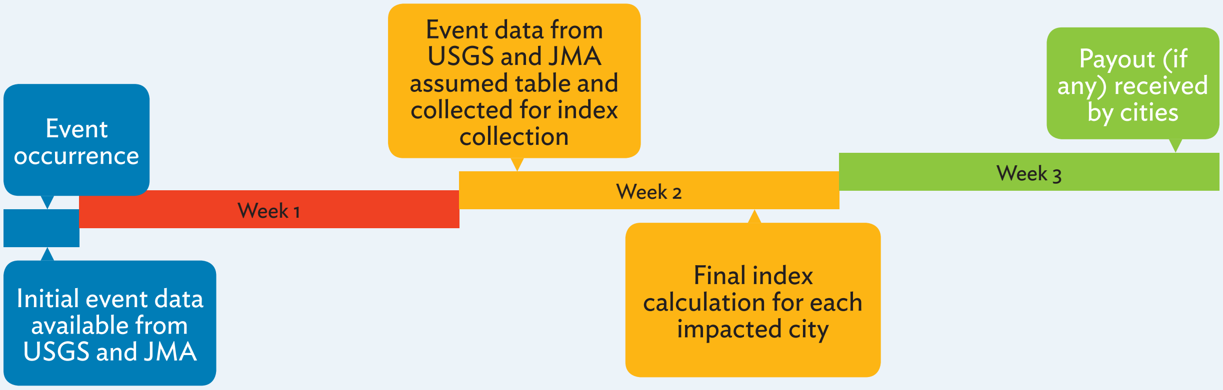
- If the index value for an event is above the attachment point specified for the city and relevant natural hazard, the city will receive a minimum payout.[14]
- If the index value for an event reaches the applicable exhaustion point, the city will receive its maximum payout.
- For an index value between the applicable attachment and exhaustion point, the payout will increase linearly between minimum and maximum payout: the higher the index value, the higher the payout the city receives.

How quickly are payouts disbursed?

Importantly, the parametric insurance trigger structure described above enables cities to receive payouts within a few weeks of a disaster occurring, as no explicit loss adjustment process is required. For PCDIP, payouts will be available to the cities within 15 business days of an event. This time frame incorporates appropriate time to allow for data gathered from USGS or JMA, as relevant, to settle upon a stable view of the level of ground shaking or wind speed, respectively, generated by the event, and for the completion of data processing required to calculate the "index values" of ground shaking or wind speed for each city (Figure 11).

[14] The minimum and maximum payout amounts can be selected by each city. See Section 5 for further details.

Figure 11 : Post-Event Time line



JMA - Japan Meteorological Agency, USGS - United States Geological Survey
Source: Asian Development Bank.

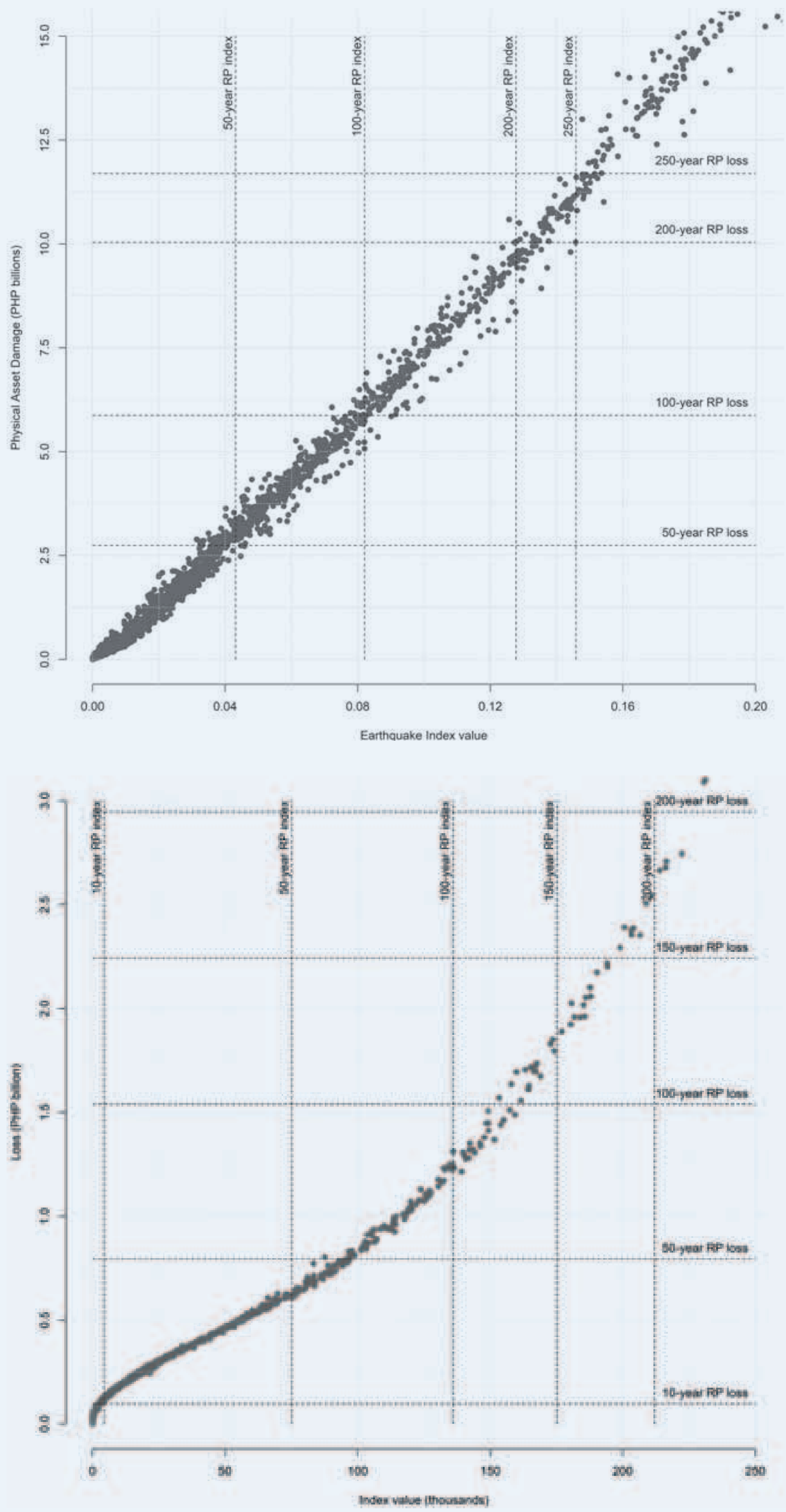
Proposed parametric index

- Once the key criteria described above are defined, the resulting trigger structure has to be extensively tested to ensure that it is likely to result in payouts when they are needed. As a parametric insurance policy does not rely on an explicit loss adjustment process to determine the actual amount of damage caused by an event, there is a chance that the insurance pays out even though no severe loss is suffered, or, conversely, that no payout is received despite suffering large losses. These instances of "basis risk" (Section 4) have to be minimized in order to make the insurance coverage an effective disaster risk financing instrument, providing funding as intended when required.

- The proposed parametric index structures for earthquake and typhoon have been designed using the RMS Southeast Asia Earthquake Model and the RMS Philippines Typhoon Model to ensure that levels of basis risk are acceptable. Example results of this assessment are shown for the earthquake trigger (Davao City) and for the typhoon wind trigger (Bacolod City) in Figure 12. Each point in the figures represents the modeled index value and modeled total physical asset damage derived for a specific event. The close correlation between modeled index and loss suggests that the index is a good proxy for gauging physical damage, and therefore early recovery costs after an event.[15] Payouts from an insurance policy based on this parametric index are therefore expected to correlate well with the early recovery costs faced by cities. Similarly, high levels of correlations were observed for the other cities participating in the design of PCDIP, indicating acceptable basis risk for the proposed structure.

[15] As described in Section 2, early recovery costs can be estimated as a percentage of physical damage.

Figure 12 : Example Comparisons of Index Value and Modeled Physical Asset Loss for Earthquake (Davao City, top) and Typhoon Wind (Bacolod City, bottom)



Source: Asian Development Bank.

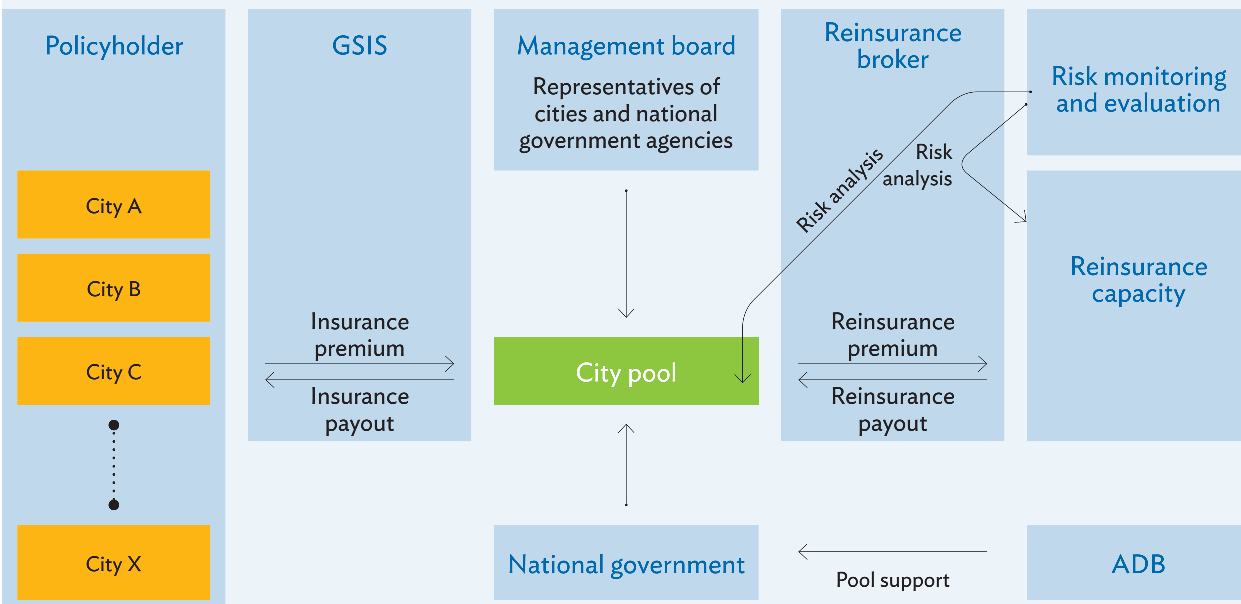
Proposed legal and administrative structure

- In recent years a number of regional catastrophe risk pools have emerged, from the Caribbean to the Pacific islands and Africa. These facilities vary in terms of their risk structure, their payout mechanisms, and their governance and legal framework.

- A legal structure which is widely considered attractive for a risk pool is that of a mutual company: the key idea of a mutual insurance company is that the company is owned by its policyholders and can therefore be run entirely for their benefit, without having to consider external stakeholders or investors. Even though this structure is not legally or practically possible in many countries, legal structures of this nature have been developed for existing risk pools such as the African Risk Capacity (ARC) and CCRIF (formerly known as Caribbean Catastrophe Risk Insurance Facility, see Box 5), which can be used as a template for PCDIP.

- The legal and administrative structure proposed for PCDIP is depicted in Figure 13 subject to any further refinement.

Figure 13 : Proposed Pool Structure



ADB - Asian Development Bank, GSIS - Government Service Insurance System.
Source: Asian Development Bank.

GSIS is mandated by law to provide insurance coverage for city assets and properties in the Philippines. While the PCDIP cover is not property insurance per se, the consensus is that GSIS should have an active role in the pool. GSIS will sponsor the creation of PCDIP as a special purpose vehicle within GSIS. PCDIP assets will be ring-fenced from GSIS's assets.

Insurance cover under the pool will work as follows:

- Risk modeling services will be provided by an external provider and used to set premium levels for individual cities.
- City governments (the policyholders) will buy parametric insurance from GSIS.
- GSIS will pass the premium through to the PCDIP company, which will act as a reinsurer to GSIS.
- GSIS will take a small fee (known as a fronting fee) to perform the service of providing the policies and handling payouts.
- The PCDIP company itself will then reinsure with the domestic and international reinsurance markets. Risk modeling services will be used to determine the level and structure of reinsurance that the company should buy.
- Any payouts from PCDIP will be channeled to cities through GSIS within 15 business days from the date of the disaster. PCDIP itself may receive payouts from its reinsurers in accordance with its reinsurance policies.
- Payouts to cities will be used for the early recovery of public infrastructure, in accordance with guidance provided by the Commission of Audit (COA).

PCDIP will be run by a management board or board of trustees which will be comprised of members representing each stakeholder including participating cities, DoF, GSIS, Insurance Commission, Department of Budget Management, Bureau of Treasury, National Economic and Development Authority, and Department of the Interior and Local Government.

An independent chairperson and a core secretariat consisting of, as a minimum, a chief executive officer and a chief operating officer, plus administrative support is recommended.

The management board will be responsible for appointing the reinsurance broker, risk modeler, calculation agent, investment managers, the scheme administrator, and other outsourced functions such as legal, accounting, and public relations. The management board will set PCDIP policies and strategies, such as reinsurance and investment strategies, together with performance metrics and targets.

The initial pool capital will be provided by the government, which is expected to secure a sovereign loan from ADB for this purpose. Other development partners or national entities may provide additional support to the pool in due course.

For significant disasters, which cause large or multiple payouts by PCDIP to its member cities, reinsurance cover will contribute to the payouts made by PCDIP. The exact size and timing of these reinsurance contributions will depend on the amount and type of reinsurance purchased by PCDIP, as discussed in further detail in Section 5.

In general, payouts from a parametric insurance policy, as offered by PCDIP, can be used for any purpose and in particular are not tied to the restoration of a specific asset. Cities should therefore be able to spend payouts from PCDIP to cover a broad range of uses, ensuring that they are able to use the additional funding where it is needed most. However, clear guidance by COA will be provided on the use of payouts.

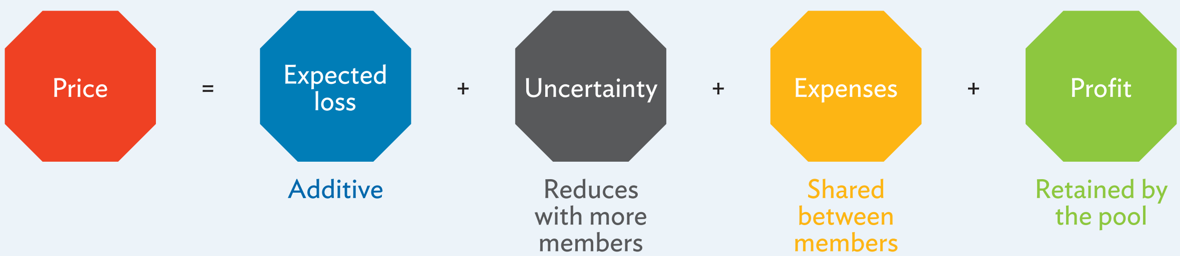
5| PREMIUM PRICING AND AFFORDABILITY

This section discusses the initial proposed pricing for the protection provided by PCDIP, outlining the factors determining the level of insurance premium set for each participating city, and recommending an approach for setting premiums.

Costs incurred by insurance providers

One primary motivation for creating a company to pool city disaster risk is to minimize the cost of insurance coverage to members. As a minimum, if the pool is to be sustainable in the long term, its income must, on average, exceed its costs. The cost of insurance is made up of 4 key cost elements (Figure 14).

Figure 14 : Impact of Risk Pooling on Key Elements of Insurance Pricing



Source: Asian Development Bank.

- **Expected loss cost.** The expected annual payouts that will be made in accordance with the agreed terms and conditions, averaged over a long period of time (thousands of years).
- **Uncertainty.** Fluctuations, or volatility, between years in total pool payouts depending on when and where qualifying disaster events occur. Greater interannual volatility in payouts implies greater uncertainty in the total amount an insurer might have to pay out in any given year. This increases the amount of capital the insurer has to be able to access, which comes at an additional cost for the insurer. These additional costs result in higher premium prices.
- **Expenses.** Costs incurred in the setup of the pool and ongoing administration and management costs such as pool employee salaries, consultant fees and operating costs.
- **Profit.** Returns to shareholders or investors.

The key benefits of pooling arise via the impact of pooling on the latter 3 cost elements. Uncertainty is reduced through insuring a diverse portfolio of different cities which are unlikely to all require a payout at the same time and therefore reduce the volatility of total payouts required from the pool each year; expenses for each city can be reduced by sharing them across all pool members; and any profit made by the pool can be retained to the benefit of the pool members instead of being paid to external stakeholders.[16]

[16] Please refer to Section 6 for further detail on the benefits of risk pools.

Reinsurance considerations

The cost of reinsurance purchased by PCDIP will be a key factor determining the premium prices for its members.

The reinsurance cost will largely be driven by the amount of insurance cover offered by the pool and the amount and type of reinsurance PCDIP decides to purchase.

How much reinsurance protection is required?

The size of a pool's own capital base is a key factor in deciding how much reinsurance it should buy. If the pool is able to fund payouts to its members up to a certain size from its own capital base, it does not require its reinsurance to cover such payouts and is therefore able to reduce its need (and associated costs) for external reinsurance. This is typically referred to as "retaining" the risk of these payouts. In the case of PCDIP, a sovereign loan from ADB is expected to provide the pool with an initial capital base. This will ensure that the pool has sufficient funds to retain some of its risk and is therefore able to reduce its reinsurance needs and costs. Over time, PCDIP might be able to increase its capital base through any profit made by the pool and further decrease its need for external reinsurance.

The amount of reinsurance purchased by a pool also depends upon the level of risk which the pool is willing to accept for losses that exceed the maximum protection provided by its reinsurance coverage, and therefore that also has to be (co-)funded from the pool's own capital, in addition to small to medium losses retained by the pool.

The emerging rule among international insurance regulators is that an insurer should be able to fund payouts (out of its own capital base or reinsurance agreements) up to an amount which can be expected to occur only once every 200 years, on average (the "1-in-200 year return period level"). However, stakeholders in facilities such as PCDIP generally wish to see a higher level of protection.

CCRIF, a similar pool arrangement offering parametric disaster insurance cover for countries in the Caribbean, seeks to be able to withstand a 1-in-1000 year loss, and so buys reinsurance up to roughly a 1-in-700 year return period, the remainder being absorbed by existing capital and grants. A regional parametric insurance pool for countries in the Pacific, the Pacific Catastrophe Risk Insurance Company (PCRIC), buys reinsurance to a similar level. A regional parametric insurance pool for countries in Africa, ARC, buys reinsurance up to roughly the 1-in-500 year return period level as it currently has strong capital reserves to address its liabilities above this level.

Defining where the reinsurance protection for a pool should begin and how much risk should be retained requires an understanding of the pool's risk appetite, and the proportion of premiums that it can afford to spend on reinsurance. Part of the decision also rests on how much of a pool's underlying capital can be exposed to losses, as well as being influenced by how often the pool is expected to pay out. CCRIF, for example, buys its main reinsurance to cover losses to the overall pool (not to an individual pool participant) above around a 1-in-5 year return period level, and funds payouts below this level from its own capital base. PCRIC bought protection above a 1-in-8 year return period level in 2017/18.

What reinsurance would be most appropriate for PCDIP?

Many re/insurers already have at least some exposure to Philippine disaster risk. However, a low reinsurance price can be expected to be achieved through a competitive tender process. Based on the initial modeling conducted for the portfolio of 10 cities participating in the design of PCDIP, the proposed structure assumes that the pool uses its initial capital base to retain losses up to the 1-in-10 year return period level and buys reinsurance to cover larger losses up to at least its 1-in-500 year return period level. Given the current pricing environment in the Philippines, it is estimated that such reinsurance coverage can be purchased by PCDIP at a rate of 1.35 times its annual expected loss cost, in line with the assumed premium price offered by PCDIP to its members. See Section 5 for further details.

PCDIP policy proposal

Policy Pricing

The pricing of insurance coverage offered by PCDIP will be a key factor in determining how much protection cities can afford to purchase from the pool. This pricing will be determined by a number of factors, as outlined above. PCDIP's biggest decision regards its preferred balance between keeping premiums affordable to its members and maintaining the financial viability of the pool company and, thus, its ability to pay claims and continue in business following extremely adverse disaster years. These factors will also determine the amount of reinsurance PCDIP ultimately decides to buy.

Similar to existing disaster risk pools, premiums for member cities of PCDIP will be calculated as a multiple of the expected loss cost, which is the average annual payout amount cities can expect to receive (Section 5). In practice, it is likely that cities will not receive any payouts in some years, and payouts larger than their expected loss cost in other years; however, the expected loss cost defines the payout amount they can expect to receive annually on average over a very long term. Setting premium amounts as a multiple of this loss cost ensures that pricing is based purely upon the level of risk that each city individually brings to the pool, without any cross-subsidization of premiums between participating cities.

Drawing on previous experience of other facilities, the ARC pool has always applied a multiplier over expected loss of 1.35, in other words, premiums have been set at the expected loss multiplied by a factor of 1.35. PCRIC also applied a multiplier of 1.35 when it moved to a true pool basis under its second phase in 2017/18. In both cases, this load factor allows for sustainability of the pools while minimizing premiums to pool members.

It is proposed that a premium price based on the same multiple of 1.35 of expected loss is initially offered for PCDIP clients. This is broadly in line with comparable structures and the expected cost of running the pool. It is also consistent with international pooling arrangements and sustainable according to initial financial modeling. Profit would be retained within the PCDIP company and could be returned to participant cities if the pool company's capital grows. However, the likelihood of such returns would have to be factored into the original premium calculation. Returns could, for example, take the form of reduced premium costs or a system of "no claim bonuses" which are perhaps then required to be used for disaster risk reduction purposes. Returns can be seen as a "profit share," giving each city an explicit share in the performance of PCDIP.

Coverage Options

Cities will be able to flexibly choose what insurance cover they would like to secure through PCDIP, ensuring that the coverage each city purchases is optimally aligned with its disaster risk financing needs, targets, and available budget for insurance premiums.

Key parameters which can be individually set by each city include:

- **Type of natural hazard.** Cities can buy coverage for earthquake, typhoon (wind), or both.
- **Event severity.** Insurance coverage can be purchased for different levels of event severity. The type of events covered by a policy is defined by the index values chosen as its attachment, and exhaustion points (Section 4): the higher the attachment point, the more severe an event has to be for the policy to start to pay out; and the higher the exhaustion point, the more severe an event has to be for the policy to pay out its maximum amount. Attachment and exhaustion points are typically expressed in terms of return periods (Box 4). For example, a policy with an attachment point at the 1-in-10 year return period level can be expected to pay out once every 10 years, on average; whereas a policy with an attachment point at the 1-in-50 year return period level can be expected to pay out only once every 50 years, on average.
- **Minimum and maximum payout amounts.** Cities can choose the minimum payout they want to receive once their policy has been triggered, that is, once the attachment point is reached. Similarly, they can set a maximum payout amount, which is the amount they will receive if an event meets or exceeds the exhaustion point of their policy. These amounts can be chosen depending on the specific funding need a city faces for events of different severities.
- **Premium amount.** Cities may specify the amount of funding they have available to cover premium payments in order to tailor the insurance coverage to the budgetary resources of a city. Minimum and maximum payouts and event severity can then be chosen to match the specified premium amount.

City-specific financial models were built for engagement with each of the 10 cities participating in the design of PCDIP. These financial models enable each city to see how the above parameters interact, supporting them in choosing coverage options which best suits their needs and budgetary resources.

Premium affordability and funding sources

PCDIP premiums could be covered through several sources, including through:

- a city's existing budget allocations for disaster risk management, the city's LDRRMF, and the related special trust fund (STF)
- an allocation from the city's development fund; and
- a tax increase.

Interview evidence shows the STF is the most promising source of funding for PCDIP premiums for a number of the cities that have participated in the design of PCDIP. There are 2 reasons for this:

- Most cities retain resources in the STF as a source of rapidly deployable funding after a disaster, rather than spending them for disaster risk reduction or preparedness purposes. If a portion of the trust fund is used to pay for parametric insurance, then whenever a trigger event occurs the quantity of post-disaster funding available will be greater than it would have been without insurance. In this respect, insurance can ensure the trust fund is more efficiently utilized.

- The STF is an existing disaster risk management resource, which is already integrated into the cities' budgets. The financing of premiums from this existing funding is therefore very likely to be significantly easier to implement compared to an allocation from the city's development fund or a tax increase.

Cities could regularly allocate up to 100% of the unutilized QRF allocation from preceding years, once deposited into the STF, to pay for insurance premiums without incurring a significant impact on their other budgets or spending. Analysis undertaken in designing PCDIP suggests that cities could cover a large proportion of their early recovery funding needs by allocating an amount equivalent to 50-100% of their annual QRF allocations for PCDIP premiums, corresponding to 15-30% of their total LDRRMF budget. Unless there is a disaster event depleting the entire STF, such allocations toward PCDIP premiums could therefore give a city access to significant additional post-disaster funding through parametric insurance offered by PCDIP without significant budgetary impacts on the city. It is, however, also important to recognize that even though the STF was identified as the most promising premium funding source which is suitable across all cities participating in the design of PCDIP, individual cities might be able to fund premiums from alternative sources, such as their development funds of via tax increases, which are better suited to their individual situation.

Premium and Protection Levels for Cities

All of the structuring decisions have been taken so as to ensure that PCDIP is affordable for participant cities and that premiums could be supported through currently available funding mechanisms, at the same time ensuring the long-term viability of the pool.

Cities will purchase insurance cover based on the type(s) of hazard they want to insure against, the frequency (expressed in terms of return periods; Box 4 and Figure 12) and scale of payouts they would like to receive, and the funding available for premium payments. The premiums paid by each city and the levels of payouts it receives will be based on the level of risk that that city individually brings to the pool. There will be no cross-subsidization of premiums among participating cities.

Table 2 shows 3 sample insurance options that cities could hypothetically select. Based on these options, the financial model developed in designing PCDIP was used to calculate the level of protection (i.e., the maximum payout) that could be provided if a ₱1 million annual premium was paid by 4 different cities with varying levels of earthquake and typhoon risk, as shown in Table 3. As can be seen, the same annual premium purchases a lower level of typhoon protection than earthquake cover since the typhoon cover is selected to pay more frequently than the earthquake.

Table 2 : Layer Options Based on Defined Event Return Period Targets

	Earthquake		Typhoon	
	Attachment (Return period)	Exhaustion (Return period)	Attachment (Return period)	Exhaustion (Return period)
Layer option 1	1-in-10	1-in-25	1-in-50	1-in-100
Layer option 2	1-in-25	1-in-50	1-in-100	1-in-150
Layer option 3	1-in-10	1-in-50	1-in-50	1-in-150

Source: Asian Development Bank.

Table 3 : Coverage Amounts Purchased for a ₱1 Million Premium: Sample Cities and Layer Options

City	Option 1 (million ₱)		Option 2 (million ₱)		Option 3 (million ₱)	
	Earthquake	Typhoon	Earthquake	Typhoon	Earthquake	Typhoon
A (North)	50.8	10.9	90.4	25.4	60.7	14.7
B	52.2	11.0	90.9	25.2	63.4	14.9
C	53.2	11.2	91.5	25.4	66.2	16.3
D (South)	51.8	13.7	90.9	27.8	63.0	23.0

₱ - Philippine peso.

Source: Asian Development Bank.

The premium price of PCDIP coverage will also be a key factor in determining how much insurance cities should purchase. The expectation is that the policies offered by PCDIP will be priced at a level which allows cities to pay premiums entirely through the allocation of currently unutilized funds in already-existing disaster risk budgets. Unutilized allocations to cities' quick response funds, which have been transferred to their special trust funds, were identified as a form of funding which is particularly suitable across all cities included in the initial design phase of PCDIP and could be more effectively used by purchasing insurance coverage through PCDIP. Individual cities might, however, also be able to fund premiums from alternative sources, such as allocations from their development funds or tax increases, which are better suited to their individual situation.

6| BENEFITS OF DISASTER INSURANCE POOLS

Disaster insurance pools provide significant benefits to their participants compared to purchasing individual insurance policies.

Diversification Benefit

When different risks are combined into a single pool, the variability (often termed volatility) of total losses experienced by this pool of risks reduces compared to the variability in the losses experienced by an individual. For example, a city in the north of the Philippines is unlikely to be impacted by the same earthquake event as a city in the south of the country. If the northern city is impacted by a significant earthquake loss in a given year (affecting 10% of its assets, for example), it is therefore unlikely that the southern city faces a loss in the same year as well. So even though 10% of assets in the northern city is impacted in that year, a much smaller proportion of the total assets across both cities is affected (as no assets are affected in the southern city at all). In other words, the losses occurring in the northern city are offset against the lack of losses in the southern city. This leads to greater stability in the overall losses experienced across both cities. This phenomenon is typically referred to as risk diversification and occurs if different types of risk are combined into a pool. Differences in risk are typically due to different geographic locations or provision of protection against several different types of natural hazards or different levels of event severity.

For a city insurance pool, this means that the disaster risks different cities bring to the pool can offset each other, which reduces the variability around the overall losses the pool experiences from year to year. This reduces the level of funding the pool has to make available to finance those losses, which ultimately results in lower costs to the pool. This reduction in costs can be passed on to its members through lower insurance premiums.

Facility Structuring and Management Costs

All risk transfer facilities, including traditional insurance companies and risk pools, have inherent costs associated with their setup and their ongoing administration. These include:

- Cost of licensing services and data, policy structuring and setup of the risk transfer facility
- Administration, operational costs and consultant/broker costs
- Development of data and modeling

By grouping together, pool members can share these costs, rather than each city paying them individually. As a result, each pool member benefits from reduced costs for the above items, which is ultimately reflected in lower insurance premiums. These benefits have been well documented by existing risk pools such as CCRIF, which in 2016 had administrative expenses of only 6% of the total insurance premiums paid in by its participants.

Costs of Accessing External Capital

A risk pool, like any insurance company, has 2 main ways to ensure it has access to sufficient funds to pay potential claims by its policyholders: it can use its own capital, or it can reinsure itself against any claims it receives. In practice, both strategies are typically combined in order to achieve an optimal financial strategy which minimizes the costs faced by the pool and the premium prices it can offer to its members.

Accessing external capital through reinsurance does, however, come at a cost: the reinsurer will charge a fee or premium on any reinsurance purchase. A pool has notable advantages when accessing the reinsurance markets:

- The diversification of risk within the pool portfolio leads to greater stability in its funding requirements and therefore reduces its total need for external funding (see "diversification benefit" above).

- Risk pools typically receive an initial capital base through a grant or loan. This capital within the pool reduces the need for external capital from the reinsurance markets.

- Profits made by a pool do not have to be paid to external investors or stakeholders but, instead, can be kept within the pool to increase the pool's capital base. This further decreases the need for costlier external capital and can ultimately reduce premium prices. For example, CCRIF was able to nearly half the premiums for its members after building up its own capital during several years of operation without substantial disaster losses.

- A diversified pool of different risks is more attractive to the reinsurance market and can be expected to attract more competitive reinsurance pricing.

Capacity Building

A risk pool provides its members with an effective platform to increase their knowledge and capacity around disaster risk. This does not have to be confined to disaster risk insurance alone but can also be extended to broader disaster risk financing and disaster risk management strategies, and the role of insurance within those. By offering a platform to share experiences and expertise, as well as to conduct joint knowledge-building initiatives, a risk pool can effectively support its members in aspects such as enhancing their understanding of risk, establishing clear risk ownership and creating incentives to reduce risk.

There is international precedent of risk pools playing a role in providing support for government entities (Box 5).

Box 5 : CCRIF Segregated Portfolio Company

Established in 2007, CCRIF[a] Segregated Portfolio Company (SPC) is a catastrophe pool, set up to support participating member states in the Caribbean by providing parametric insurance protection against hurricane, earthquake and excess rainfall. The parametric approach enables payouts to occur rapidly after the event and usually represents the first injection of financial support after a disaster.

CCRIF was initially capitalized via grants and loans from partner countries. In later years, this capital has been supplemented by CCRIF's own profits and has been supported by reinsurance and catastrophe bonds from the international markets.

CCRIF SPC has demonstrated a strong track record of payouts to its members and is seen as a template for sovereign risk pooling. Since its inception, CCRIF SPC has made payouts totaling over $130 million to 13 member governments – all made within 14 calendar days of the disaster.

[a] Formerly, the Caribbean Catastrophe Risk Insurance Facility.

Source: The Caribbean Catastrophe Risk Insurance Facility. https://www.ccrif.org/

7| CONCLUSIONS

Key findings

- There is a strong case for the development of a city disaster insurance pool in the Philippines.

- There is significant disaster risk across the Philippines, with many cities exposed to high levels of typhoon and/or earthquake risks. Moreover, with the expected continuation of rapid urban growth, future disaster losses could be significantly higher than recently experienced.

- Under current arrangements, a number of cities do not have adequate dedicated financial resources to combat the effects of severe typhoons or earthquakes. Just as there is significant variation in the potential financial impacts of disasters between the cities participating in the design of PCDIP, there is also notable variation in their ability to finance post-disaster relief, early recovery, and longer-term reconstruction. The funding currently available to some cities could be exceeded within a matter of a few weeks under certain realistic disaster scenarios, requiring improvements in both the timeliness, and scale of financing arrangements. All 10 cities that participated in the design of PCDIP face challenges around the efficiency and scale of the liquidity available to them for early recovery activities in the weeks and early months immediately after a disaster.

- Parametric insurance coverage would enhance the effectiveness of current post-disaster funding sources by providing rapid post-disaster liquidity. Parametric insurance can provide payouts within a few weeks of a disaster, and can be structured to allow payouts to be flexibly used to address a range of potential funding needs. Such rapid payouts would complement existing post-disaster financing arrangements, such as indemnity insurance purchased through GSIS which is targeted at longer-term financing needs during the post-disaster reconstruction phase. To enable cities to take full advantage of the benefits of parametric insurance, it is crucial that the implementation of the proposed parametric pool is embedded into the Philippine legal and regulatory environment, and that appropriate inputs and guidance provided from relevant national government agencies, including from COA on the use of payouts, are implemented.

- A well-structured and administered insurance pooling structure is an effective and affordable mechanism through which to offer cities parametric insurance coverage. Given the current availability of unutilized city government funding from sources such as the LDRRMFs, many cities should have adequate funding available to purchase sufficient insurance cover to provide meaningful post-disaster protection. Reflecting the diversification and efficiency benefits of insurance pooling, PCDIP would offer insurance cover at notably lower premiums than cities would face if they individually purchased insurance cover. The pooling structure also offers cities significant opportunities to share knowledge, and increase their disaster risk management capacity through joint initiatives.

- Appropriate exposure data to support the generation of city disaster risk profiles is available.

- Applying a collaborative approach between risk analysts, the cities and national government agencies, detailed databases of vertical physical assets can be developed at the barangay level, as has been done for all 10 cities participating in the design of PCDIP. These databases are adequate to directly model potential vertical physical asset damage and to extrapolate relief and early recovery costs, allowing the development of comprehensive city disaster risk profiles.

- Advanced modeling capabilities to assess earthquake and typhoon risk faced by Philippine cities are available. These capabilities have been leveraged to develop a fully probabilistic risk analysis for both types of natural hazard for all 10 cities participating in the design of PCDIP. The modeling outputs take advantage of the latest science and modeling techniques and are consistent with methodologies and metrics commonly used in the domestic and international re/insurance markets and are therefore ideally placed to enable the marketing and pricing of coverage offered by PCDIP.

- Parametric index structures are a feasible and suitable form of parametric insurance for earthquake and typhoon wind risk in the Philippines. Appropriate real-time hazard data is available to support parametric structures for these natural hazards. The proposed structures are parametric indexes based on peak gust (wind) and spectral acceleration (earthquake), an approach consistent with existing, tested parametric insurance structures in the global re/insurance markets. The indexes are closely correlated with levels of physical assets damage and can be similarly applied to all of the 10 cities participating in the design of PCDIP and other cities which could join the pool in the future. The indexes are also consistent with existing parametric insurance structures already used and tested by the global re/insurance markets.

- No adequate real-time data has been identified to facilitate a parametric flood trigger in the Philippines. The availability of real-time flood data is generally lower than that for earthquake and typhoon and, as such, is not considered either appropriate for proxying levels of damage experienced as a consequence of floods or acceptable by the international insurance markets as a trigger for parametric products. Options to support a parametric flood solution will continue to be explored.

Proposed structural characteristics of PCDIP

- PCDIP should take the form of an independently managed company, run for the benefit of its members by a management board to represent key stakeholders. GSIS would seem to have the relevant mandate to act as the issuer of primary policies to the participant cities, with PCDIP acting as a policy-level reinsurer to GSIS.

- PCDIP is expected to be primarily capitalized through a sovereign loan from ADB in its initial years.

- PCDIP would access the national/international reinsurance and capital markets to provide reinsurance coverage for the pool as a whole.

- The government may consider providing premium support financing for cities in certain cases.

Proposed policy and premium characteristics of PCDIP

- City-level premiums are assumed to be priced at a multiplier of 1.35 over the city's expected loss cost, ensuring that each city's premium reflects the level of risk it brings to the pool without any subsidization across cities.

- Cities could cover a large proportion of their early recovery funding needs by allocating an amount equivalent to 50-100% of their annual quick response funds from their special trust funds for PCDIP premiums, corresponding to 15-30% of their total LDRRMF budget. A number of cities would be able to fund this level of premium payments directly out of unutilized resources in their special trust funds.

- Coverage offered by PCDIP to participating cities can be readily tailored to meet individual city needs and resources. Cities can purchase insurance cover based on the type(s) of hazard they want to insure against (earthquake, typhoon, or both), the frequency and scale of payouts they would like to receive, and the funding available for premium payments.

- It is proposed that PCDIP reinsurance protection should be set at an attachment point equivalent to the 1-in-10 year return period loss in order to achieve reasonable protection of the pool's capital base, whilst ensuring that reinsurance costs are as low as possible.

- It is proposed that exhaustion of the pool's reinsurance protection should be set at a 1-in-500 year return period loss, in line with other multinational pools performing a similar function.

- The market reinsurance premium is assumed to be priced at a multiplier of 1.35 the pool's average annual loss cost, in line with other multinational pools performing a similar function.

Glossary

1-in-100 loss	The loss corresponding to an event, which has an annual exceedance probability of 1%, i.e. can be expected to be exceeded once in 100 years on average
AAL	Average annual loss: The expected value of the modeled loss distribution, or the loss one would expect to see in a year on average
AEP curve	Average expected loss: A cumulative distribution showing the probability of the total losses within an annual period exceeding a range of loss thresholds
basis risk	The difference between actual loss and the parametric loss from a catastrophe
deductible	The amount of money paid by the insured before his insurance plan starts to pay
deterministic model	Model based on a single scenario (hazard footprint) or a set of independently developed scenarios of the peril under consideration; reflecting their nature, deterministic models do not capture the full range of possible impacts of a given peril, or their associated likelihoods
disbursement	A payment made from a fund to the insured
exposure	Assets such as buildings and infrastructure that, when impacted by an event, can generate a financial loss for the parties responsible
exposure database	A data set containing information about the location, characteristics and value of assets exposed to the peril under consideration
frequency	The rate at which something occurs over a particular period of time or in a given sample
hazard information	Peril-specific damage parameter(s) of an event, such as water depth for flood events and wind speed for typhoon events
indemnity	An insurance structure whose payout is determined by the actual losses suffered by the insured.
loss cost	AAL divided by the total value of exposure considered by the loss model; loss cost gives an indication of the proportion of exposure value that can be expected to be lost in any given year, on average
modeled loss	Loss calculated by overlaying the hazard footprint of an event (e.g., distribution of wind speeds) with a given set of exposure in a catastrophe model; resulting modeled loss can be used as trigger mechanisms for an insurance product
model uncertainty	Sources of uncertainty in loss results produced by a catastrophe model; primary uncertainty measures the uncertainty in the likelihood of event occurrence; secondary uncertainty is the uncertainty in the amount of loss given that an event has occurred
mutual insurer	An insurance company created in order for insureds to buy cover and which is owned by its clients/policyholders

occurrence exceedance probability curve A cumulative distribution showing the probability that the maximum loss from a single event within an annual period will exceed a range of loss thresholds

parametric / parametric index Type of insurance trigger mechanism for which insurance payouts are determined based on physical hazard measurements (e.g., wind speed or earthquake magnitude) rather than actual losses suffered by the insured

peak gust The highest windspeed experienced during a typhoon over a set time period (typically 3 seconds)

peak ground acceleration Movement of the ground during an earthquake (typically measured in acceleration due to gravity)

premium Amount paid by the insured for a contract of insurance

probabilistic model A model based on a large set of simulated scenarios for the peril under consideration which have been developed to capture the full range of potential impacts from that peril; each simulated scenario is associated with an annual rate of occurrence, enabling the model to quantify the probability with which any given level of impact can be expected to occur

reinsurance Insurance purchased by an insurance company, typically to cover large-scale losses

resilience The ability of an organization to withstand and recover from catastrophic events

return period The time frame over which a particular loss threshold can be expected to be exceeded at least once

risk reduction Steps taken to reduce vulnerability and exposure to a risk

risk pool Multiple insureds who collectively buy insurance through a pool structure

risk retention Risk that an organization absorbs itself, rather than transferring

risk tolerance The level of impact an organization is willing to withstand or absorb

risk transfer The transfer of risk from one party to another through, e.g., an insurance policy

spectral acceleration Acceleration experienced by an object (typically a building) during an earthquake due to movement of the ground (typically measured in acceleration due to gravity)

trigger A defined occurrence which instigates a payment to an insured party

vulnerability The susceptibility of an element of risk to physical damage or monetary loss resulting from exposure to a hazard

Philippine City Disaster Insurance Pool
Rationale and Design

This report presents the rationale for and design of a city government disaster insurance pool in the Philippines. Insurance pools help governments enhance their financial preparedness for disasters, focusing on the provision of rapid post-disaster financing for early recovery. The Philippine City Disaster Insurance Pool was developed under the guidance of the Department of Finance as part of the 2015 Disaster Risk Financing and Insurance Strategy. It utilizes a parametric insurance structure, basing payouts on the occurrence of earthquakes and typhoons according to their physical features, rather than actual losses.

About the Asian Development Bank

ADB is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate extreme poverty. Established in 1966, it is owned by 67 members—48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

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