

# Central Asia Regional Economic Cooperation Program Disaster Risk Engagement Meeting

## Session 8: Disaster Relief Bond

Islamabad, Pakistan  
July 2023





# Catastrophe Bonds and Disaster Relief Bonds

## What is a Catastrophe Bond (Cat Bond)?

- A cat bond is a way to transfer insurance risk to the capital markets, it is NOT a debt obligation for the covered entity (i.e. sponsor)
- Climate and Disaster Risk is transferred typically through a Special Purpose Vehicle (SPV) which provides insurance to the sponsor in return for an annual premium
- The SPV is capitalised by a bond where the capital is at risk: if a pre-defined disaster occurs over the term of the bond, there is a pay-out
- Investors receive an enhanced coupon equivalent to the premium in addition to a rate matching the SPV's bond proceeds in a defined "risk-free" investment
- The SPV is wound up at the end of the bond period (typically 3 years) or at bond exhaustion
- The World Bank's Capital at Risk Notes Program platform, used for Sovereign cat bonds, replaces the SPV with its own balance sheet
- Governments enter into a re/insurance transaction, or more commonly an equivalent derivative contract, a cat swap, with the World Bank, the World Bank hedges its risk with the bond issuance

## What is a Disaster Relief Bond (DRB)?

- A DRB builds on a cat bond but explicitly linked into **efficient, integrated disaster risk reduction (DRR), disaster risk management (DRM) and efficient disaster risk response**
- The DRB uses the ADB's balance sheet to replace the SPV of a standard cat bond, similar to the WB sovereign cat bond structure
- Loss payments may be explicitly targeted to address the needs of **vulnerable communities** with agreed disaster response plans, attracting donor funding with that focus
- Complements other ex-ante and ex-post products and services, providing a truly integrated suite of DRR and DRF solutions
- Solutions are tailored to the needs of CAREC member countries, with potential donor support for linked DRM and DRR projects
- A new donor friendly instrument, attractive to ESG and climate-impact bond investors, which drives more competitive pricing
- Supports the financing of projects that promote SDGs and the Paris Agreement

### Simplified Disaster Relief Bond Structure issued by ADB



# Sovereign Catastrophe Bond Pay-Outs

## MEXICO

**Issuer:** World Bank IBRD

**Date of issue:** Aug 2017

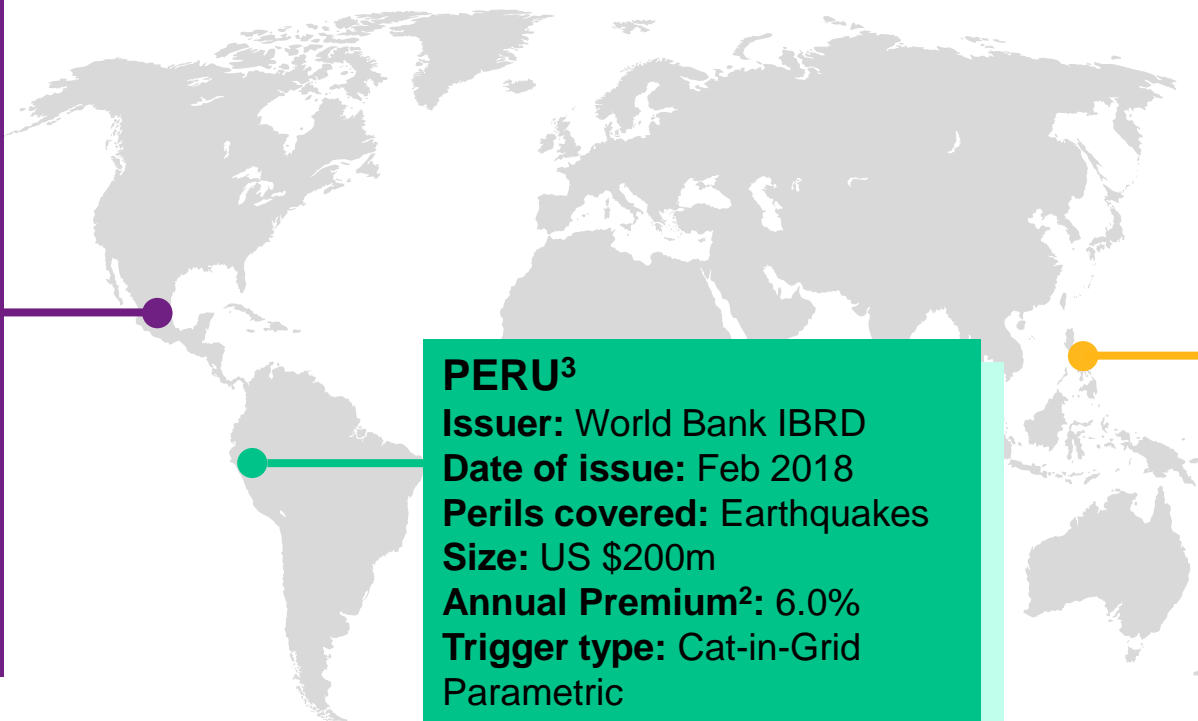
**Perils covered:** Earthquakes and named storms

**Size:** US \$360m total (US \$150m earthquake / US \$210m storms)

**Annual Premium<sup>1</sup>:** 4.5%

**Trigger type:** Cat-in-Grid Parametric

**Pay-out:** US \$150m (100%) of the earthquake bond following a magnitude 8.1 earthquake in September 2017.



## PERU<sup>3</sup>

**Issuer:** World Bank IBRD

**Date of issue:** Feb 2018

**Perils covered:** Earthquakes

**Size:** US \$200m

**Annual Premium<sup>2</sup>:** 6.0%

**Trigger type:** Cat-in-Grid Parametric

**Pay-out:** US \$60m (30%) triggered by a magnitude 8.0 earthquake in May 2019.

## PHILIPPINES

**Issuer:** World Bank IBRD

**Date of issue:** Nov 2019

**Perils covered:** Earthquakes and tropical cyclones

**Size:** US \$225m total (US \$75m EQ / US \$150m TC)

**Annual Premium<sup>2</sup>:** 5.50% EQ  
5.65% TC

**Trigger type:** Modelled Loss Parametric

**Pay-out:** US \$52.5m (35%) of the tropical cyclone tranche after super typhoon Rai (locally known as Odette) breached the parametric trigger for wind in late 2021.

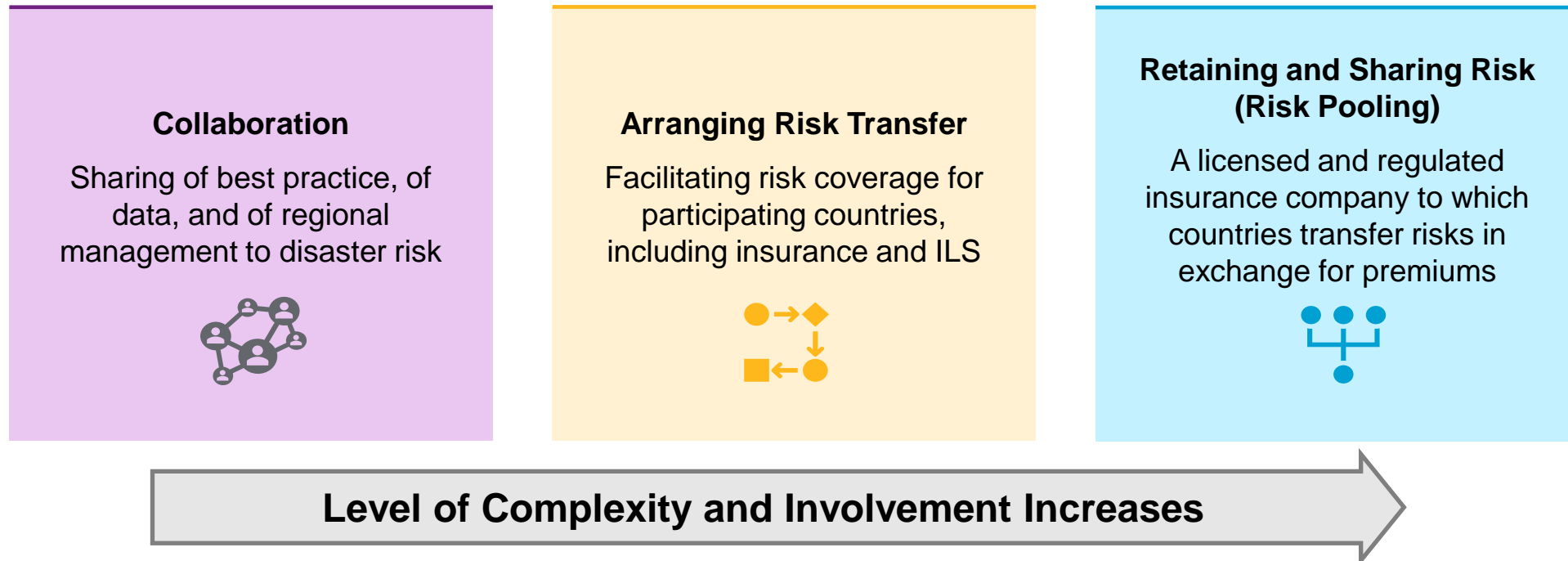
<sup>1</sup> Transacted as part of an insurance chain protecting disaster fund FONDEN, with the World Bank acting as ultimate reinsurer

<sup>2</sup> Transacted as a cat swap with the World Bank, the “fixed amount” of the swap being equivalent to annual premium

<sup>3</sup> Placed as part of the Pacific Alliance transaction

# A Catalyst for a CAREC Regional Facility

- The proposed DRB serves as a pilot for a future CAREC Risk Facility (CRF), a roadmap to implementation has been elaborated under TA9878.
- A DRB can be set up relatively quickly, and so offer the ability to bridge the protection gap in CAREC countries in the shorter- to medium-term whilst the creation of a CRF is a longer-term goal for regional cooperation.
- Countries around the world have collaborated on regional risk financing, including in the Caribbean and Central America, in South America, in Africa, in the Pacific, and in Southeast Asia. The CRF can have several functions:



# Disaster Relief Bond Proposal

## Addressing a Real Need

- This TA has evidenced funding gaps for both severe events and insufficient funding for average annually occurring events for most CAREC countries
  - The difference between the estimated annual average losses from earthquake and flood risk and the existing ex-ante financing tools in CAREC countries is estimated to be as much as US \$1.9 billion
- Further engagement is required to formulate Disaster Risk Reduction (DRR) and Financing (DRF) strategies with each country

## The Proposal

- An ADB-funded pilot Disaster Relief Bond (DRB) for all CAREC countries demonstrating its benefit and mechanism
- The DRB provides identical financial coverage for each country

## Catalyst for Broader DRR and DRF Engagement

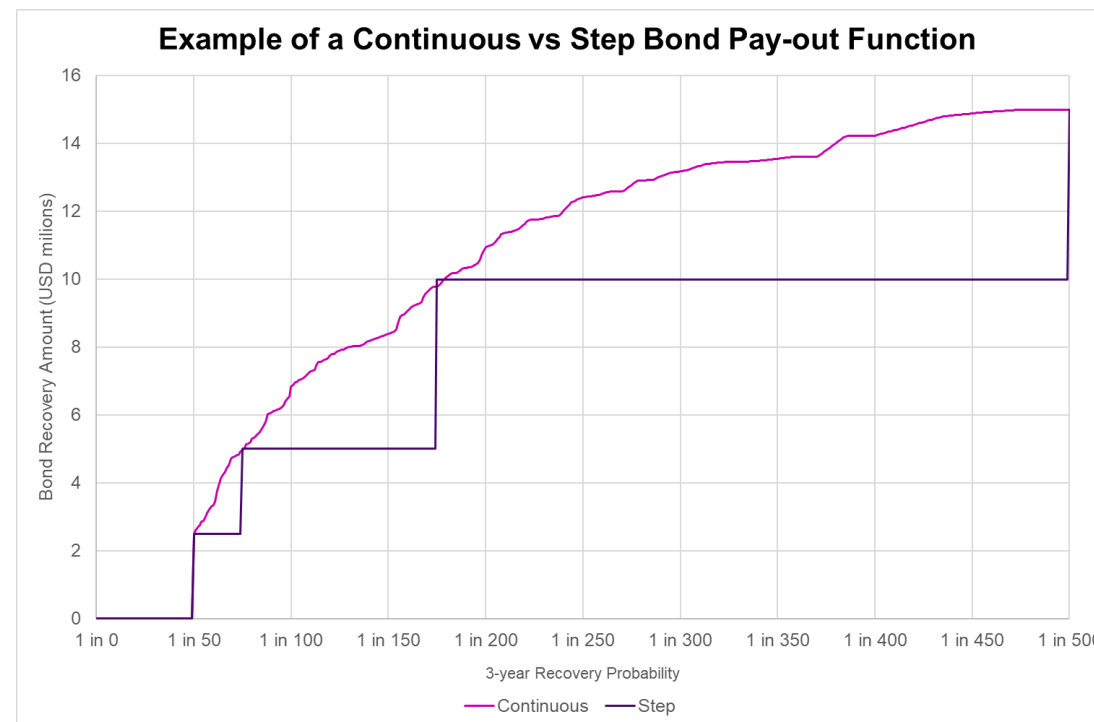
- To be a beneficiary, countries will need to commit to engage in a broader DRR/DRF process where all other forms of financial support will be considered (e.g., PBLs, CDFs, etc.)
- A complementary country specific bond (or insurance placement) tailored to the specific needs of member countries can follow



*Protection Gap Assessments completed as part of this TA quantify the difference between the estimated losses from earthquake and flood risk and the existing ex-ante financing tools in CAREC countries*

# DRB Design Considerations Affect Expected Loss and, therefore, Cost

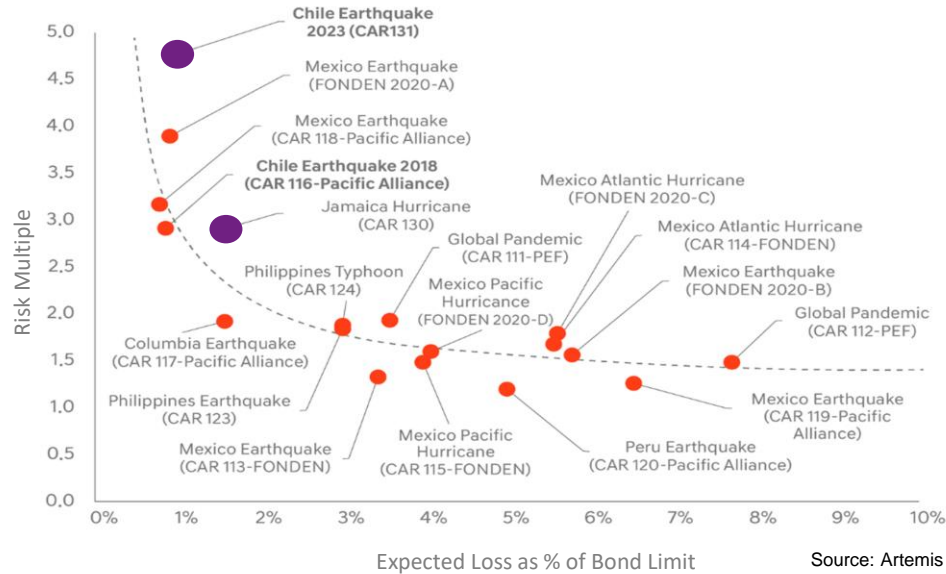
- **What size of event does the bond respond to?** The more frequently the bond is designed to pay, the more it will cost
- **Format of index - Continuous or Step?** A step function will be cheaper BUT it will generally pay-out lower amounts than a bond with a continuous function
- **Event Payment Amounts.** The higher the bond pay-out amounts (country and/or bond limits), the higher the cost
- **How likely will a country get full payment and/or the bond to exhaust?** The more likely a full pay-out (country and/or bond limits), the more it will cost
- **Hazards covered.** A simple one hazard (e.g., earthquake) bond is likely cheaper than a multi-hazard (earthquake + flood) bond and may allow faster issuance
- **Bond structure.** A single bond covering multiple countries and hazards allows scope to benefit from diversification, and so lower cost per country



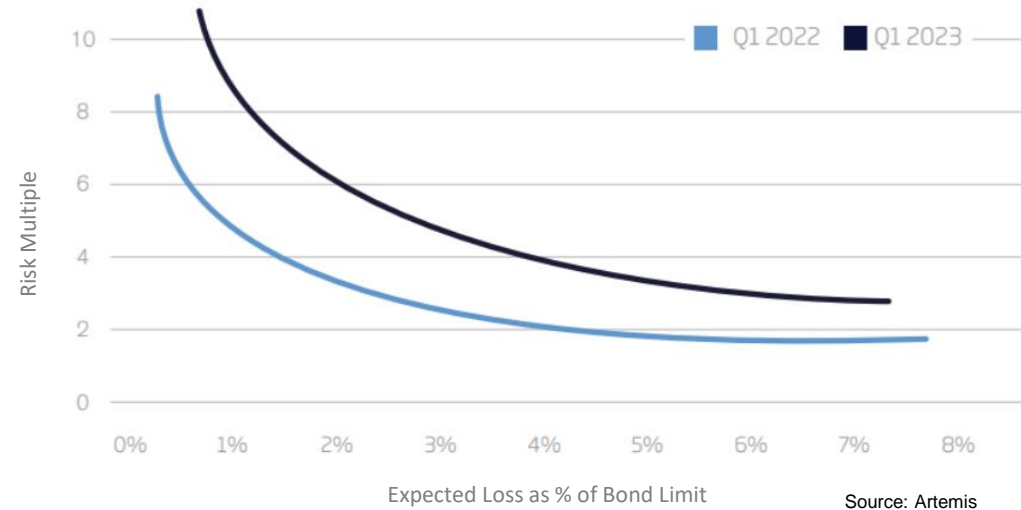
The chart illustrates annual pay-outs for two bonds, one step and the other continuous, both with a minimum payment of \$2.5m for a 1 in 50 event, and with a maximum bond limit of \$15m paying in full for a 1 in 500 event. On average, the step bond pays ~19% less for this example and should be cheaper.

# Insurance Linked Security (ILS) Pricing

Sovereign Cat Bonds – multi-year, price trends ignored



12-month risk multiple increases Q1 2023 over Q1 2022



- The risk multiple rises as the expected loss as a percentage of bond limit reduces, i.e. more remote catastrophe bonds are more expensive (see top left graph)
- Catastrophe bond costs have recently risen (see top right graph), the two most recent bonds, Chile CAR131 and Jamaica CAR 130 are well above the best fit line reflecting current high pricing (purple circles, top left graph)



# Illustrative DRB Placement and Cost



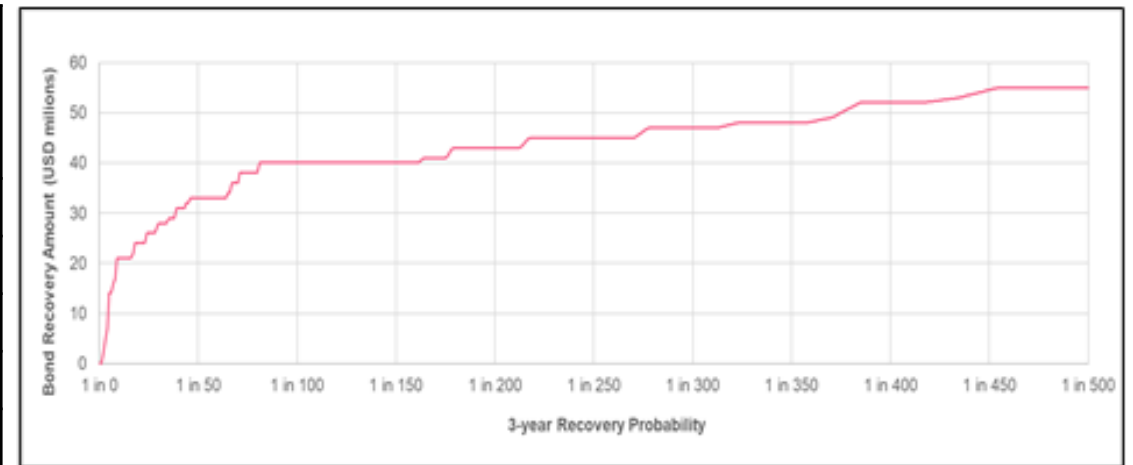
## Coverage and Cost

- A regional bond will be cheaper for countries (and donors) than with separate issuances, benefiting from economies of scale and, if correctly structured, diversification
- The ILS market pricing is fluid, **all pricing will need to be market tested at the time of the transaction**

## Structure

- Several structures for a potential DRB, including single-hazard and multi-hazard bonds across multiple tranches using both stepped and continuous functions, have been tested (see Annex for details).
- The graph and table below shows an **illustrative 3-Year Bond for Earthquake and Flood which covers 10 countries**

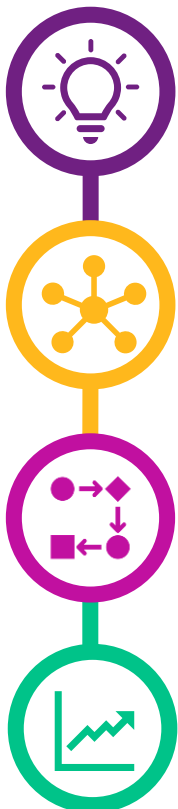
|   |            |
|---|------------|
| <b>Cover per Country and Hazard (US\$)</b>          |            |
| For 1 in 100 hazard event                           | 3,000,000  |
| For 1 in 250 hazard event                           | 10,000,000 |
| For 1 in 500 hazard event                           | 15,000,000 |
| <b>Overall Bond Limit (US\$)</b>                    | 57,500,500 |
| <b>Annual Premium Equivalent (US\$)</b>             | 4,250,000  |
| <b>Per Country Premium per Hazard (US\$)</b>        | 212,500    |
| <b>Annual Premium Rate (per Country and Hazard)</b> | 1.42%      |
| <b>Annual Premium</b>                               | 7.39%      |





# Why Does a DRB Work for CAREC Member Countries?

Integrating Disaster Risk Management, Reduction, Financing and Response Planning



## **Links Disaster Risk Finance (DRF), Disaster Risk Management (DRM) and Disaster Risk Reduction (DRR)**

A DRB is designed explicitly to complement and encourage DRM and DRR, attractive to potential donors, who may subsidise costs of the DRB and support technical assistance for complementary DRM and DRR projects.

## **Enables Integrated Approach to Create Custom-Designed Solutions to meet CAREC Country Needs**

Complementarity with existing financing modalities provided by the ADB and others; for example climate policy-based lending (PBL), contingent disaster financing (CDF) and emergency assistance loan and grants.

## **Donor Attractive**

Donors will appreciate linkages to DRM and DRR strategies. Pay-outs may also be explicitly targeted, in full or in part, to vulnerable populations, accessing donor funds expressly created for this purpose.

## **Competitively Priced**

A DRB is a new form of instrument likely to be attractive to investors, particularly those looking for climate-impact and ESG investment opportunities, coupled with the effective financial structure, pricing should be attractive.

## Appendix: Additional Information and Context



## Mechanism and Structuring



- An opportunity to **leverage a greater potential funding amount by mobilising private sector financing**, which can be rapidly deployed on the occurrence of a qualifying event
- Issuing a DRB via the ADB's Global Medium-Term Notes (GMTN) program could – with some modification\* - allow for direct DRB issuance and brings several technical, operational and financial benefits
- It is proposed that **the ADB and other donors support premium payment** on behalf of the countries
- The Risk Transfer Agreement will detail country-specific plans outlining the usage of potential pay-outs as well as a commitment from participating countries to invest in DRR and climate change adaptation interventions

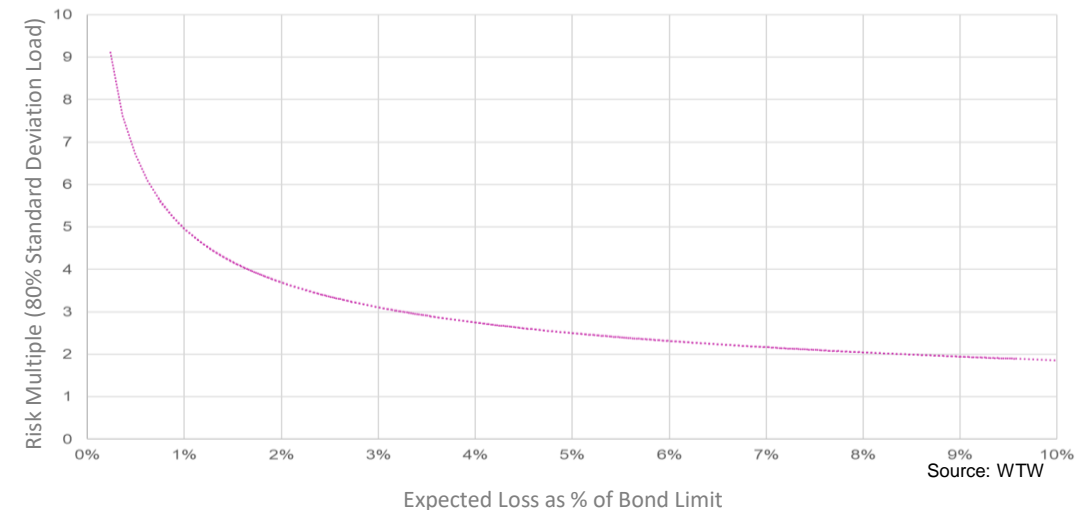
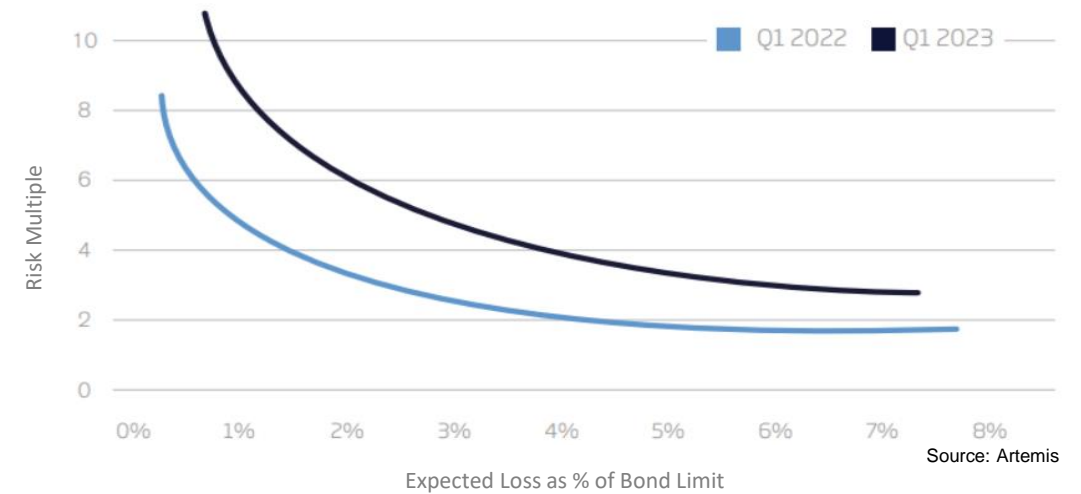
\*We understand that the ADB's GMTN program is not currently ready to issue a DRB; in order to issue a DRB an annex will need to be set up. This annex would be modest and relatively short and so is feasible, but will need OGC's involvement and external council will need to be sought. There will be costs associated with any change to the GMTN, which should be considered/factored in.



# Pricing of Proposed DRB Transaction



- **The ILS market pricing is fluid, all pricing will need to be market tested at the time of the transaction.**
  - Most ILS transactions are issued by insurers transferring their peak accumulation zones to the capital market.
  - Sovereign bonds trade at lower multiples as they are diversifying for insurance investors.
  - Many sovereign bond investors are re-insurers or catastrophe funds that operate in both markets.
- **A close relationship is observed between ILS price curves and a reinsurance pricing method using standard deviation (SD).**
  - A multiple of the SD of modelled losses is added to the expected loss for a sample of potential coverages for CAREC countries as a proxy for capital cost.
  - An SD load of 80% exactly matches the pricing of the March 2023 Chilean bond.
  - The 80% SD load curve sits lower than the most recent Artemis curve, i.e. cheaper and sits between the Artemis first quarter curves for 2023 and 2022 both in quantum and shape.





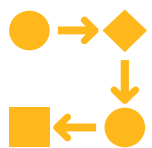
## Two tranches are issued

- First: a relatively small stepped pay-out for a more likely event
- Second: larger pay-outs using stepped or continuous function for larger, less frequent events
- Investors can participate in either or both tranches dependent upon their risk appetite



## Both tranches cover all countries

- This allows an overall bond limit to be applied less than the sum of coverage for each country
- This drives lower risk multiples and so lower cost but with a small risk (under 0.1%) cover may exhaust



## Three options are considered

- The first two options have a step bond and a higher continuous bond attaching at different levels
- A third option uses a step trigger for both bonds to compare effectiveness and pricing



## Single hazard (earthquake) and multi-hazard (flood and earthquake) are considered

- A flood and earthquake bond offers greatest diversification benefit and theoretically relatively lower pricing
- But more work is required to design and model appropriate flood triggers, delaying issuance
- A single hazard earthquake bond is near ready to go (from a modelling perspective) and its purity will be welcomed by some investors

# Option 1: Earthquake and Flood - Terms

3-year total bond limit: \$57.5m (Tranche 1: \$12.5m, Tranche 2: \$45m)



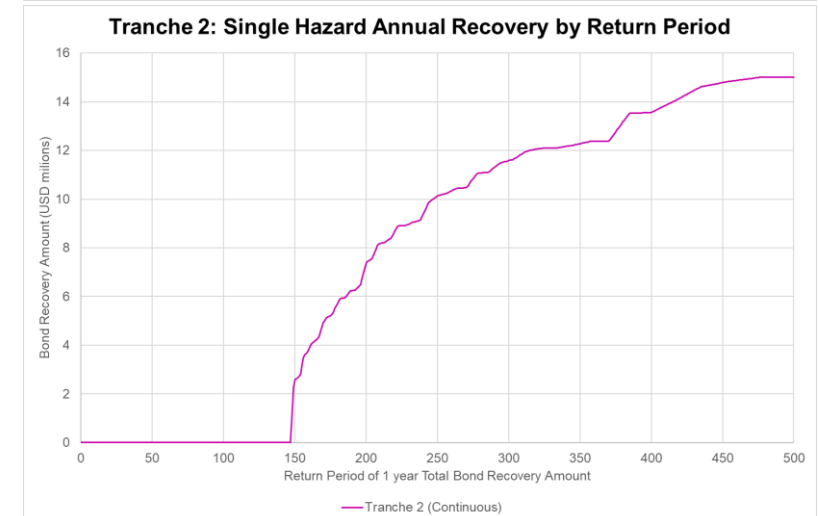
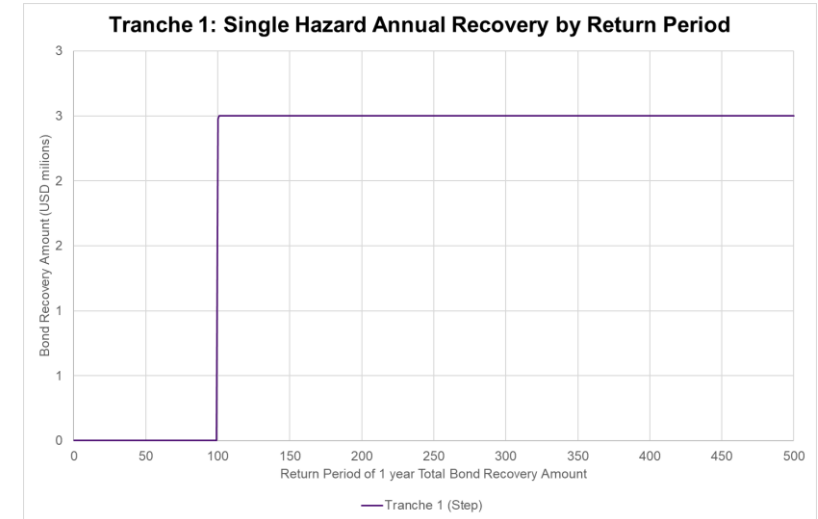
## Attachment /detachment per country, year and hazard

### Tranche 1

Type: Single Step  
 Event Attachment: 1 in 100  
 Event Payment: \$2.5m

### Tranche 2

Type: Continuous  
 Event Attachment: 1 in 150  
 Minimum Event Payment: \$2.5m  
 Event Detachment: 1 in 500  
 Maximum Event Payment: \$15m





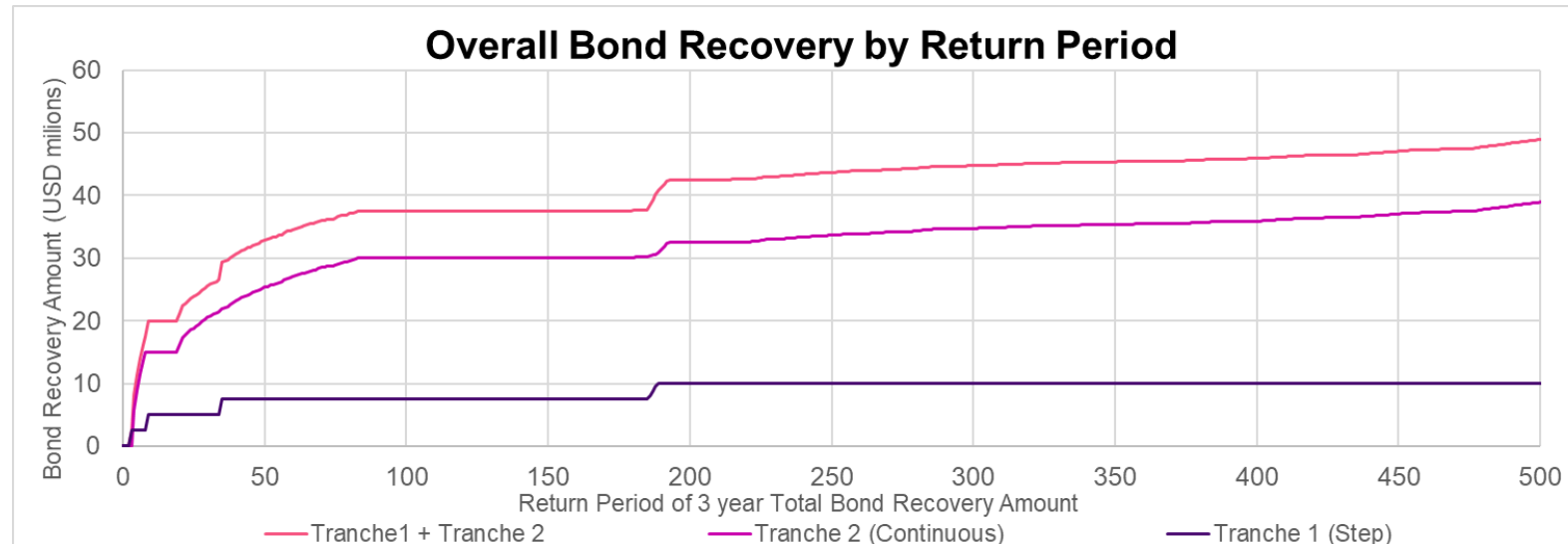
# Option 1: Earthquake and Flood - Recoveries

3-year total bond limit: \$57.5m (Tranche 1: \$12.5m, Tranche 2: \$45m)



## Results over 3 year bond term

|   | Tranche 1  | Tranche 2  | Total      |
|---|------------|------------|------------|
| Bond Limit                                | 12,500,000 | 45,000,000 | 57,500,000 |
| Expected Loss                             | 1,499,250  | 4,489,815  | 5,989,065  |
| Attachment Probability                    | 44.1%      | 38.4%      |            |
| Expected Loss as Percentage of Bond Limit | 12.0%      | 10.0%      | 10.4%      |
| Estimated Risk Margin Multiplier          | 1.93       | 2.10       | 2.06       |
| Risk Margin                               | 2,897,621  | 9,432,187  | 12,329,807 |



## Option 2: Earthquake and Flood - Terms

3-year total bond limit: \$60m (Tranche 1: \$12.5m, Tranche 2: \$47.5m)



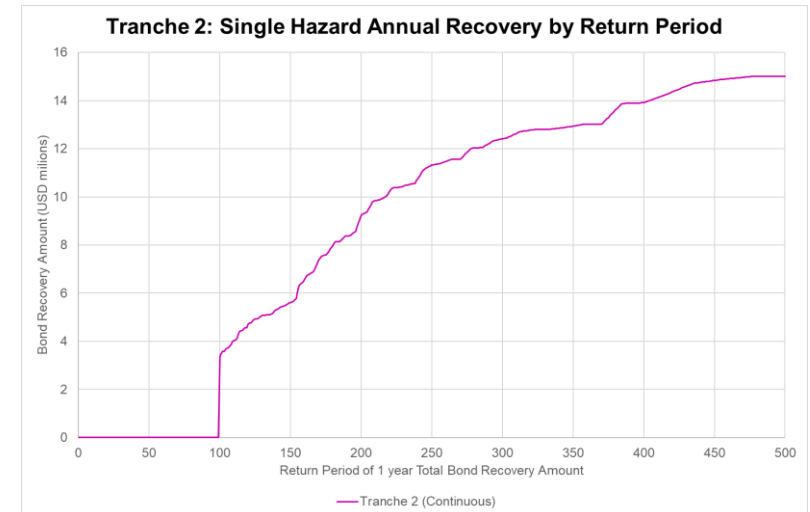
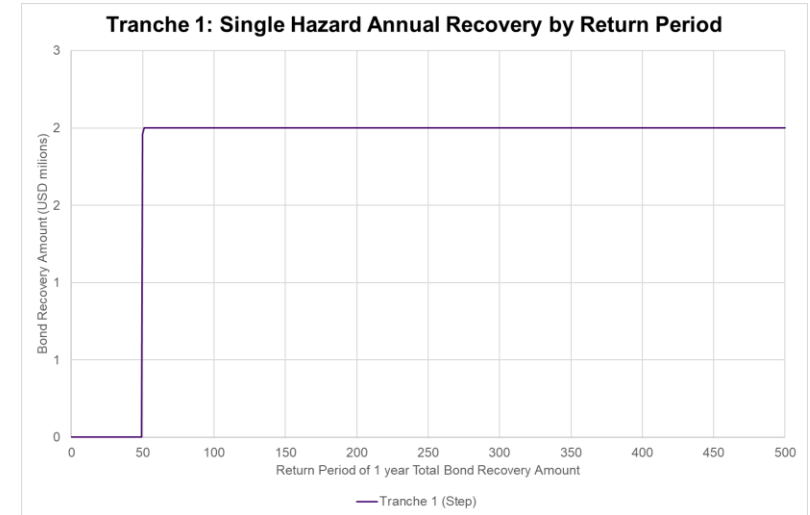
### Attachment /detachment per country, year and hazard

#### Tranche 1

|                  |             |
|------------------|-------------|
| Type             | Single Step |
| Event Attachment | 1 in 50     |
| Event Payment    | \$2m        |

#### Tranche 2

|                       |            |
|-----------------------|------------|
| Type                  | Continuous |
| Event Attachment      | 1 in 100   |
| Minimum Event Payment | \$3m       |
| Event Detachment      | 1 in 500   |
| Maximum Event Payment | \$15m      |



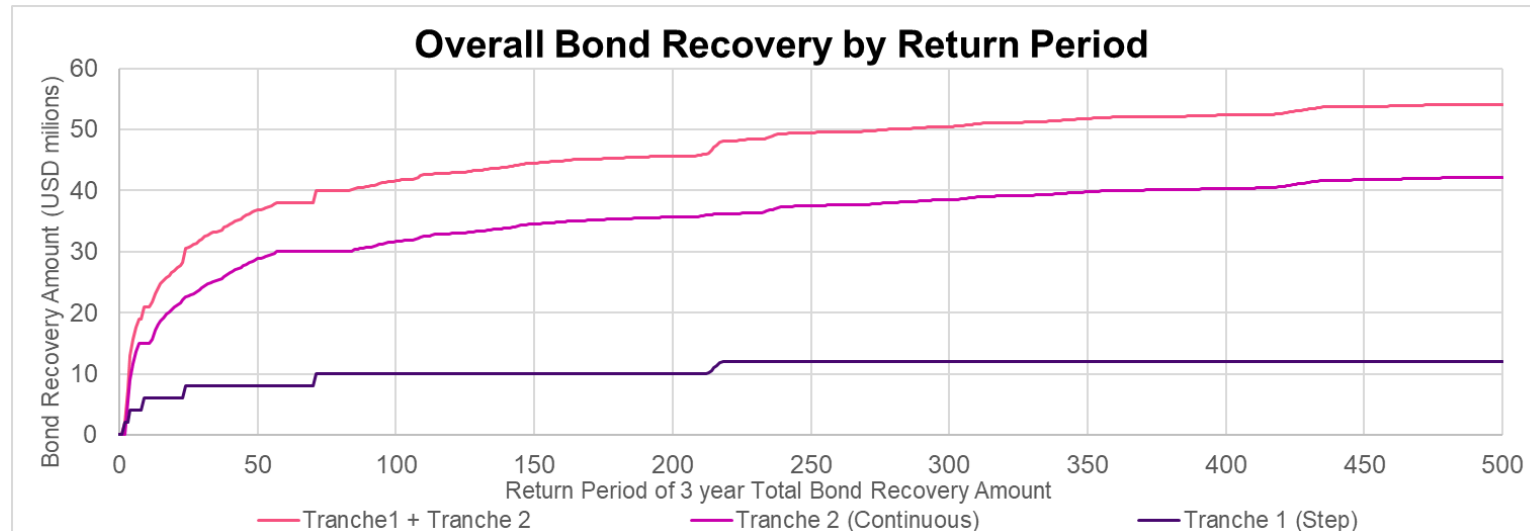
## Option 2: Earthquake and Flood - Recoveries

3-year total bond limit: \$60m (Tranche 1: \$12.5m, Tranche 2: \$47.5m)



### Results over 3 year bond term

|   | Tranche 1  | Tranche 2  | Total      |
|---|------------|------------|------------|
| Bond Limit                                | 12,500,000 | 47,500,000 | 60,000,000 |
| Expected Loss                             | 2,398,450  | 5,226,331  | 7,624,781  |
| Attachment Probability                    | 68.6%      | 44.1%      |            |
| Expected Loss as Percentage of Bond Limit | 19.2%      | 11.0%      | 12.7%      |
| Estimated Risk Margin Multiplier          | 1.56       | 2.01       | 1.87       |
| Risk Margin                               | 3,746,800  | 10,503,502 | 14,250,301 |





# Option 3: Earthquake and Flood - Terms

3-year total bond limit: \$57.5m (Tranche 1: \$12.5m, Tranche 2: \$45m)



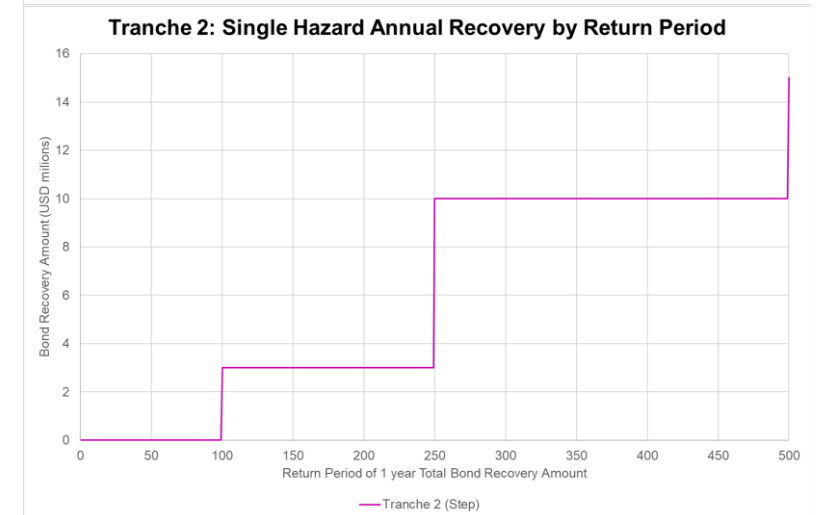
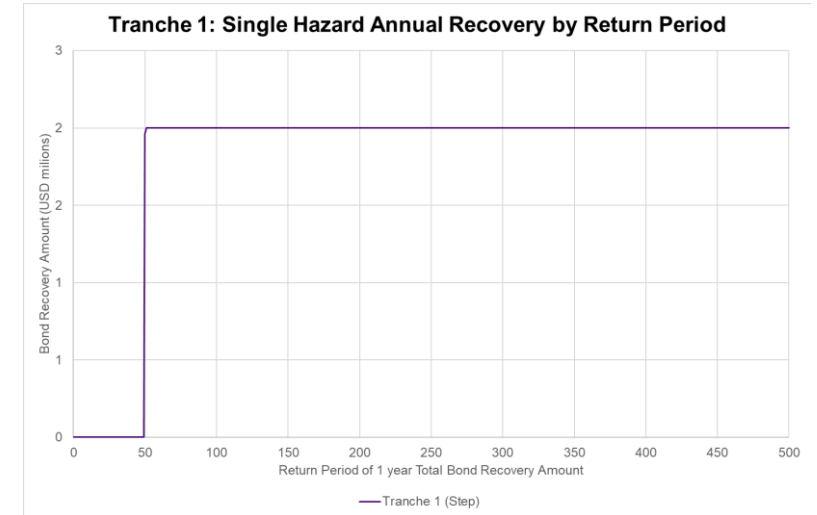
## Attachment /detachment per country, year and hazard

### Tranche 1

|                  |             |
|------------------|-------------|
| Type             | Single Step |
| Event Attachment | 1 in 50     |
| Event Payment    | \$2m        |

### Tranche 2

|                  |              |              |              |
|------------------|--------------|--------------|--------------|
| Type             | Multi-step   |              |              |
|                  | <i>Step1</i> | <i>Step2</i> | <i>Step3</i> |
| Event Attachment | 1 in 100     | 1 in 250     | 1 in 500     |
| Event Payment    | \$3m         | \$10m        | \$15m        |



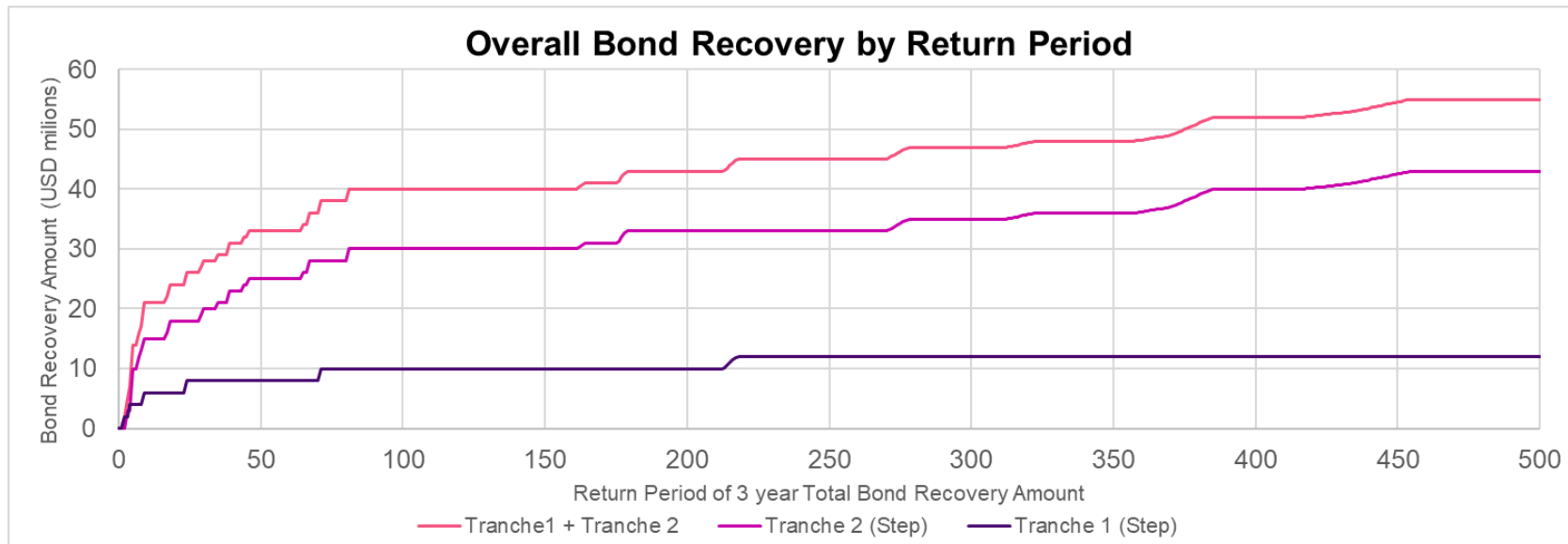
## Option 3: Earthquake and Flood - Recoveries

3-year total bond limit: \$57.5m (Tranche 1: \$12.5m, Tranche 2: \$45m)



### Results over 3 year bond term

|   | Tranche 1  | Tranche 2  | Total      |
|---|------------|------------|------------|
| Bond Limit                                | 12,500,000 | 45,000,000 | 57,500,000 |
| Expected Loss                             | 2,398,450  | 4,072,400  | 6,470,850  |
| Attachment Probability                    | 68.6%      | 44.1%      |            |
| Expected Loss as Percentage of Bond Limit | 19.2%      | 9.0%       | 11.3%      |
| Estimated Risk Margin Multiplier          | 1.56       | 2.20       | 1.96       |
| Risk Margin                               | 3,746,800  | 8,941,938  | 12,688,737 |



# Cost Comparisons



|                                    |                            | Option 1         |                  |                   | Option 2         |                   |                   | Option 3         |                  |                   |
|------------------------------------|----------------------------|------------------|------------------|-------------------|------------------|-------------------|-------------------|------------------|------------------|-------------------|
|                                    |                            | Tranche 1        | Tranche 2        | Total             | Tranche 1        | Tranche 2         | Total             | Tranche 1        | Tranche 2        | Total             |
| Two Hazards:<br>Earthquake & Flood | Bond Limit                 | 12,500,000       | 45,000,000       | 57,500,000        | 12,500,000       | 47,500,000        | 60,000,000        | 12,500,000       | 45,000,000       | 57,500,000        |
|                                    | Expected Loss              | 1,499,250        | 4,489,815        | 5,989,065         | 2,398,450        | 5,226,331         | 7,624,781         | 2,398,450        | 4,072,400        | 6,470,850         |
|                                    | Expected Loss / Bond Limit | 12.0%            | 10.0%            | 10.4%             | 19.2%            | 11.0%             | 12.7%             | 19.2%            | 9.0%             | 11.3%             |
|                                    | Risk Margin Multiplier     | 1.93             | 2.10             | 2.06              | 1.56             | 2.01              | 1.87              | 1.56             | 2.20             | 1.96              |
|                                    | Estimated Premium          | <b>2,897,621</b> | <b>9,432,187</b> | <b>12,329,807</b> | <b>3,746,800</b> | <b>10,503,502</b> | <b>14,250,301</b> | <b>3,746,800</b> | <b>8,941,938</b> | <b>12,688,737</b> |
| One Hazard:<br>Earthquake Only     | Bond Limit                 | 7,500,000        | 35,000,000       | 42,500,000        | 10,000,000       | 33,500,000        | 43,500,000        | 10,000,000       | 32,500,000       | 42,500,000        |
|                                    | Expected Loss              | 748,500          | 1,959,533        | 2,708,033         | 1,199,800        | 2,146,158         | 3,345,958         | 1,199,800        | 2,032,450        | 3,232,250         |
|                                    | Expected Loss / Bond Limit | 10.0%            | 5.6%             | 6.4%              | 12.0%            | 6.4%              | 7.7%              | 12.0%            | 6.3%             | 7.6%              |
|                                    | Risk Margin Multiplier     | 2.10             | 2.73             | 2.56              | 1.93             | 2.57              | 2.34              | 1.93             | 2.60             | 2.35              |
|                                    | Estimated Premium          | <b>1,572,258</b> | <b>5,348,210</b> | <b>6,920,468</b>  | <b>2,318,519</b> | <b>5,510,645</b>  | <b>7,829,165</b>  | <b>2,318,519</b> | <b>5,276,042</b> | <b>7,594,561</b>  |

- Option 3 provides an optimal balance of cover for flood and earthquake (total bond limit of \$57.5m with a maximum payment per country per event of \$17m) over a period of 3 years until exhaustion
- Premium costs reflects the average three year total cost, single year premium for option 3 is circa \$4.25m
- The annual coverage to premium equivalent is over 13.5 times (\$57.5m to \$4.25m)

# Factors Driving Lower Pricing



## Attractiveness of ADB as an issuer

- Investors and donors will welcome an alternative issuing platform (currently only World Bank has a platform to issue sovereign cat bonds); introducing competition, increasing issuance frequency and drawing in new potential investors
- The unique DRR features of the DRB bond will also increase ESG investors' appetite (and attract donor interest and support)

## The multi-country / multi-hazard nature of the DRB

- Some investors prefer the purity of a single country, single hazard bond, but an innovative multi-country, multi-hazard bond structure will attract many traditional and new investors
- Diversification within a multi-country, multi-hazard bond allows scope to apply an overall bond limit lower than the sum of country and hazard limits, leading to potentially lower pricing (see example opposite)

## Leveraging the reinsurance market

- Placing tranche 1 in the reinsurance market would further reduce price
- Buy complementary reinsurance to reinstate the DRB cover once exhausted at relatively cheap costs

## Example of Diversification Benefit

- The lower the bond limit for a given expected loss, the lower the risk multiple; and so the lower the price
- The CAREC portfolio is well diversified. For example, a 1 in 100 earthquake in a country in the west of the CAREC region is very unlikely to happen in the same year as a 1 in 100 earthquake in a country in the east.
- Applying a cap covering two or more countries will yield significant cost savings with a very low probability that cover for either country is impacted
- For example: Option 3, tranche 2, earthquake only: if each country had its own earthquake bond the average expected loss (EL) to bond limit ratio would be circa 1.4%; giving a risk multiple of 5.1 using the pricing curve. The modelled multi-country bond, which has a similar expected loss but an EL bond limit ratio of 6.3%, an implied multiple of 2.6 only leading to significantly lower cost

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