Knowledge Exchange Series on Building Sovereign Financial Resilience in Middle Income Countries

Disaster Risk Financing Analytics Training

March 31, 2022

Disaster Risk Financing & Insurance Program

SUPPORTED BY WORLD BANK GROUP

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WITH SUPPORT FROM

GFDRR
Global Facility for Disaster Reduction and Recovery

Opening Remarks

Jean Pesme

Global Director, Finance, Competitiveness & Innovation (FCI) Global Practice, World Bank Group (WBG)

Opening Remarks

Rosmarie Schlup

Head of Macroeconomic Support Division,
Switzerland's State Secretariat for Economic Affairs (SECO)

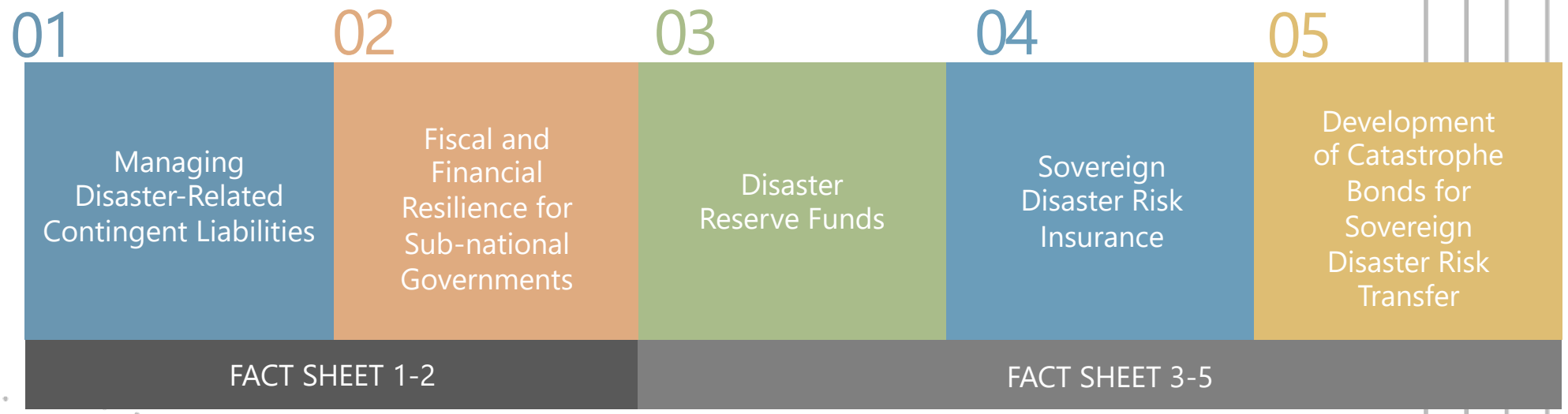
Overview

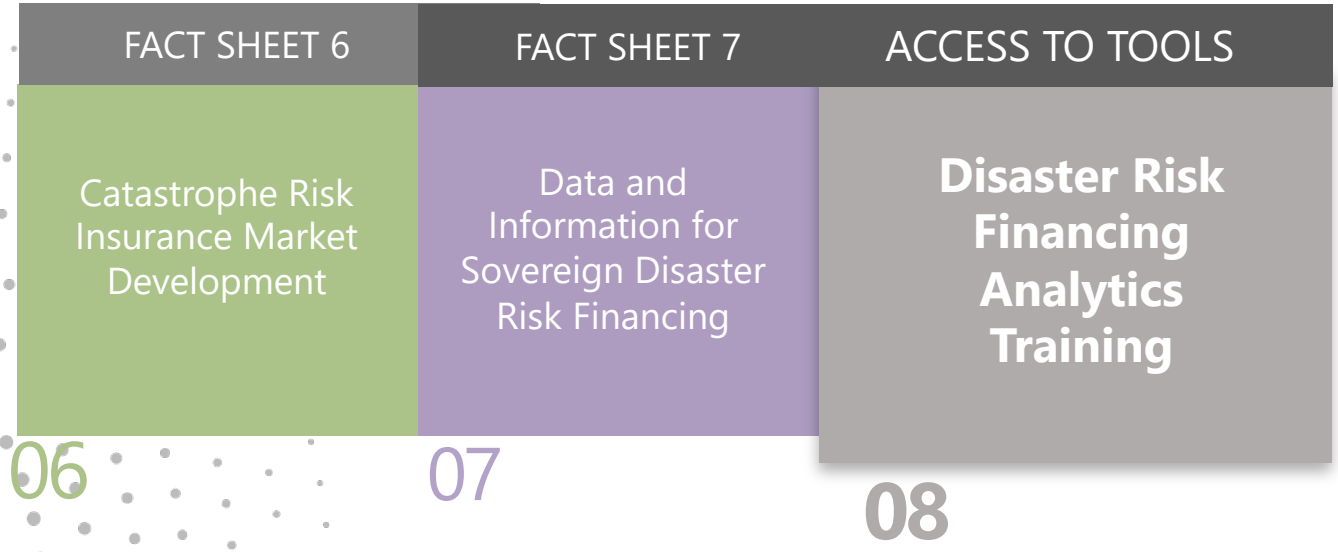
Middle-income countries face fiscal challenges in effectively responding to disasters, with many governments primarily relying on (short term) international support to fund disaster response.

Since 2012, Switzerland's State Secretariat for Economic Affairs (SECO) and the World Bank's Disaster Risk Financing and Insurance Program (DRFIP) have developed a joint program to support middle-income countries (MICs) in building their financial resilience against natural disasters. The Sovereign Disaster Risk Financing and Insurance Program for Middle-Income Countries (the Program) is one component of a broader WB-SECO partnership on fiscal risk management for MICs.

This webinar series, as part of the Program, aims to: assist governments with developing and implementing more effective and cost-efficient financial protection strategies to better manage government disaster related contingent liabilities; and bring countries together to share knowledge, experiences and good practices on disaster risk financing.

Today – Final webinar





Structure of Webinars

Total of 7 Fact Sheets & 8 webinars

Different guest speakers

Live audience polls: Please participate

Q&A: Please share your questions via chat box (If possible, please indicate which speaker(s) to address your question(s))

Certificate of Participation

Certificate of Participation

- Participants will have an opportunity to obtain certificate(s) on successful completion of following criteria:

Certificate of Completion: Participants need to attend 6 out of 8 webinars and complete a short survey

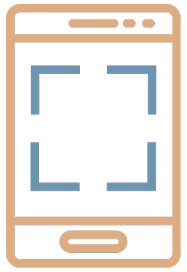
SCAN ME

Scan the QR Code to complete the short survey and obtain the certificate of completion.

Word Cloud : Where are you currently based?

Option 01

Go to www.menti.com



Option 02

Scan the QR Code

Use Code: 4160 0804

Poll 1 : Recap

What was the last Webinar about?

- Different types of data and analytics and how these can be used for sovereign disaster risk financing
- What is a public asset registry?
- I did not attend the previous webinar – this is my first time
- I don't remember

Option 01 –

Go to www.menti.com

Option 02 –

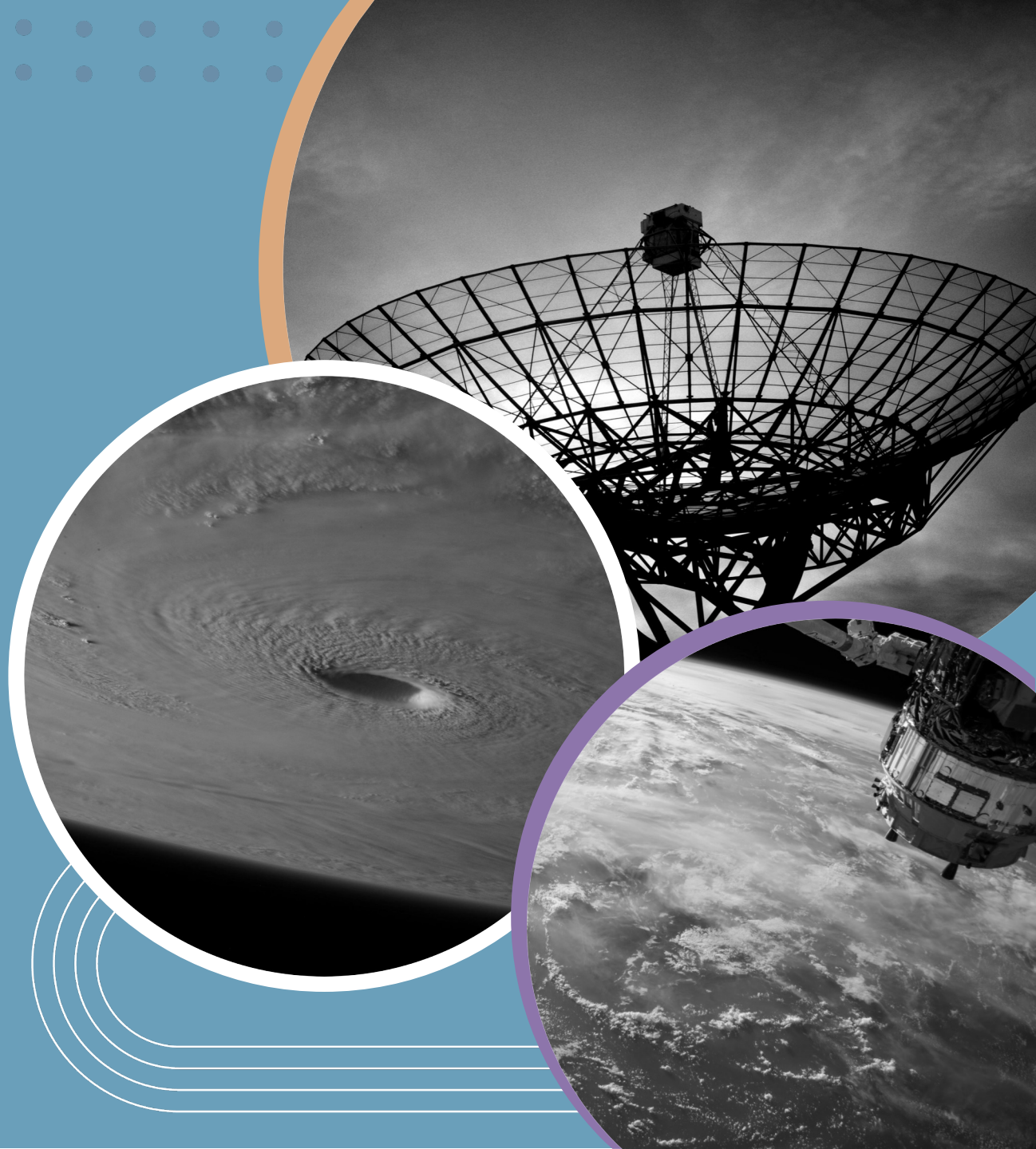
Scan the QR Code

Use Code: 4160 0804

Disaster Risk Financing Analytics

Framing Presentation

Evie Calcutt
Financial Sector Specialist, FCI Global Practice,
Crisis and Disaster Risk Finance (CDRF), WBG



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Introduction to DRF Tools

Financial Risk Assessment
(Tool 1)

What could happen?

Financial Response Design
(Tool 2)

How to best respond financially?

Introduction to DRF Tools

Financial Risk Assessment (Tool 1)

1. Use historical event data to **estimate the potential financial needs**.
2. Quantify the resulting **funding gap** based on the assumed available funding.
3. **Understand the uncertainty and variability** of the historical event data itself.

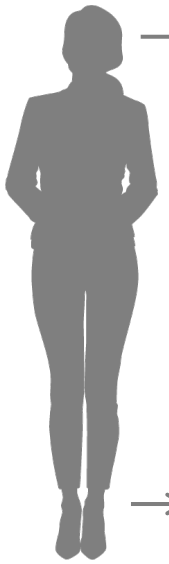
Financial Response Design (Tool 2)

1. **Compare the funding gap** under various DRF strategies.
2. **Optimize the use of funds by designing a layered DRF strategy with the most cost-effective instruments.**
3. **Evaluate the impact of assumptions** on the cost-effectiveness of various DRF strategies.

2. Financial Risk Assessment Tool

Risk Metrics Review: Average

Beware of the flaws

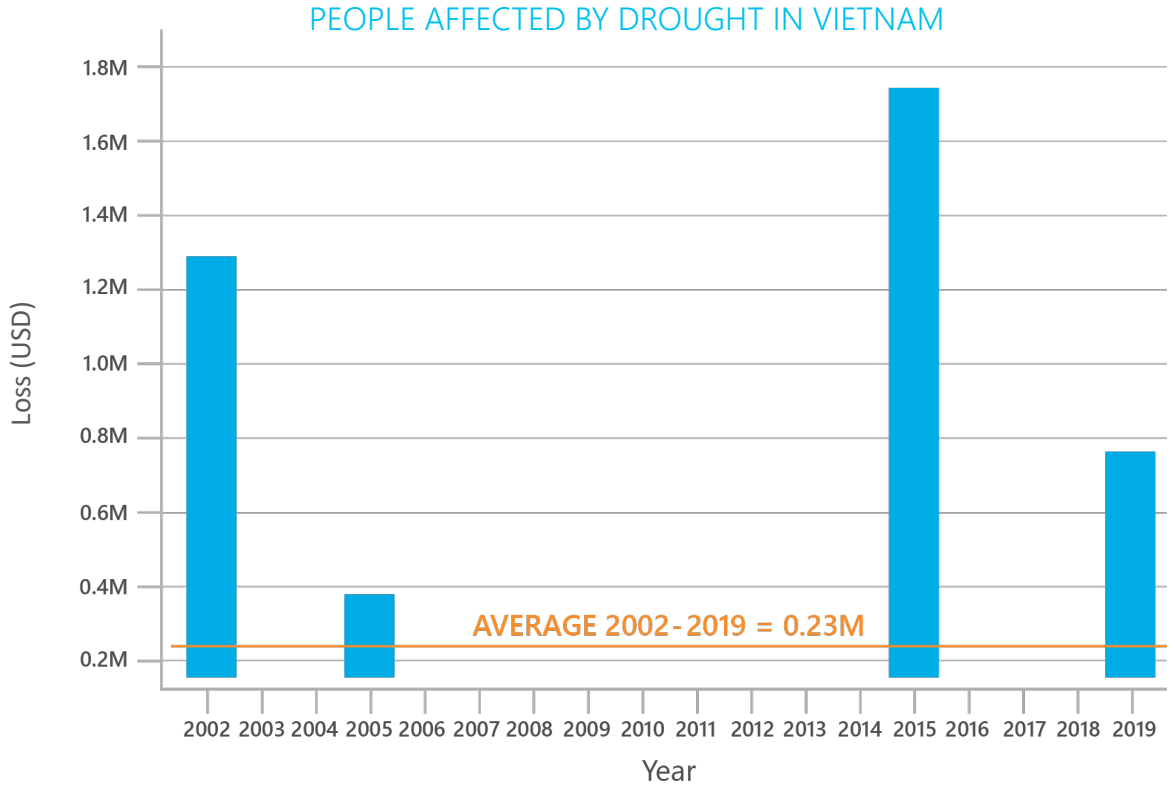


Head in the oven.

Feet in the freezer.

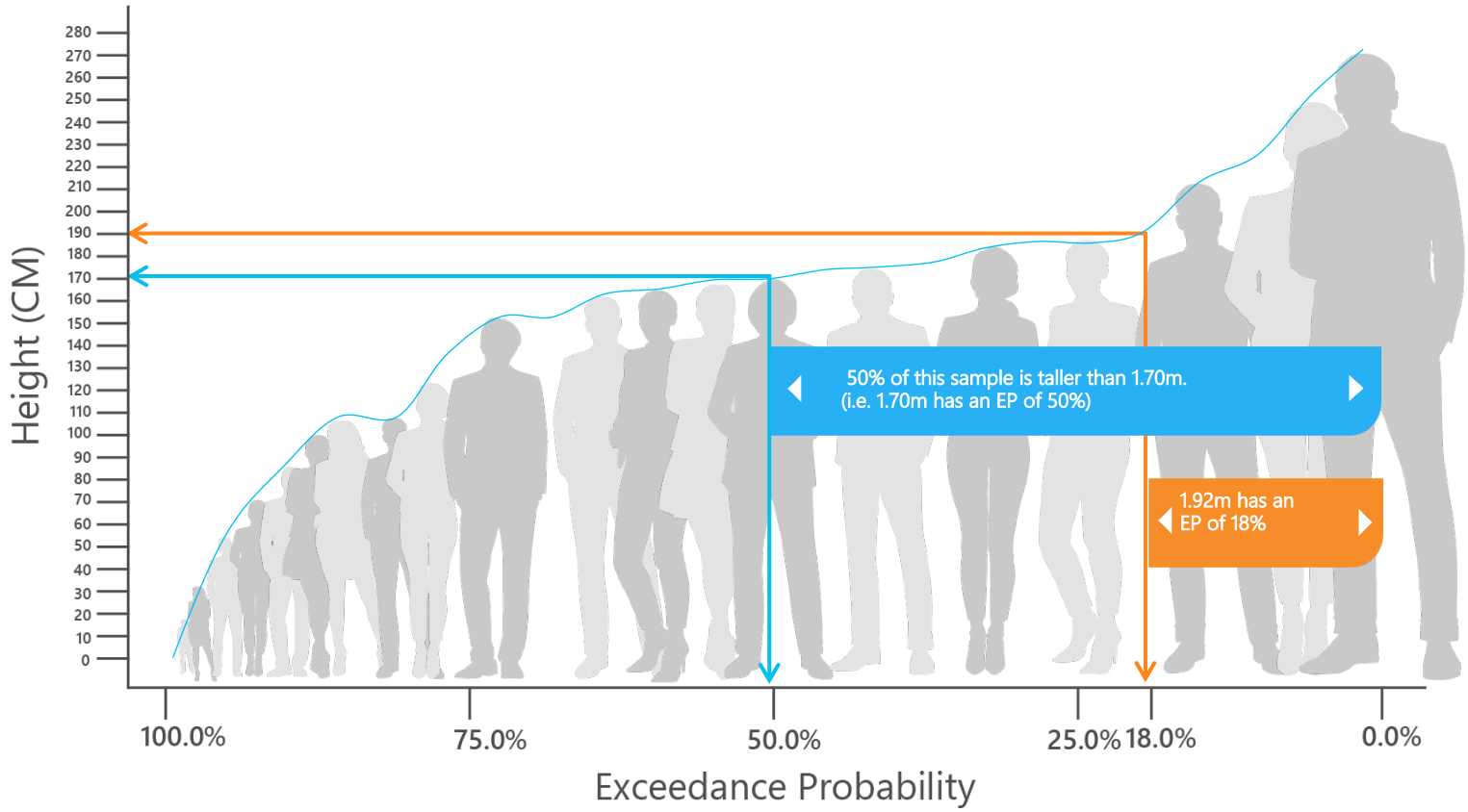
On average, you are doing fine.

Low frequency climatic disasters.
Average does not reflect the impact when an event occurs.



Risk Metrics Review: Exceedance Probability Curve

Exceedance Probability (EP) versus associated Value of the Variable of Interest



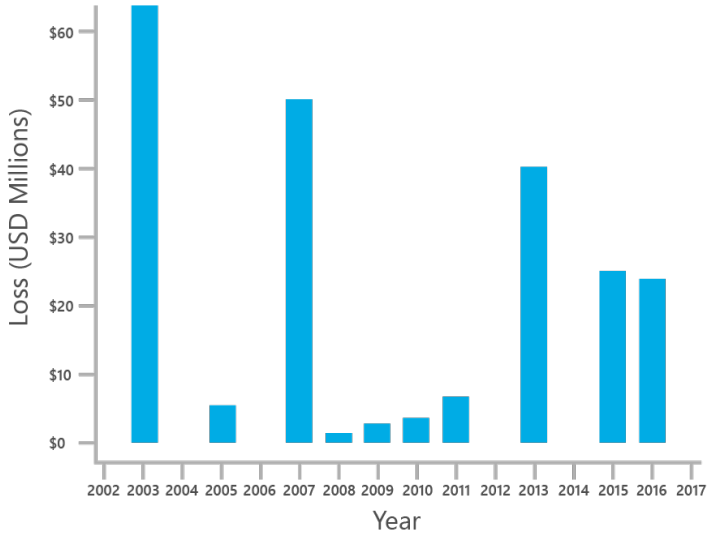
Remark: Notice that the EP Curve represents only the data in the **sample**.

Remark: The **Return Period (RP)** is calculated as the inverse of the Exceedance Probability (EP). E.g. 100 years RP is the same as 1% EP, 20 years RP means 5% EP, and so on.

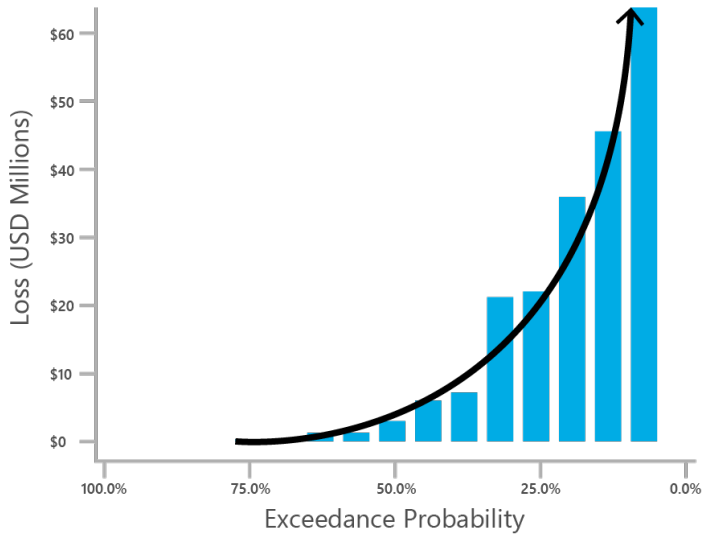
Financial Risk Assessment Tool

From Data to Risk Metrics and Funding Gaps

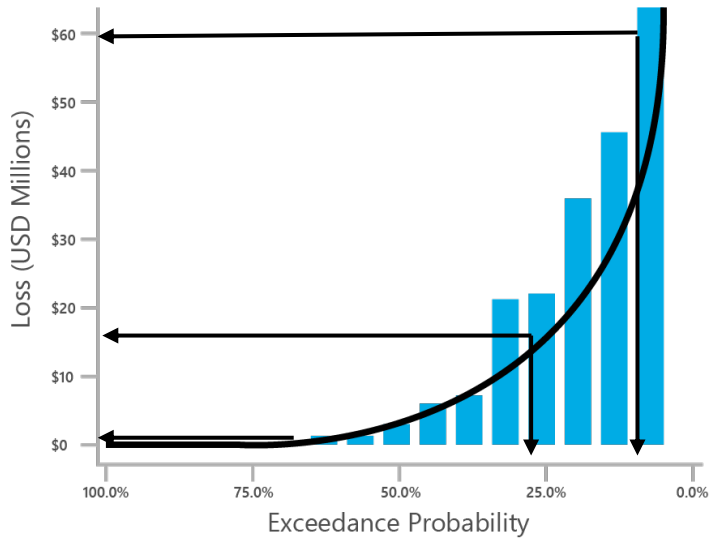
Step 01: Input Historical loss data



Step 02: Reorder from low to high



Step 03: Distribution fitting. Fit a smooth line



Risk Metrics from fitted distribution (smoothed line) → **Funding Gap** by comparing the metrics with available funds

Disaster Risk Financing Analytics

Live Demo

Lisa Yu

Risk Finance Consultant, FCI Global Practice, Crisis and Disaster Risk Finance (CDRF), WBG

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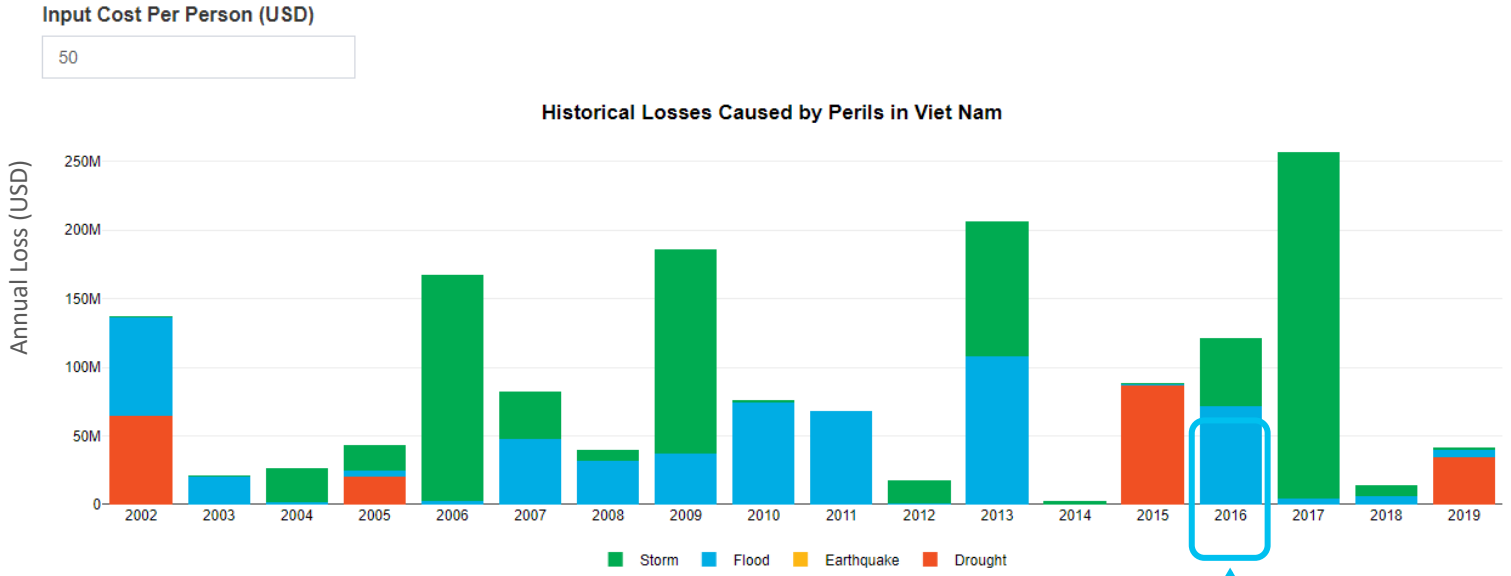
Example of application: Vietnam

Vietnam is one of the most hazard-prone countries in the South East Asia region, with droughts, storms, and floods causing substantial economic and human losses.



Around 1.4 million people affected by floods in 2016

Vietnam floods: deaths reported, tens of thousands of homes destroyed

Local authorities mobilise army and police to rescue trapped residents in central Vietnam following torrential rain

https://www.theguardian.com/world/2016/oct/16/vietnam-floods-deaths-reported-tens-of-thousands-of-homes-destroyed

Province drowns as non-stop rains, floods hit central Vietnam

12:03 15/10/2016

Thousands of houses in Quang Binh have been submerged and transport disrupted.

http://en.cand.com.vn/Law-Society/Province-drowns-as-non-stop-rains-floods-hit-central-Vietnam-412663/

What do past events in Vietnam tell us about the future?

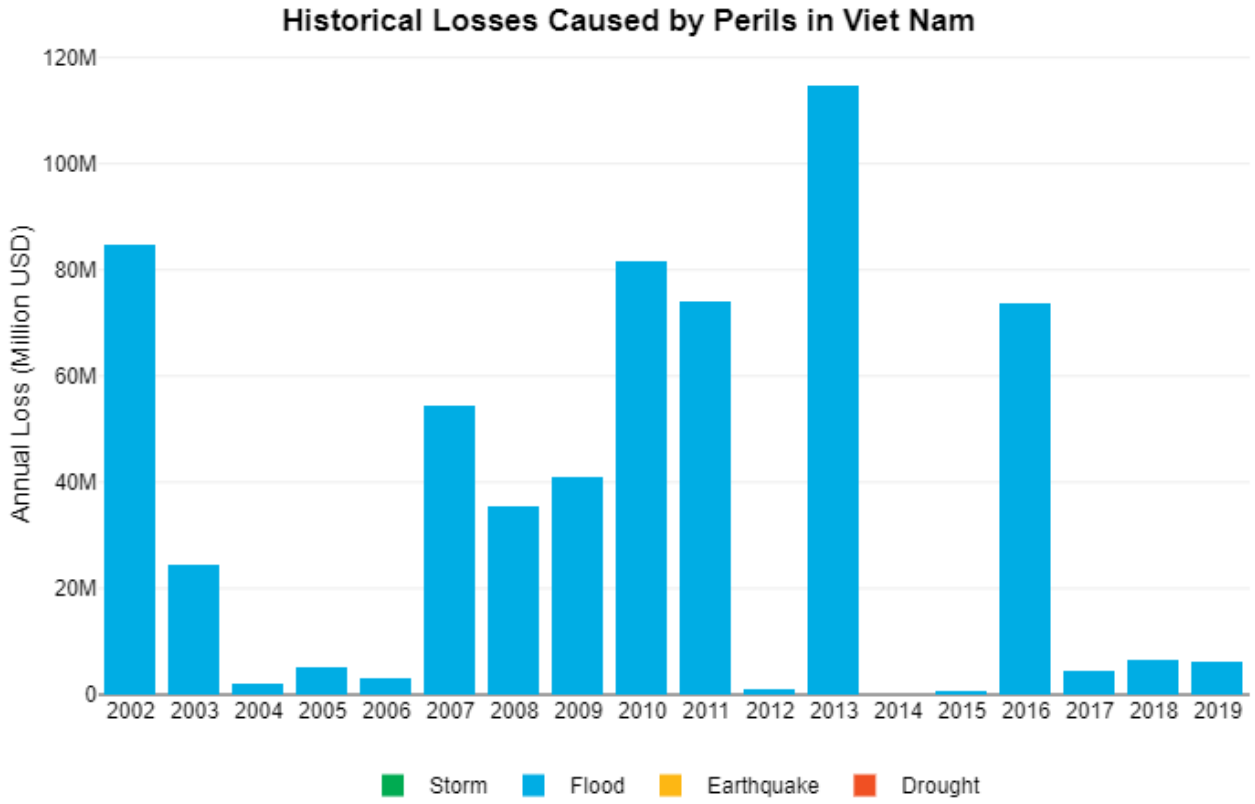
DRF for floods in Vietnam

As part of the DRF planning, the Ministry of Finance (MoF) wants to estimate **potential losses** in the future and related **funding gaps** caused by floods

Assumptions

1. Number of persons historically affected are adjusted by Population growth.
2. Assistance costs = USD 50 per person affected

Remark: Historical losses are the main INPUT. Be aware that Garbage In/Garbage Out.

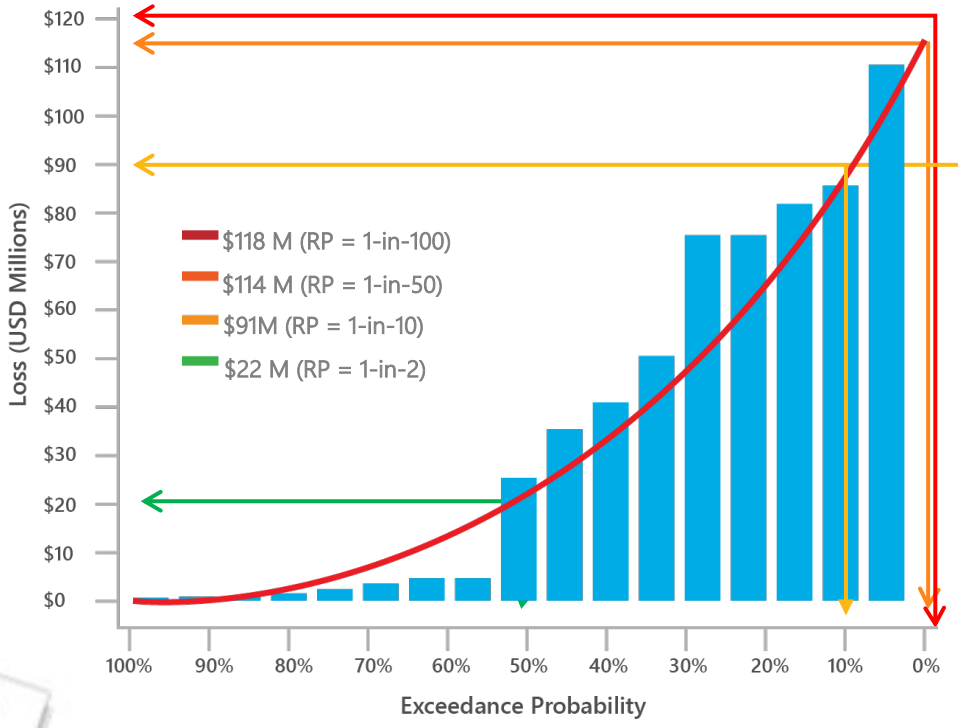


DRF for floods in Vietnam

As part of the DRF planning, the MoF wants to estimate
potential losses(1) in the future and related funding gaps(2) caused by floods

1. How likely are worst case scenarios?

Vietnam Floods: Distribution Fitting



2. How likely will budget be exceeded?

- How big could the funding gap be in worst case scenarios?

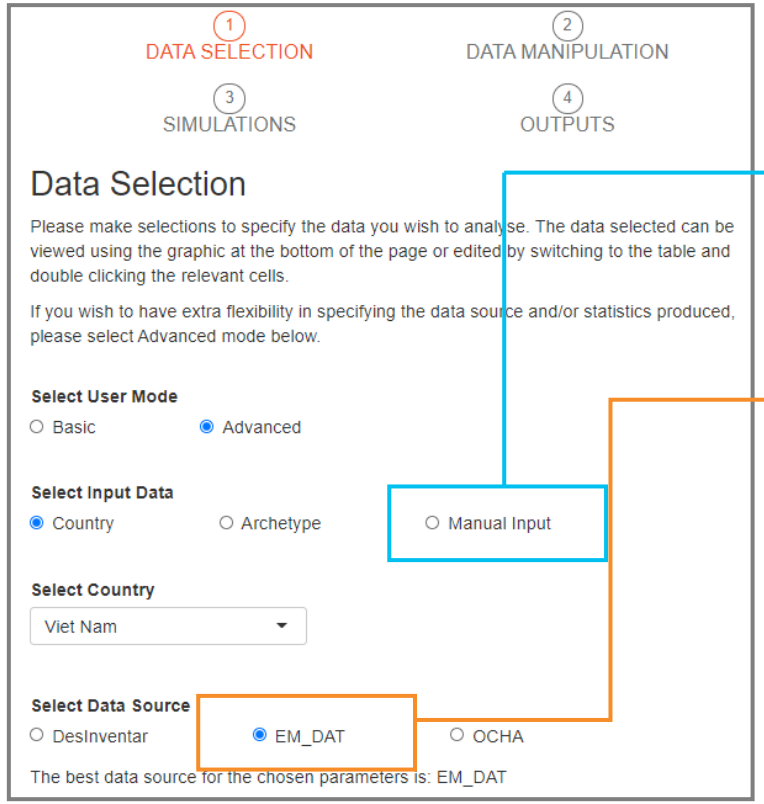
A Budget of USD 91m has 10% chance of exhaustion (1-in-10 years)

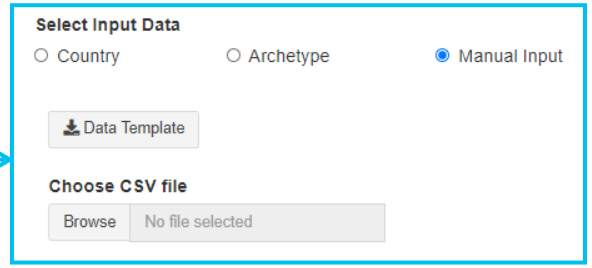
There is 2% chance (1-in-50) of a funding gap higher than USD 23m

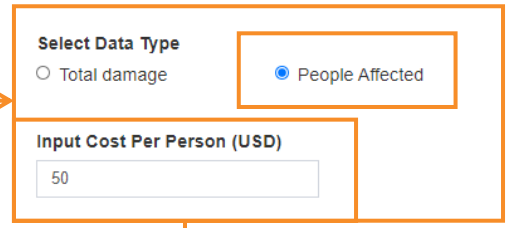
There is 1% chance (1-in-100) of a funding gap higher than USD 27m

DRF for floods in Vietnam

Solution Using Risk Assessment Tool: Data Selection







Remark: Loss Data Inputted. Different kinds of (user-supplied) data could be used, such as Emergency relief expenditures, Cost per person, Agricultural losses, replacement cost of infrastructure, Reconstruction of public assets, etc.

Historical Losses Frequency

Plot Table

Copy CSV

Year	Drought, USD	Earthquake, USD	Flood, USD	Storm, USD
2002	65,000,000	0	71,590,800	90,000
2003	0	0	20,841,150	250,900
2004	0	0	1,750,900	25,045,250
2005	20,500,000	0	4,619,650	18,383,000
2006	0	0	2,606,000	164,864,500
2007	0	0	48,108,600	34,271,500

DRF for floods in Vietnam

Solution Using Risk Assessment Tool: Data Manipulation

✓ DATA SELECTION 2 DATA MANIPULATION

3 SIMULATIONS 4 OUTPUTS

Scaling

Scaling can remove trends caused by known indexes such as population, to help make losses more comparable between years. Basic mode always scales by population but advanced mode allows for more options.

For each given year, a scaling factor is calculated by dividing the scaling data for the most recent year by the given year. Each peril year is then multiplied by the scaling factor for that year to give a corrected loss in terms of the most recent scaling year.

Scale Data By

Population

- Population
- Inflation
- GDP
- No Scaling
- Manual Input

		Population Factor
2002	81,534,407	1.18
2003	82,301,656	1.17
2004	83,062,821	1.16
2005	83,832,661	1.15
2006	84,617,540	1.14
2007	85,419,591	1.13
2008	86,243,413	1.12

You are using raw scaling data.

Final Data

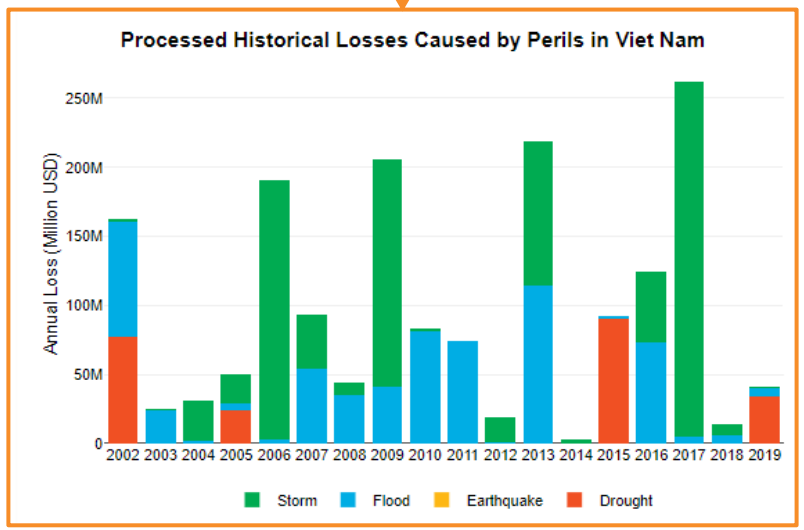
The peril data displayed below has been multiplied by the chosen scaling factors and detrended (if selected).

This data is what the tool will use to fit the parametric distributions to each peril and produce the outputs.

Plot | Table

Copy CSV

Year	Drought, USD	Earthquake, USD	Flood, USD	Storm, USD
2002	76,900,503	0	84,697,977	106,478
2003	0	0	24,426,984	294,069
2004	0	0	2,033,347	29,085,426
2005	23,588,338	0	5,315,603	21,152,411
2006	0	0	2,970,782	187,941,848
2007	0	0	54,327,781	38,701,907



Remark: These data are the main input for DRF analysis. Be aware that Garbage In/Garbage Out.

DRF for floods in Vietnam

Solution Using Risk Assessment Tool: Simulation

✓ DATA SELECTION ✓ DATA MANIPULATION 3 SIMULATIONS 4 OUTPUTS

Simulations

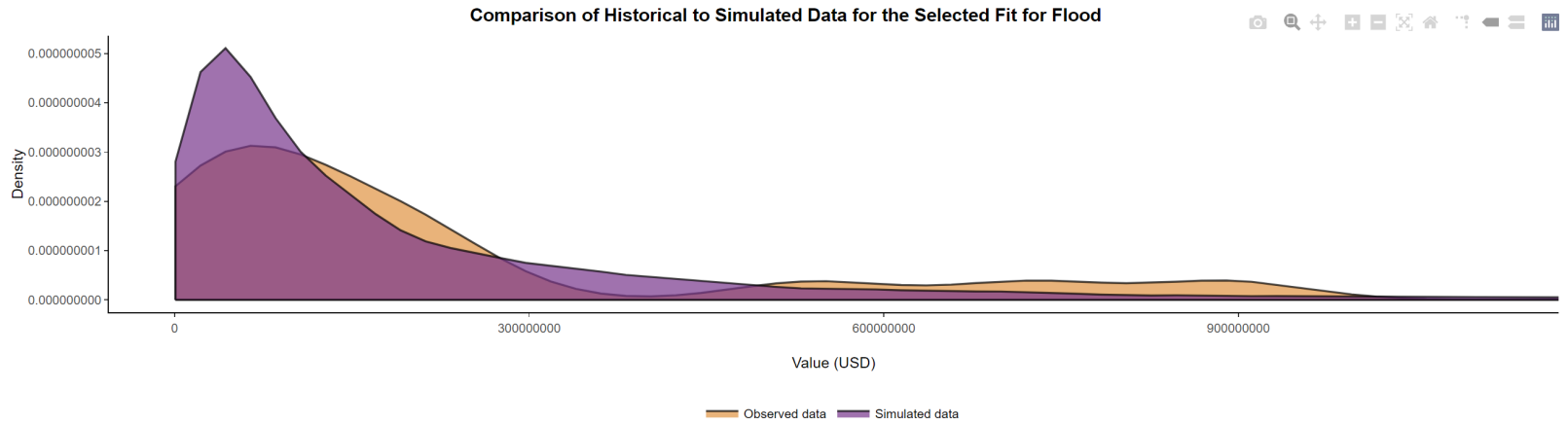
The Tool runs 15,000 simulations for each parametric distribution that has been successfully fitted to a given peril. If multiple distributions are fit for a peril, the one with the highest Criterion) weight is selected.

In advanced mode the user can change the selected distribution for a given peril.

Choose Distribution for Flood

Log normal

◉ Observed and Simulated Data ○ Observed Data ○ Simulated Data



DRF for floods in Vietnam

Solution Using Risk Assessment Tool: Outputs

DRF for floods in Vietnam

Solution Using Risk Assessment Tool: Outputs

DATA SELECTION ✓ DATA MANIPULATION ✓

SIMULATIONS ✓ OUTPUTS 4

Outputs

In this tab, the user can view the simulated losses across the selected perils calculated from the distributions selected on the previous page. Selecting combinations of perils will combine each peril's simulations to produce a new 15,000 simulations therefore the risk profile of two perils is not the sum of the losses at each return period.

95% confidence interval's can be toggled. These show the range of possible values for each return period that 95% of losses will fall within.

Select Perils to View

☐ Drought ☑ Flood ☐ Storm

Toggle Confidence Intervals

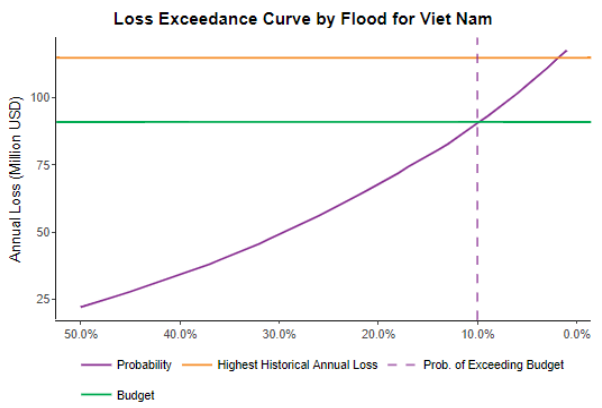
○ On ◉ Off

Budget in Millions USD

91

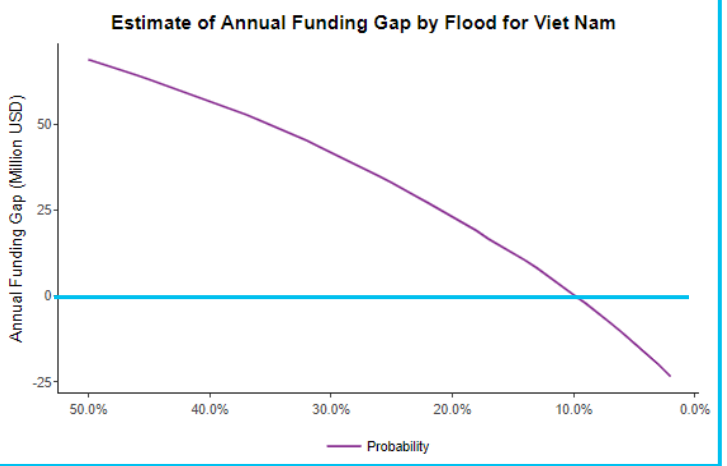
POTENTIAL LOSSES & FUNDING GAPS

Exhibit 1 | Exhibit 2 | Exhibit 3 | Exhibit 4



0.1

Probability of Exceeding Budget



3. Financial Response Design Tool

Link between DRF Tools

Financial Risk Assessment (Tool 1)

What could happen?

Financial Response Design (Tool 2)

How to best respond financially?

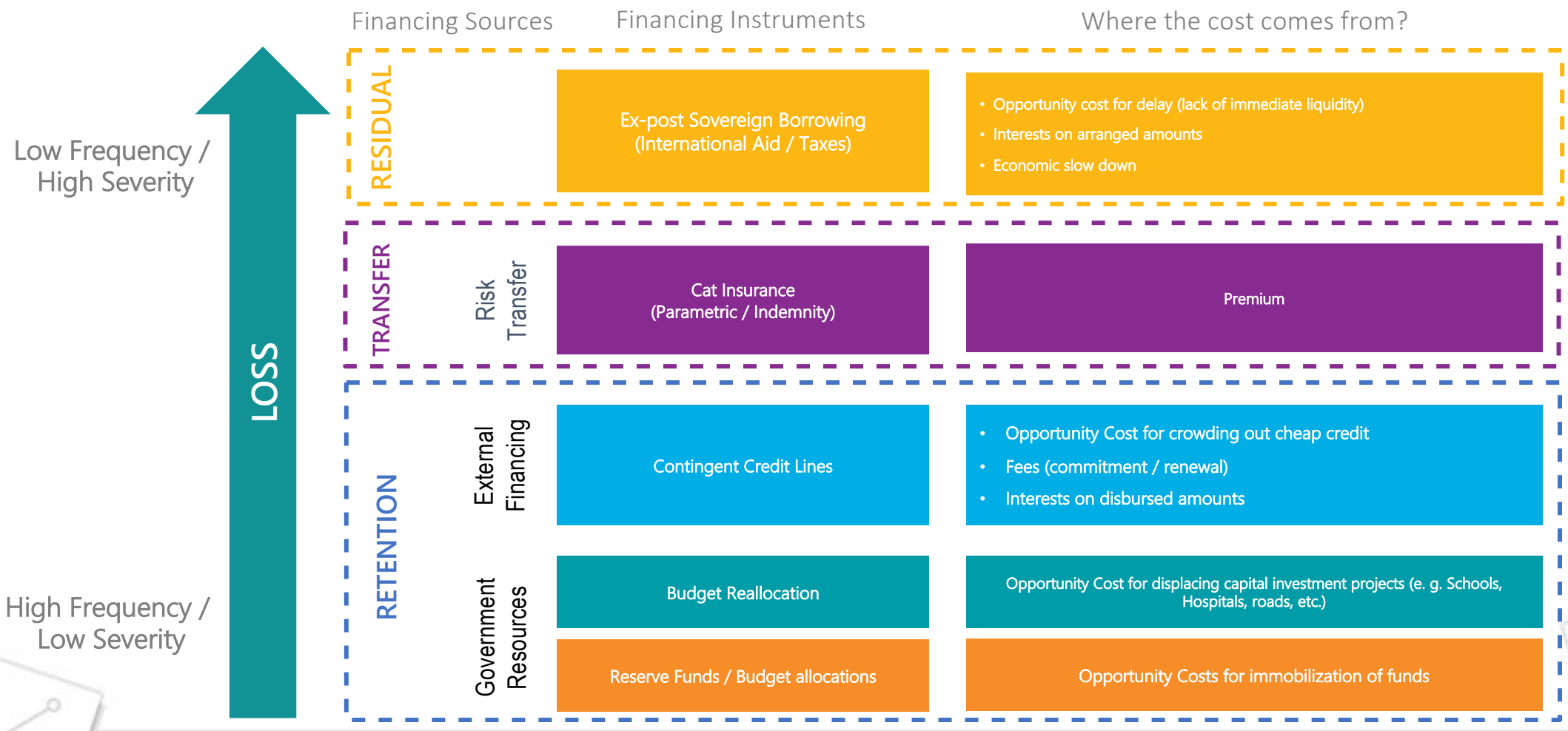
Output from Tool 1 is used as Input in Tool 2

Tool 1 outputs a Risk Profile (i.e. losses associated to Exceedance Probabilities)

Tool 2 analyzes alternative DRF strategies for funding the losses from the risk profile outputted in Tool #1 in order to optimize the cost-effectiveness of funds.

Financial Response Design: Layered DRFI Strategy

Instruments and Costs

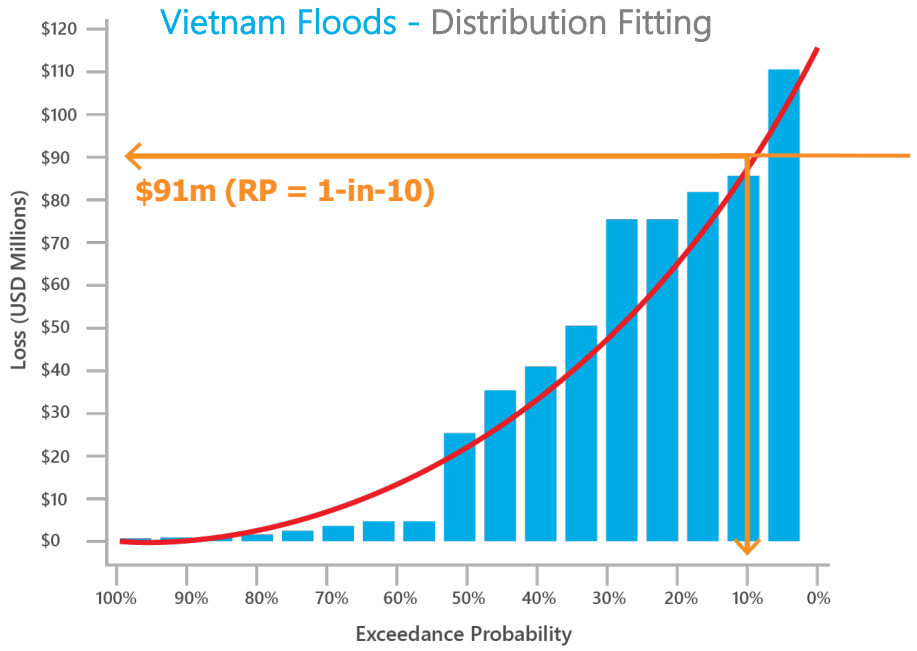


DRF for floods in Vietnam

As part of the DRF planning, the MoF wants to estimate **potential losses (1)** and to **design a DRF strategy (2)**

1. How likely are worst case scenarios?

Financial Risk Assessment (Tool 1)



Target DRF Protection $ 91m

2. How to best respond financially?

Financial Response Design (Tool 2)

Optimize combination of instruments

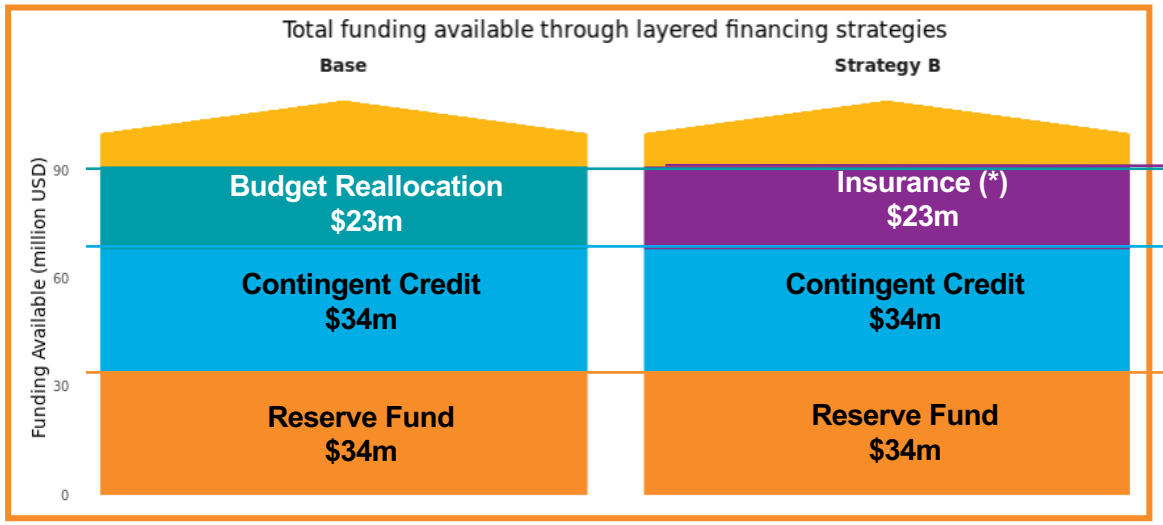
Risk Retention	Risk Transfer
Line of Contingent Credit	Insurance
Budget Reallocation	
Reserve Fund	

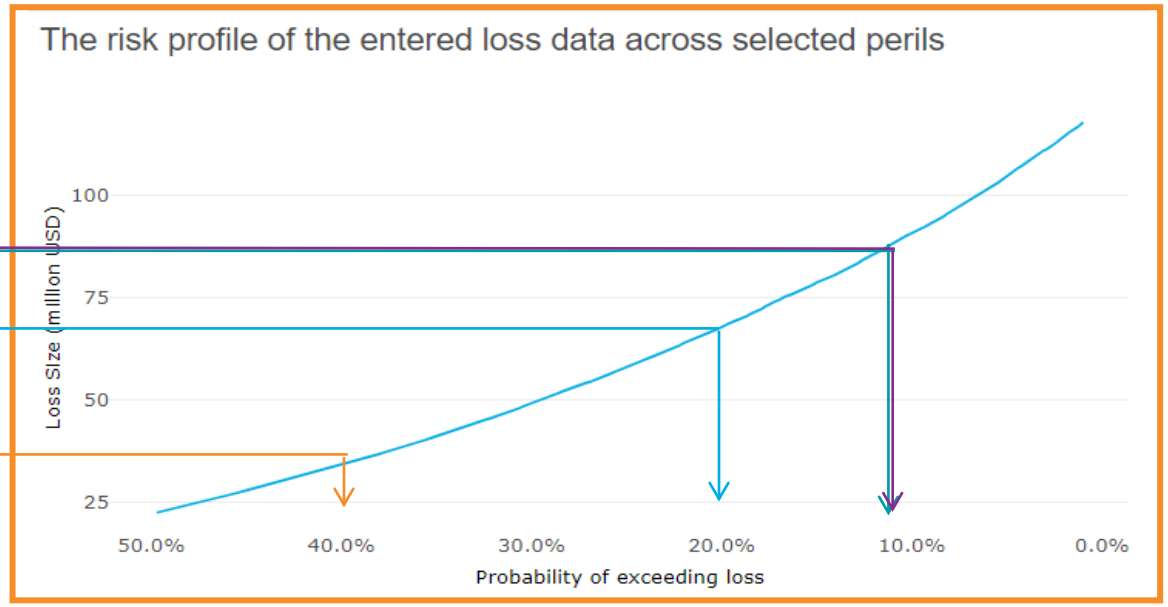
Residual Risk on top of USD 91m

Ex-post Sovereign Borrowing (International Aid / Taxes)

DRF for floods in Vietnam

MoF wants to design a DRF strategy to allocate the DRF Protection of USD 91m among Risk Retention and Risk Transfer instruments

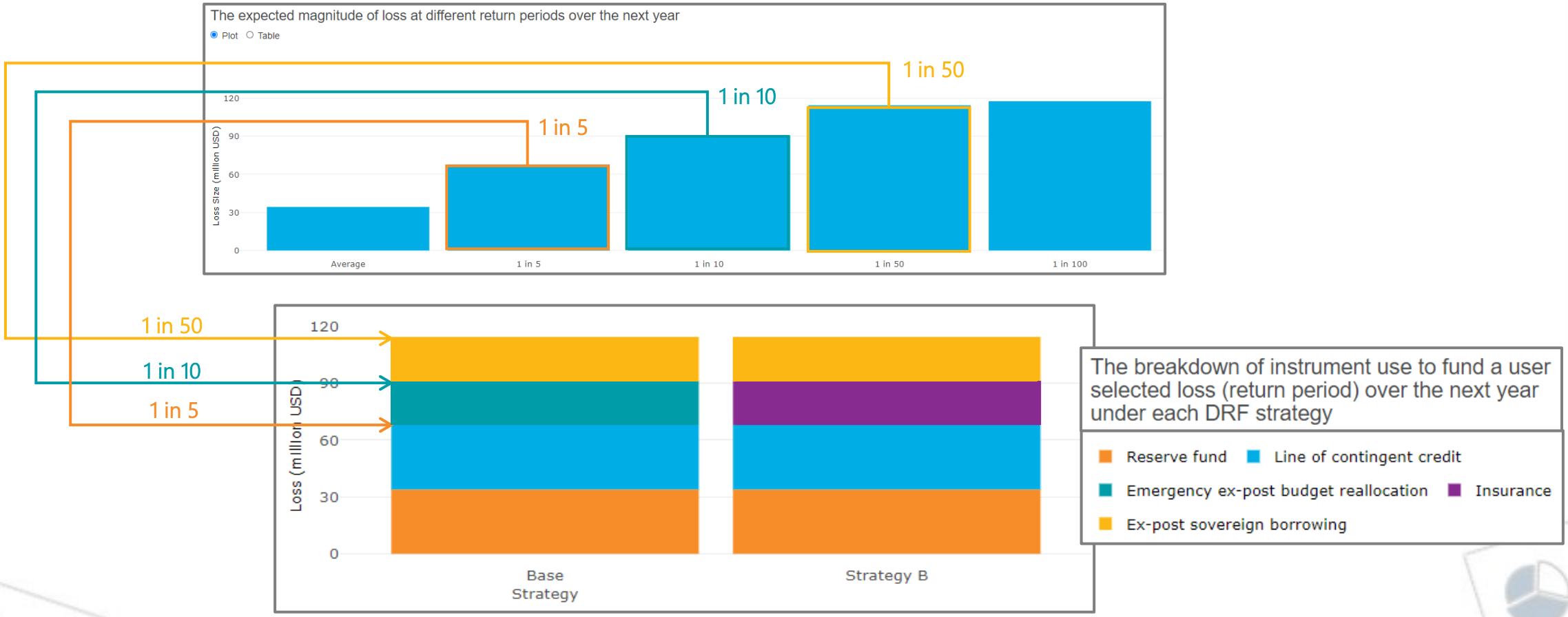




Remark: In this example the two strategies were designed to have the same layering and same total budget, but decision makers can design strategies with different layering, instruments and amounts (e.g. different size and EP for Reserve Fund, exclude Contingent Credit, etc.).

DRF for floods in Vietnam

MoF wants to understand how losses of different severity are financed under each DRF strategy designed

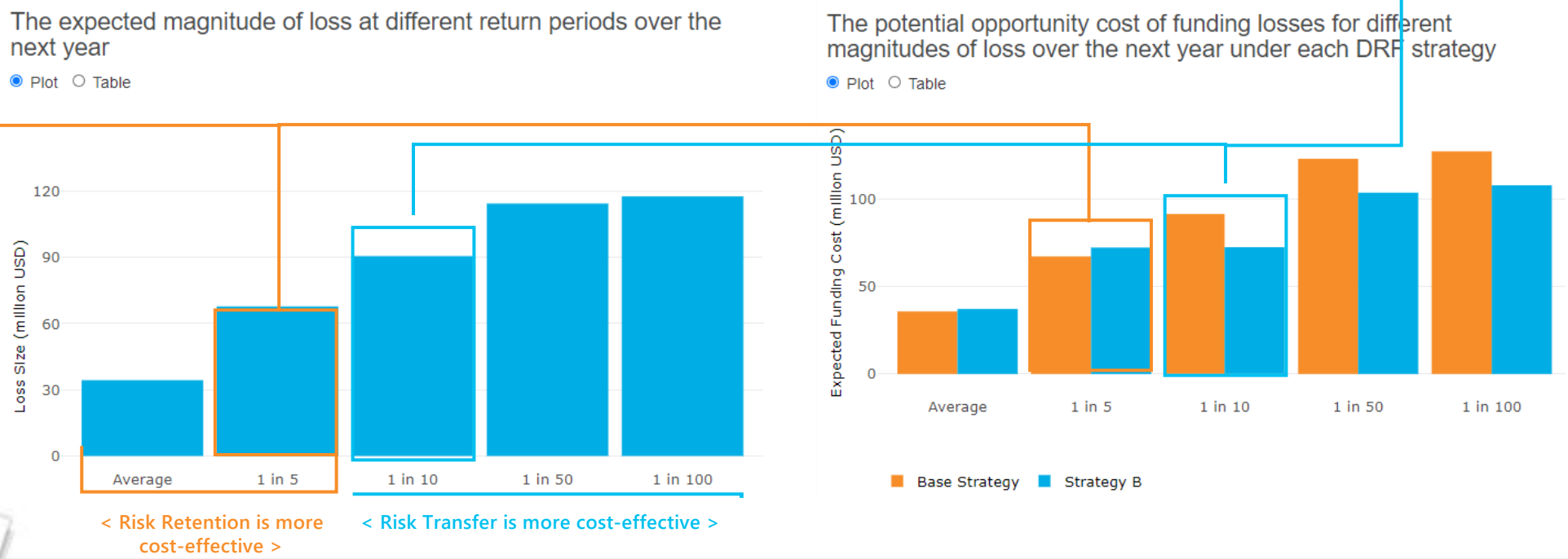


DRF for floods in Vietnam

MoF wants to **optimize the use of funds** by designing instruments where most cost-effective.

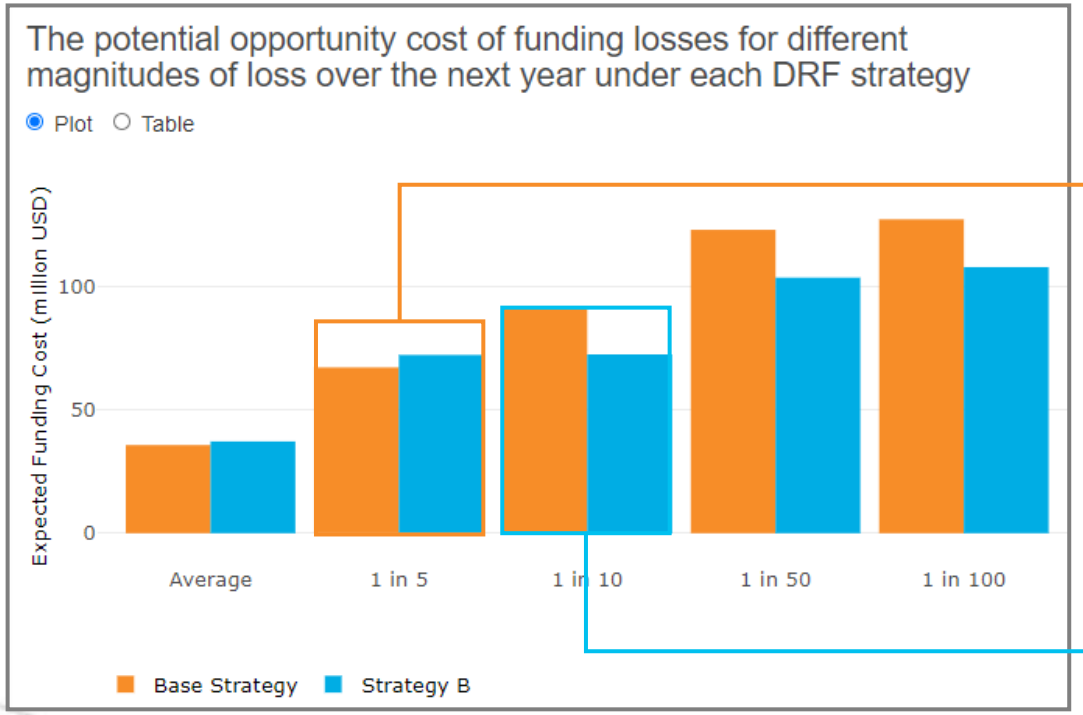
Base Strategy results more cost-effective: the insurance included in Strategy B is not triggered and consequently the premium increases the Opportunity Cost.

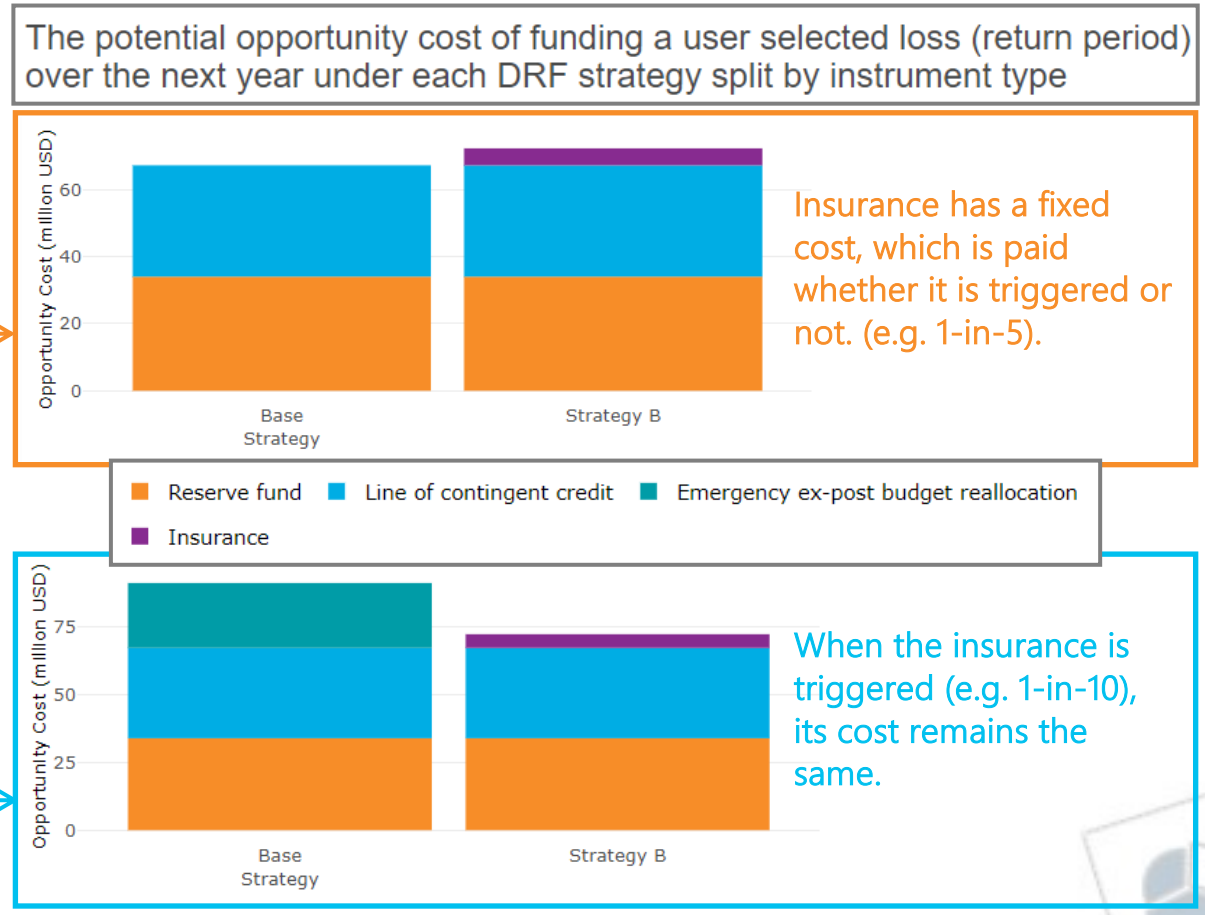
Strategy B is more cost-effective: the insurance is triggered (and payouts much more than the premium spent) and consequently the Opportunity Cost is reduced.



DRF for floods in Vietnam

MoF wants to **optimize the use of funds** by designing instruments where most cost-effective.



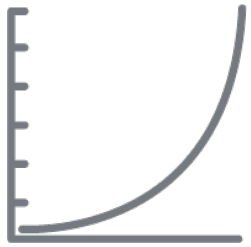


Insurance has a fixed cost, which is paid whether it is triggered or not. (e.g. 1-in-5).

When the insurance is triggered (e.g. 1-in-10), its cost remains the same.

Key Messages

Financial Risk Assessment Tool



1. Probabilistic risk assessment helps governments to make informed decisions going beyond historical data.

2. Risk Metrics: being aware of average flaws and understanding *loss exceedance curves/tables.*

Remark: Remember Garbage In/Garbage Out.

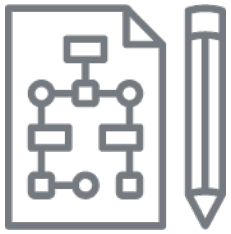
Key Messages

Financial Response Design Tool

1. Risk Retention and Risk Transfer instruments carry opportunity costs.

2. The design of the financial response generates opportunity cost savings.

2B. In the case presented, designing instruments where most cost-effective produces saving of more than 20%.



3. *Risk Retention* instruments are more cost-effective for *high frequency/low severity* scenarios, while Risk Transfer is more appropriate for *low frequency/high severity* events.

GEORGIA: Natural Disaster Related Fiscal Risks

Disclosure practices

Case study

Eka Guntsadze
Deputy Minister, Ministry of Finance, Georgia

Shota Gunia
Head of Fiscal Risk Management Department, Ministry of Finance, Georgia

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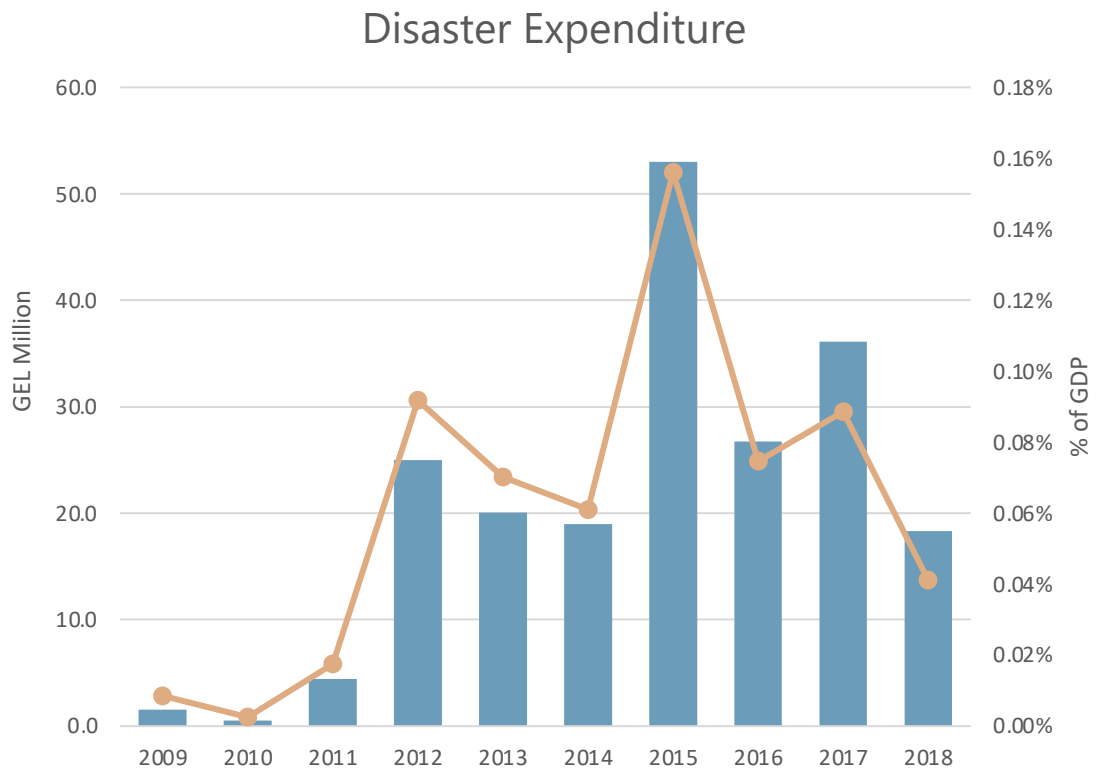
MINISTRY OF FINANCE OF GEORGIA

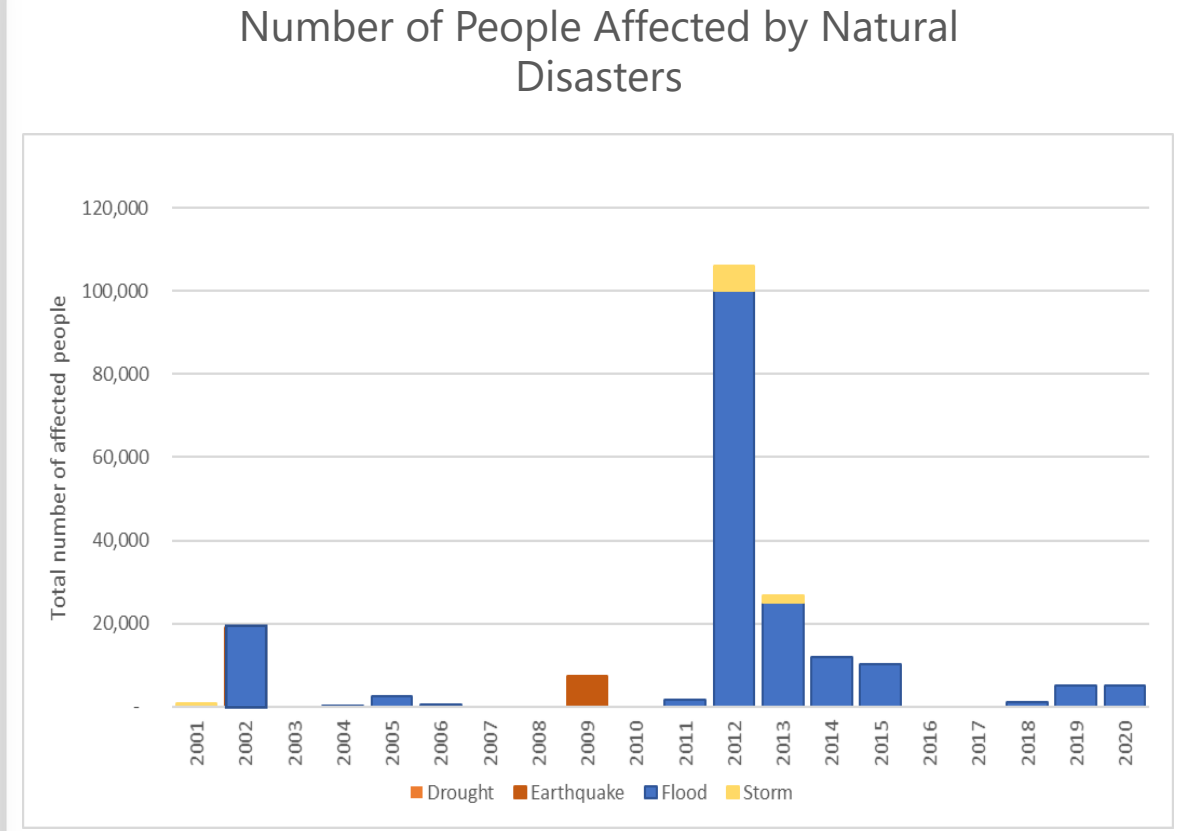
Natural Disasters Fiscal Risks Disclosure Practices

Disaster-related fiscal risks represent implicit contingent liabilities
Accentuation of natural disasters is likely to be an important effect of climate change.

Principle	Practices		
	Basic	**Good**	**Advanced**
The potential fiscal exposure to natural disasters and other major environmental risks is analyzed, disclosed, and managed.	The government identifies and discloses the main fiscal risks from natural disasters in qualitative terms.	The government identifies and discloses the main fiscal risks from natural disasters, quantifying them on the basis of historical experiences.	The government identifies and discloses the main fiscal risks from natural disasters, quantifying them on the basis of historical experiences, and managing them according to a published strategy.

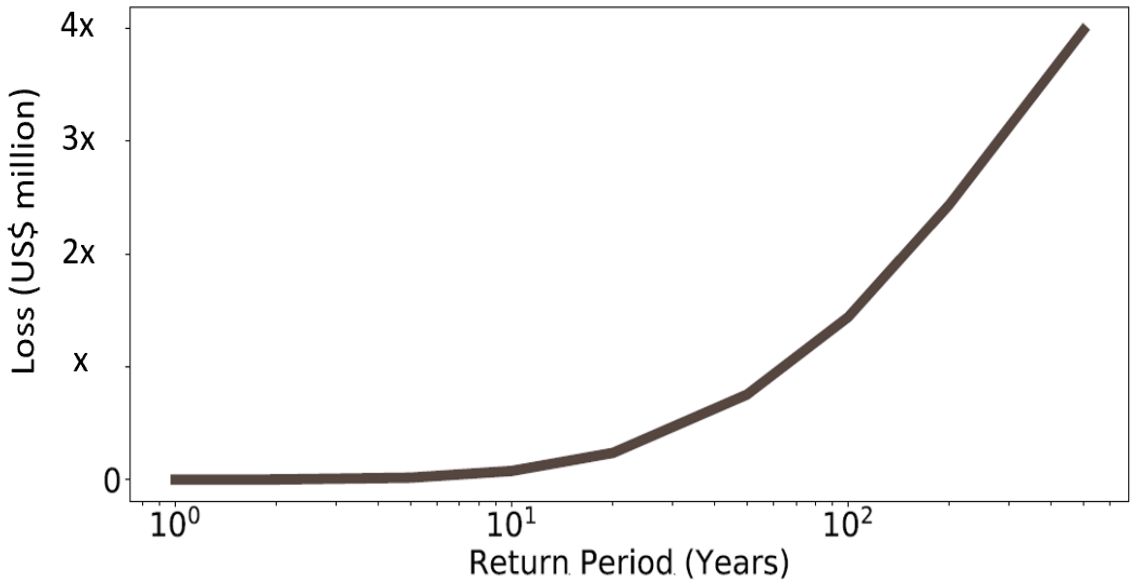
Historical Data



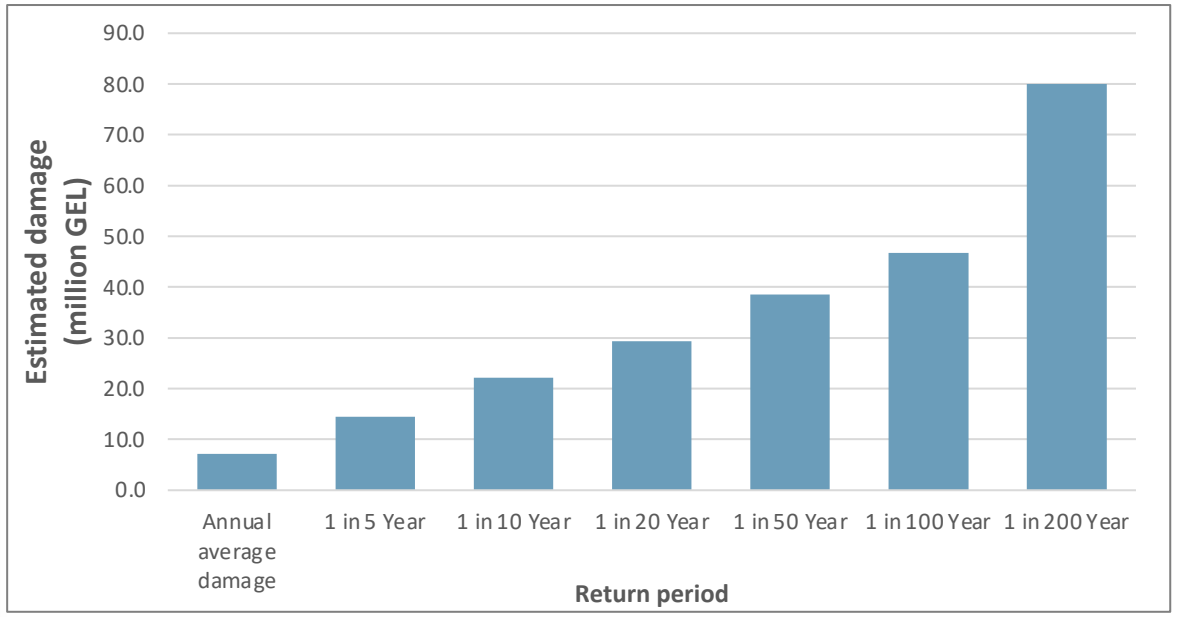


Expectations

Exceedance Probability of Earthquakes at Different Return Periods for Georgia

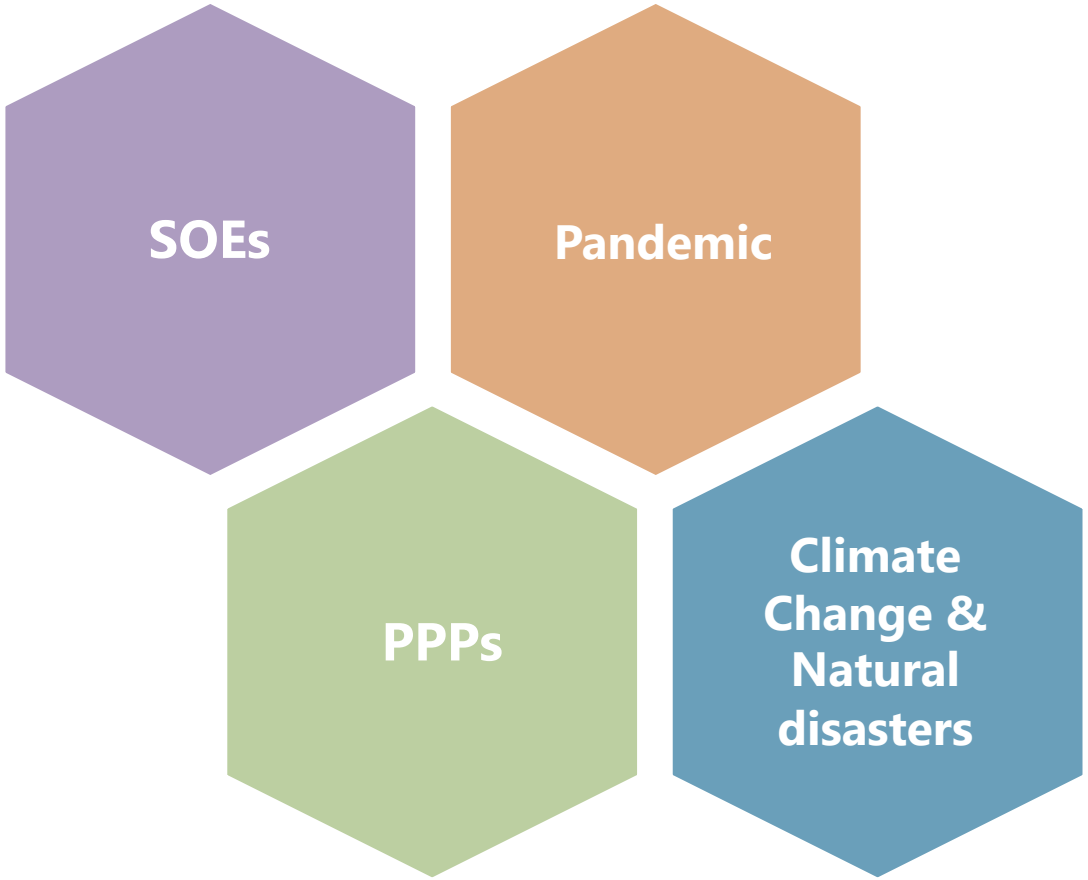


Government Contingent Liabilities for Residential Assets

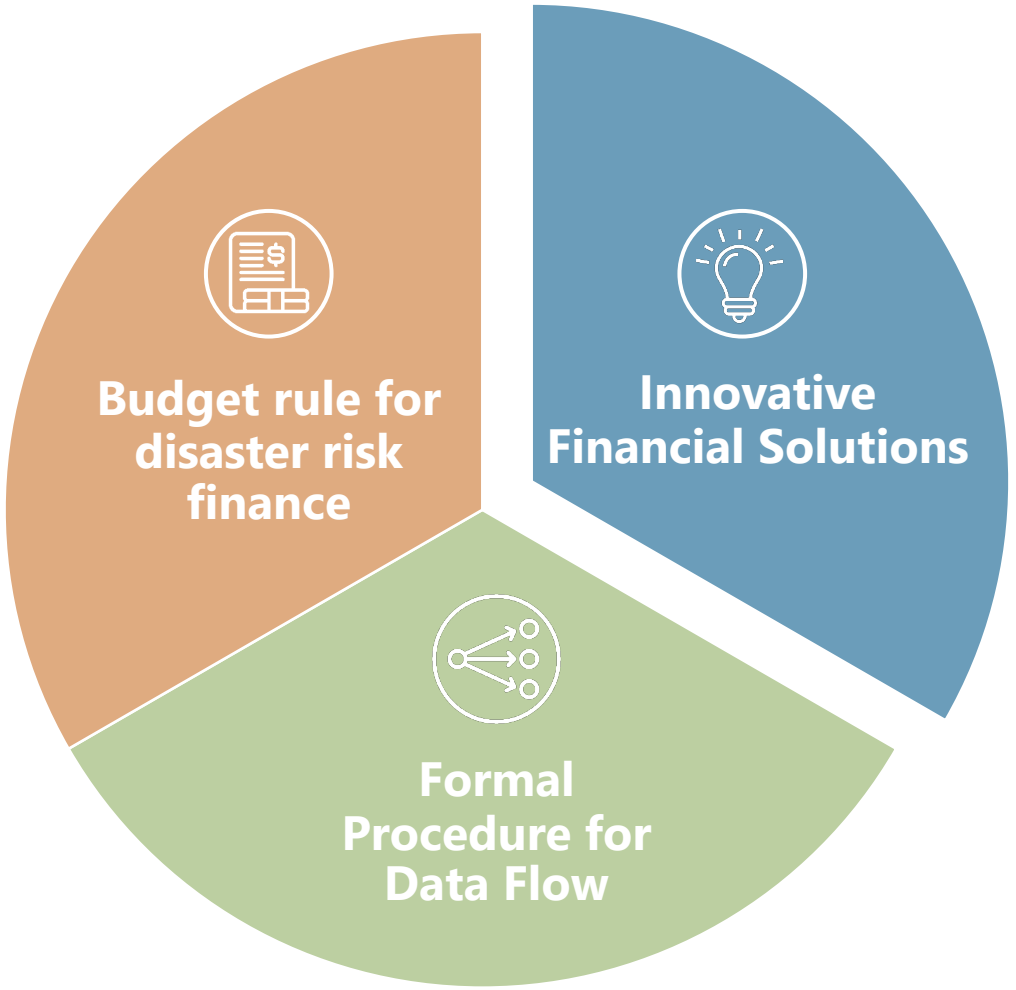


Exceedance Probability (EP) is one of the most commonly used metrics in catastrophe modeling. It is the probability that a certain loss value will be exceeded in a predefined future time period.

Georgia Fiscal Risk Statement 2021



Challenges/Opportunities



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Tools are available online, password-protected, at https://www.financialprotectionforum.org/online-learning-financial-risk-response-tools

SCAN ME

Scan the QR code to join the Disaster Risk Finance Community!

Time for questions

Closing Remarks

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Thank you

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