

Managing the financial impact of natural catastrophes (introduction and example)

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Work Package 6: Strategies to increase the financial resilience of coastal cities

SCORE WEBINAR #3 | 30 March 2023



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101007142



Why are quantitative models relevant to formulate financial risk management strategies?

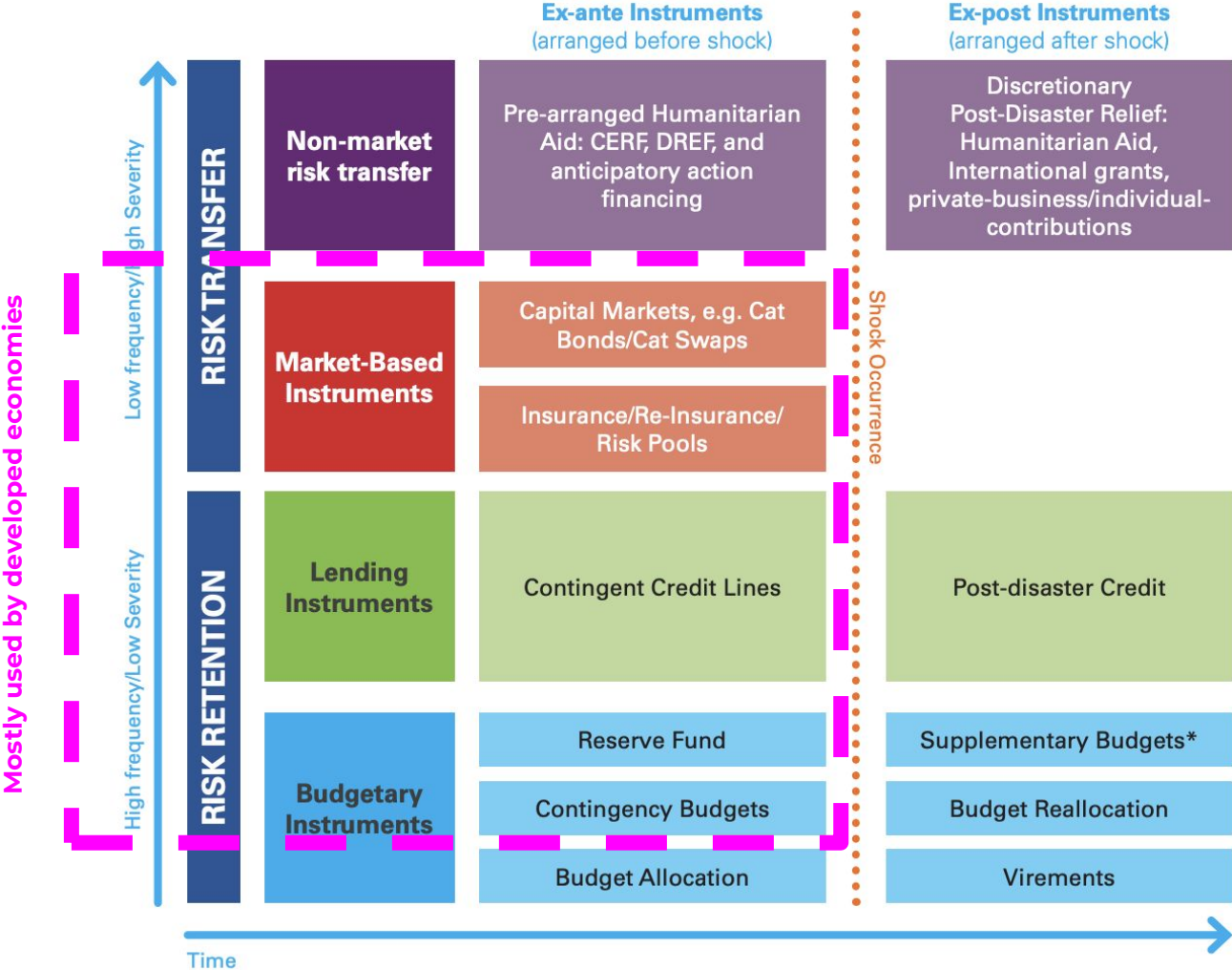
1. They can **estimate the potential impacts** of natural disasters, including the likelihood of an event occurring, the extent of damage it could cause, and the economic and social costs associated with emergency relief and reconstruction.
2. They can identify **areas that are particularly vulnerable** to natural disasters, such as coastal regions. This information can be used to prioritize investments in disaster risk reduction measures.
3. They can help policymakers to **better understand the costs and benefits of different disaster risk management strategies**. By modeling thousands of scenarios, decision-makers can compare the costs and benefits of different approaches and choose the most effective and cost-efficient strategies.

The financial policymaker tool set

A **comprehensive strategy** would typically involve several of these policy tools and instruments.

The key question is: how can policymakers build the best performing strategy?

Figure 5 DRF instruments

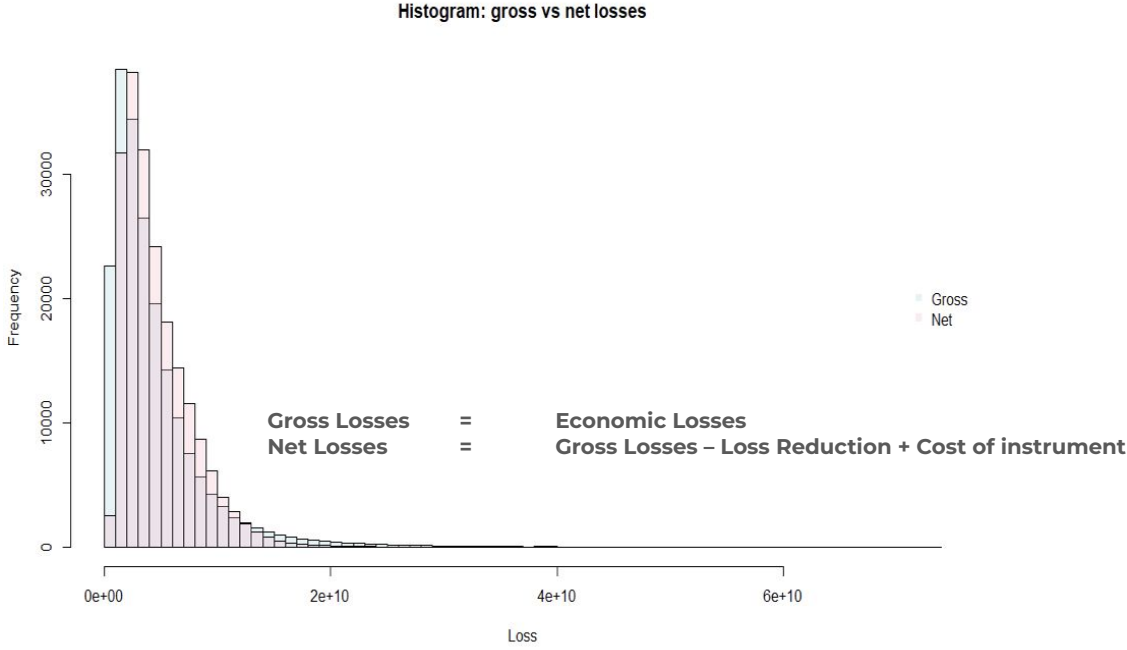


A step-by-step mini guide to formulating strategies



1. Generate Gross and Net Loss Scenarios (i.e. the benefit is the risk reduced)

2. Use financial realistic assumptions to model the costs of each instrument



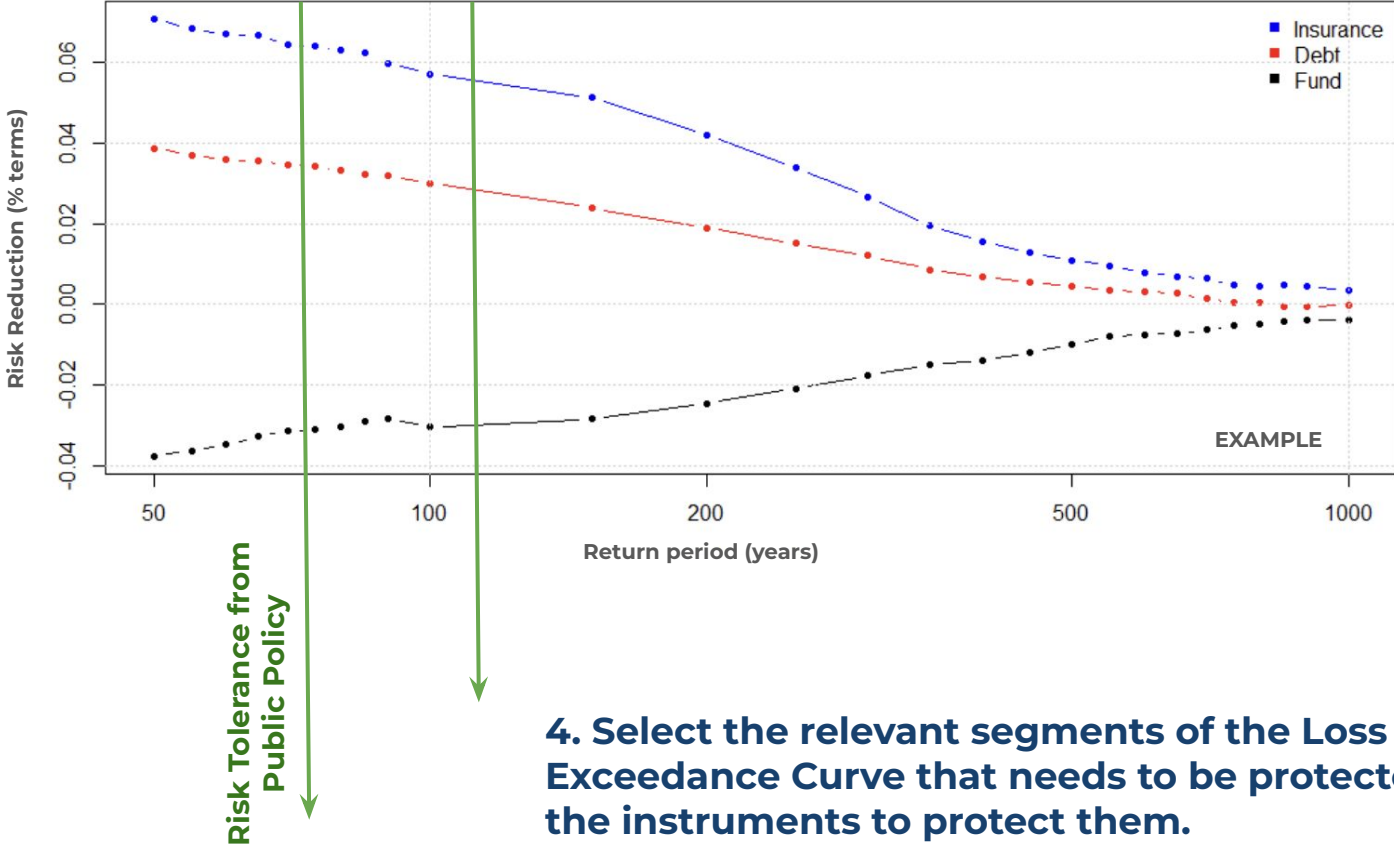
Discount rate (reserve fund)	Refers to the rate at which socially desirable projects implemented by the Government are discounted. It's the opportunity cost of not doing those projects and spending on risk financing instruments
Insurance Costs	The quantitative model provides an actuarial price of insurance (the Average Annual Loss), that must be "loaded" to account for the cost of capital and operational expenses incurred by the insurance company and its capital providers (reinsurers or capital markets)
Contingent Debt Costs	Terms offered by Multilateral Organizations or Banks, includes all fees and interest rates

We use the Loss Exceedance Curves to generate over 100,000 random economic losses over any given time period (5 or 10 years).



A step-by-step mini guide to formulating strategies

3. Measure the relative risk reduction potential of each instrument at specific segments of the Loss Exceedance Curve (gaps)



4. Select the relevant segments of the Loss Exceedance Curve that needs to be protected, and the instruments to protect them.

Case study: Jamaica - Tropical Cyclone

Main exposures concentrated in coastal cities

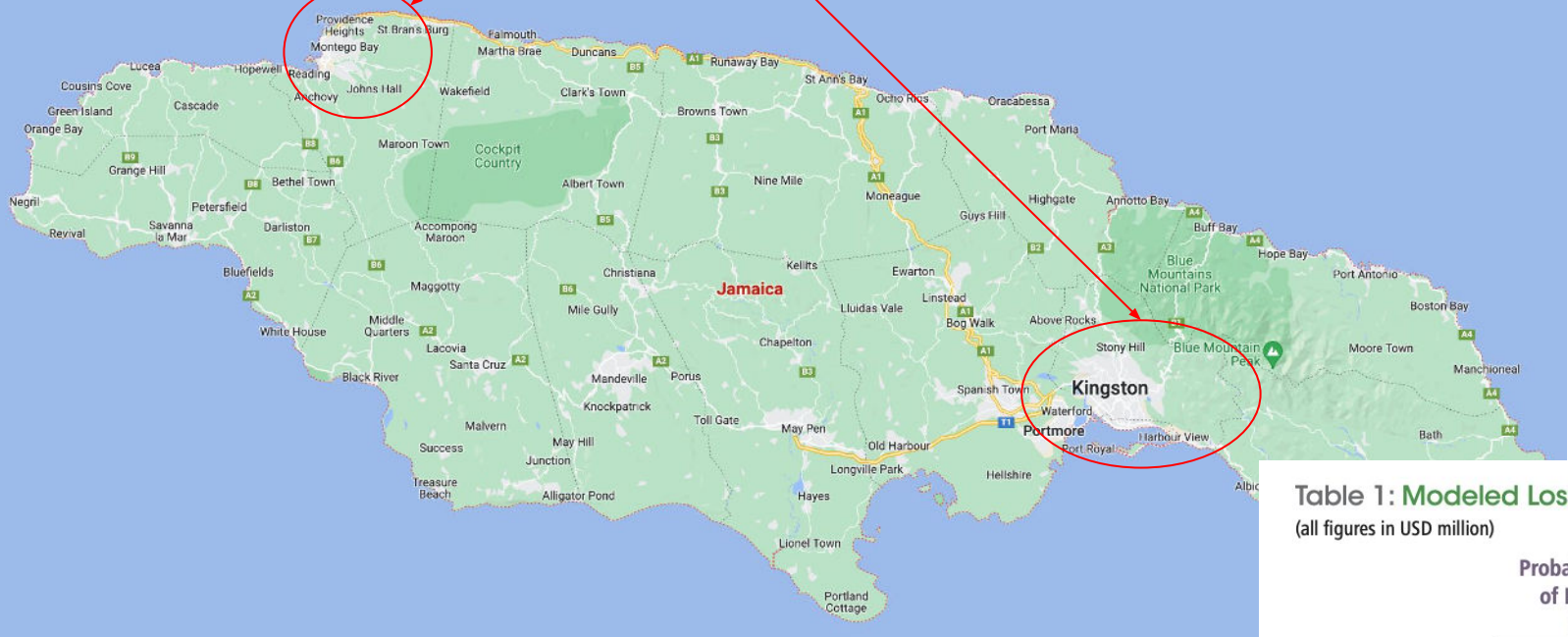


Table 1: Modeled Loss Metrics for Key Return Periods
(all figures in USD million)

Return Period (Years)	Probabilistic Modeling of Building Losses (Hurricane)		Actuarial Analysis of Historic Events, Floods, and Hurricanes	
	Total Direct Damage	Total Direct and Indirect Impact	Total Direct Damages	Total Government Contingent Liability
Average Annual Loss (AAL)	67	300	223	121
10	27	317	238	131
50	953	2,785	1,973	1,057
100	1,870	4,734	3,347	1,729
250	3,468	7,304	5,155	3,276

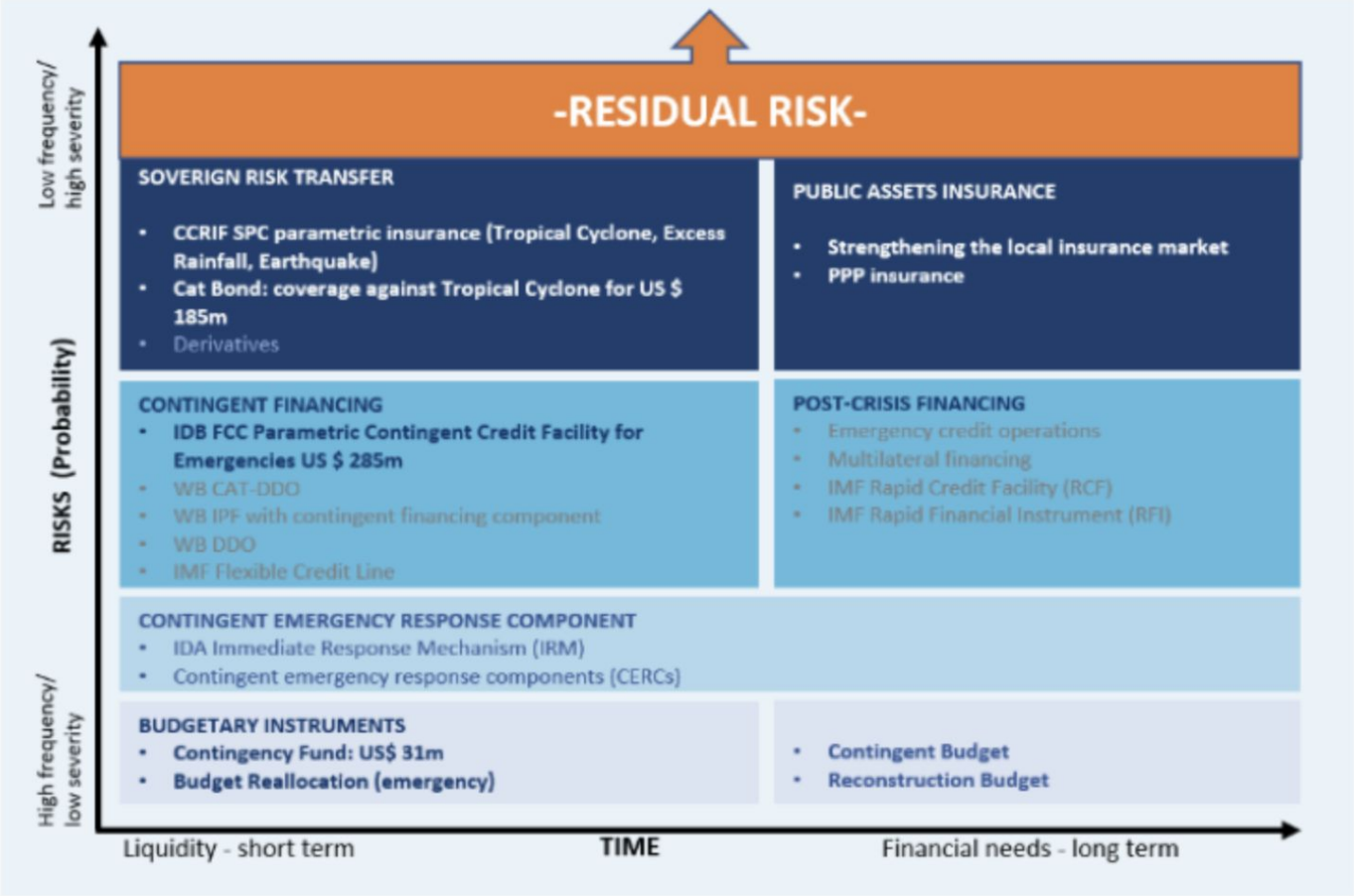
Source: Authors' analysis.



Case study: Jamaica - comprehensive strategy

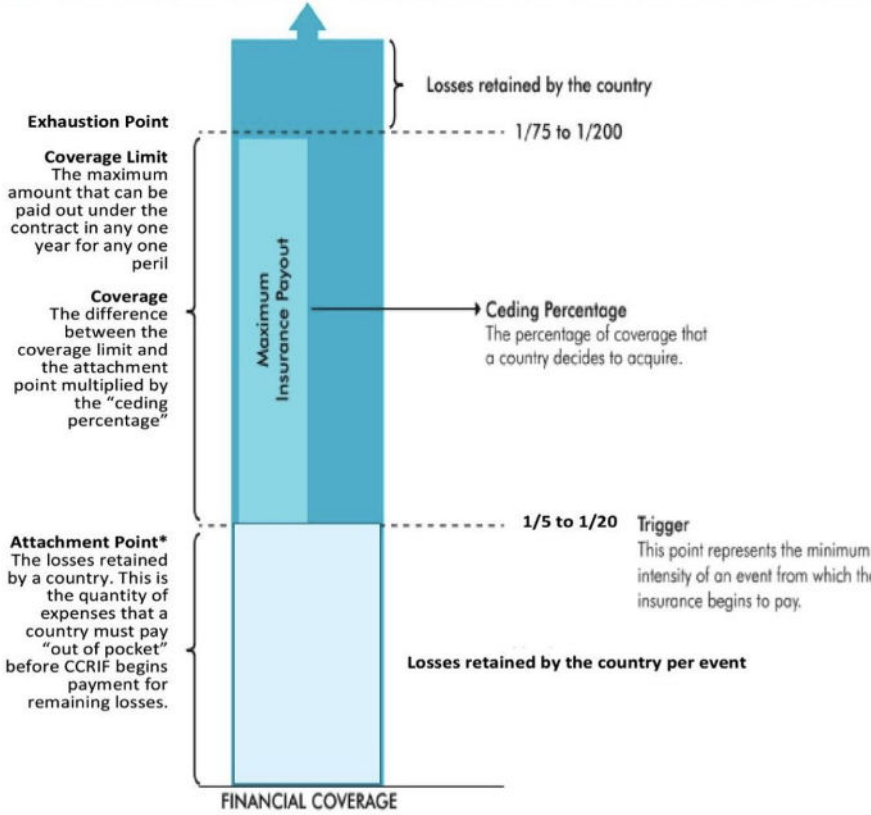
There are many quantitative models for Jamaica that allow the formulation of their comprehensive financial strategy.

Jamaica: Disaster Risk Financing Strategy



Case study: zoom in Jamaica's sovereign risk transfers

Parametric Insurance from CCRIF (1y)



Cat Bond provided by the World Bank (3y)



Transaction Summary

Peril	Tropical Cyclones
Principal (Coverage Amount)	US\$185 million
Risk Period	2.4 years (24 July 2021 to 21 Dec 2023)
Trigger Type	Parametric CAT-in-a-grid
Payout Structure	Linear sliding scale based on severity of storm with a minimum payout of 30% of principal and maximum payout of 100% of principal
Risk Statistics (Annual)	Expected Loss: 1.52%, Attachment Probability 2.37%
Price/ Premium Multiple	Risk Margin: 4.4%



Final remark

- Always measure and understand basis risk!!

Significant economic or social loss occurs?	Yes	False negative	Effective protection
	No	Desired outcome	False positive
		No	Yes
		Did the financial instrument pay?	

We want the financial instrument/strategy to have:

- a) Symmetry of outcomes -fair game
- b) Minimal blue areas



Thank you!

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- 30 March 2023

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