



Institute
and Faculty
of Actuaries

Around the world with Disaster Risk Financing

Evie Calcutt, Jack Carroll
Government Actuary's Department



Introductions

Who are GAD?

- Government Actuary's Department
- Non-ministerial government department
- 180 staff (90 actuaries, 50 actuarial students and technicians, and 40 support staff)
- GAD work in a range of areas:
 - pensions and social security
 - insurance and investment
 - modelling and quality assurance
- We provide advice to UK's Department for International Development (DFID) and the World Bank on development related issues

GAD's mission is to support effective decision-making and robust reporting within government as the first choice provider of actuarial and specialist analysis, advice and assurance.

Agenda

- International development and disasters context
 - Where are we now?
 - Looking ahead to improved policy and decision making
- Example of actuarial advice supporting the World Bank to meet its development objectives





Institute
and Faculty
of Actuaries

International development and disasters context

27 September 2018

Sustainable Development Goals (SDGs)



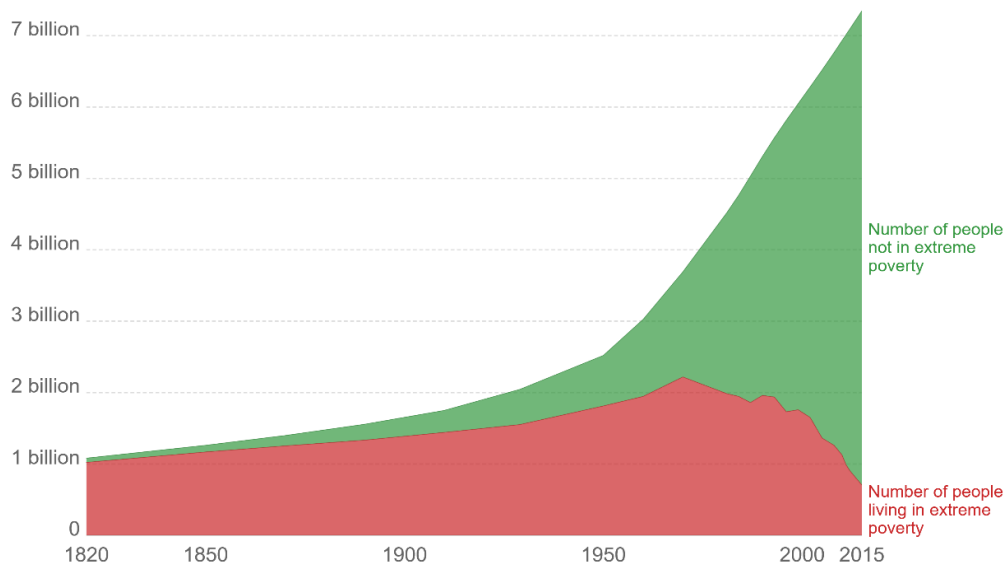
Sustainable Development Goals (SDGs)



World population living in extreme poverty, 1820-2015

Extreme poverty is defined as living at a consumption (or income) level below 1.90 "international \$" per day. International \$ are adjusted for price differences between countries and for price changes over time (inflation).

OurWorld
in Data



Source: World Poverty in absolute numbers - OWID based on World Bank (2016) and Bourguignon and Morrisson (2002)
OurWorldInData.org/extreme-poverty/ • CC BY-SA

Sustainable Development Goals (SDGs)

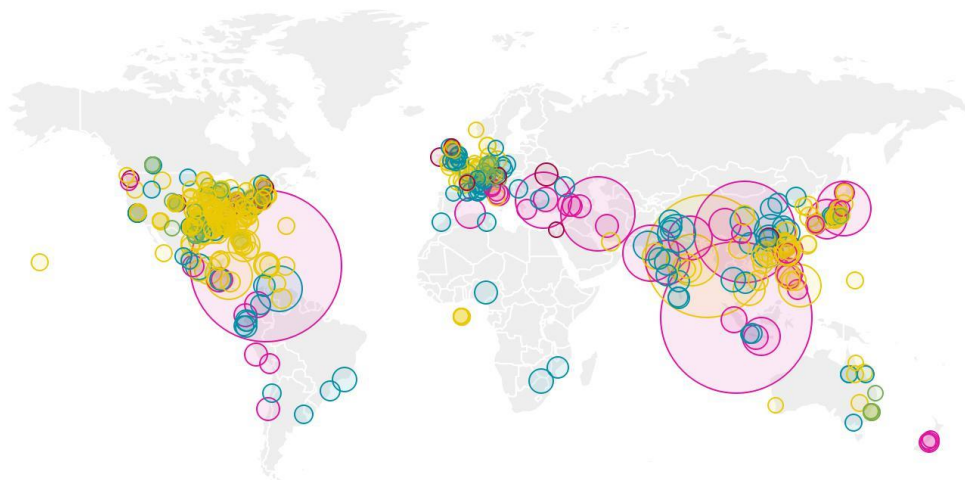


First goal includes a target focused on disaster resilience:

“By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters”

Number of victims, 1990-2018

Catastrophes (data point size according to number of victims)



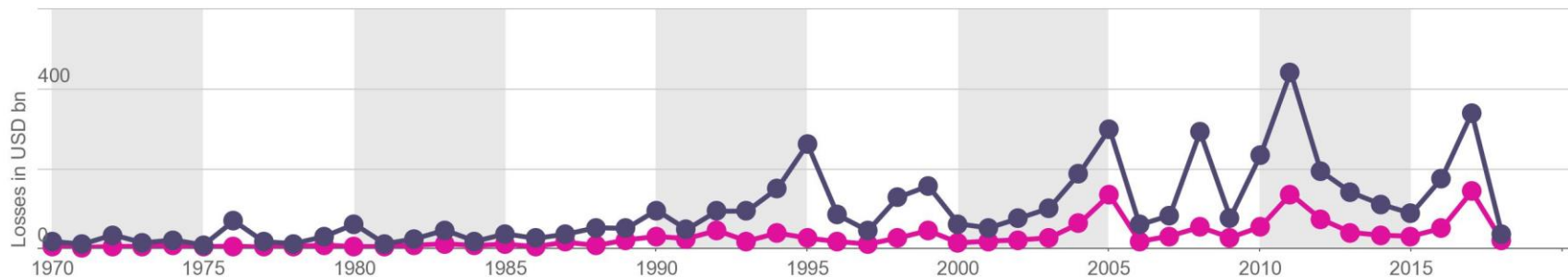
Source: sigma world insurance database

© 2017 Swiss Re Economic Research & Consulting. All Rights Reserved © Natural Earth

● Cold, frost ● Droughts, bush fires, heat ● Earthquakes ● Floods ● Hail ● Storms

Economic losses and protection gap, 1970-2017

Total vs. insured losses



Data set

● Natural catastrophes (insured) ● Natural catastrophes (total)

Source: sigma world insurance database

© 2017 Swiss Re Economic Research & Consulting. All Rights Reserved

Impact of natural disasters on poorest countries

- The number of extreme natural disasters is on the rise
- Disasters push **26m** people into poverty each year (Source: World Bank)
- Losses from natural disasters in low and middle income countries are largely uninsured – the “protection gap”



Source: RMS

How is action currently financed? (Post-disaster funding model)

Before the disaster

- Poor preparedness planning
- Underinvestment in data and systems for response
- Underinvestment in adaptation and risk reduction

After the disaster

- Slow, politicised, tactical decision making
- Funding slow to materialise
- Poorly coordinated response
- Underfunded with overreliance on budget reallocation and donor funding

UK Government – Humanitarian Reform Policy



Saving lives, building resilience, reforming the system: the UK Government's Humanitarian Reform Policy



- Prevention is better than cure
- Responding late costs lives and money
- Insurance and other risk-based finance should be used to have funds on standby, allowing earlier and faster response

UK Government – different approach to managing risk



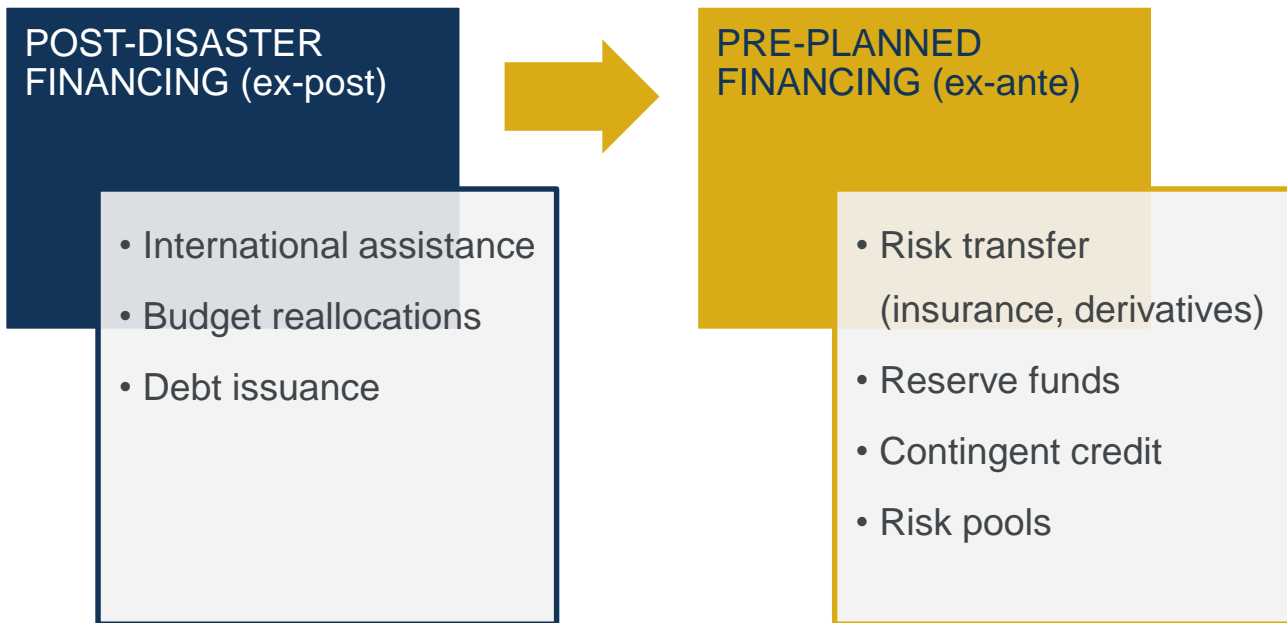
Disaster Risk Finance (DRF)

How can a public sector organisation credibly commit to take on a contingent liability?

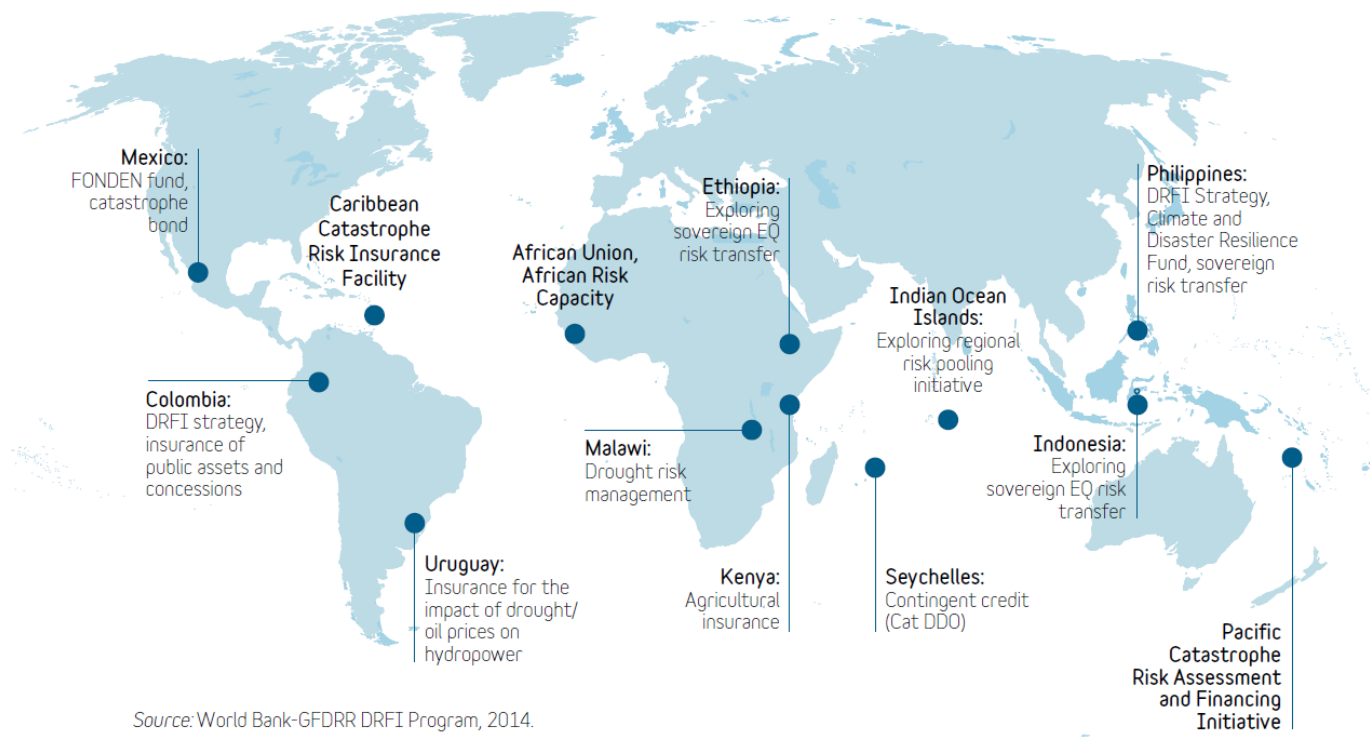
- Coordinated, credible, **plan, capability and systems** for post-disaster action
- A fast, evidence-based **decision-making process (triggers)**
- **Financing on standby** to ensure that the plan can be implemented



From ex-post borrower to ex-ante risk manager



Existing risk finance schemes



Recent payouts from ex-ante risk finance schemes

- January 2017: **Malawi received \$8.1m payout from ARC Ltd** following a drought caused by El Niño
- September 2017: **Mexico received \$150m payout from FONDEN** Catastrophe Bond following M8.1 Earthquake
- September 2017: **Caribbean countries received \$55m payout from CCRIF** after Hurricanes Irma and Maria
- February 2018: **Tonga received £3.5m from PCRAFI** risk pool following Cyclone Gita in the Pacific
- March 2018: **Mauritania received \$2.4m payout from ARC Ltd** following a drought

Summary of current challenges

- Current system is biased to ex-post model
- Evidence base is limited and closed
- Countries lack the technical capacity and find it difficult to get technical impartial advice (not asking the right questions)
- There are a lack of financial instruments to meet the challenges, innovation needed and closer ties with the private sector
- The principles of Disaster Risk Finance need to be brought into the mainstream development/humanitarian agenda - it's critical to meeting SDGs

The Centre for Global Disaster Protection

VISION - A world where countries and the international community commit targeted political and financial resources to **anticipate, mitigate, prepare for, and respond** to potential extreme natural events before they occur, to reduce their impact, protect poor and vulnerable people and enable sustainable economic development



CENTRE FOR
GLOBAL
DISASTER
PROTECTION

The Centre for Global Disaster Protection





Institute
and Faculty
of Actuaries

Example of actuarial advice supporting the World Bank to meet its development objectives

27 September 2018

Disaster Risk Financing and Insurance Program (DRFIP)

World Bank DRFIP was established to improve the financial resilience of governments, businesses, and households against natural disasters through:

- Sovereign Disaster Risk Finance
- Market Development
- Analytics
- Knowledge Management and Global Partnerships



SOVEREIGN CLIMATE AND DISASTER RISK POOLING

World Bank Technical Contribution to the G20



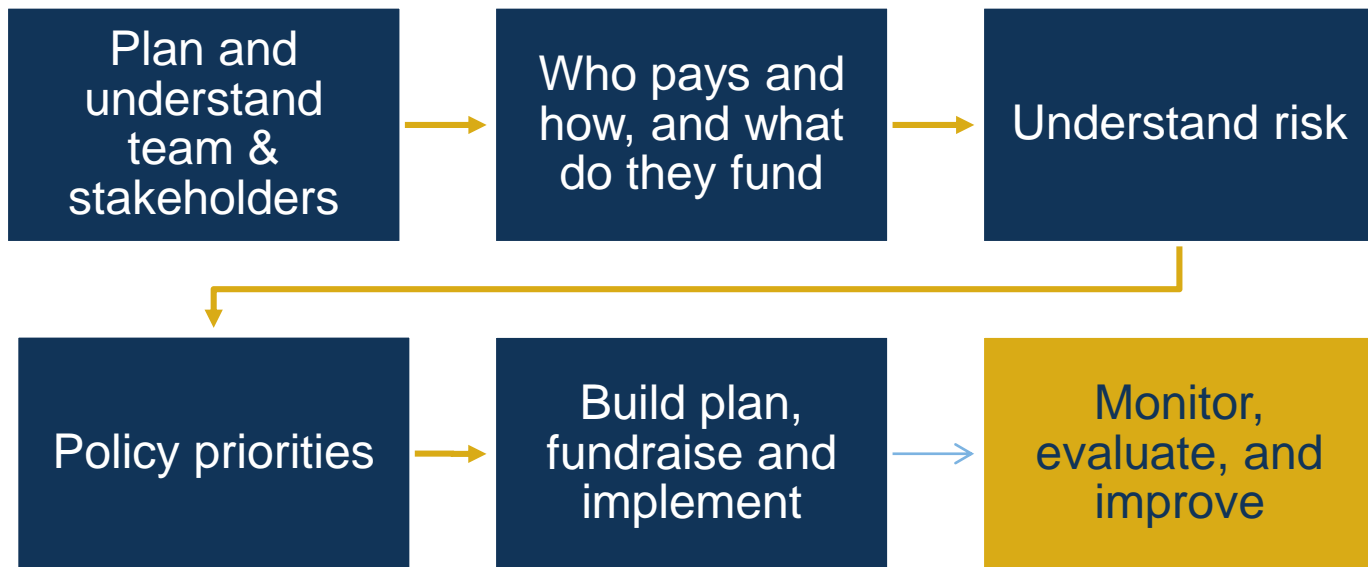
Institute
and Faculty
of Actuaries

The problem

Developing Country X is susceptible to severe flooding and has:

- Limited understanding of their risks
- Focused decision-making on short-term thinking
- Limited plans and finance ready to scale up in response to severe flood. They have a small reserve fund for flooding but this is not ring fenced
- Historically redirected funds from other important budget lines and asked the international community for help
- Slow processes to find funding, increasing the damage and cost of recovery
- No expertise to put a DRF strategy in place
- **But... the World Bank and donors such as the UK Government are working with them to build capacity and help them ask the right questions.**

Process to respond to the problem



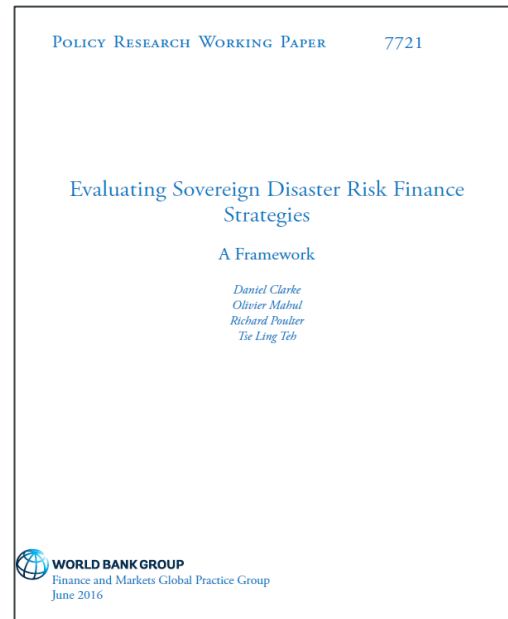
Educational tools to support conversations

Actuaries at GAD are working with the World Bank to develop educational tools to support:

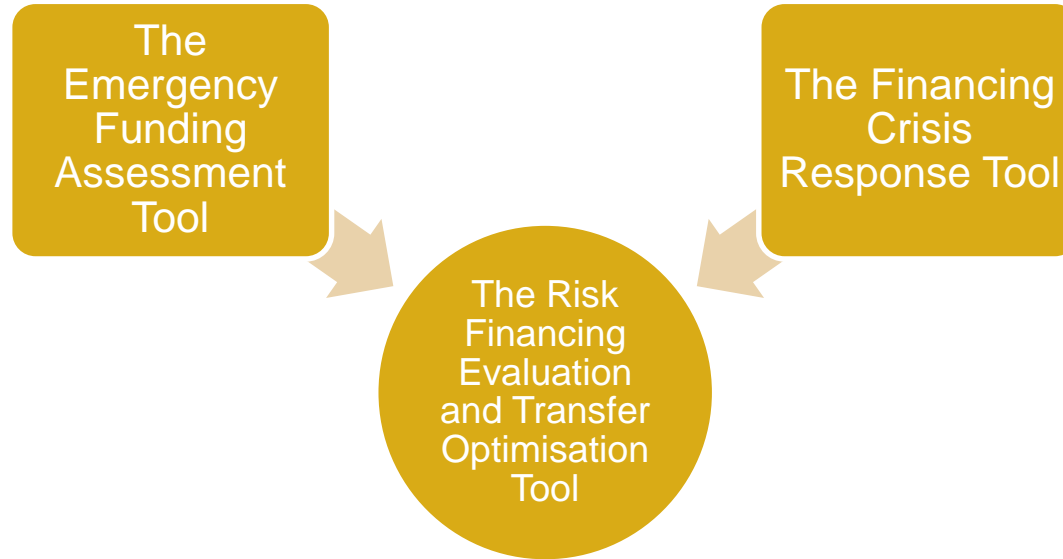
- Understanding of financial risks related to natural disasters
- Development of DRF strategies based on efficient financial and actuarial analysis
- Support initial conversations (not policy decisions) with country engagements

World Bank's underlying framework

| Instrument Type | Opportunity Cost Formula |
|---------------------------------------|---|
| Reserve fund | $C_1(x) = \left(\frac{i-r}{1+d} \right) \times (\bar{\theta}_1 - \theta_1(x)) + \theta_1(x)$ |
| Line of Contingent credit | $C_2(x) = \delta \bar{\theta}_2 + \beta \left(\frac{i-c}{1+d} \right) \bar{\theta}_2 + \left(\frac{1+c}{1+d} \right) \theta_2(x)$ |
| Emergency ex-post budget reallocation | $C_3(x) = \left(\frac{1+h}{1+d} \right) \theta_3(x)$ |
| Ex-post sovereign borrowing | $C_3(x) = \left(\frac{1+b}{1+d} \right)^t \frac{a_{n i}}{a_{n e}} \theta_3(x)$ |
| Insurance | $C_5(x) = m \int_0^{\bar{x}} f(x) \theta_5(x) dx$ |



Three Tools



Risk Financing Evaluation & Optimisation Tool

Compare cost effectiveness of Disaster Risk Financing strategies to finance losses from perils such as flood, drought, earthquake, storm.

Inputs

- Loss risk profile for each peril
- Risk retention/transfer instruments
- Economic assumptions (e.g. interest rate on sovereign debt, arrangement fees, insurance pricing multiple)

Outputs

- Layered DRF strategy
- Opportunity cost
- Funding gap

Country X – Example of how the tool is to be used

Assume Country X has \$280m of funding available

Base Strategy (insurance)

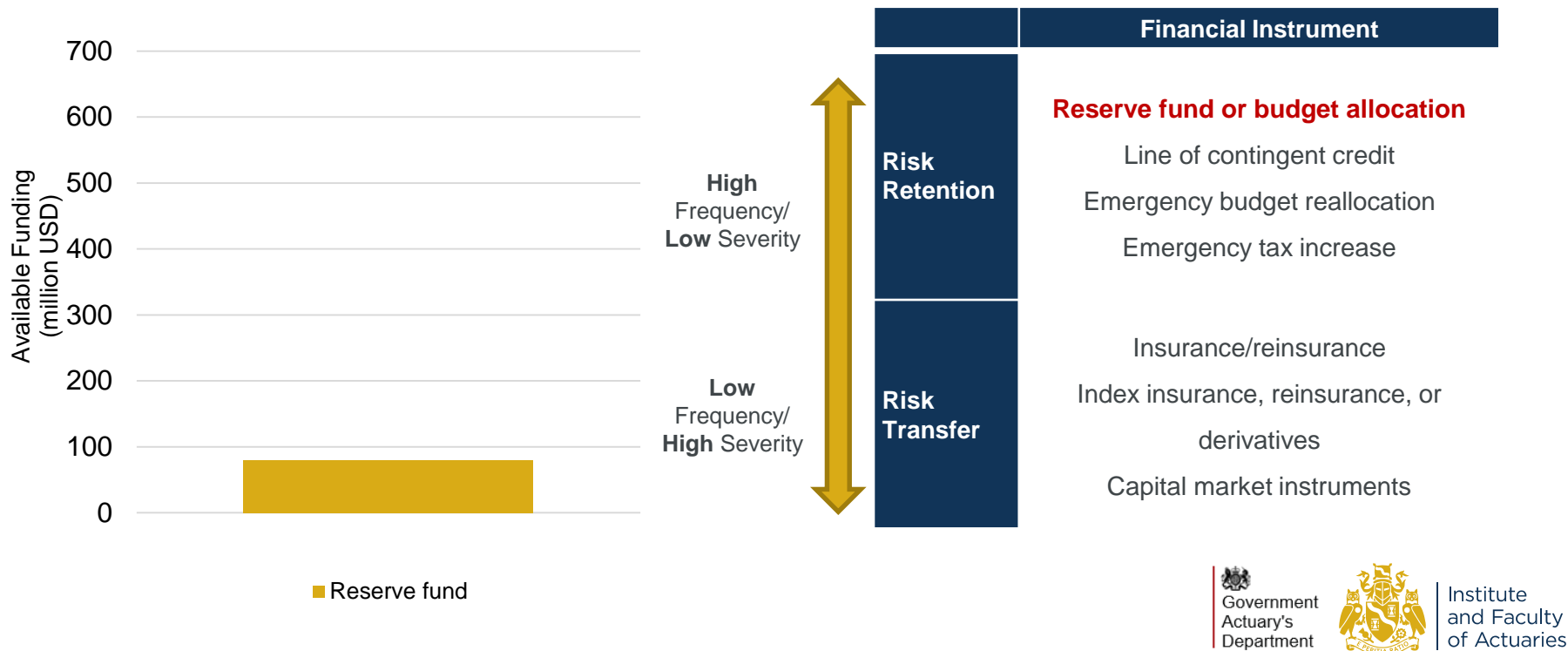
- \$80m reserve fund
- \$170m line of contingent credit
- \$30m insurance premium
 - \$250m-\$600m insurance layer with 80% ceding

Strategy B (no insurance)

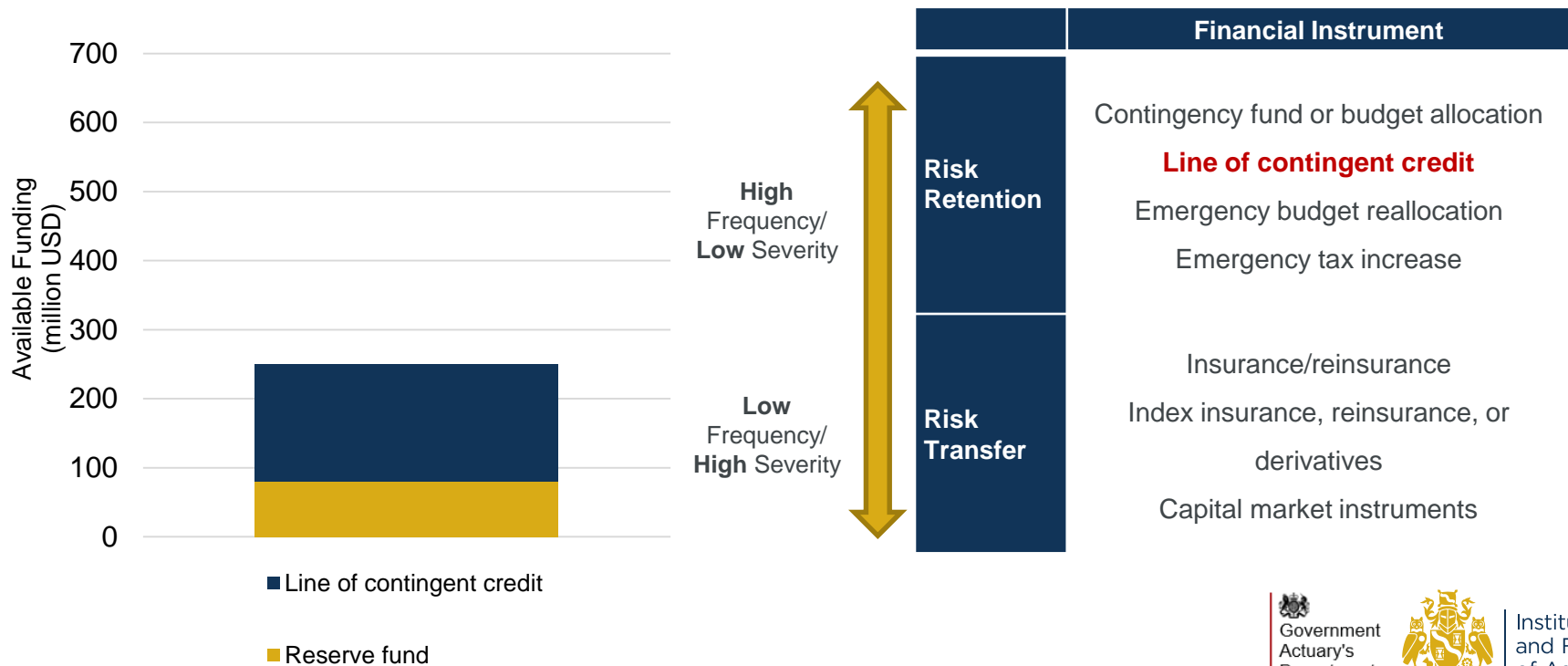
- \$80m reserve fund
- \$200m line of contingent credit

Figures are for illustrative purposes only

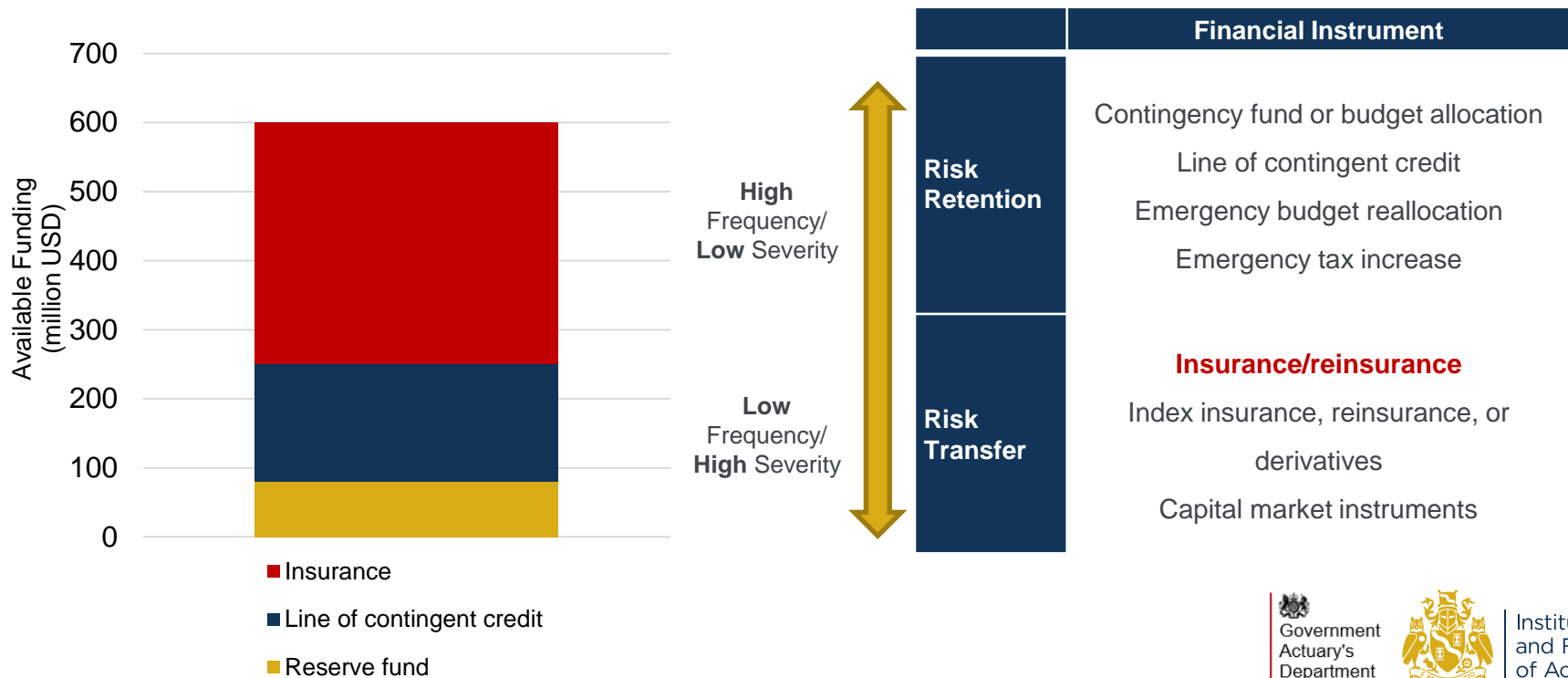
Layered financing strategy



Layered financing strategy



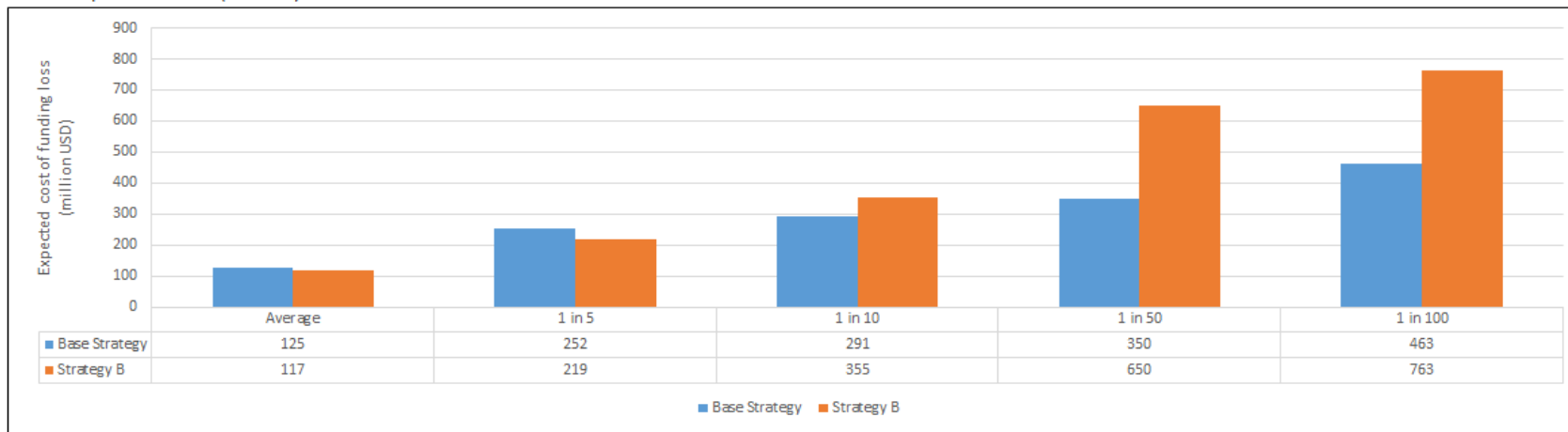
Layered financing strategy



Country X – Comparing different strategies

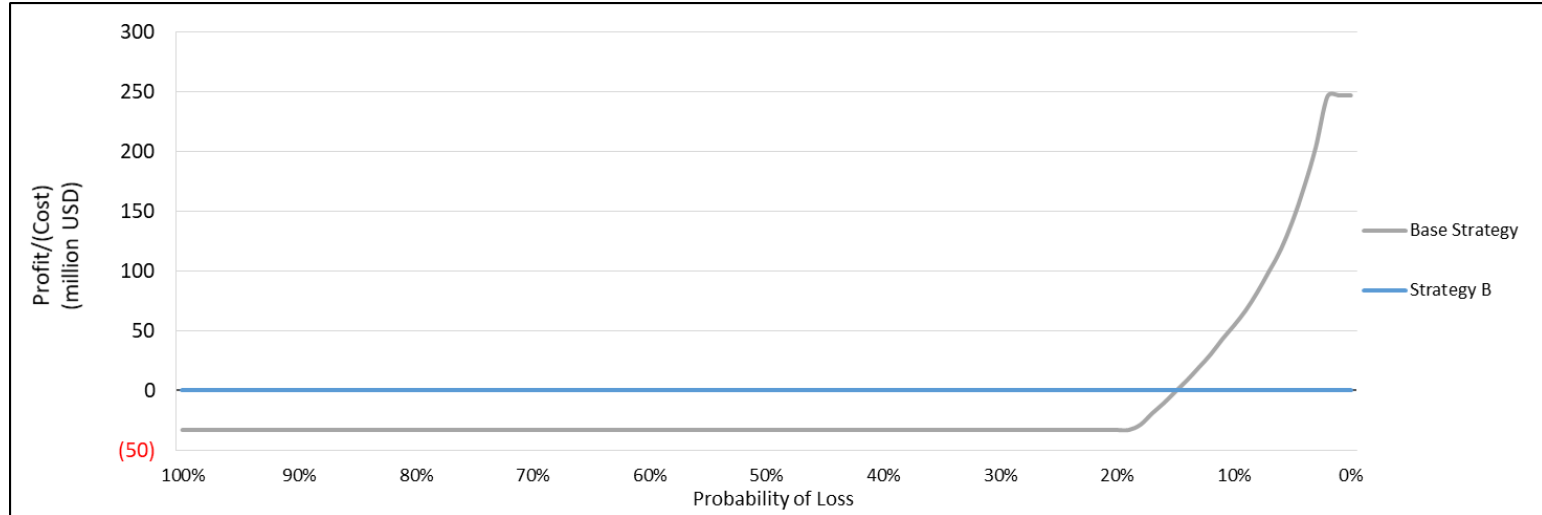
Exhibit 3a: The potential opportunity cost of funding losses for different magnitudes of loss over the next year under each DRF strategy

Amounts are expressed in USD (millions)



Comparing the cost of the strategy for different event rarities.

Country X – Comparing different strategies

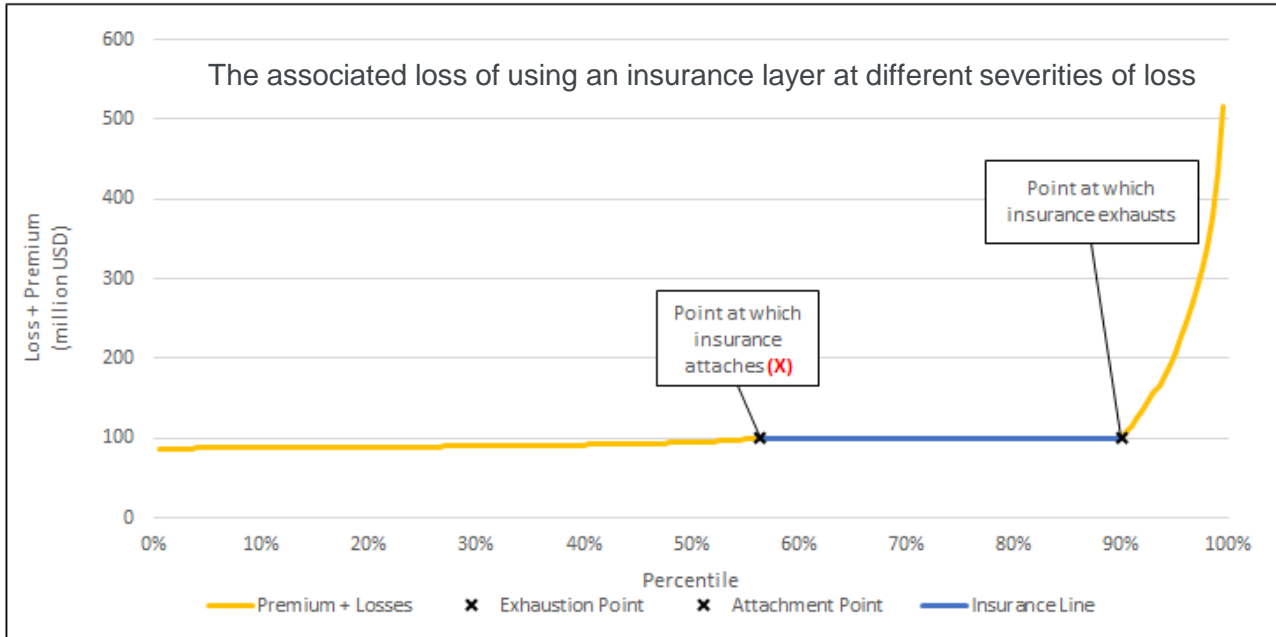


Comparing the cost/benefit of insurance in the different strategies.

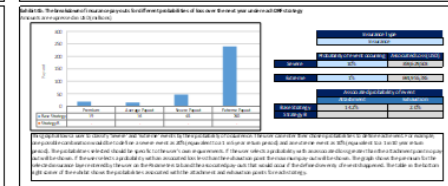
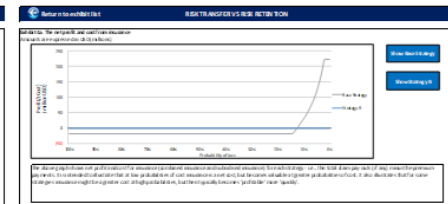
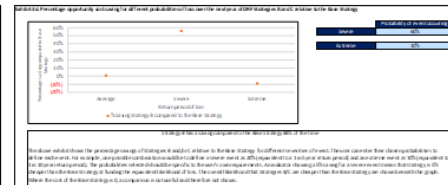
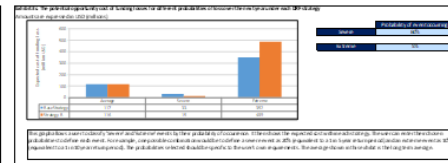
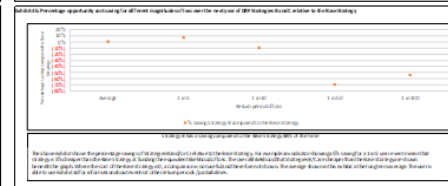
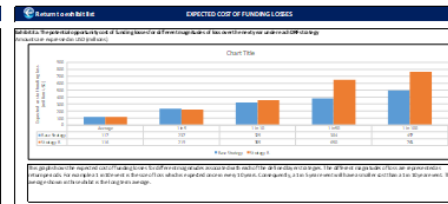
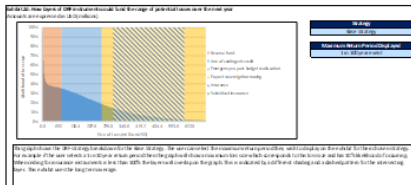
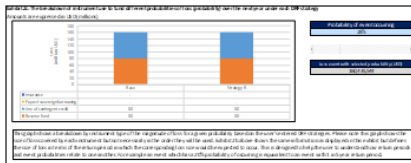
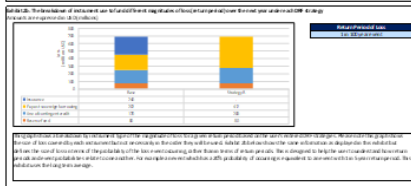
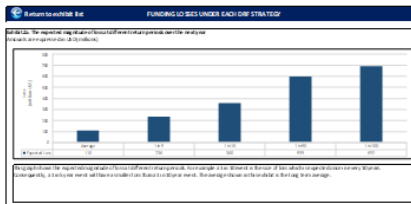
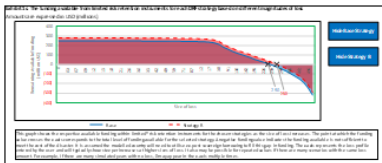
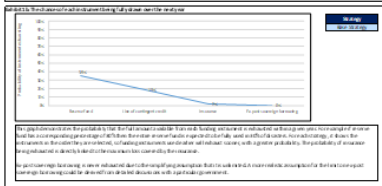
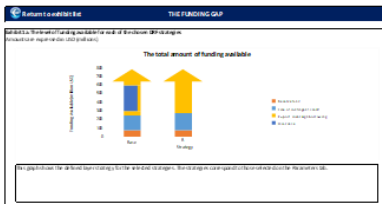
Example of the - Optimisation

- Based on the improved understanding gained from the Tool, Country X wants to understand where to optimally place an insurance layer within the strategy
- Given Country X's preference to minimise the cost of less frequent disasters we investigate the optimal point to attach their insurance layer for their given risk appetite.

Using Tool 2 - Optimisation



Country X – The Tools answer many different questions



Importance of Tools

- Educational Tools are a key aid in the first step to better disaster risk financing.
- Assist countries in understanding the way donors consider these issues.
- Helps advisory services including actuaries to maximise the value of the limited access they have to government ministers.

Summary

- International development context
 - The number of extreme natural disasters is on the rise – contributing to continued and worsened poverty cycles
 - Momentum is growing for disaster risk financing – but care needed so that right questions asked and appropriate solutions put in place
 - Supporting developing countries to manage their disaster related risks can lead to better public financial management and the allocation of risk responsibility
- The contribution of actuaries
 - Actuaries are contributing to the evidence base in this current and evolving context
 - Supporting the development of educational tools that communicate complex concepts in a straight forward way

Questions

Comments

The views expressed in this [publication/presentation] are those of invited contributors and not necessarily those of the IFoA. The IFoA do not endorse any of the views stated, nor any claims or representations made in this [publication/presentation] and accept no responsibility or liability to any person for loss or damage suffered as a consequence of their placing reliance upon any view, claim or representation made in this [publication/presentation].

The information and expressions of opinion contained in this publication are not intended to be a comprehensive study, nor to provide actuarial advice or advice of any nature and should not be treated as a substitute for specific advice concerning individual situations. On no account may any part of this [publication/presentation] be reproduced without the written permission of the IFoA [*or authors, in the case of non-IFoA research*].



Government
Actuary's
Department



Institute
and Faculty
of Actuaries