WORLD BANK GROUP
Social, Urban, Rural & Resilience

COUNTRY DISASTER RISK PROFILES

Disaster Risk Assessment:
Towards a General Methodology to Quantify Disaster Risk at the National Level

Keiko Saito and Rashmin Gunasekera

Disaster risk management

- Disaster (or catastrophic) events can jeopardize the financial stability of companies and national, provincial governments.

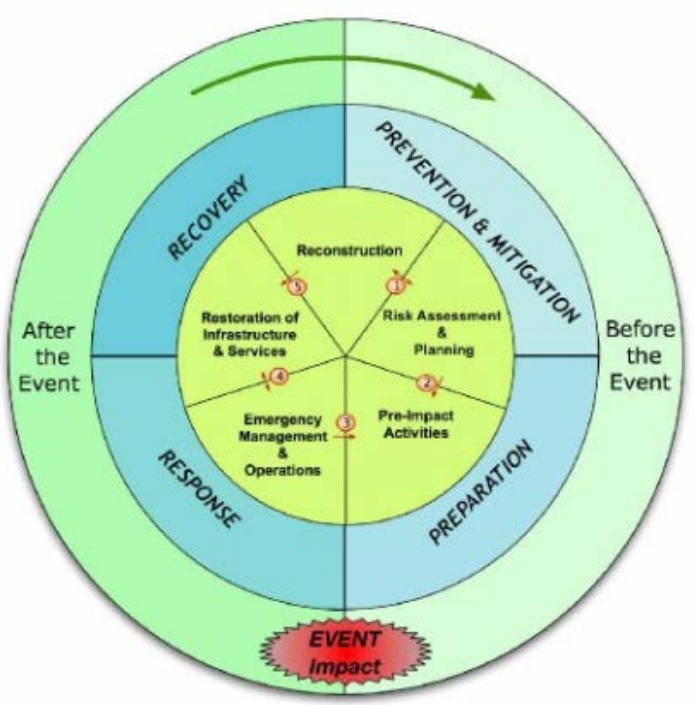
- Key questions *before* an event with respect to management of disaster risk are:

- **How much is at risk?**

- **What would it take to reduce the risk?**

- **Where and what can we prioritize as interventions?**

- **What are their costs and benefits?**



Source: Atkinson et al. (2006)

COUNTRY DISASTER RISK PROFILES

WORLD BANK GROUP
Social, Urban, Rural & Resilience

Styles of risk assessment

Hazard/Risk Index

Pros: fast, low data requirements, output easy to understand

Cons: Low resolution, subjective

Historical Scenario

Pros: based on event-specific data, good for frequent hazards

Cons: misses extreme events, potential impacts of climate change

Probabilistic

Pros: accounts for both frequent/low-impact and rare/extreme events

Cons: high data/expertise requirements, need to ensure outputs can be understood

COUNTRY DISASTER RISK PROFILES

WORLD BANK GROUP
Social, Urban, Rural & Resilience

Product	Purpose	Scale	Data Requirements	Cost
Qualitative national risk profile	For advocacy and initiation of DRM dialogue	National	Low: Requires global, regional, and/or national data sets	$
Community-based disaster risk assessment	To engage communities, communicate risk, and promote local action	Community level	Low: Typically based on historical disaster events	$
Quantitative national risk profile	For advocacy and initiation of DRM dialogue based on quantitative assessment	National	Low-moderate: Requires global, regional, and/or national data sets	$$
Asset-level risk assessments, including cost-benefit and engineering analysis	To inform design of building-level/asset-level risk reduction activities and promote avoidance of new risk	Building / infrastructure level	Moderate-high: Requires high-resolution local data for large spatial areas with clear articulation	$$
Macro-level risk assessment for risk reduction, including cost-benefit analysis	To inform urban/regional risk reduction measures	Urban, regional, national	Moderate-high: Requires moderate to high resolution across large spatial areas	$$$
Risk identification to identify critical infrastructure and establish early warning systems	To inform preparedness and risk reduction, based on understanding of potential damage at the regional/local level	Urban, regional, national	Moderate-high: Requires asset-level information across large spatial areas	$$-$$$ [broad range depending on geographic scope]
Catastrophic risk assessment for financial planning	For financial and fiscal assessment of disasters and to catalyze catastrophe risk insurance market growth	National to multi-country	High: Requires high-resolution, high-quality data of uncertainty	$$$

Solution: Disaster Risk Quantification

COUNTRYDISASTER RISK PROFILES WORLD BANK GROUP

EL SALVADOR Earthquakes and Hurricanes RISK PROFILE

What is a country disaster risk profile?

An estimation of the potential economic losses to property caused by adverse natural events.

Country Disaster Risk Profile

Applications

- **Develop** key baseline data
- **Evaluate** impact of disasters
- **Promote and inform** risk reduction
- **Inform** disaster risk financing

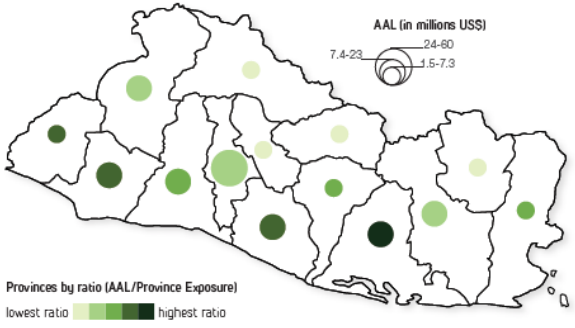
Country At-A-Glance

GDP US$	Population	Total Building Exposure US$ (Replacement Value)
25.2 billion	6.4 million	37.1 billion

Population: Rural 34%, Urban 66%

Gross Capital Stock: Public 16%, Private 84%

Two representations of earthquake risk



Absolute Risk: The larger the circle, the higher the Annual Average Losses that the province could potentially incur over the long term.

Relative Risk: The darker the color, the higher the ratio of AAL/Province Exposure. The darkest color represents the province of Usulutan which has a higher proportion of vulnerable structures due to construction types and/or potentially higher earthquake intensity.

Snapshot

- The **earthquake risk** in El Salvador is more significant than the **hurricane risk**.
- Annual Average Loss (AAL) from **earthquakes** is **US$ 175.93M (0.70% of GDP)** and from **hurricanes** is **US$ 2.94M (0.01% of GDP)**.
- The Probable Maximum Loss for **earthquakes** (250 year return period) is **US$ 3.9B (15.5% of GDP)** and for **hurricanes** (250 year return period) is **US$ 374M (1.5% of GDP)**.
- Single-family, residential houses constructed with reinforced masonry bearing walls are the buildings most vulnerable to **earthquakes** **accounting for over 31% of AAL.**

What is Disaster Risk Quantification?

A **quantification** of the likelihood (probability) of estimated property, infrastructure, monetary or casualty losses caused by adverse natural event in a specific area.

Hazard

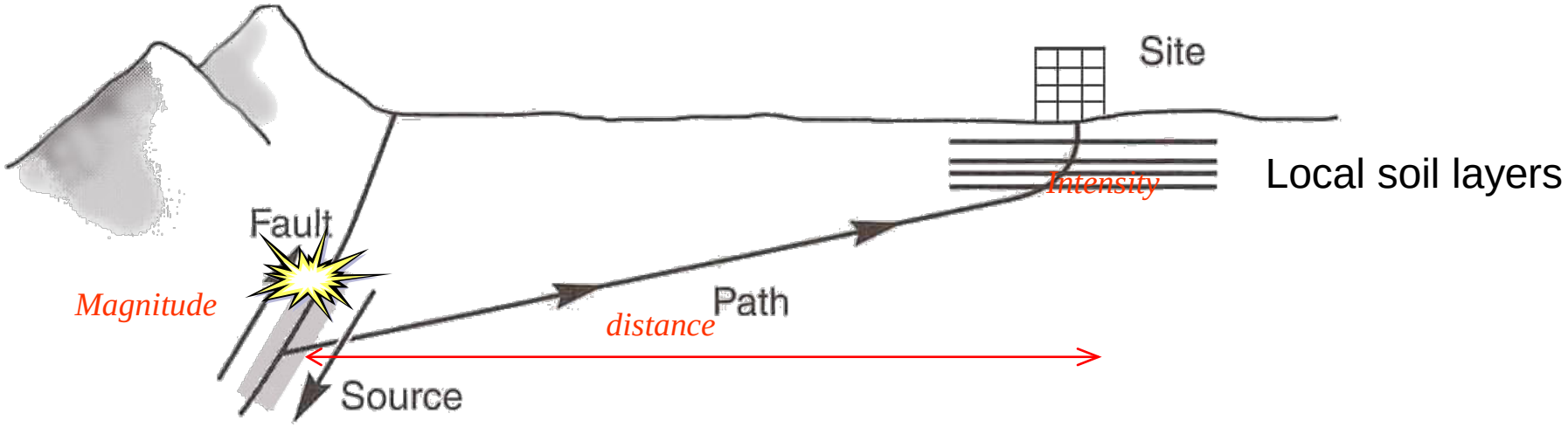
Exposure

Vulnerability

Fatalities, injuries, displaced persons
Damage to buildings, infrastructure, financial loss

Impact

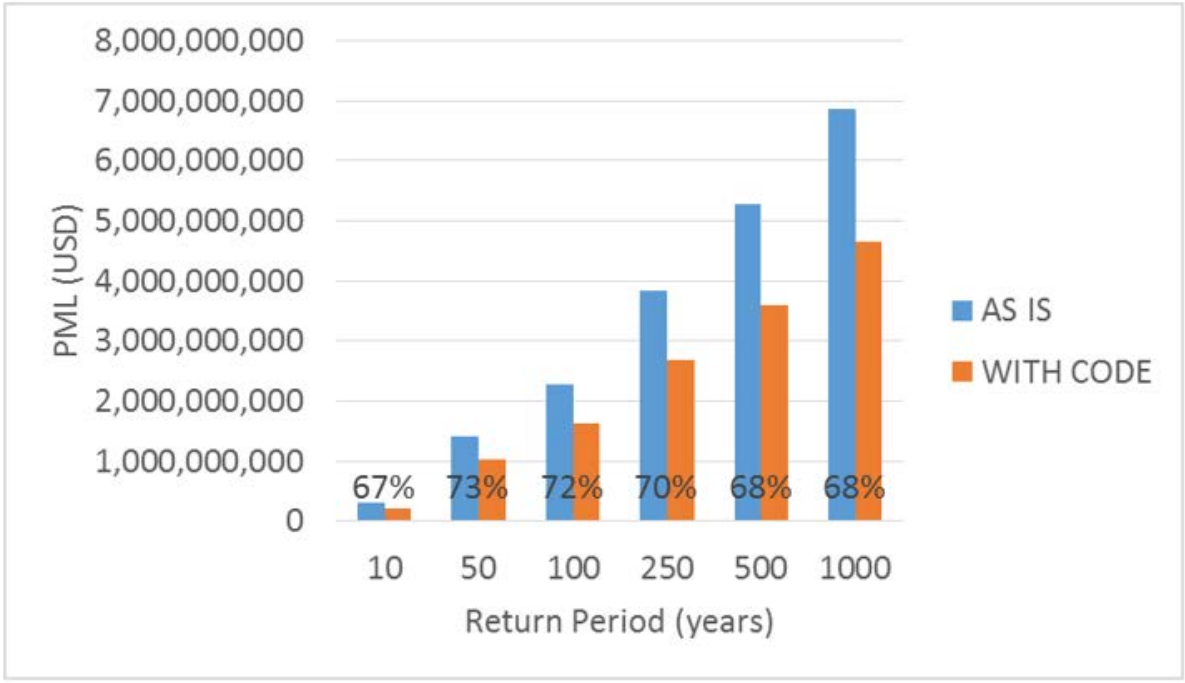
Disaster loss estimation: Earthquake and its describing parameters



- Released energy of the Earthquake in the source is represented by *Magnitude*
- Severity of ground motion in a site at a certain distance from source is indicated by *Intensity* (*spectral parameters, etc.*) based on the magnitude and *attenuation relation*
- Due to the intensity and based on the resistance of structures, they will undergo different grades of *damage*
- This damage will result in *loss* (financial or casualties)
- *Achieved through deterministic or probabilistic approaches*

A comparison of the “to code” and “as is” runs: Probable Maximum Loss Curve in El Salvador

In terms of the PML (probable maximum loss), the total run is around 67-73% of the original “as is”. For a 500 year event, it could be expected that a reduction of close to $2 billion would be expected with full code influence.

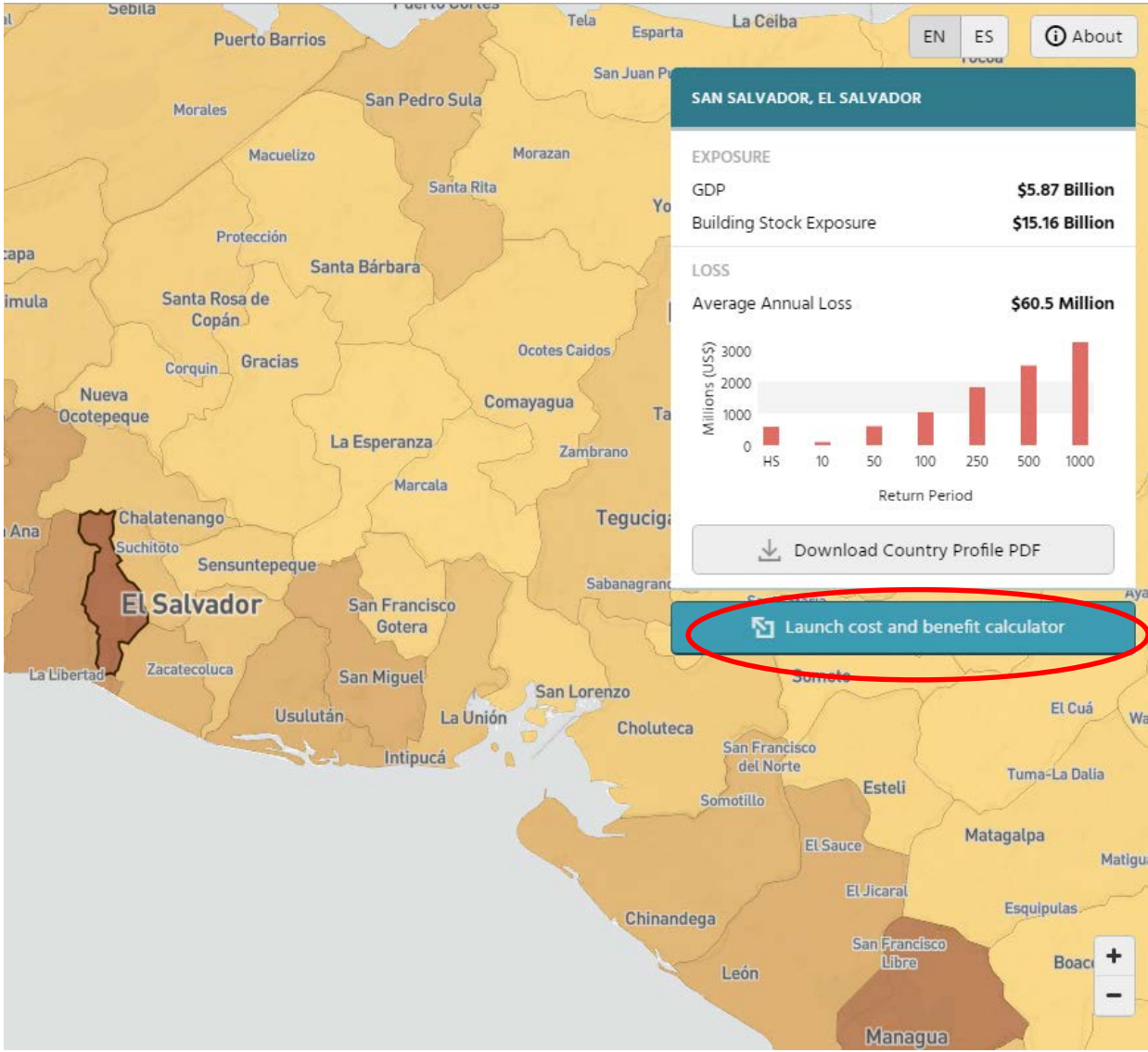


: PML in terms of loss for Concreto-Mixto classes: blue = “as is” run, orange: “to code” run

COUNTRY DISASTER RISK PROFILES

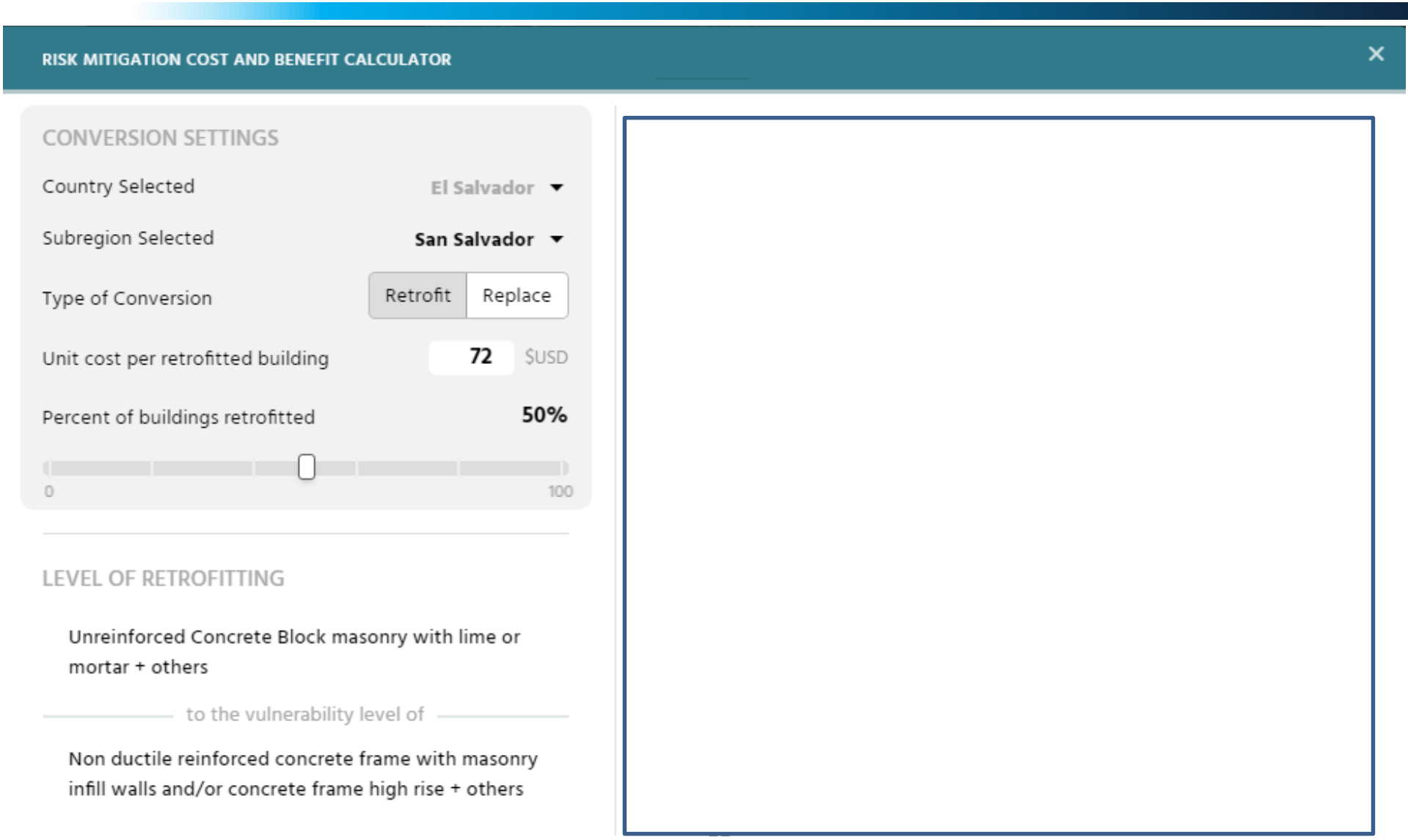
WORLD BANK GROUP
Social, Urban, Rural & Resilience

El Salvador – How to reduce risk?

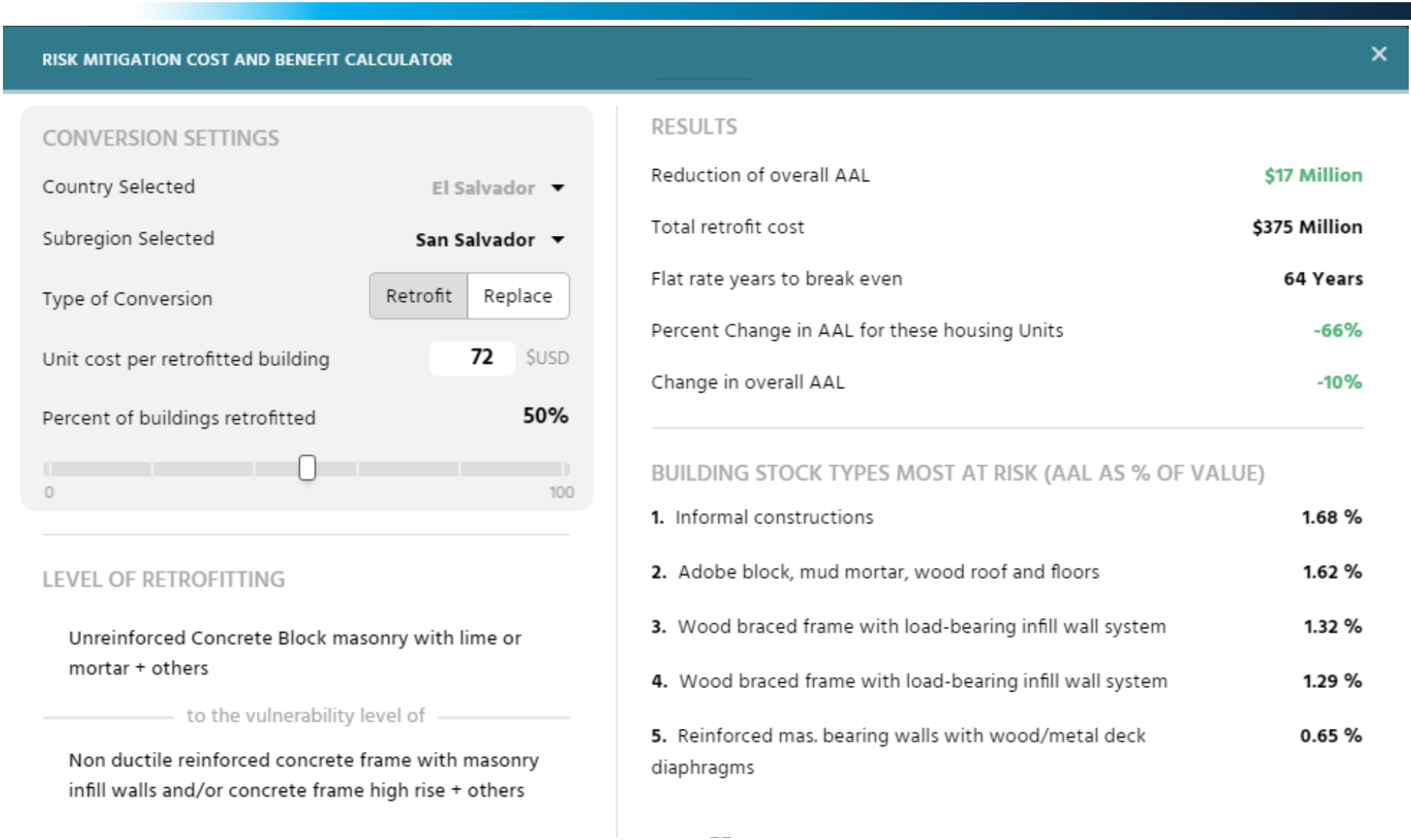


COUNTRY DISASTER RISK PROFILES

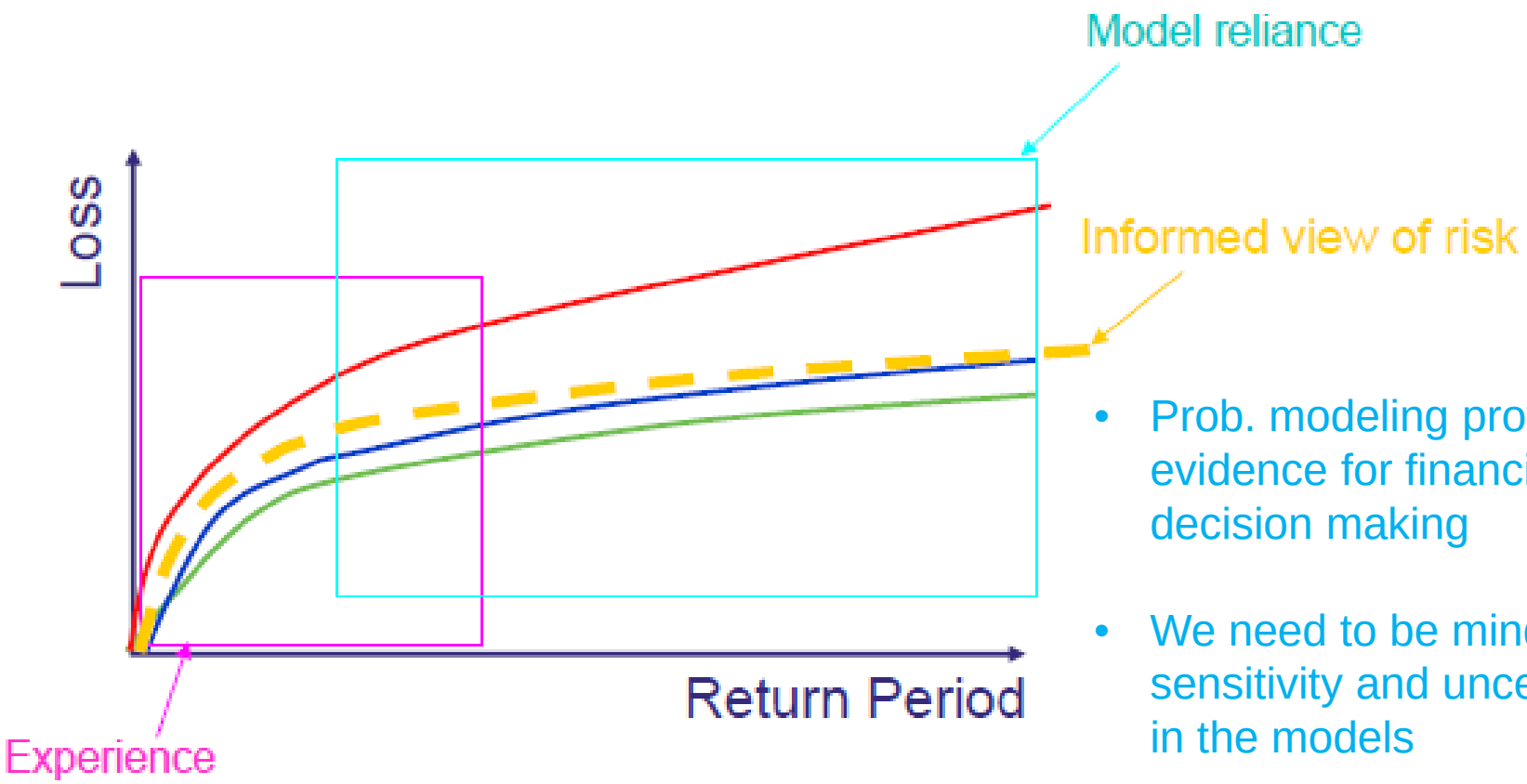
Impact: What would it take to reduce risk?



Impact: What would it take to reduce risk?



Output: EP curves and implications



- Prob. modeling provides evidence for financial decision making
- We need to be mindful of sensitivity and uncertainty in the models

COUNTRY DISASTER RISK PROFILES

WORLD BANK GROUP
Social, Urban, Rural & Resilience

Questions by our clients answered

- ✓ **How much is at risk?**
- ✓ **Where is it located?**
- ✓ **What would it take to reduce risk?**
- ✓ **Help prioritize interventions/strategies**

COUNTRY DISASTER RISK PROFILES

WORLD BANK GROUP
Social, Urban, Rural & Resilience


After
Before

COUNTRY DISASTER RISK PROFILES

THANK YOU!

Disclaimer

- Results presented are part of the *ongoing* Country Disaster Risk Profile (CDRP) study. Therefore, presented estimations and results should be considered as preliminary.

- The contents expressed in this presentation are entirely those of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent.

COUNTRY DISASTER RISK PROFILES

WORLD BANK GROUP
Social, Urban, Rural & Resilience