Climate Change, Resilience & the Economics of Risk

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The Challenge

• Why natural catastrophes pose a material risk to the finances of the public sector
The cost of disasters is widening along with the gap between uninsured and insured losses

Global natural catastrophe losses, 1970-2013 (in USD bn)

Source: Swiss Re sigma 1/2014
Growing Exposures: Climate change is not the main driver for rising natural catastrophe losses in recent decades

Shanghai: 1990 to 2013
The proportion of economic losses absorbed by the USG: Is this sustainable?

Figure 4: Ratio of Total Federal Government Disaster Expenditures to Measured Losses
Source: Cummins, Suher, and Zanjani (2010)
FEMA Disaster Declarations: 1970-2014
Disasters Have Tripled Since in the 1970s

![Bar chart showing the increase in FEMA disaster declarations from 1970 to 2014. The chart indicates that disasters have tripled since the 1970s.](chart.png)
Economics of Climate Adaptation

Please find the full study at www.swissre.com/climatechange
Swiss Re's climate change strategy

Coping with climate change requires both mitigation and adaptation measures

### Swiss Re assesses and manages the risk
- Advance (our) knowledge about climate change risk
- Quantify climate change risk
- Integrate climate change risk into underwriting and risk management framework

### Swiss Re seizes business opportunities
- Develop appropriate solutions for adapting to and mitigating climate change
- Traditional catastrophe insurance
- Weather risk solutions

### Swiss Re influences the business environment
- Raise awareness, actively disseminate knowledge to all stakeholders and advocate a long-term, marked-based policy framework, through
- Publications, platforms (e.g. World Economic Forum), Centre for Global Dialogue, speaking engagements

### Swiss Re leads by example
- Greenhouse neutral since October 2003
- Reduced emissions per employee by 54.4% by 2013
- CO\textsubscript{You2} Programme since 2006
Climate-resilient development needs to **assess** and **address** total climate risk

**Objectives**
- Provide decision makers with the **facts and methods** necessary to design and execute a climate adaptation strategy
- Supply insurers, financial institutions, and potential funders with the **information** required to unlock risk prevention funding and deepen global risk transfer markets

**Methodology**
1) Follow a rigorous risk management approach to **assess local total climate risk**, the sum of
   - today’s climate risk,
   - the economic development paths that might put greater population and value at risk
   - the additional risks presented by climate change
2) Propose and prioritize a basket of adaptation measures to **address** total climate risk on an economic basis
The working group studied 18 regions with diverse climate hazards:

- New York: Tropical cyclones and storm surge risk to a metropolis
- Hull, UK: Flood and storm risk to urban property
- US Gulf Coast: Hurricane risk to the energy system
- Florida: Hurricane risk to public and private assets
- Caribbean: Hurricane risk to small islands
- Guyana: Flash flood risk to a developing urban area
- Mali: Risk of climate zone shift to agriculture
- Tanzania: Drought risk to health and power generation
- China: Drought risk to agriculture
- Samoa: Risk of sea level rise to a small island state
- India: Drought risk to agriculture

Results
Loss Frequency Curve

<table>
<thead>
<tr>
<th>Quantity</th>
<th>2013</th>
<th>2020s</th>
<th>2050s</th>
</tr>
</thead>
<tbody>
<tr>
<td>USD 19 billion</td>
<td>70 years</td>
<td>60 years</td>
<td>50 years</td>
</tr>
</tbody>
</table>

70 year return period loss

USD 19 billion
USD 35 billion
USD 90 billion

Source: A Stronger, More Resilient New York
Results
Annual Expected Loss (AEL)

- Average annual impact to assets and GDP
- Some years will have a single or multiple large losses, other years will be zero.
- Today: USD 1.7 billion
- 2050s: USD 4.4 billion
  - USD 1.5 billion from sea level rise
  - USD 1.2 billion from changes in storm frequency

Source: A Stronger, More Resilient New York
Results
Annual Expected Loss by ZIP code

- Current drivers of loss: east and south shores of Staten Island, southern Brooklyn and Queens, Brooklyn and Queens waterfront and southern Manhattan.

- Under future scenarios: Same geographic regions, plus northern Queens and the Bronx

- Under 2050s scenario: 400% increase in ZIP codes which have an AEL of USD 30 million
Results
Cost-Benefit Analysis

• Model can be used to assess the financial savings from various mitigation efforts.

• Combining the modeled savings with cost estimates can provide helpful guidance for decision makers when selecting which efforts to focus on.

• NYC decided to focus on efforts where the cost-benefit ratio was less than 2.

Source: A Stronger, More Resilient New York
The Road Ahead: Closing the protection gap
Closing the Gap: Including ex-ante instruments into the overall risk financing strategy

Including ex-ante instruments in the overall risk financing mix helps a government to lower its financial exposure to catastrophic risks, natural and man-made.
Case study Caribbean: Caribbean Catastrophe Risk Insurance Facility (CCrif)

Solution features
- The CCRIF offers parametric hurricane and earthquake insurance policies to 16 CARICOM governments
- The policies provide immediate liquidity to participating governments when affected by events with a probability of 1 in 15 years or over
- Member governments choose how much coverage they need up to an aggregate limit of USD 100 million
- The mechanism will be triggered by the intensity of the event (modelled loss triggers)
- The facility responded to events and made payments:
  - Dominica & St. Lucia after earthquake (2007)
  - Turks & Caicos after Hurricane Ike (2008)
  - Haiti, Barbados, St. Lucia, Anguilla and St. Vincent (2010)

Involved parties
- Reinsurers: Swiss Re and other overseas reinsurers
- Reinsurance program placed by Guy Carpenter
- Derivative placed by World Bank Treasury
Case study Uruguay: Largest Energy Risk Transfer to Protect Against Drought Risk

Solution features

- Insured peril: Drought
- Payments to be used to purchase energy from alternative sources when drought conditions cause lack of hydro power
- Derivative contract: between UTE, Uruguayan state-owned hydro-electric power company, and World Bank Treasury. Risk is then placed in the market
- Payment mechanics:
  - Trigger: Level of rainfall monitored at weather stations
  - Settlement: Market price of brent crude oil
- Transaction Size: USD 450 million
- Largest of its kind in the weather risk management market

Involved parties

- Client: UTE (Uruguayan state-owned power company)
- Arranger: World Bank Treasury
- Risk Takers: Swiss Re and Allianz
Case study United States: Alabama – First parametric cover for a government in an industrialized country

Solution features
- Insured peril: Hurricane
- Payments to offset economic costs of hurricanes
- Trigger type: Disaster occurring within a defined geographic area ("box") along coast ("cat-in-the-box")
- Trigger based on wind speed of hurricane eye as it passes through pre-determined box
- Payout in as little as two weeks
- Time horizon: July 2010 – July 2013
- First parametric catastrophe risk transfer for a government in an industrialized country

Involved parties
- Insured: State Insurance Fund of Alabama
- Swiss Re: Lead structurer and sole underwriter
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