Assessing Total Climate Risk: A Toolbox for Governments

Reto Schnarwiler, Head Public Sector
2010 International Climate Change Adaptation Conference, Australia
Burning questions

- What is the potential climate-related loss to our economies and societies over the coming decades?
- How much of that loss can we avert, with what measures?
- What investment will be required to fund those measures?
- And will the benefits of that investment outweigh the costs?
The working group studied eight regions with diverse climate hazards.
The economic value at risk is comprised of two components: economic growth and climate change.

**Expected loss from exposure to climate**

*Extreme climate scenario, USD millions*

- Potential impact from economic growth: 56
- Potential impact from change in climate: 23
- Total expected loss: 96

*Example City of Hull, UK*

Change: +71%
Managing total climate risk requires a cost-effective adaptation portfolio.
Adaptation measures were prioritized according to their costs and benefits.

- Benefits include the loss averted and additional revenues (if applicable).
- Costs include capital and operating expenses as well as potential operating savings generated – and therefore can be negative.

**Diagram Explanation:**

- Measures below the 0 line are beneficial also in terms of cost reduction.
- Actions below ratio line on the y axis are defined as cost effective.
- Loss averted dollars.
- Reduction of the expected loss by implementing the measure.

**Notes:**

- Costs and benefits calculated using existing practices and costs.
- Cost per unit of benefit is a NPV calculation discounted at local rates.
The initial portfolio of responses cost-effectively averts much of the expected losses.

Example city of Hull, UK:

- Measures below this line have net economic benefits.
- ~65% of total expected loss can be averted cost-effectively.
The adaptation cost / benefit curve for Maharashtra, India

1 Estimated present value out to 2030 at 2009 dollars
Global overview: Expected Loss averted by adaptation measures

Percent of expected loss (high climate change scenario), 2030¹

100% = total expected loss

<table>
<thead>
<tr>
<th>Country</th>
<th>Remaining loss</th>
<th>Non-cost-effective measures, CB&gt;1</th>
<th>Cost-effective measures, CB&lt;1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mali</td>
<td>100</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Guyana</td>
<td>68</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>UK</td>
<td>65</td>
<td>29</td>
<td>6</td>
</tr>
<tr>
<td>Samoa</td>
<td>53</td>
<td>47</td>
<td>4</td>
</tr>
<tr>
<td>China²</td>
<td>48</td>
<td>48</td>
<td>4</td>
</tr>
<tr>
<td>India</td>
<td>47</td>
<td>47</td>
<td>4</td>
</tr>
<tr>
<td>Tanzania</td>
<td>43</td>
<td>44</td>
<td>20</td>
</tr>
<tr>
<td>Florida</td>
<td>40</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

¹ Based upon select regions analyzed within the countries (e.g., Mopti, Mali; Georgetown, Guyana, UK; North and Northeast China; Maharashtra, India; Central regions of Tanzania; Southeast Florida, U.S.)
² Based upon moderate scenario data and analysis
The Main Functions of Risk Transfer

**Without risk transfer**
- Cost equals economic damage from hazard events (loss)

**With risk transfer**
- Cost equals premiums (plus deductible in case of loss)

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**Risk transfer**

**Benefits**
- Caps losses, protects livelihood from catastrophic events
- Smooths costs, reduces volatility
- Increases willingness to invest
- Provides incentives ("price signals")

**Costs**
- Expected loss plus markup for production and distribution
Summary

- A tested toolbox for governments
- The framework presented can help societies better understand the climate risk to their economies – and provide vital input into impactful, cost-effective adaptation strategies that boost overall economic development
  - Quantify a location’s total climate risk
  - Select feasible and applicable measures to adapt to the expected risk by using cost-benefit curves
Economics of climate adaptation – a framework for decision-makers

Please find the full study at www.swissre.com/climatechange
Assessing Total Climate Risk: A Toolbox for Governments

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Appendix: Case study China
Economics of climate adaptation (ECA) study group

Partner consortium:

<table>
<thead>
<tr>
<th>Partner</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Global Environment Facility (GEF)</td>
<td>is a trust fund partnership among 178 countries, international institutions, non-governmental organizations (NGOs), and the private sector</td>
</tr>
<tr>
<td>Climate Works</td>
<td>is a newly formed global philanthropic network organized to win the battle against climate change</td>
</tr>
<tr>
<td>The United Nations Environment Programme (UNEP)</td>
<td>is an international inter-governmental organization established by the General Assembly of the United Nations</td>
</tr>
<tr>
<td>Standard Chartered</td>
<td>operates in many of the world’s fastest growing markets, and derives over 90 per cent of its profits from the emerging trade corridors of Asia, Africa and the Middle East</td>
</tr>
<tr>
<td>Swiss Re</td>
<td>is a leading global reinsurer, was a lead contributor to the research, risk assessment and quantification</td>
</tr>
<tr>
<td>McKinsey &amp; Company</td>
<td>drove the analytical execution and contributed to the fact base</td>
</tr>
<tr>
<td>The Rockefeller Foundation</td>
<td>is a global philanthropic corporation</td>
</tr>
<tr>
<td>The European Commission</td>
<td>is the executive branch of the EU responsible for proposing legislation, implementing decisions, upholding the Union’s treaties,</td>
</tr>
</tbody>
</table>
China has a highly diverse climate

- Highly diverse climate across the country, including tropical climate in the South, as well as sub arctic climate in the far Northeast
- Rainfall volume and pattern varies greatly by region, the farther from coastal, the drier

SOURCE: CIA World Factbook; FAO; IMF
We focused on drought due to its strategic importance to agriculture.

2004-2007 annual average impact of hazards in China

<table>
<thead>
<tr>
<th></th>
<th>Cultivated land affected</th>
<th>People affected</th>
<th>Direct economic loss</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Million hectare</td>
<td>Millions</td>
<td>USD billions¹</td>
</tr>
<tr>
<td>Drought</td>
<td>21</td>
<td>140</td>
<td>8</td>
</tr>
<tr>
<td>Flood</td>
<td>9</td>
<td>108</td>
<td>10</td>
</tr>
<tr>
<td>Tropical cyclone</td>
<td>3</td>
<td>52</td>
<td>8</td>
</tr>
</tbody>
</table>

¹ 1 USD = RMB 6.8 for all calculations

SOURCE: Yearbook of Meteorological Disasters in China, 2004–07
We analyzed the areas of North and Northeast China – regions most impacted by drought.
Given the uncertainty in future climate prediction, we developed 3 scenarios for climate change.

- PRECIS is a regional circulation model (RCM) developed by Hadley Center of U.K. It simulates daily meteorological conditions at a resolution of 50 km x 50 km in a selected region driven by an emission scenario.

- A2 scenario is an SRES scenario defined by IPCC¹, often referred to as medium-high emission scenario.

- Extreme drought in the report refers to particularly severe drought event that happens once every 30 or 50 years.

### 2030 scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Today’s Climate</strong></td>
<td>- Assuming the climate remains the same as historical climate conditions.</td>
</tr>
<tr>
<td></td>
<td>- Use PRECIS model’s output based on 1961-90 data for normal drought</td>
</tr>
<tr>
<td></td>
<td>- Use historic condition for extreme drought</td>
</tr>
<tr>
<td><strong>2 “Moderate” Change</strong></td>
<td>- Use the average value of the forecast by PRECIS model under A2 scenario</td>
</tr>
<tr>
<td></td>
<td>- Assume a 50% increase of the severity and the frequency of extreme drought from historic condition</td>
</tr>
<tr>
<td><strong>3 “High” Change</strong></td>
<td>- Use the average value of the driest 10% forecast from PRECIS model under A2 scenario</td>
</tr>
<tr>
<td></td>
<td>- Assume a 100% increase of the severity and the frequency of extreme drought from historic condition</td>
</tr>
</tbody>
</table>

¹ The Intergovernmental Panel on Climate Change

SOURCE: Team analysis
The economic value at risk for each scenario is comprised of two components – economic growth and climate change.

Expected loss from exposure to climate – Combined North and North East China
Moderate climate change scenario, USD billions

- Potential impact from economic growth: 0.8
- Potential impact from change in climate: 2.6
- Total expected loss: 2.6 (103% increase from today's expected loss of 1.3)

2008, Today's expected loss: 1.3
Incremental increase from economic growth; no climate change: 0.8
Incremental increase due to climate change: 0.5
2030, total expected loss: 2.6
Managing total climate risk requires a cost-effective adaptation portfolio.
Adaptation measures were prioritized according to their costs and benefits.

- Benefits include the loss averted and additional revenues (if applicable)
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Cost per unit of benefit ratio

- Measures below 0 line are beneficial also in terms of cost reduction
- Actions below ratio line on the y axis are defined as cost effective

Loss averted Dollars

- Reduction of the expected loss by implementing the measure

- Costs and benefits calculated using existing practices and costs
- Cost per unit of benefit is a NPV calculation discounted at local rates
The initial portfolio of responses cost-effectively averts much (~50%) of the expected losses.

Example China:
Global overview: Losses by GDP impact

1 Based upon select regions analyzed within the countries (e.g., Mopti, Mali; Georgetown, Guyana Hull, UK; North and Northeast China; Maharashtra, India; Central regions of Tanzania; Southeast Florida, U.S.)
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