The Economic Impacts of Risk

New Orleans – 100 Resilient Cities
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The Rising Cost of Disasters
The cost of disasters is growing and the portion absorbed by governments and its citizens are even greater.

Source: Swiss Re Economic Research & Consulting, sigma catastrophe database
Disasters place a significant burden on the public sector

- Despite prevention and mitigation efforts, no country can fully insulate itself against extreme natural disasters
- The brunt of economic losses from natural disasters ends up with individuals, corporations and governments, both on national and sub-national level
- Government budgets are impacted by:
  - Primary effects include immediate expenses for emergency relief efforts, costs for rebuilding public infrastructure or loss of capital and durable goods
  - Secondary effects, for instance, include lower economic growth, lower tax and non-tax revenues, budget deficits, increased indebtedness and costs from refinancing, higher inflation or currency movements
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)
Natural Disaster Exposures of New Orleans
Historical Tropical Cyclone Tracks
1891-2008

Source: Swiss Re CatNet
Storm Surge – Category 1 Hurricane

Source: Swiss Re CatNet/SLOSH
Storm Surge – Category 5 Hurricane

Source: Swiss Re CatNet/SLOSH
Storm Surge – Category 1 Hurricane

Source: Swiss Re CatNet/SLOSH
River Flood Exposure

Source: Swiss Re CatNet/FEMA
People Affected by Disasters

New Orleans' two greatest threats are river flooding and storm surge.

- Storm Surge: 528,000 people or 56% of the total population
- River Flood: 695,000 or 73% of the population
- Hurricane/Storm: 182,000 or 19% of the population

Source: Swiss Re CatNet
Mind the Risk – How does New Orleans compare to other cities?

- 13th globally for population exposed to storm surge
- 16th in the world for economic production lost (all perils)
- 7th globally for economic production lost to storm surge
- 4th in the United States for economic production lost (all perils)
Economics of Climate Adaptation
Analysis scope includes 77 counties along the Gulf Coast, involving an asset value of over $2 trillion

US Gulf coast case study

Key areas examined within 70 miles of the coast

<table>
<thead>
<tr>
<th>US Gulf Coast region and counties in scope¹</th>
<th>Basic metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2010 GDP ($M)</strong></td>
<td><strong>Counties</strong> 77</td>
</tr>
<tr>
<td>≤1,000</td>
<td></td>
</tr>
<tr>
<td>1,000-2,500</td>
<td></td>
</tr>
<tr>
<td>2,500-5,000</td>
<td></td>
</tr>
<tr>
<td>5,000-10,000</td>
<td></td>
</tr>
<tr>
<td>&gt;10,000</td>
<td></td>
</tr>
<tr>
<td><strong>Area</strong> 61,685 sq. mi</td>
<td></td>
</tr>
<tr>
<td><strong>GDP</strong> $634 B</td>
<td></td>
</tr>
<tr>
<td><strong>Population</strong> 11.7 million</td>
<td></td>
</tr>
</tbody>
</table>

Asset values by class

<table>
<thead>
<tr>
<th>Replacement value by class</th>
<th>$ Billions, 2010 dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>882</td>
</tr>
<tr>
<td>Commercial</td>
<td>455</td>
</tr>
<tr>
<td>Critical infrastructure</td>
<td>141</td>
</tr>
<tr>
<td>Agriculture/fisheries</td>
<td>6</td>
</tr>
<tr>
<td>Non-energy industrials</td>
<td>85</td>
</tr>
<tr>
<td>Electric utility assets</td>
<td>300</td>
</tr>
<tr>
<td>Oil &amp; gas assets</td>
<td>499</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,367</strong></td>
</tr>
</tbody>
</table>

¹ Includes 30 Louisiana parishes

Source: ESRI; Energy Velocity

Source: ECA group
The risk profile of the region will shift going forward

US Gulf coast case study

Annual average expected loss in 2010 and 2030
$ Billions; 2010 dollars

- Extreme climate scenario
- Average climate scenario
- No climate change

Climate scenarios:
- 2010:
  - 14.2
- 2030:
  - 23.4
  - 18.8
- 2050:
  - 39.5
  - 34.6
  - 26.3

Percent of area’s capital investment:
- 2010: 7.6
- 2030: 6.8
- 2050: 6.4

Percent of GDP:
- 2010: 2.7
- 2030: 2.4
- 2050: 2.3

Average annual losses can increase significantly by 2100 (to $131-211 M)

1 No climate change; includes impact of subsidence
2 Based on BEA historical average of capital investment (private and total government expenditures) as a percentage of GDP

Source: Swiss Re
The risk profile of the region will shift going forward

US Gulf coast case study

Source: Swiss Re
More than 33% of loss can be averted by cost-effective measures

US Gulf coast case study

1 Estimated present value out to 2030 at 2009 dollars

Source: ECA group

Incremental increase in loss under average change $7.3 billion

Average annual loss in 2030 is $21.5 bn
Measures are analyzed in respect of costs (CapEx) and benefits (averted loss) in great detail.

### US Gulf coast case study

<table>
<thead>
<tr>
<th>Category</th>
<th>Measure</th>
<th>Loss averted, 2030</th>
<th>CapEx required</th>
<th>Average C/B ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential/commercial</td>
<td>Improved building codes</td>
<td>1.4 $Billions</td>
<td>12 $Billions</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>Beach nourishment</td>
<td>0.1 $Billions</td>
<td>1 $Billions</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>Wetlands restoration</td>
<td>0.4 $Billions</td>
<td>25 $Billions</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>Levee systems</td>
<td>0.3 $Billions</td>
<td>18 $Billions</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>Improved standards for offshore platforms</td>
<td>1.7 $Billions</td>
<td>16 $Billions</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>Floating production systems</td>
<td>1.1 $Billions</td>
<td>18 $Billions</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Replacing semi-subs with drill ships</td>
<td>0.5 $Billions</td>
<td>11 $Billions</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>Levees for refineries and petrochemical plants</td>
<td>0.7 $Billions</td>
<td>5 $Billions</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Improving resilience of electric utility systems</td>
<td>1.3 $Billions</td>
<td>15 $Billions</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td>7.5 $Billions</td>
<td>76 $Billions</td>
<td></td>
</tr>
</tbody>
</table>

1. Included despite high C/B ratios due to strong co-benefits, risk aversion
2. Total capital investment, non-discounted, across 20 years

- The government may need to support or incentivize some private capital investment, e.g., by subsidizing homes in low-income areas built to higher building codes.

Source: ECA group
Comprehensive Risk Management
Country Risk Management: Making societies more resilient

• Societies are becoming more vulnerable as the risks they face become more interconnected

• Integrated risk management approaches can help countries to identify and prepare for risks

  Identification ➔ Assessment ➔ Prevention and Mitigation ➔ Adaptation

• Such an all-hazard approach demands a high level of coordination across government, political and private sector bodies

• A Country Risk Office or Ministry could be responsible for managing such a prioritized risk landscape, taking an holistic approach to risks before events occur and ultimately reducing the risk burden to society
The public and the private sector are exposed to a broad variety of risks.
SONAR: Early Warning System – What risks are on the horizon?

![Diagram showing potential risks with high, medium, and low impact over 1-3 years, 4-10 years, and >10 years.](image-url)
Case Studies
Case study Mexico: MultiCat - Funding for immediate relief efforts after disasters

Solution features

• Insured perils: Earthquake and hurricane
• Payments to be used for immediate emergency relief after a disaster
• Parametric catastrophe bond: USD 315 million
• Trigger type: Index
  – Earthquake: physical trigger (quake magnitude)
  – Hurricane: physical trigger (barometric pressure)
• Time horizon: October 2012 – November 2015
• Renewed cat bond launched through the World Bank’s MultiCat facility and third cat bond for Mexico

Involved parties

• Insured: Fund for Natural Disasters (FONDEN) of Mexico
• Reinsured: AGROASEMEX S.A.
• Arranger: World Bank Treasury
• Swiss Re: Co-lead manager and joint bookrunner
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 500 million
- Largest of it's 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
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
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