Resilience Funding Forum: Innovative Options for Coastal Localities

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Capital, Science & Policy

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Climate Risk: Changing Context

- Climate Risks to Communities & Institutions
- Public Finance & Credit Risk
- Catastrophe Models
- Insurance & Finance Tools

Moody's Warns Cities to Address Climate Risks or Face Downgrades

Source: NOAA Sea-Level Rise Viewer
Climate Change – The Statistics Tell the Story

U.S. Insured Catastrophe Losses

Billions, 2018 $

<table>
<thead>
<tr>
<th>Decade</th>
<th>Average for Decade</th>
<th>Hurricane Andrew</th>
<th>Katrina, Rita, Wilma</th>
<th>WTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980s</td>
<td></td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990s</td>
<td></td>
<td>1990s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000s</td>
<td></td>
<td>37</td>
<td></td>
<td>79</td>
</tr>
<tr>
<td>2010s</td>
<td></td>
<td></td>
<td></td>
<td>2010s</td>
</tr>
<tr>
<td>2018</td>
<td>104</td>
<td></td>
<td></td>
<td>79</td>
</tr>
</tbody>
</table>

There is no question that climate change is happening; the only arguable point is what part humans are playing in it.

— Sir David Attenborough

Source: Property Claims Service, a Verisk Analytics business; Swiss Re; Insurance Information Institute

*2018: Inflation-adjusted PCS estimate, subject to change. 2010s is average of 2010 to 2018.
Risks & Impacts to Communities and Organizations

Varied – but fundamentally, increased costs and increased unpredictability as a result of:

Physical Risks – for example, the impact of changing weather patterns on asset values and insurance costs

Transition Risks – for example, a reassessment of the value of certain assets or products as we transition to a carbon constrained economy

Liability Risks – for example, parties that suffer loss or damage from climate change seek to recover losses from those they deem to have been responsible
For climate risks, we can help assessing the financial impacts, disclosing risks as well as identify opportunities for relevant time horizons.

Task Force on Climate Related Financial Disclosures ‘TCFD’ developed recommendations in 4 thematic areas that are applicable to organisations across sectors and jurisdictions promoting transparency and financial stability.

Source: https://www.cicero.oslo.no/en/CF-transitional-risk
Public Finance & Credit Risk
US Public Finance Issue Ratings By Sector

Of nearly 17,000 US public finance ratings, almost 80% are secured by taxes or an appropriation by a government entity.
What Is A Credit Rating?

<table>
<thead>
<tr>
<th>What Credit Ratings Are</th>
<th>What Credit Ratings Are Not</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opinions about relative credit risk</td>
<td>Indications of market liquidity or price</td>
</tr>
<tr>
<td>Opinions about ability &amp; willingness of an issuer to meet financial obligations in full &amp; on time</td>
<td>Investment advice or guarantees of future credit risk</td>
</tr>
<tr>
<td>Forward looking and continually evolving</td>
<td>Absolute measures of default probability</td>
</tr>
<tr>
<td>Intended to be comparable across different sectors and regions</td>
<td>Expected ultimate loss given default</td>
</tr>
</tbody>
</table>

- Assessing Creditworthiness of Issuers and Obligations
Overview of the Local Government Rating System

- Institutional framework: 10%
- Economy: 30%
- Management: 20%
- Liquidity: 10%
- Budgetary performance: 10%
- Budgetary flexibility: 10%
- Debt & contingent liabilities: 10%

Indicative Rating + Overrides + Potential one notch adjustment = Final Rating

<table>
<thead>
<tr>
<th>Relevant Overrides</th>
<th>Caps rating at:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural imbalance</td>
<td>BBB+</td>
</tr>
<tr>
<td>Weak liquidity</td>
<td>BBB+ or BB+</td>
</tr>
<tr>
<td>Weak management</td>
<td>A or BB+</td>
</tr>
</tbody>
</table>
Public Finance & Climate Risk

- **Population Declines**
  - Institutional framework: 10%
  - Economy: 30%
  - Management: 20%

- **Management & Planning**
  - Institutional framework: 10%
  - Economy: 30%
  - Management: 20%
  - Liquidity: 10%
  - Budgetary performance: 10%
  - Budgetary flexibility: 10%

- **Insurance & Reserves**
  - Debt & contingent liabilities: 10%

Assessment includes:
1. Income levels
2. Tax value of property

Assessment most relevant to extreme climate-related risk:
- Available Cash, Available Reserves, and Operating Results
- Consideration of cash and reserves on hand to manage event and impact on ongoing performance
- Ongoing performance may be impacted or if resiliency investments aren’t made, we may consider these expenses deferred
Case Study: Rockport, Texas

Approximately 80% of structures in Aransas County, where Rockport is located, sustained damage from Hurricane Harvey.

60% of residents, or 5,768 people, have been displaced and management is unsure when--or if--residents will return.

We downgraded Rockland based on our view of:
- Potential tax-base deterioration
- Revenue declines
- Rockport's uncertainty with regard to its budgetary performance and flexibility following the effects of Hurricane Harvey.

Each dot is one building
- Green dot = Destroyed
- Red dot = Major damage
- Yellow dot = Minor
- Orange dot = Some flooding

Source: Federal Emergency Management Agency, data as of Aug. 31
Catastrophe Modeling
U.S. Flood analytics – historical view

- Flood is a complex peril to model
  - Technological barriers made it difficult to adequately generate a complete view of flood hazard
  - Without a private market for residential flood, commercial vendors didn’t invest resources in developing a model
  - Technology advances and market pressures have changed the landscape of flood analytics
- FEMA maps have largely been the basis for evaluating flood risk in the U.S.
  - These maps only determine if a risk is in or out of a flood zone, without providing information on potential flood depths
  - FEMA maps are hazard-only, and do not consider vulnerability or financial terms to help determine losses
Coverage and extent of FEMA Flood Insurance Rate Maps (FIRMs)

- FEMA FIRMs do not cover the entire U.S.
  - There is not a consistent methodology for developing FEMA flood maps across the country
  - Many areas have maps that are outdated, based on old technology, or do not take into account construction and development
  - Older maps have not been digitized

- In many areas FEMA FIRMs cover the main rivers but not smaller streams
- It is important to model the water getting to the rivers as well as out of the rivers

Red outlines – FEMA 100 year flood zones
Blue shading – high resolution model including pluvial (surface) and fluvial (riverine) flooding
Hazard Analyst app – compare data sources

Left side displaying FEMA data

Right side displaying KatRisk data
Implementation: Insurance & Finance
Implementation Considerations

INVESTMENTS IN RISK MITIGATION

- Enhanced Operations
- Supply Chain Resilience
- On-going Capital Upgrades
- Investment Decision-Making

OPTIMAL INSURANCE PROGRAM

- Regular Reassessment
- Adequacy of Limits and Coverage
- Appropriate Insurer Partners

ALTERNATIVE HEDGING STRATEGIES

- Triggers-Based Programs
- A contract that responds to the characteristics of an event, not the damage caused
- E.g. Flood, Temperature, Windstorm

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## The Tools: Indemnity or Parametric
Or Something In Between

<table>
<thead>
<tr>
<th>Indemnity</th>
<th>Modelled Loss Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Scheme pays on actual loss</td>
<td>• Model pays based on estimated loss from a catastrophe model</td>
</tr>
<tr>
<td>• Limited basis risk</td>
<td>• Basis risk should be low but still real</td>
</tr>
<tr>
<td>• But high cost of loss adjustment</td>
<td>• Requires time and expense to build the catastrophe model</td>
</tr>
<tr>
<td>• Loss adjustment also results in payment delays</td>
<td>• Catastrophe models are good for homogenous exposures (i.e. domestic property), less good for complex risks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parametric Index</th>
<th>Parametric</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Essentially a simplified version of a modelled loss</td>
<td>• An event occurs, payment is made</td>
</tr>
<tr>
<td>• Formulate estimate hazard at certain reference points (e.g. wind speed, ground shaking, rainfall)</td>
<td>• Simple, easy to understand</td>
</tr>
<tr>
<td>• Additional formula estimate the loss resulting from this hazard</td>
<td>• Event definition made by a verifiable independent agency</td>
</tr>
<tr>
<td>• Lower basis risk than pure parametric; higher than Modelled Loss</td>
<td>• But high basis risk: smaller events may cause a large loss, a large event conversely may cause few losses</td>
</tr>
</tbody>
</table>

HydroMet Triggers

- Rainfall
- Flow / CFS
- Water Surface Elevation
- Wind Speed
- Temperature

Gage images courtesy of NOAA
Structuring for a Trigger-Based Solution for Flood and Drought Case Study for Texas River District

- Risks from localized rainfall and river flows from upstream precipitation
- Structure accounts for both of these risks with separate triggers that can operate independently and in combination
- Graduated payouts support non-damage costs and damaging droughts and floods
Catastrophe Bonds

Sponsor → Premium (spread) → Special Purpose Vehicle → Capital
Reinsurance contract → Collateral Trust → Coupon (Libor + spread)*
Investment return → Permitted Investments → Investment

Return of principal at maturity*

* Payment subject to the insured natural disaster not occurring during lifetime of bond
Catastrophe bond and ILS issuance in Q2 2018 was the second highest ever recorded, at $5.151 billion.

H1 2018 issuance $9.39 billion, already the second most active full-year ever recorded.
Resilience Bonds: Risk Transfer + Project Finance

Debt Instrument
Raise capital to fund resilience
- Municipal Bond
- Federal Credit or Loan
  - E.g. HUD s.108 Loan, FEMA Community Assistance Loan

Risk Transfer
Protect investments
- Uses analytics for deep understanding of extreme risk
- E.g. Catastrophe Bond, Index / Parametric Cover
Resilience Bond Example Structure

**Issuance**
- Investors (No Event)
  - Pay principal
  - Receives principal in cash and uses it to fund project

**Life of the transaction (3-5 years)**
- Receive interest
- Pays interest

**Mitigation Project**
- Pays interest
- Does not pay interest

**Maturity**
- Receives principal back
- Reimburse principal
- Project Complete
- Does not reimburse principal

**Triggering Event**

- **Option 1**
  - CITY / PROJECT SPONSOR
  - Investors (No Event)

- **Option 2**
  - Investors (With Event)

There is a lot of flexibility in the product and this slide only shows one example.
Global Resilience
Sovereign, Regional, and Global Risk Finance

Caribbean Catastrophe Risk Insurance Facility (CCRIF)
- First regional risk pool set up in 2007
- Parametric cover for tropical cyclone, earthquake, and excess rainfall
- Pays out within 14 days of a triggering event, notifying countries within 2 to 3 days

African Risk Capacity (ARC)
- Hybrid mutual insurer
- Parametric cover for drought and tropical cyclone
- ARC Agency provides technical advice on insurance and contingency planning

Pacific Catastrophe Risk Insurance Company (PCRIC)
- Captive Insurer backed by multi-donor trust fund
- Parametric cover for tropical cyclone, earthquake, and tsunami
- Precursor was the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI), providing pilot risk transfer via the WB

Global Ecosystem Resilience Facility (GERF)
- Global facility providing finance and risk management to coastal communities, protecting ecosystems and incentivizing stewardship of the environment
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