Public Natural Catastrophe Losses Funded through Private Capital Markets: The Case of the Mexican Parametric Earthquake Catastrophe Bond

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The Mexico Catastrophe Bond

Origins of Bank / Government Dialogue:

• Country hazard risk exposure and insurance studies (during preparation / impl. of ERL loan).
• Optimizing insurance for public assets with possible bulk pooling to lower premiums.
• Improving risk data for all hazard impacts.
• Hedging federal disaster budget fund using insurance tools, such as catastrophe bonds.

Catastrophe Bond Features

• Type of payment trigger: (a) indemnity, (b) index or (c) parametric.
• Parametric (e.g.: e'quake magnitude 8.0) has least moral hazard or need to verify on-ground losses.
• No loss: investors get above market yield.
• Loss: if Bond defaults.
• Pmt. amount specified.
Initial Specification of Trigger

<table>
<thead>
<tr>
<th>Quake Magnitude</th>
<th>7.0</th>
<th>7.5</th>
<th>8.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Bond loss Inner grid</td>
<td>40</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>% Bond loss Outer grid</td>
<td>20</td>
<td>60</td>
<td>100</td>
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</tbody>
</table>

Insurance contract versus bond: Payment trigger is Richter magnitude 8.0, Perimeter of epicenter specified, Maximum specified depth, e.g.: 100 km. at epicenter.

Works as a Market Bond

• Corporate bonds priced based on default probability (e.g. 1%, 2%, 3%), rated by credit rating agencies.
• Catastrophe bond has hazard probability (e.g.: earthquake magnitude of Richter 8.0) of 1%. Rated BB / BB- as potential 'default' by credit rating agency.
• So catastrophe bond should at least pay rate to investors: 5% (risk free rate) + 1% (default probability) + 3% (variance/uncertainty of probability) = 9% rate. Investors thus fully covered for risk factor.
• If e'quake occurs, investors lose principal, and government keeps proceeds for disaster needs.

Cat Bond Structure

Investors

High credit rating & protection, e.g.: AA / AAA, SPV is de facto bond issuer.

Special Purpose Insurance Vehicle / Co.

Investors' Funds Trust Account 9%

Government

Gov't not the issuer, but Gov't credit rating also matters.
Actual Deal Structure

- Insurance vehicle (SPV-like) set up as 'intermediary'.
- Swiss Re acted as underwriter (and guarantor) of bond issuance.
- Bond sold to investors in the private placement market.
- Final spread was 2.36% over LIBOR. Binary: “all/nothing”.
- Swiss Re was last resort guarantor of bond purchase.

Actual Deal Structure, continued

- Two additional earthquake zones covered by Swiss Re under a parametric contract (but with no cat bond).
- Cat bond maturity is 3 years.
- If qualifying earthquake occurs, investors lose principal (not a staggered trigger as previously considered) – kept simple.

Benefits to Parties

- Government pays a premium (similar to pre-amortizing future disaster costs).
- Capital market absorbs loss if disaster trigger occurs.
- Bond is attractive: of low probability, and uncorrelated with financial markets.
- Immediate cash after onset of disaster for first response.
Pre-Requisites

- Inventory of infrastructure and public assets.
- Geographic and topographic locational vulnerability (near faults, mountains, coasts, etc).
- Construction material and its damage potential.
- Valuation of property/infrastructure in $$$.
- Projected frequencies and intensities of hazards.
- Determination of probability distribution of loss $$$ amounts to allow pricing of coverage.
- Cost effectiveness vis-à-vis budget financing.

Physical/Financial Risk Modeling

Measure

- locational vulnerability
- structural vulnerability

Estimate

- probable losses

Calculate

- price of insurance

Price

- alternative risk financing instruments

Evaluate against present funding arrangements.

Operation as Financing Tool

- Mexico has legislated a natural disaster fund. Upon occurrence of disaster, federal and state governments co-share in costs. Fund was pre-budgeted (at time idle funds).
- Instead of building up budget, in future, premium can be financed ex ante. Disaster fund regulations had to be modified to allow insurance.
Bank Role / Added Value

• Objective country risk exposure diagnostic and loss potential scenarios.
• Risk management institution building (data).
• Determination of fiscal disruption & situation if large catastrophe occurs.
• Combining insurance, and other financing, for ex ante preparedness.