High-Level Roundtable on the Financial Management of Earthquakes

OECD Headquarters, 2 rue André Pascal, 75116 Paris

CATASTROPHE FINANCING FOR GOVERNMENTS
LEARNING FROM THE 2009-2012 MULTICAT PROGRAM IN MEXICO

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Catastrophe Financing for Governments
Learning from the 2009-2012 Multicat program in Mexico

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OECD Advisory Board's High Level Roundtable on Earthquake Risk Financing
June 23-24, 2011 – Paris, France

Outline

I. Why Is Catastrophe Financing Raising Fast on The Agenda of Top Decision Makers?

II. A Word on Catastrophe Bonds

III. Application: The 2009-2012 MultiCat Program in Mexico
Outline

I. Why Is Catastrophe Financing Raising Fast on The Agenda of Top Decision Makers?

II. A Word on Catastrophe Bonds

III. Application: The 2009-2012 MultiCat Program in Mexico
With rapidly increasing population and sustained economic development in their countries, many Presidents and Prime ministers are now faced with a strategic question:

How can we best develop a national strategy to hedge against the massive economic burden of extreme events that could hit our country tomorrow?
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III. Application: The 2009-2012 MultiCat Program in Mexico
### Alternative Risk Transfer Instruments: A Useful Tool For Governments?

- The field of alternative risk transfer (ART; “alternative” as opposed to traditional insurance and reinsurance mechanisms) grew out of a series of insurance capacity crises in the 1970s through the 1990s.
- ART instruments can comprise a wide range of alternative solutions (including the creation of captives or risk-retention groups)
- We concentrate here on catastrophe bonds; instruments that transfer part of the risk exposure not to traditional insurers or reinsurers but directly to investors in the financial markets

### What Is A Catastrophe Bond?

- A multi-year contingent bond which pays its issuer only if a pre-defined event has occurred (trigger)
- The trigger can be an external event (e.g. an earthquake of magnitude 8.0 and above) or be based on the losses of the issuer (indemnity)
- In both cases there is a need for a transparent measure of the triggering event so the transaction can take place
- The coverage is typically offered for more than one year, which provides valuable stability in our volatile world
**Simplified Structure of a Cat Bond**

- **Potential Investors**
  - Investment in the dedicated cat bond

- **Contract with Special Purpose Vehicle BigCat (Issuer)**
  - Principal invested in safe investments

- **Proactive Country (Sponsor)**
  - Provide the government with rapid capital post disaster
  - High value given right budget priorities in many countries
  - Fund financial aid to victims of disasters

- **Payment of interest and principal of the cat bond (at maturity, no disaster)**

- **Disaster claim (investors lose their investment)**

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**Parametric versus Indemnity Trigger**

- **Basis risk for the country**

- **Parametric trigger**

- **Indemnity trigger**

- **Transparency to potential investors**
Evolution of the Catastrophe Bond Market
1997-December 31, 2010

Sources: Michel-Kerjan et al (2011); data from Goldman Sachs and Swiss Re

Cat Bonds Are Attractive …

For the issuer
• Provide an additional (potentially very large) source of capital
• Can be tailored to the need of the issuer
• Cover several years in a row (reinsurance prices are highly volatile after a disaster)
• Demonstrate a certain “financial maturity” of the issuer

For the investor
• Increase portfolio diversification (very low beta)
• Good return on investment
• “Investing with a meaning”
Cumulative Performance of the Swiss Re Cat Bond Index.
January 2002-February 2011

Who Is Using Cat Bonds?

- **Companies and trade associations**
  - Disney; Universal Studios; Dominion; Electricité de France (EDF)
  - Insurers and reinsurers
  - FIFA (World Cup)

- **State/national disaster insurance pools**, as part of their reinsurance program
  - The US California Earthquake Authority (CEA) (Glenn Pommery’s presentation later)
  - The Taiwanese Residential Earthquake Insurance Pool (TREIP)
  - The Turkish Catastrophe Insurance Pool

- Mexico became in 2006 the first **government** in the world to use a cat bond to hedge its disaster-related **fiscal** liability
Why More Governments Are Thinking about it?

- Governments remain the ultimate risk financier
- Government relief still provides the majority of post-disaster relief in OECD countries: from a low 40-50% (US; France) to 80-90% in others

But….
- Major stress on public spending post financial crisis
- Proper spending of taxpayers money (accountability) and economic resiliency are central elements for (re)-election

Things to keep in mind though…

For the issuer
- Not cheap (see Ivan Zelenko’s presentation later)
- Not a liquid asset; it takes some time to put in place and requires expertise in structured finance (external/consultants or in house)

For the investors
- Can lose their entire investment in the case of a single triggering events (or series of events)
Outline

I. Why Is Catastrophe Financing Raising Fast On The Agenda of Top Decision Makers

II. A Word on Catastrophe Bonds

III. Application: The Multicat Program in Mexico
Global Seismic Hazard Map

Sources: Global Seismic Hazard Assessment Program

Historical Tropical Storms


Sources: AIR Worldwide
The World Bank’s MultiCat Program

- The MultiCat Program is a shelf documentation that facilitates the issuance of notes covering multiple perils and for multiple zones
- Some of its key features are the following:
  - Common documentation
  - Legal and operational framework for the offerings
  - “MultiCat” brand name, offering name recognition with investors
  - Wide variety of structures
- The World Bank acts as arranger in all MultiCat issues and selects on a competitive basis the lead managers and other service providers

Preparation and Execution of the 2009 MultiCat Program: A 7-step Process

Step 1. Understand the Country’s Exposure and Institutional Framework and Risk Management Infrastructure
Step 2. Selection of the Partners, Roles and Responsibilities
Step 3. Kick off meeting and Key Decisions on the Execution
Step 4. Structuring of the MultiCat Bond
Step 5. Establishment of the Special Purpose Vehicle (SPV) and Drafting of the Multicat Legal Documents
Step 6. Launch Road Show, Distribution and Issuance
Step 7. Conclude Legal Formalities
• MultiCat Mexico 2009 offers parametric-based insurance to Mexico’s FONDEN covering 3 different perils and 6 regions
  – Earthquake in the Pacific coast and the area surrounding Mexico City
  – Pacific Hurricanes in two different parts of the coast
  – Atlantic Hurricanes in the Yucatan peninsula

• MultiCat Mexico 2009 successfully issued US$290 million of 3-year bonds, for emergency funding only
  – Swiss Re and Goldman Sachs, Joint-Lead Managers; Munich Re, advisor
  – AIR conducted the risk modeling
  – Pricing after a successful 4-day roadshow in Europe, Bermuda and the US
  – Books over 2.5x oversubscribed
  – Pricing at the tight end of the original price guidance
<table>
<thead>
<tr>
<th>Class A</th>
<th>Class B</th>
<th>Class C</th>
<th>Class D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peril</td>
<td>Earthquake</td>
<td>Pacific Hurricane</td>
<td>Pacific Hurricane</td>
</tr>
<tr>
<td>Notional (US$mm)</td>
<td>140</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Risk Period</td>
<td>3 years</td>
<td>3 years</td>
<td>3 years</td>
</tr>
<tr>
<td>Trigger Type</td>
<td>Parametric</td>
<td>Parametric</td>
<td>Parametric</td>
</tr>
<tr>
<td>Trigger</td>
<td>7.9</td>
<td>944</td>
<td>944</td>
</tr>
<tr>
<td>AIR Modeled Annualized Expected Loss</td>
<td>4.65%</td>
<td>3.94%</td>
<td>4.00%</td>
</tr>
<tr>
<td>S&amp;P Ratings</td>
<td>B</td>
<td>B</td>
<td>B</td>
</tr>
</tbody>
</table>
Earthquake Trigger Event Conditions

- 100% Principal Reduction of Class A Notes if Earthquake Trigger Event Conditions are met
- Payment of losses requires determination by the Calculation Agent (AIR) at the commencement of the transaction of Earthquake Trigger Event Conditions based on parameters as reported by the Earthquake Reporting Agency
- Earthquake Trigger Event Conditions:
  - Earthquake Occurrence Time is during the Risk Period
  - State of emergency declaration issued by the Secretaría de Gobernación ("SEGOB") and published in the Federal Official Gazette (the "SEGOB Declaration")
  - Epicenter location in or on the boundary of an Earthquake Zone
  - The Magnitude Condition and Depth Condition as set forth in the table below:

<table>
<thead>
<tr>
<th></th>
<th>Earthquake Zone A (Northwest Cocos)</th>
<th>Earthquake Zone B (Central Cocos)</th>
<th>Earthquake Zone C (Mexico City)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnitude ($M_w$)</td>
<td>7.9 or higher</td>
<td>8.0 or higher</td>
<td>7.4 or higher</td>
</tr>
<tr>
<td>Depth (km)</td>
<td>200 or lower</td>
<td>200 or lower</td>
<td>200 or lower</td>
</tr>
</tbody>
</table>

Sources: Courtesy of the World Bank and Government of Mexico

AIR Expert Loss Estimation Analysis:

Tectonic Setting of Mexico, Central and South America

- Mexico's tectonic setting is formed by the interaction of four major tectonic plates:
  - The Cocos Plate
  - The Pacific Plate
  - The Caribbean Plate
  - The North American Plate
- Earthquakes impact the western part of central Mexico predominantly along the Cocos subduction zone
- Much less active than the Cocos subduction zone is the Trans-Mexican Volcanic Belt ("TMVB"), a volcanic system trending from southeast to northwest across central Mexico
- Northwestern Mexico is exposed to hazard arising from faults in southern California near Mexico's border
- Southern Mexican states are exposed to hazard arising from faults in Guatemala and Belize
- The AIR historical catalog was created after merging several regional catalogs, including:
  - GSHP Latin American catalog
  - Preliminary Determinations of Epicenters (POE) catalog from the U.S. National Earthquake Information Center
  - The USGS catalog with supplements from a Universidad Nacional Autónoma de Mexico (UNAM) study

Sources: Courtesy of the World Bank and Government of Mexico
AIR Expert Loss Estimation Analysis:
Distribution of Large Historical Earthquakes

Historical Earthquakes of $M_w$ 5.0 and Greater, 1527-2004

Sources: Courtesy of the World Bank and Government of Mexico

AIR Expert Loss Estimation Analysis:
Subduction Zone Segmentation

- The Cocos subduction zone is segmented based on regional tectonic setting and historical data

Sources: Courtesy of the World Bank and Government of Mexico
AIR Expert Loss Estimation Analysis:
Historical Earthquakes

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Magnitude (Mw)</th>
<th>Depth (km)</th>
<th>Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>1787</td>
<td>South Mexico</td>
<td>8.4</td>
<td>-</td>
<td>B</td>
</tr>
<tr>
<td>1818</td>
<td>Morelos-Guerrero</td>
<td>8.2</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>1848</td>
<td>Acapulco-San Marcos</td>
<td>8.3</td>
<td>-</td>
<td>B</td>
</tr>
<tr>
<td>1864</td>
<td>Puebla</td>
<td>7.4</td>
<td>-</td>
<td>C</td>
</tr>
<tr>
<td>1928</td>
<td>Oaxaca</td>
<td>7.7</td>
<td>100</td>
<td>C</td>
</tr>
<tr>
<td>1932</td>
<td>Jalisco</td>
<td>8.2</td>
<td>20</td>
<td>A</td>
</tr>
<tr>
<td>1937</td>
<td>Guerrero-Oaxtepec</td>
<td>7.4</td>
<td>-</td>
<td>C</td>
</tr>
<tr>
<td>1967</td>
<td>Acapulco</td>
<td>7.5</td>
<td>-</td>
<td>C</td>
</tr>
<tr>
<td>1985</td>
<td>Michoacan (Mexico City)</td>
<td>8.1</td>
<td>18</td>
<td>A</td>
</tr>
<tr>
<td>1986</td>
<td>Jalisco</td>
<td>8.0</td>
<td>18</td>
<td>A</td>
</tr>
</tbody>
</table>

Recent Non-Triggering Earthquakes

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Magnitude (Mw)</th>
<th>Depth (km)</th>
<th>Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>Guerrero</td>
<td>7.5</td>
<td>22</td>
<td>B</td>
</tr>
<tr>
<td>1999</td>
<td>Puebla</td>
<td>6.9</td>
<td>61</td>
<td>C</td>
</tr>
<tr>
<td>1999</td>
<td>Oaxaca</td>
<td>7.4</td>
<td>48</td>
<td>B</td>
</tr>
<tr>
<td>2003</td>
<td>Colima</td>
<td>7.5</td>
<td>28</td>
<td>A</td>
</tr>
</tbody>
</table>

1 There is a significant uncertainty associated with the depth, location, and magnitude of older historical earthquakes. The list includes only events that can be categorized as Trigger Events based on the best estimates of parameters. Some of these earthquakes may not have been Trigger Events and others may have been Trigger Events.
2 The historical earthquakes, as — indicates an unknown depth. It is possible, but not certain, that the depth was less than or equal to 20 km.
3 Definition 1999 and the end of the historical catalog in 2004.

Sources: Courtesy of the World Bank and Government of Mexico

Hurricane Trigger Event Conditions

- **100% Principal Reduction if Hurricane Trigger Event Conditions are met**
- **Payment of losses requires determination by the Calculation Agent (AIR at the commencement of the transaction) of Hurricane Trigger Event Conditions based on parameters as reported by the Hurricane Reporting Agency**
- **Hurricane Event Trigger Conditions:**
  - Hurricane Occurrence Date is during the Risk Period
  - The SEGOB Declaration
  - Location of Storm Track in or on boundary of the applicable Zone
  - The lower of the central pressure as reported by the Hurricane Reporting Agency or interpolated by the Calculation Agent ("Calculated Central Pressure") as set forth in the table below:

<table>
<thead>
<tr>
<th>Class B (Zone 1)</th>
<th>Class C (Zone 2)</th>
<th>Class D (Zone 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>944 mb or lower</td>
<td>944 mb or lower</td>
<td>920 mb or lower</td>
</tr>
</tbody>
</table>

Sources: Courtesy of the World Bank and Government of Mexico
The 4 Classes of The Bond

<table>
<thead>
<tr>
<th>Class</th>
<th>Class A</th>
<th>Class B</th>
<th>Class C</th>
<th>Class D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazards covered</td>
<td>Earthquakes in three regions</td>
<td>Hurricanes in zone 1</td>
<td>Hurricanes in zone 2</td>
<td>Hurricanes in zone 3</td>
</tr>
<tr>
<td>Original Principal Amount</td>
<td>$140,000,000</td>
<td>$50,000,000</td>
<td>$50,000,000</td>
<td>$50,000,000</td>
</tr>
<tr>
<td>Rating by S&amp;P</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>BB-</td>
</tr>
<tr>
<td>Interest Spread (over US Treasury money market funds)</td>
<td>11.50%</td>
<td>10.25%</td>
<td>10.25%</td>
<td>10.25%</td>
</tr>
<tr>
<td>Maturity</td>
<td>3 years</td>
<td>3 years</td>
<td>3 years</td>
<td>3 years</td>
</tr>
</tbody>
</table>
### MultiCat Mexico 2009-2012-I Notes
Investor Distribution by Investor Type

<table>
<thead>
<tr>
<th>Investor Type</th>
<th>Amount Invested</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated Funds</td>
<td>$117.50 million</td>
<td>40%</td>
</tr>
<tr>
<td>Reinsurers</td>
<td>$98.75 million</td>
<td>34%</td>
</tr>
<tr>
<td>Money Managers</td>
<td>$43.75 million</td>
<td>15%</td>
</tr>
<tr>
<td>Hedge Funds</td>
<td>$16.75 million</td>
<td>6%</td>
</tr>
<tr>
<td>Insurers</td>
<td>$13.25 million</td>
<td>5%</td>
</tr>
</tbody>
</table>

### MultiCat Mexico 2009-2012-I Notes
Investor Distribution by Region

<table>
<thead>
<tr>
<th>Region</th>
<th>Amount Invested</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>$149.75 million</td>
<td>51%</td>
</tr>
<tr>
<td>Bermuda</td>
<td>$101.00 million</td>
<td>35%</td>
</tr>
<tr>
<td>Europe</td>
<td>$37.00 million</td>
<td>13%</td>
</tr>
<tr>
<td>Japan</td>
<td>$1.75 million</td>
<td>1%</td>
</tr>
<tr>
<td>Canada</td>
<td>$0.50 million</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>
A Look Back At 2010

- **The Baja California earthquake (7.2) (04/10)**
  Because the quake was far north and outside of the boxes covered by the cat bond, it did not trigger.

- **Cat 2 Hurricane Alex (Soto la Marina, Tamaulipas) (07/10)**
  This event was also outside the scope of the cat bond (did not pass thru the specified boxes and its intensity was below the threshold necessary to trigger the bond anyway).

Key take-aways

- The choice of the area to be covered by the cat bond and the selection of the trigger is thus critical
- If the bond covers the entire country and the trigger is a low probability of occurrence, then of course the government is more likely to receive some payment. But such a bond would be very costly too because investors could more often lose their money.
- This is a **trade-off** any government thinking about issuing a cat bond needs to consider seriously
- This is also why cat bonds have to be thought as **part of a national strategy** for catastrophe risk management and financing.
Catastrophe Financing for Governments

LEARNING FROM THE 2005-2012 MULTILAT PROGRAM IN MEXICO

Elvira M. Kerla, Ivan Zelenko, Victor Cárdenas and Daniel Hugler