Reducing Losses from Flood-Related Disasters
Dealing with Affordability

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Roles of Insurance and Mitigation:

• An insurance market can be a highly efficient and effective device for cushioning consequences of large losses

• It can also encourage risk mitigation through premium reductions

• Consumers are reluctant to purchase insurance and invest in loss reduction measures from flood-related events

Challenges:

• Developing long-term strategies for encouraging adoption of mitigation measures while providing short-term incentives for undertaking these measures

• Recognizing the biases and simplified decision rules used by consumers in making choices with respect to extreme events
Outline of Talk

Linking Intuitive and Deliberative Thinking for Dealing with Extreme Events

Guiding Principles of Insurance

Strategy for Implementing Flood Insurance Reform Act of 2012

Dealing with Affordability in Ocean County, NJ

Future Challenges and Questions for Discussion
A radical change in the scale and rhythm of catastrophes

Natural disasters have caused large numbers of fatalities and destruction in recent years

- Sichuan Earthquake (May 2008): 70,000 fatalities and 5 million residents homeless
- Honshu Earthquake (March 2011): Over 10,000 fatalities, 17,000 missing; estimated damage $183 billion (3% of Japan’s GDP)
- Hurricane Ivan (Grenada, Sept. 2004): $889 million in damage (365% of GNP)
- Hurricane Katrina (Sept. 2005): $81 billion in damage and 1,836 fatalities
- Hurricane Sandy (Oct. 2012): $65 billion in damage and 285 fatalities

Many victims are uninsured and complain about receiving substantially less than the actual costs to repair or rebuild their damaged structures

Challenge: How can we devise strategies so that those in harm’s way will take protective measures in advance of a disaster so public sector relief is reduced following the next catastrophe?
Worldwide Evolution of Catastrophes, 1980-2012

Overall losses and insured losses 1980-2012 (US$ bn)

- Overall losses (2012 values)
- Of which insured losses (2012 values)
- Trend: Overall losses
- Trend: Insured losses

Munich Re Topics Geo 2012
<table>
<thead>
<tr>
<th>$ BILLION</th>
<th>EVENT</th>
<th>VICTIMS (dead and missing)</th>
<th>YEAR</th>
<th>AREA OF PRIMARY DAMAGE</th>
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</thead>
<tbody>
<tr>
<td>76.3</td>
<td>Hurricane Katrina; floods</td>
<td>1,836</td>
<td>2005</td>
<td>USA, Gulf of Mexico</td>
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<td>39</td>
<td>9/11 Attacks</td>
<td>3,025</td>
<td>2001</td>
<td>USA</td>
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<td>35.7</td>
<td>Earthquake (M 9.0) and tsunami</td>
<td>19,135</td>
<td>2011</td>
<td>Japan</td>
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<tr>
<td>35.0</td>
<td>Hurricane Sandy; floods</td>
<td>237</td>
<td>2012</td>
<td>USA</td>
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<tr>
<td>26.2</td>
<td>Hurricane Andrew</td>
<td>43</td>
<td>1992</td>
<td>USA, Bahamas</td>
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<tr>
<td>21.7</td>
<td>Northridge Earthquake (M 6.6)</td>
<td>61</td>
<td>1994</td>
<td>USA</td>
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<tr>
<td>21.6</td>
<td>Hurricane Ike; floods</td>
<td>136</td>
<td>2008</td>
<td>USA, Caribbean</td>
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<td>15.7</td>
<td>Hurricane Ivan</td>
<td>124</td>
<td>2004</td>
<td>USA, Caribbean</td>
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<tr>
<td>15.3</td>
<td>Floods; heavy monsoon rains</td>
<td>815</td>
<td>2011</td>
<td>Thailand</td>
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<tr>
<td>15.3</td>
<td>Earthquake (M 6.3); aftershocks</td>
<td>181</td>
<td>2011</td>
<td>New Zealand</td>
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<td>14.7</td>
<td>Hurricane Wilma; floods</td>
<td>35</td>
<td>2005</td>
<td>USA, Gulf of Mexico</td>
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<tr>
<td>11.9</td>
<td>Hurricane Rita</td>
<td>34</td>
<td>2005</td>
<td>USA, Gulf of Mexico, et al.</td>
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<tr>
<td>11.0</td>
<td>Drought in the Corn Belt</td>
<td>123</td>
<td>2012</td>
<td>USA</td>
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<tr>
<td>9.8</td>
<td>Hurricane Charley</td>
<td>24</td>
<td>2004</td>
<td>USA, Caribbean, et al.</td>
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<tr>
<td>9.5</td>
<td>Typhoon Mireille</td>
<td>51</td>
<td>1991</td>
<td>Japan</td>
</tr>
<tr>
<td>8.5</td>
<td>Hurricane Hugo</td>
<td>71</td>
<td>1989</td>
<td>Puerto Rico, USA, et al.</td>
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<tr>
<td>8.4</td>
<td>Earthquake (M 8.8); tsunami</td>
<td>562</td>
<td>2010</td>
<td>Chile</td>
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<tr>
<td>8.2</td>
<td>Winter Storm Daria</td>
<td>95</td>
<td>1990</td>
<td>France, UK, et al.</td>
</tr>
<tr>
<td>8.0</td>
<td>Winter Storm Lothar</td>
<td>110</td>
<td>1999</td>
<td>France, Switzerland, et al.</td>
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<tr>
<td>7.4</td>
<td>Storms; over 350 tornadoes</td>
<td>350</td>
<td>2011</td>
<td>USA (Alabama et al)</td>
</tr>
<tr>
<td>7.2</td>
<td>Major tornado outbreak</td>
<td>155</td>
<td>2011</td>
<td>USA (Missouri et al)</td>
</tr>
<tr>
<td>6.7</td>
<td>Winter Storm Kyrill</td>
<td>54</td>
<td>2007</td>
<td>Germany, UK, NL, France</td>
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<tr>
<td>6.2</td>
<td>Hurricane Frances</td>
<td>38</td>
<td>2004</td>
<td>USA, Bahamas</td>
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<tr>
<td>6.0</td>
<td>Hurricane Irene</td>
<td>55</td>
<td>2011</td>
<td>USA, Caribbean</td>
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</table>
Higher degree of urbanization

Huge increase in the value at risk
Population of Florida
  2.8 million inhabitants in 1950 -- 6.8 million in 1970 -- 13 million in 1990
  19.3 million population in 2010 (590% increase since 1950)
Cost of Hurricane Andrew in 2004 would have been $120bn

Weather patterns and sea level rise
  Changes in climate conditions and/or return to a high hurricane cycle?

Sea level rise will cause more flood damage

More intense weather-related events coupled with increased value at risk will cost more, much more.

What Will 2014 Bring?
Linking Intuitive and Deliberative Thinking for Dealing with Extreme Events
Intuitive Thinking (System 1) & Deliberative Thinking (System 2)

System 1 operates automatically and quickly with little or no effort
• Individuals use simple associations including emotional reactions
• Highlight importance of recent past experience
• Basis for systematic judgmental biases and simplified decision rules

System 2 allocates attention to effortful and intentional mental activities
• Individuals undertake trade-offs implicit in benefit-cost analysis
• Recognizes relevant interconnectedness and need for coordination
• Focuses on long-term strategies for coping with extreme events
Behavior Triggered by Intuitive (System 1) Thinking

*Availability Bias* – Estimating likelihood of a disaster by its salience

*Threshold Models* – Failure to take protective measures if perceived likelihood of disaster is below threshold level of concern

*Imperfect Information* – Misperceives the likelihood of event occurring and its consequences.

*Mathopia* – Focus on short-time horizons in comparing upfront costs of protection with expected benefits from loss reduction
Many homeowners cancel their flood policy if they have not experienced a flood for several years.

**Reason:** Flood insurance was not a good investment.

**Data:** Of 1,549 victims of a flood in August 1998 in northern Vermont, FEMA found 84% of residents in SFHAs did *not* have flood insurance. 45% were required to purchase it. (Tobin and Calfee, 2005).
## Dynamic Analysis of Flood Insurance Tenure

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</thead>
<tbody>
<tr>
<td>Housing Units</td>
<td>841,000</td>
<td>876,000</td>
<td>1,186,000</td>
<td>986,000</td>
<td>849,000</td>
<td>1,299,000</td>
<td>974,000</td>
<td>894,000</td>
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<tr>
<td>1 year</td>
<td>73%</td>
<td>67%</td>
<td>77%</td>
<td>78%</td>
<td>76%</td>
<td>73%</td>
<td>74%</td>
<td>73%</td>
</tr>
<tr>
<td>2 years</td>
<td>49%</td>
<td>52%</td>
<td>65%</td>
<td>65%</td>
<td>63%</td>
<td>59%</td>
<td>58%</td>
<td></td>
</tr>
<tr>
<td>3 years</td>
<td>39%</td>
<td>44%</td>
<td>57%</td>
<td>55%</td>
<td>53%</td>
<td>48%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 years</td>
<td>33%</td>
<td>38%</td>
<td>50%</td>
<td>48%</td>
<td>44%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 years</td>
<td>29%</td>
<td>33%</td>
<td>44%</td>
<td>38%</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>6 years</td>
<td>25%</td>
<td>30%</td>
<td>33%</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>7 years</td>
<td>22%</td>
<td>26%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 years</td>
<td>20%</td>
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</table>

Note: our analysis of the American Community Survey reveals that the median length of residence was about 6 years over this period.

Sources: Michel-Kerjan, Lemoyne de Forges and Kunreuther – Data from NFIP/FEMA
Overcoming Barriers to Flood Risk
Encouraging Long-term Thinking with Short-term Incentives

Required flood insurance coupled with loans and well-enforced standards to encourage investment in cost-effective loss reduction measures (*System 2 behavior*)

Transparency to address misperceptions of risk, and financial incentives to address myopia (*System 1 behavior*)

Means-tested vouchers to address affordability issues for those requiring special treatment
Guiding Principles for Insurance

**Principle 1: Premiums reflecting risk**
- Signals to individuals about the hazards they face
- Encourage investment in cost-effective adaptation measures

**Principle 2: Dealing with equity and affordability issues**
- Provide vouchers to individuals requiring special treatment
- Use HUD Section 8 Housing Choice Vouchers
- Provide vouchers if homeowners only if they mitigate their property to reduce future flood losses

**Principle 3: Multi-year insurance contracts**
- Premiums reflecting risk with vouchers to deal with affordability
- Addresses myopia
- Encourages investment in loss-reduction measures through loans
Risk-based premiums for second homes and those with repetitive flooding (Principle 1)

Study by FEMA and the National Academy of Sciences will examine the feasibility of means-tested insurance vouchers (Principle 2)
Proposed Strategy for Implementing Biggert-Waters

Encouraging Investment in Loss Reduction Measures
• Risk-based premiums based on updated FEMA flood maps
• Home improvement mitigation loans tied to property
• Premium reductions for undertaking mitigation measures

Addressing Affordability Issue
• Means-tested vouchers for those currently in flood-prone areas
• Covers insurance premium and home improvement loan
• Condition for a voucher: You must mitigate
• Required flood insurance and loans tied to the property not the homeowner
Dealing with Affordability in Ocean County, NJ (Population 580,000)
Two Families Residing in Ocean County, NJ

Family 1 is in the A Zone and pays $4,000 for flood insurance.

Family 2 is in the V Zone and pays $18,550 for flood insurance.

- Both homes are 3 feet below Base Flood Elevation (BFE)
- Each family has annual income of $50,000 per year

Cost of elevating home to 1 foot above BFE:

- Family 1: $25,000 20-Year 3% Loan (Annual Payment $1,680)
- Family 2: $55,000 20-Year 3% Loan (Annual Payment $3,660)

Means-tested voucher covers insurance and mitigation costs above $2,500 (i.e., above 5% of income)
Cost to the Federal Government and the Two Families
Estimates of Program Costs for Ocean County Tracts that Experienced Storm Surge

<table>
<thead>
<tr>
<th>Cost of Program in Millions of Dollars</th>
<th>Insurance Voucher</th>
<th>Insurance/Mitigation Loan Voucher, Years 0-20</th>
<th>Insurance/Mitigation Loan Voucher, Years 20+</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>140</td>
<td>60</td>
<td>20</td>
</tr>
</tbody>
</table>
Future Challenges and Questions for Discussion

Long-Term Issues:

How long will it take FEMA to develop new maps that more accurately assess the risks of flooding in a timely fashion that reflect climate change projections?

What are the challenges in implementing means-tested vouchers?

How costly will programs be to the Federal government and residents in flood-prone areas in the United States?

Immediate Challenge:

• How can we preserve the best feature of Biggert-Waters?
  Many legislators are concerned with increased premiums due to revised flood maps in their areas

• New legislation has been proposed to maintain current NFIP program for the next four years (Grimm-Waters bill)
The Challenges of Linking Flood Insurance with Mitigation Measures

"Jerry looked into flood insurance but says it's too darned expensive."
Disaster Resilience: A National Imperative
The National Research Council – National Academies of Science

http://www.nap.edu/catalog.php?record_id=13457
Part I: Contrasting Ideal and Real Worlds of Insurance
Chapter One: Purposes of this Book
Chapter Two: An Introduction to Insurance in Practice and Theory
Chapter Three: Anomalies and Rumors of Anomalies
Chapter Four: Behavior Consistent with Benchmark Models

Part II: Understanding Consumer and Insurer Behavior
Chapter Five: Real World Complications
Chapter Six: Why People Do or Do Not Demand Insurance
Chapter Seven: Demand Anomalies
Chapter Eight: Descriptive Models of Insurance Supply
Chapter Nine: Anomalies on the Supply Side

Part III: The Future of Insurance
Chapter Ten: Design Principles for Insurance
Chapter Eleven: Strategies for Dealing with Insurance-Related Anomalies
Chapter Twelve: Innovations in Insurance Markets through Multi-Year Contracts
Chapter Thirteen: Publicly-Provided Social Insurance
Chapter Fourteen: A Framework for Prescriptive Recommendations