Insurance and Behavioral Economics: 

*Improving Decisions in the Most Misunderstood Industry*

(with Mark Pauly and Stacey McMorrow)

Howard Kunreuther  
kunreuther@wharton.upenn.edu

OPIM Dept. and Risk Management and Decision Processes Center  
Wharton School, University of Pennsylvania

*Legal Issues in Managed Coastal Retreat*  
*Columbia Law School*  
March 28, 2013
An insurance market can be a highly efficient and effective device for cushioning the consequences of large losses. It can also encourage risk mitigation through premium reductions.

Behavioral economics raises some problems and challenges for buyers, sellers, and policymakers particularly for low-probability, high-consequence (LP-HC) events.
Some insurance markets work well

- Term life insurance
- Auto collision insurance
- Homeowners’ insurance

But LP-HC events puzzle consumers, insurers and politicians/regulators.

- Consumers: Very limited personal experience with events
- Insurers: Correlated losses pose challenges
- Politicians/Regulators: Concerned with re-election, as well as fairness and equity
A radical change in the scale and rhythm of catastrophes

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

- Honshu Earthquake (March 2011): Over 10,000 fatalities, 17,000 missing; estimated damage $183 billion (3% of Japan’s GDP)
- Sichuan Earthquake (May 2008): 70,000 fatalities and 5 million residents homeless
- 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): $75 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, 1980-2011

NatCatSERVICE

Natural catastrophes worldwide 1980 – 2011
Overall and insured losses with trend

© 2012 Münchener Rückversicherungs-Gesellschaft, Geo Risks Research, NatCatSERVICE – As at January 2012
(14 in the U.S., 15 since 2001)

<table>
<thead>
<tr>
<th>$ BILLION</th>
<th>EVENT</th>
<th>VICTIMS (DEAD OR MISSING)</th>
<th>YEAR</th>
<th>AREA OF PRIMARY DAMAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>50.1</td>
<td>Hurricane Katrina</td>
<td>1,836</td>
<td>2005</td>
<td>USA, Gulf of Mexico</td>
</tr>
<tr>
<td>38.2</td>
<td>9/11 Attacks</td>
<td>3,025</td>
<td>2001</td>
<td>USA</td>
</tr>
<tr>
<td>35-40</td>
<td>Earthquake and Tsunami</td>
<td>15,840</td>
<td>2011</td>
<td>Japan</td>
</tr>
<tr>
<td>25.6</td>
<td>Hurricane Andrew</td>
<td>43</td>
<td>1992</td>
<td>USA, Bahamas</td>
</tr>
<tr>
<td>21.2</td>
<td>Northridge Earthquake</td>
<td>61</td>
<td>1994</td>
<td>USA</td>
</tr>
<tr>
<td>18.5</td>
<td>Hurricane Ike</td>
<td>348</td>
<td>2008</td>
<td>USA, Caribbean</td>
</tr>
<tr>
<td>15.3</td>
<td>Hurricane Ivan</td>
<td>124</td>
<td>2004</td>
<td>USA, Caribbean</td>
</tr>
<tr>
<td>15.3</td>
<td>Hurricane Wilma</td>
<td>35</td>
<td>2005</td>
<td>USA, Gulf of Mexico</td>
</tr>
<tr>
<td>13.0</td>
<td>Earthquake</td>
<td>181</td>
<td>2011</td>
<td>New Zealand</td>
</tr>
<tr>
<td>11.7</td>
<td>Hurricane Rita</td>
<td>34</td>
<td>2005</td>
<td>USA, Gulf of Mexico, et al.</td>
</tr>
<tr>
<td>10.0</td>
<td>Floods, landslides</td>
<td>813</td>
<td>2011</td>
<td>Thailand</td>
</tr>
<tr>
<td>9.6</td>
<td>Hurricane Charley</td>
<td>24</td>
<td>2004</td>
<td>USA, Caribbean, et al.</td>
</tr>
<tr>
<td>9.3</td>
<td>Typhoon Mireille</td>
<td>51</td>
<td>1991</td>
<td>Japan</td>
</tr>
<tr>
<td>8.2</td>
<td>Maule earthquake (Mw: 8.8)</td>
<td>562</td>
<td>2010</td>
<td>Chile</td>
</tr>
<tr>
<td>8.2</td>
<td>Hurricane Hugo</td>
<td>71</td>
<td>1989</td>
<td>Puerto Rico, USA, et al.</td>
</tr>
<tr>
<td>8.0</td>
<td>Winter Storm Daria</td>
<td>95</td>
<td>1990</td>
<td>France, UK, et al.</td>
</tr>
<tr>
<td>7.8</td>
<td>Winter Storm Lothar</td>
<td>110</td>
<td>1999</td>
<td>France, Switzerland, et al.</td>
</tr>
<tr>
<td>7.3</td>
<td>Storms and tornadoes</td>
<td>350</td>
<td>2011</td>
<td>USA</td>
</tr>
<tr>
<td>7.0</td>
<td>Hurricane Irene</td>
<td>55</td>
<td>2011</td>
<td>USA, Caribbean</td>
</tr>
<tr>
<td>6.6</td>
<td>Winter Storm Kyrill</td>
<td>54</td>
<td>2007</td>
<td>Germany, UK, NL, France</td>
</tr>
<tr>
<td>6.1</td>
<td>Hurricane Frances</td>
<td>38</td>
<td>2004</td>
<td>USA, Bahamas</td>
</tr>
<tr>
<td>5.5</td>
<td>Winter Storm Vivian</td>
<td>64</td>
<td>1990</td>
<td>Western/Central Europe</td>
</tr>
<tr>
<td>5.5</td>
<td>Typhoon Bart</td>
<td>26</td>
<td>1999</td>
<td>Japan</td>
</tr>
<tr>
<td>4.8</td>
<td>Hurricane Georges</td>
<td>600</td>
<td>1998</td>
<td>USA, Caribbean</td>
</tr>
</tbody>
</table>
Quiz

How much insured value is located on the coasts from Texas to Maine (residential and commercial)?

(1) $1 Trillion
(2) $2 Trillion
(3) $5 Trillion
(4) $10 Trillion
Insured Exposure on the Coasts
(Texas to Maine as of Dec. 2007):

$10 trillion
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 2013 Bring?
The Lowland family did not purchase flood insurance or invest in protective measures when they moved into their home 10 years ago because they misperceived the risk of damage to be extremely low.

After the 2008 floods, they purchased flood coverage but have not experienced any losses since that time.

Last year they cancelled their policy considering it to be a poor investment.

The bank holding their mortgage has not followed up on the flood insurance requirement.
Lack of Interest in Protection Against Disasters: Cancellation of Flood Insurance Even When Required

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% of whom were required to purchase it (Tobin and Calfee, 2005).
Dynamic Analysis of Flood Insurance Tenure

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</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>
</tr>
<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>
</tr>
<tr>
<td>6 years</td>
<td>25%</td>
<td>30%</td>
<td>33%</td>
<td></td>
<td></td>
<td></td>
<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>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sources: Michel-Kerjan, Lemoyne and Kunreuther (2012) – Data from NFIP/FEMA

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

**Principle 1: Premiums reflecting risk**
Insurance premiums should be based on risk in order to provide signals to individuals as to the hazards they face and to encourage them to engage in cost-effective mitigation measures to reduce their vulnerability to catastrophes. Risk-based premiums should also reflect the cost of capital that insurers need to integrate into their pricing to assure adequate return to their investors.

**Principle 2: Dealing with equity and affordability issues**
Any special treatment given to homeowners currently residing in hazard-prone areas (e.g., low-income uninsured or inadequately insured homeowners) should come from general public funding and not through insurance premium subsidies.

**Principle 3: Multi-year insurance**
To overcome myopia and encourage investment in preventive or protective measures, insurers should design multi-year contracts with premiums reflecting risk. Insurance vouchers should deal with issues of equity and affordability.
Insurance Vouchers: Existing Programs as Models

Food Stamp Program

*Mission*: Vouchers to purchase food based on annual income and family size

Low Income Home Energy Assistance Program

*Mission*: Assist low-income households in meeting immediate energy needs

Universal Service Fund

*Mission*: Provide discounts to low-income individuals in rural areas so rates for telecommunications services are comparable to urban areas
Proposed Strategy for Flood Insurance

Multi-year flood insurance contracts through the National Flood Insurance Program (NFIP) (5-, 10-, 20-years insurance coverage)

Long-term home improvement loans for mitigating one’s property

Insurance and loans tied to the property not the homeowner
Rates would reflect risk *(Principle 1)*
(FEMA is in the process of updating flood maps)

Insurance vouchers for those needing special treatment *(Principle 2)*
(Only for those currently residing in flood-prone areas)

Homeowners would have knowledge that their premiums are stable over time *(Principle 3)*

**Congress renewed NFIP for 5 years in July 2012**
Authorized studies by the Federal Emergency Management Agency and the National Academy of Sciences to examine ways to incorporate risk-based premiums coupled with means-tested insurance vouchers
Applying the Three Principles to Flood Insurance

$160 billion loss

$82 billion saving with Adaptation measures in place

A New Era of Catastrophes

State

FL NY SC TX

Savings from Mitigation
Remaining Losses
Encouraging Adaptation Measures: An Example

Characteristic of Adaptation Measures: Upfront cost/long-term benefits

Cost of Mitigation: $1,500 to strengthen roof of house

Nature of Disaster:

– 1/100 chance of disaster

– Reduction in loss ($27,500)

Expected Annual Benefits: $275 (1/100 * $27,500)

Annual Discount Rate of 10%
Expected Benefit-Cost Analysis of Mitigation
(Annual Discount Rate 10%)
Rationale for Multi-Year Flood Insurance
Encouraging Mitigation with Multi-Year Loans

Illustrative Example

Cost of partial roof mitigation: $1,500

Expected annual benefit of partial roof mitigation: $275 (1/100 * $27,500)

Annual payments from 20 year $1,500 loan at 10% annual interest rate: $145

Reduction in annual insurance payment: $275

Reduction in annual payments due to mitigation: $275-$145= $130
Linking Multi-Year Home Improvement Loans with Multi-Year Flood Insurance

Everyone is a Winner:

*Homeowner:* Lower total annual payments

*Insurer:* Reduction in catastrophe losses and lower reinsurance costs

*Financial institution:* More secure investment due to lower losses from disaster

*General taxpayer:* Less disaster assistance
Insurance markets can do a lot in the face of serious risks. They can help to spread risk of unavoidable disasters and offer incentives to mitigate risk. But they cannot work miracles, especially in LP-HC settings.

Regulators can encourage System 2 rather than System 1 thinking if they are wise and far-sighted and/or incentivized to do so.

Hurricane Sandy provides an opportunity to reevaluate the role insurance and adaptation measures can play to reduce future losses from catastrophic disasters.
The Challenges of Linking Flood Insurance with Adaptation Measures

"Jerry looked into flood insurance but says it's too darned expensive."
Insurance and Behavioral Economics: Improving Decisions in the Most Misunderstood Industry

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