The Role of Insurance and Other Policy Tools for Reducing Losses from Future Flood Damage

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A radical change in the scale and rhythm of catastrophes

Natural disasters have caused large numbers of fatalities and destruction in recent years and damage from riverine floods and storm surge from hurricanes are greatest victims

- Hurricane Andrew (August 1992): $30 billion in damage
- Mississippi River Floods (July-August 1993): $15 billion in damage
- Hurricane Katrina (Sept. 2005): $81 billion in damage
- Hurricane Sandy (Oct. 2012): $65 billion in damage

Many victims are uninsured, do not mitigate their property and complain about receiving substantially less than the actual costs to repair or rebuild their damaged structures

**Challenge:** What role can insurance play coupled with other policy instruments so that those in harm’s way will undertake loss reduction measures in advance of a disaster?
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?
Framework for Analysis for Dealing with Extreme Events
Based on Daniel Kahneman, *Thinking, Fast and Slow*
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
Biases and Heuristics Triggered by System 1 Behavior
(Barriers to Management of Flood Risks)

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

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

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

**Myopic Behavior** – Focus on short-time horizons in comparing upfront costs of protection with expected benefits from loss reduction
The Lowland family resides in the Rockaways and is considering whether to invest $1,500 in flood proofing their house so it is less susceptible to water damage.

Hydrologists have estimated that the chances of storm surge from hurricanes affecting their home is 1/100, and that if it occurs, the savings from flood proofing will be $27,500.

Their home is required to have flood insurance. Rates in the future will reflect risk as specified in the National Flood Insurance Reform Act of 2012 signed by the President in July 2012.

Their annual insurance premium will be reduced by $275 (i.e., 1/100 $27,500) if they undertake this investment.
Flood Adaptation

Responses by the Lowland family prior to Hurricane Sandy that were triggered by System 1 behavior:

- **Imperfect information:** Lowland family misperceives flood risk thinking that it is $1/1000$ rather than $1/100$
- **Threshold model:** Flood risk is below their level of concern
- **Myopic behavior:** Failure to consider long-term benefits of flood protection
- **Cancellation of flood insurance:** Consider it to be a poor investment since they have not suffered any flood-related damage

Many banks do not enforce the flood insurance requirement

Many states do not enforce building codes:

- $1/3$ of the damage from Hurricane Andrew (1992) could have been avoided had Florida enforced its building codes.
- Today, Florida has well-enforced codes (Learning from Andrew---System 1 behavior)
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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<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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<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>
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<td>2 years</td>
<td>49%</td>
<td>52%</td>
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<td>59%</td>
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<td>3 years</td>
<td>39%</td>
<td>44%</td>
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<td>4 years</td>
<td>33%</td>
<td>38%</td>
<td>50%</td>
<td>48%</td>
<td>44%</td>
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<td>5 years</td>
<td>29%</td>
<td>33%</td>
<td>44%</td>
<td>38%</td>
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<td>6 years</td>
<td>25%</td>
<td>30%</td>
<td>33%</td>
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<td>7 years</td>
<td>22%</td>
<td>26%</td>
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<td>8 years</td>
<td>20%</td>
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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 \((\text{System 2 behavior})\)

Transparency to address misperceptions of risk and financial incentives to address myopia \((\text{System 1 behavior})\)

Means-tested vouchers to address affordability issues for those requiring special treatment
Principle 1: Premiums reflecting risk
– Signals to individuals 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
– Only provide vouchers if homeowners 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

Authorized study by the FEMA and the National Academy of Sciences to examine ways feasibility of means-tested insurance vouchers

(ASFPM has designed principles related to flood insurance affordability)
Proposed Strategy for Flood Insurance
Modifying Biggert-Waters 2012

Multi-year flood insurance contracts through the National Flood Insurance Program (NFIP) (5 year policies with rates reviewed for another 5 years….)

Flood insurance vouchers for those mitigating their property

Home improvement loans for reducing property losses

Well-enforced building codes and land-use regulations

Required flood insurance, vouchers and loans tied to the property not the homeowner
Applying the Three Principles to Flood Insurance (Implementing and Extending Biggert Waters 2012)

Insurance premiums would reflect risk (Principle 1)  
(FEMA is in the process of updating flood maps)

Insurance vouchers to deal with affordability (Principle 2)  
(Only for those currently residing in flood-prone areas)

Stable premiums for five years (Principle 3)
Reduction in Losses from Well-Enforced Building Codes

$160 billion loss

$82 billion saving with Adaptation measures in place
Cost of Adaptation Measure: $1,500 to flood proof their home

Nature of Disaster:

– 1/100 chance of disaster

– Reduction in loss ($27,500)

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

Annual Discount Rate: 10%
Expected Benefit-Cost Analysis of Adaptation (Annual Discount Rate 10%)
Illustrative Example: The Lowland Family

Cost of flood proofing their home: $1,500

Expected annual benefit of partial roof adaptation:
$275 \times \frac{1}{100} \times \$27,500$

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 adaptation:
$275 - $145 = $130
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

**Federal Government**
Lower voucher costs due to reduced insurance premiums because property is mitigated (e.g. elevated; flood proofed)

**General Taxpayer**
Less disaster assistance
Insurance can play an important role in providing protection against serious risks:

- It can provide a signal as to the hazardousness of an area
- It can encourage adaptation through premium reductions
- It can provide financial assistance following a loss

Regulations and well-enforced standards are needed so people are insured and loss reduction measures are implemented

*Hurricane Sandy provides an opportunity to reevaluate the role that insurance and regulations can play in reducing future flood losses*
Future Challenges and Questions for Discussion

How can FEMA develop new maps in a timely fashion that more accurately assess the risks of flooding?

How can state leaders develop long-term strategies with short term incentives to address System 1 and System 2 behavior and reduce flood risks?

- Advocating required flood insurance, vouchers, loans tied to property not the homeowner
- Convincing individuals that “no return on an insurance policy is the best return of all”
- Encouraging communities to join Community Rating System (CRS) and engage in community-based activities to reduce flood risk

What are the challenges in substituting vouchers for premium subsidies to encourage homeowners to invest in loss reduction measures now?
The Challenges of Linking Flood Insurance with Adaptation 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