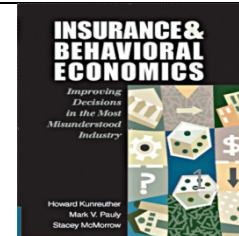
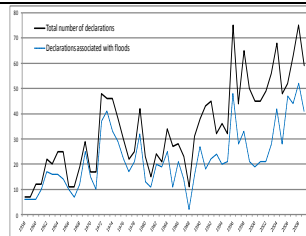


Reducing Losses from Flood-Related Disasters Dealing with Affordability

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Reducing Flood Losses from Future Natural Disasters

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 New Era of Catastrophes

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

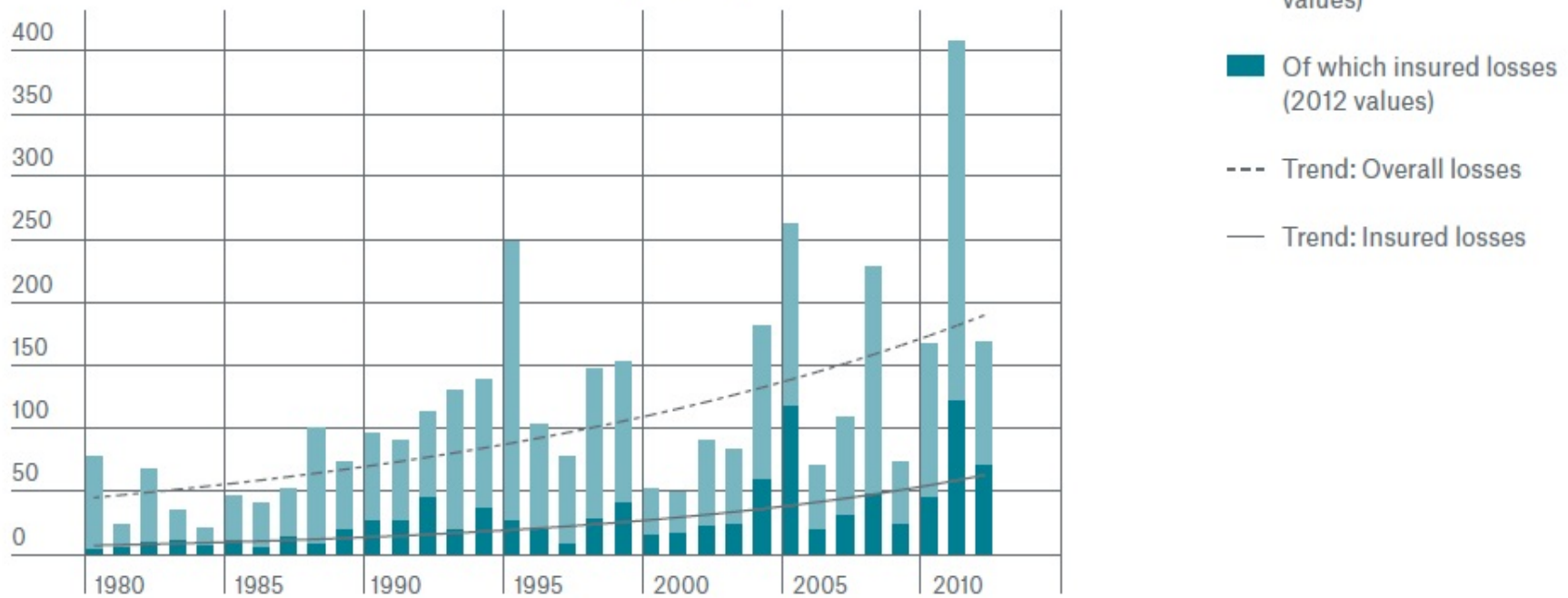
Many victims are uninsured and complain about receiving substantially less than the actual costs to repair or rebuild their damaged structures

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)



Munich Re Topics Geo 2012

Twenty-Five Most Costly Insured Catastrophes Worldwide, 1970–2012 (in 2011 prices) (15 in the U.S., 18 since 2001)

\$ BILLION	EVENT	VICTIMS (dead and missing)	YEAR	AREA OF PRIMARY DAMAGE
76.3	Hurricane Katrina; floods	1,836	2005	USA, Gulf of Mexico
39	9/11 Attacks	3,025	2001	USA
35.7	Earthquake (M 9.0) and tsunami	19,135	2011	Japan
35.0	Hurricane Sandy; floods	237	2012	USA
26.2	Hurricane Andrew	43	1992	USA, Bahamas
21.7	Northridge Earthquake (M 6.6)	61	1994	USA
21.6	Hurricane Ike; floods	136	2008	USA, Caribbean
15.7	Hurricane Ivan	124	2004	USA, Caribbean
15.3	Floods; heavy monsoon rains	815	2011	Thailand
15.3	Earthquake (M 6.3); aftershocks	181	2011	New Zealand
14.7	Hurricane Wilma; floods	35	2005	USA, Gulf of Mexico
11.9	Hurricane Rita	34	2005	USA, Gulf of Mexico, et al.
11.0	Drought in the Corn Belt	123	2012	USA
9.8	Hurricane Charley	24	2004	USA, Caribbean, et al.
9.5	Typhoon Mireille	51	1991	Japan
8.5	Hurricane Hugo	71	1989	Puerto Rico, USA, et al.
8.4	Earthquake (M 8.8); tsunami	562	2010	Chile
8.2	Winter Storm Daria	95	1990	France, UK, et al.
8.0	Winter Storm Lothar	110	1999	France, Switzerland, et al.
7.4	Storms; over 350 tornadoes	350	2011	USA (Alabama et al)
7.2	Major tornado outbreak	155	2011	USA (Missouri et al)
6.7	Winter Storm Kyrill	54	2007	Germany, UK, NL, France
6.2	Storms and floods	22	1987	France, UK, et al.
6.2	Hurricane Frances	38	2004	USA, Bahamas
6.0	Hurricane Irene	55	2011	USA, Caribbean

What's Happening?

The Question of Attribution

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?

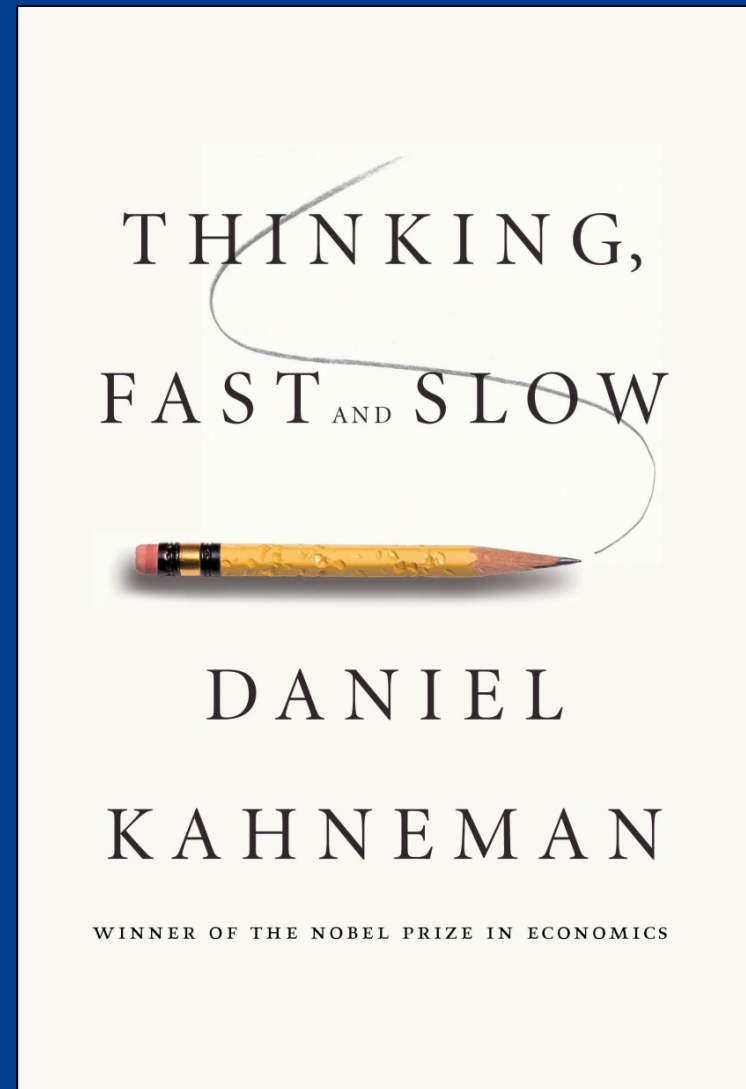
Sea level rise will cause more flood damage

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)

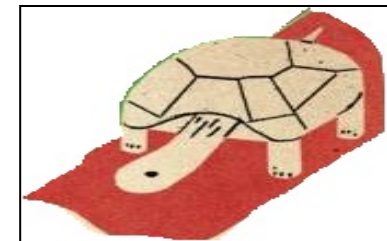
System 1 operates automatically and quickly with little or no effort

- 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.

Myopia – Focus on short-time horizons in comparing upfront costs of protection with expected benefits from loss reduction



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% were required to purchase it. (Tobin and Calfee, 2005).



Dynamic Analysis of Flood Insurance Tenure

New Business Year	2001	2002	2003	2004	2005	2006	2007	2008
Housing Units	841,000	876,000	1,186,000	986,000	849,000	1,299,000	974,000	894,000
1 year	73%	67%	77%	78%	76%	73%	74%	73%
2 years	49%	52%	65%	65%	63%	59%	58%	
3 years	39%	44%	57%	55%	53%	48%		
4 years	33%	38%	50%	48%	44%			
5 years	29%	33%	44%	38%				
6 years	25%	30%	33%					
7 years	22%	26%						
8 years	20%							

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, Lemoine 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

Biggert-Waters Flood Insurance Reform Act of 2012

Greatest Potential Achievement in Reducing Flood Risk

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

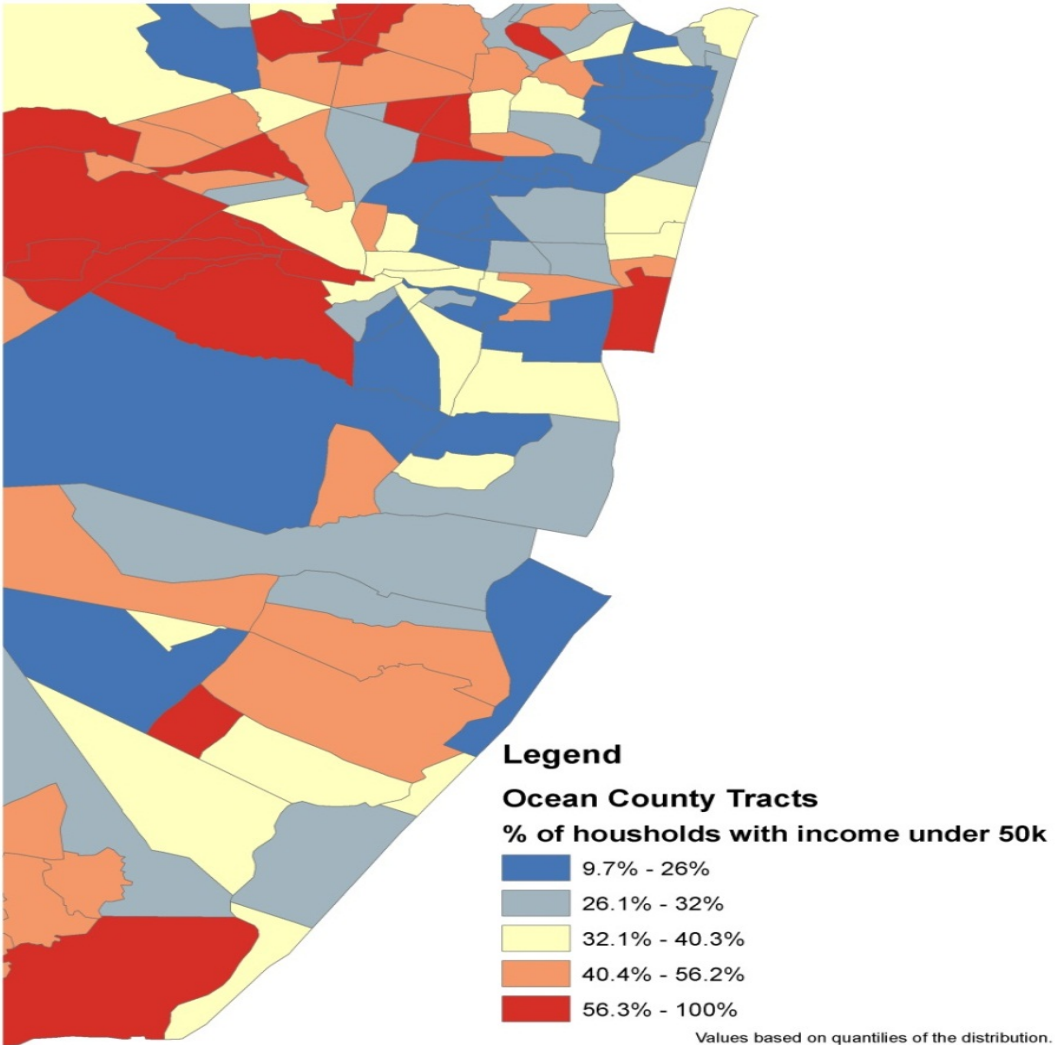
Encouraging Investment in Loss Reduction Measures

- 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.

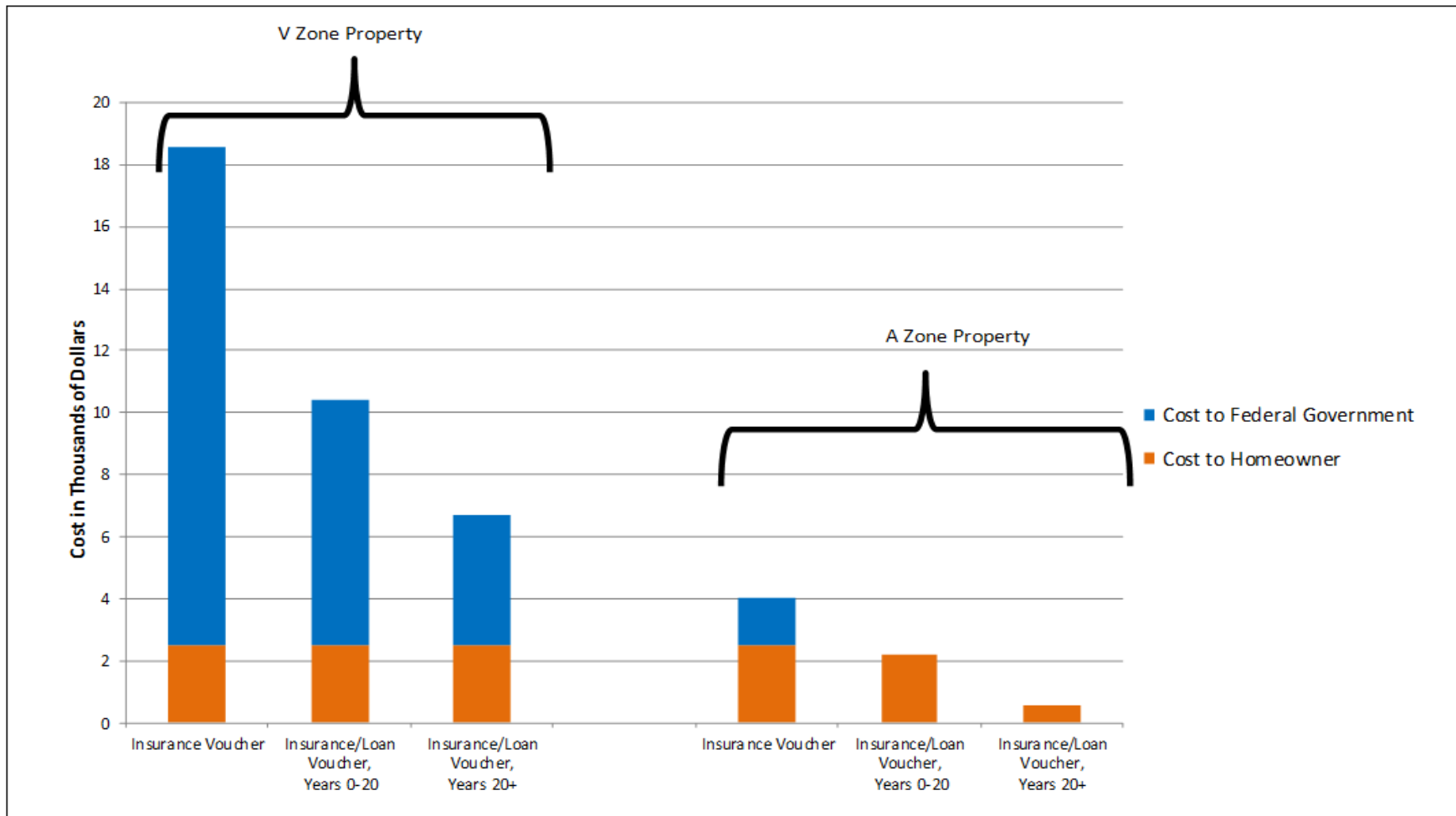
- Both homes are 3 feet below Base Flood Elevation (BFE)
- Each family has annual income of \$50,000 per year

Cost of elevating home to 1 foot above BFE:

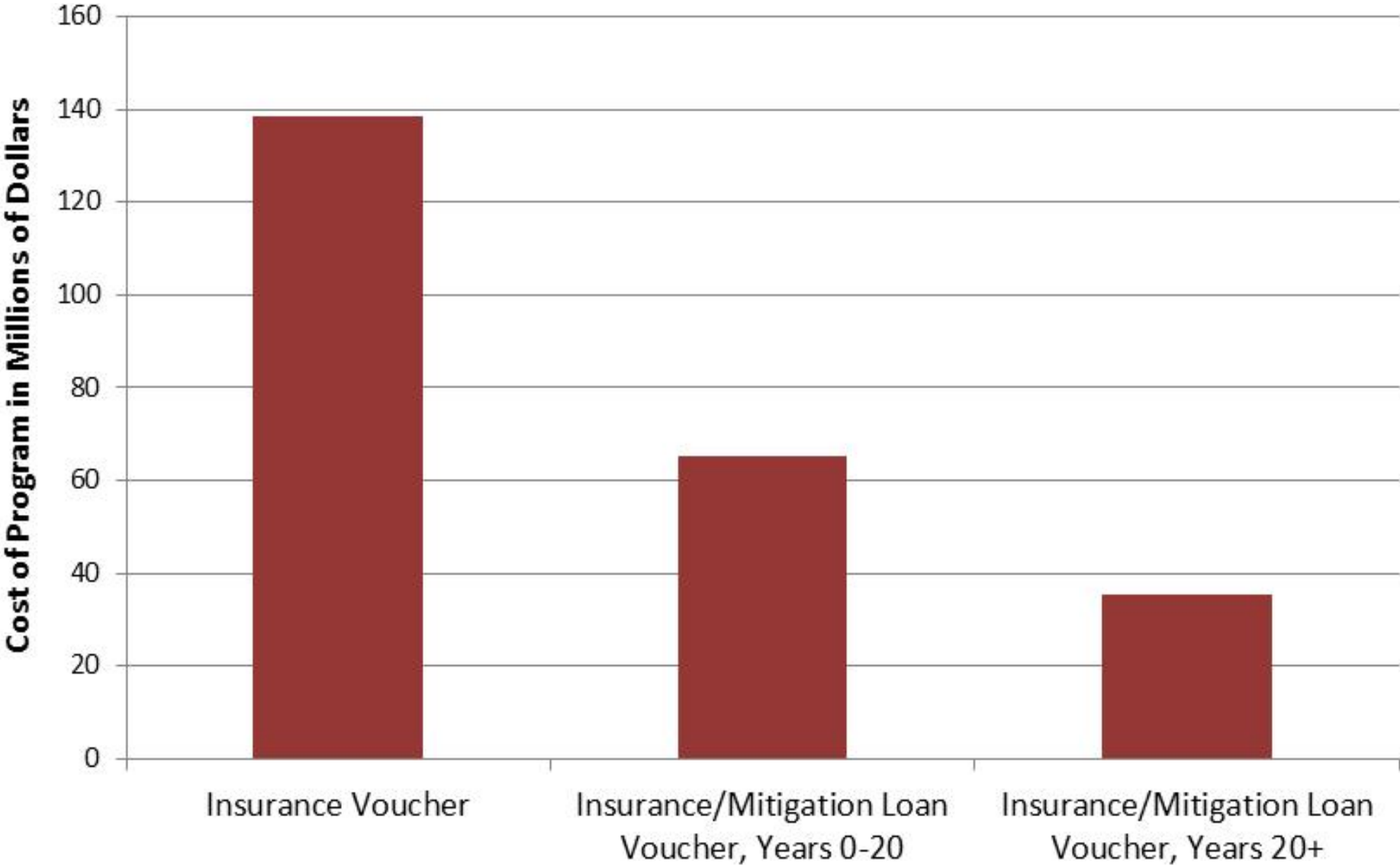
- Family 1: \$25,000 20-Year 3% Loan (Annual Payment \$1,680)
- Family 2: \$55,000 20-Year 3% Loan (Annual Payment \$3,660)

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



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:

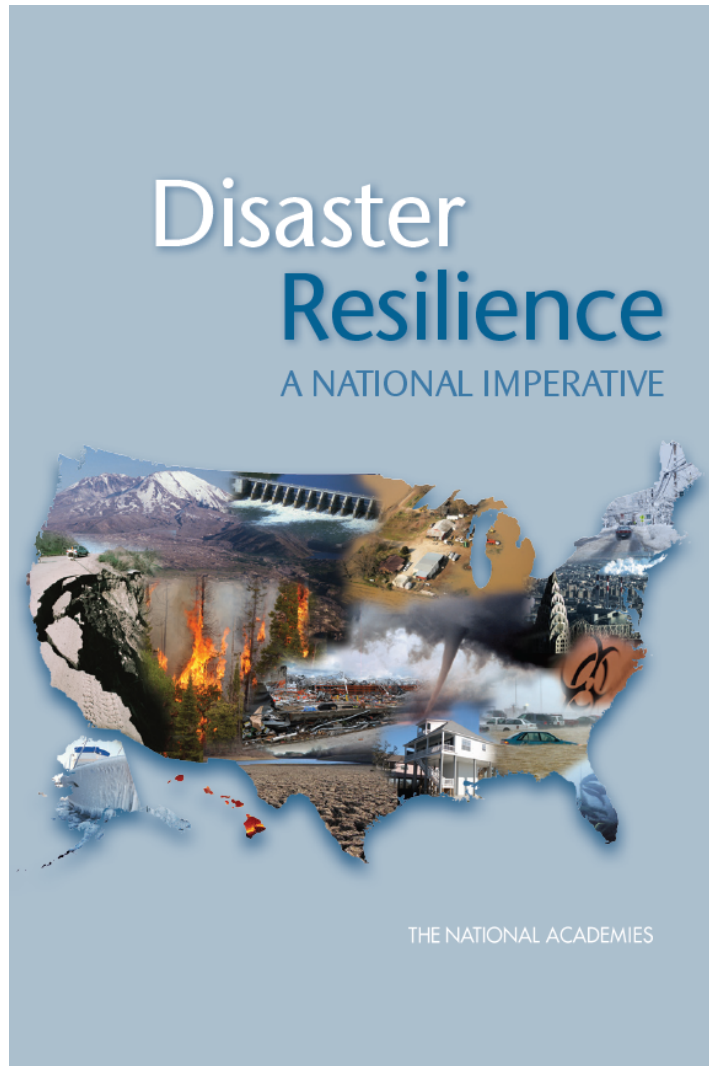
- How can we preserve the best feature of Biggert-Waters?
Many legislators are concerned with increased premiums due to revised flood maps in their areas
- New legislation has been proposed to maintain current NFIP program for the next four years (Grimm-Waters bill)

The Challenges of Linking Flood Insurance with Mitigation Measures



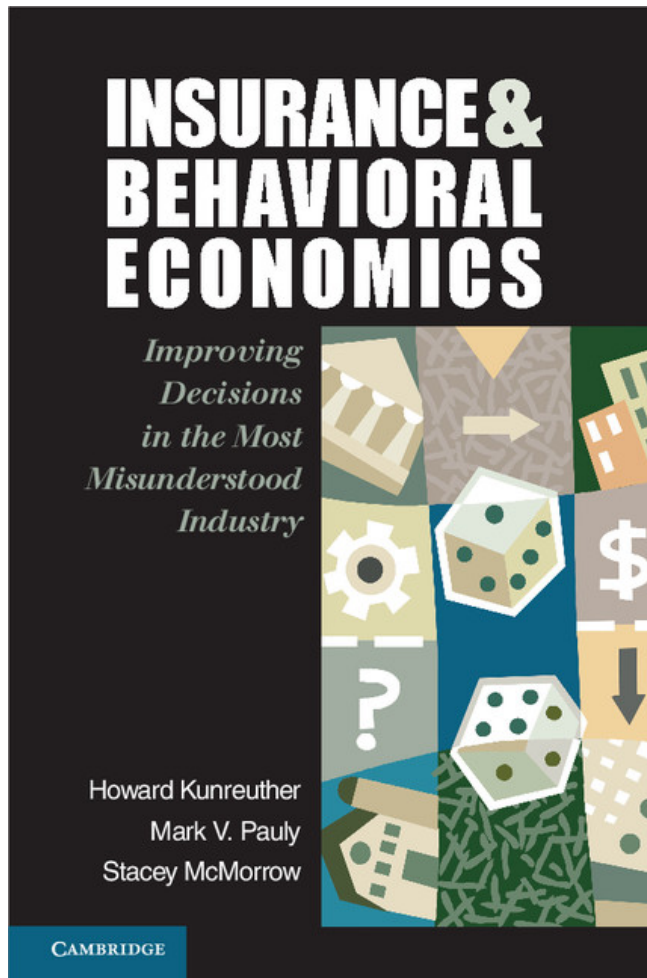
"Jerry looked into flood insurance but says
it's too darned expensive."

Disaster Resilience: A National Imperative
The National Research Council – National Academies of Science



http://www.nap.edu/catalog.php?record_id=13457

Insurance and Behavioral Economics: Improving Decisions in the Most Misunderstood Industry



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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**