Disasters and Public Policy:

Can Market Lessons Help Address Government Failures?[1]

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"Insurance is a kind of game in which one needs to be extremely cautious.
Chance must be analyzed, and players be skilled in the science of calculating probabilities;
They need to foresee hazards at sea, and hazards wrought by bad faith;
they must not fail to keep watch for exceptional and bizarre events;
they must combine all together, compare with premium rates, and assess the final result.
Such speculation is the work of genius.
However, if theory, guided by experience, is only too often faulty,
what of the fate of tradesmen who, lured by the prospect of gain,
sign policies presented to them without due consideration for the dangers into which
blind fortune and their own recklessness may lead them?"
—*Treatise on Insurances*, Emerigon - 1783

1. An Unnoticed Paradox in the New Era of Large-scale Catastrophes

Hurricane Katrina was a wake up call for the entire country, and in some sense the world, much like the September 11, 2001 terrorist attacks: both underscored the undeniable reality that we are facing a new dimension of destruction combined with a lack of preparedness to deal with this new scale. Are we better off today? According to the 2006 House of Representatives' report on the Hurricane Katrina crisis, we are not.

> "If 9/11 was a failure of imagination, then Katrina was a failure of initiative. It was a failure of leadership. If this is what happens when we have advance warning, we shudder to imagine the

[1] I would like to thank Howard Chernick, Howard Kunreuther, Carolyn Kousky, Robert Litan, Bryan Roberts, David Wildasin, Richard Zeckhauser and participants in the 99th Annual Conference of the National Tax Association in Boston for useful comments and discussions on related issues. Support from the Wharton Risk Management and Decision Processes Center is gratefully acknowledged. Usual disclaimer applies.

consequences when we do not. Four and a half years after 9/11, America is still not ready for prime time". (US House of Representatives, 2006, p. xi)[i].

In the wake of 9/11 and Hurricane Katrina, executives and policymakers more than ever share an interest in (i) avoiding new disasters on U.S. soil and (ii) making social and economic systems less vulnerable should they occur. On paper, these are two complementary components of a global homeland security approach to deal with catastrophes. Unfortunately, the roles and responsibilities of the public and private sectors in protecting the homeland are still not clearly defined, nor have enough market incentives been developed to enhance self-protection. Thus the coming years have the potential to inflict even larger losses than what we have seen recently. Who will pay?[ii]

Indeed, the 2002 White House National Strategy defines homeland security as "the concerted effort to prevent attacks, reduce America's vulnerability to terrorism, and minimize the damage *and* recover from attacks that do occur" (White House, 2002). But this strategy must be a comprehensive national effort that adequately weighs its *ex ante* (before the disaster) and *ex post* (after the disaster) components. Moreover, this definition ought to apply to natural and technological disasters as well.

In reality, there has been an unnoticed paradox: this *ex ante*/*ex post* distinction has translated into a real division between two different worlds with different cultures, expertise, political jurisdictions, and agendas: security/preparedness on the one side and insurance/reinsurance/finance on the other. These two communities rarely talk to each other. In commercial enterprises it is not unusual to see positions for Chief Risk Officer distinct from Chief Financial Officer (who deals with insurance issues). Even in Congress, jurisdictions will differ with the Homeland Security Committee being distinct from the Financial Services Committee, and so on.

I shall argue that up to this point decision-makers in the homeland security field have rarely seen as a priority the question as to how risk coverage mechanisms and insurance markets operate and how they naturally interact with prevention. This is somewhat surprising because the failure to adequately protect the country against terrorist attacks or natural disasters will directly

affect these markets, which react to disasters, in return affecting future decisions regarding protection/prevention.

This division is apparent again in the 2006 *National Infrastructure Protection Plan* (NIPP), which was released at the end of June by Secretary Chertoff. The plan, which constitutes an important attempt by the department to lay out strategies, proposes to "coordinate and implement national initiatives and develop a national plan to unify and enhance critical infrastructure protection efforts through an unprecedented partnership involving the private sector", as well as all levels of government. The need for public-private "partnerships" to facilitate fast recovery after an extreme event is mentioned many times in the document, but never is the question addressed of how to best achieve that goal. The critical role of the insurance infrastructure does not appear once in this 180-page document. Hence here we stand: In the middle of an uncompleted bridge. The homeland security paradox remains.

This omission would not matter except for the fact that we have entered a new era of catastrophes in just the past few years. After the September 11, 2001 terrorist attacks, the first event to demonstrate that we lack the capacity to adequately protect the homeland[iii], a major blackout in 2003, major natural catastrophes worldwide inflicted $230 billion in economic damage in 2005, twice as much as in 2004, the previous record holder (Swiss Re, 2006). Extreme events have continued to inflict major insured losses, especially in the United States, which is the leading country by far in term of insured losses from natural disasters. Indeed, the evolution of losses from natural disasters in different regions of the world indicates that between 1980 and 2005, North America (essentially the U.S.) accounted for losses that were more than twice those of Europe. Taking only insured losses into account, this difference is about 4 times: $320 billion in the U.S., $80 billion for Europe.

Another figure is worth contemplating: out of the 20 most costly catastrophes in terms of insured losses that occurred between 1970 and 2005 (a 35-year period), **10 of them occurred in just the last five years, and nine of these in the U.S (in grey in Table 1).** Hurricane Katrina alone inflicted nearly $150 billion of economic damage, generating half of this amount in insurance claims (including for flood damage)[iv].

This is a totally new dimension. Unfortunately, the conjunction of three factors – increasing degree of urbanization, increased value at risk, and possible impact of global warming on intensity of major hurricanes – make scenarios of disasters on even larger scales than seen in the past few years very plausible.

Table 1. The 20 Most Costly Insured Catastrophes in the World, 1970-2005 (2005 prices)

Rank	*U.S.$ billion* ***(indexed to 2005)***	*Event*	*Victims* ***(Dead or missing)***	*Year*	*Area of primary damage*
1	45.0	Hurricane Katrina	1,326	2005	USA, Gulf of Mexico et al
2	35.0	9/11 Attacks	3,025	2001	USA
3	22.3	Hurricane Andrew	43	1992	USA, Bahamas
4	18.5	Northridge Quake	61	1994	USA
5	11.7	Hurricane Ivan	124	2004	USA, Caribbean et al
6	10.3	Hurricane Wilma	35	2005	USA, Gulf of Mexico et al
7	8.3	Hurricane Charley	24	2004	USA, Caribbean et all
8	8.1	Typhoon Mireille	51	1991	Japan
9	6.9	Winterstorm Daria	95	1990	France, UK et al
10	6.8	Winterstorm Lothar	110	1999	France, Switzerland et al
11	6.6	Hurricane Hugo	71	1989	Puerto Rico, USA et al
12	5.2	Hurricane Frances	38	2004	USA, Bahamas
13	5.2	Storms and floods	22	1987	France, UK et al
14	5.0	Hurricane Rita	34	2005	USA, Gulf of Mexico et al
15	4.8	Winterstorm Vivian	64	1990	Western/Central Europe
16	4.7	Typhoon Bart	26	1999	Japan
17	4.2	Hurricane Georges	600	1998	USA, Caribbean
18	4.1	Hurricane Jeanne	3,034	2004	USA, Caribbean et al
19	3.7	Typhon Songda	45	2004	Japan, South Korea
20	3.5	Tropical Storm Alison	41	2001	USA

Sources: Data from Swiss Re and Insurance Information Institute

2. Comments on Two Proposals

Can government do a better job so the country is better prepared? I shall argue it can. That is in that spirit that I read the contributions by University of Kentucky's David Wildasin (*Rainy Days, Spillovers, and Bailouts: Problems of 'Fiscal Hydrology' in the US Federation*) and by Harvard University's Erzo Luttmer, Richard Zeckhauser, and Carolyn Kousky (2007) (LZK) (*Permits to Elicit Information*). Both contributions address in some fashion the very timely and somewhat controversial question of the role and responsibility of local and federal governments in enhancing mitigation measures in areas prone to natural disasters. They focus on two critical

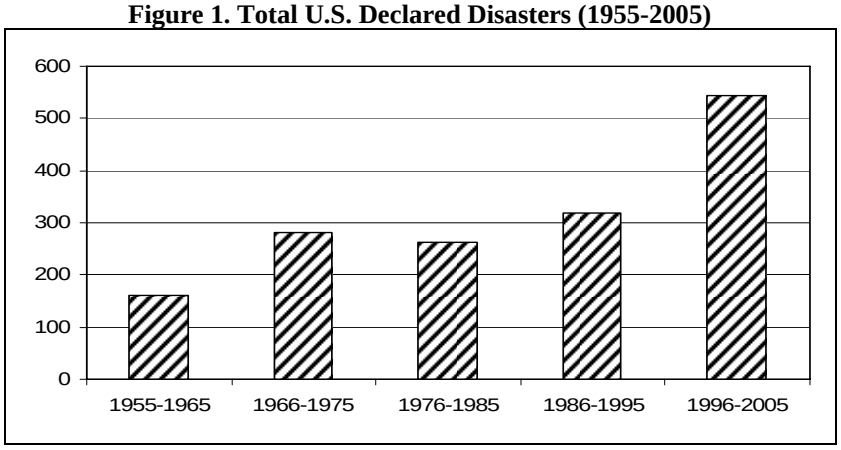
aspects: moral hazard among local communities and access to private information. Due to space limitation, my comments are essentially in the spirit of stimulating further thought and research.

Proposal 1 (Wildasin): Requiring State Governments to Fund Financial Reserves for Floods

Concerning Wildasin's proposal, I agree that major catastrophes in the scale of Katrina have clearly demonstrated that the current operation of the 1968-established National Flood Insurance Program (NFIP) is not adequate. It is clear that the program has diverged in practice from what it was assumed to accomplish originally: make coverage available and affordable, **and** encourage mitigation measures and land use in flood prone areas. Not only has the program never really succeeded in assuring that the largest number of inhabitants in high risk areas were actually covered[v], but it seems to have largely contributed to increased moral hazard at a local government level. Moreover, there is evidence that individuals with greater financial resources are more likely to take advantage of the government's flood insurance program (Browne and Hoyt, 2000; Dixon, Clancy, Seabury and Overton, 2006). This also raises the policy question as to whether or not insurance is the best approach to providing disaster protection to the lower income residents who cannot afford living in those areas.

It would be interesting to get access to granular data to measure the dimension and nature of the moral hazard phenomenon (e.g. Who does take advantage the most?). In the U.S., the President has full discretion in Presidential disaster declarations. While this number and amount of aid (decided by Congress) varies one year from another, there is a clear trend toward an increasing number of such declarations: a total of 162 declarations between 1955 and 1965, 263 between 1976 and 1985, and 545 between 1996 and 2005 (Figure 1). Knowing that a portion of the loss will be paid by the federal government (either through the NFIP, *ex post* disaster relief, or federal tax break for the uninsured) has contributed to inadequate local policies where disaster mitigation was not the top priority[vi]. A type of *Samaritan's dilemma* applied to government develops[vii].

Figure 1. Total U.S. Declared Disasters (1955-2005)



Sources: Data from the U.S. Department of Homeland Security (FEMA) (2006)

While the effect of individuals and local policymakers' expectations is difficult to measure, it certainly plays a role over time. The fact that politicians can benefit from their generous actions following a disaster raises basic questions as to the capacity of elected representative at the local, state and federal levels to induce people to adopt protection measures before the next disaster. The difficulty in enforcing these mitigation measures can be characterized as the *politician's dilemma*. Imagine an elected representative at the city or State level. Should he push for people and firms in this city or state to invest in cost-effective mitigation measures to prevent or limit the occurrence of a disaster? The long-term answer should be "yes". But the short-term answer influenced by re-election considerations might lead this individual to allocate taxpayers money elsewhere where he can gain more political capital. As a result, he might resist investing in disaster reduction measures particularly if he believes that his constituency do not worry about these events but then support federal assistance should a disaster occur in his area. Following a disaster when residents in an area are concerned with the possibility of future losses, politicians will often favor stronger building codes and other ways to reduce the damage from the next catastrophe. This mitigation dilemma facing politicians has received little attention in the hazards literature.

Making state governments responsible for part of the insured losses encountered by the NFIP might encourage them to be more active in putting pressure on local authorities to mitigate natural hazards. According to Wildasin this could be done through the creation of a state financial reserve ("rainy day fund"). A potential side effect of this proposal to consider is that some of the states might then decide to re-allocate their internal budget so the newly established financial reserve ("rainy day fund") is simply made by decreasing the budget they allocate for disaster mitigation infrastructure (if total federal funding they receive remains constant): A pure accounting substitution that might result in a even lower level of local protection than what it is under the current system.

A more fundamental limitation of the current operation of the NFIP that this proposal does not address is that incentives for private investment in mitigation work better when insurance premiums reflect risk so it is possible to adequately reward policyholders for protecting their property (then lowering the burden on the insurance program)[viii]. Moreover, the total exposure the program is liable for has been continuously increasing over the years: it was $210 billion in 1990, $570 in 2000, and in September 2006, it reached $ 1 trillion. If a large part of the premiums charged by the program do not reflect the risk and more policies continue to be sold, it is common sense that the program will continue to face financial crises. The year 2005 was certainly one of those. The NFIP will pay in excess of $23 billion in flood claims for breaches in the New Orleans levees from Hurricane Katrina coupled with the flood losses from Hurricanes Katrina, Rita, and Wilma; The equivalent of ten years of premiums. Because the program had not the financial capacity to pay for these losses, it had to borrow most of that amount from the US Treasury. This raises major questions regarding the future of the program. For instance, annual interest on this borrowing will be over $1 billion; that is 40% of the total amount of premiums the program collects today. Two bills are currently being discussed in Congress (H.R. 4973 and S. 3589) as to how to modify its operation, but neither of them went through both the House and the Senate when the 109th Congress adjourned for their electoral break in November 2006.

Proposal 2 (Luttmer-Zeckhauser-Kousky, LZK): Using Permits as an Instrument to Elicit Private Information about Investment in a Hazard Prone Area

The second proposal is broader than the question of disaster mitigation *per se*. It relates to the difficulty for a local government contemplating building infrastructure in a specific area to know in advance the decision of private investors to locate their activities in a region (reaction function). This is an important question because infrastructure decisions are typically irreversible (one-time only decisions regarding substantive level of public investment). As of today, governments mostly rely on surveys or discussions with interested parties; typically a few large investors to whom they guarantee some financial advantages should they implant their activities in the region (e.g. tax break). But, what if the government wanted to have a more precise estimation of the total level of investment it should expect?

The LZK proposal suggests the government might sell permits to elicit this information *ex ante*. Different prices are asked depending on whether or not the decision to build the infrastructure has been made yet. Under the assumptions and a specific design of the selling mechanism presented by the authors, equilibria can emerge at which investors would reveal their real intention. The authors rightly point out the possible problem of multiple local equilibria and suggest that governments offer conditional contracts (e.g. based on the level of government infrastructure), which in return will lead to the selection of the optimum global optimum.

I would like to highlight two points. The first relates to the possibly high transaction cost associated with the proposed model. Second, the current set-up does not directly integrate the risk aspect. Even if the example of the levees in New Orleans is mentioned in the paper, it is not clear how the proposed model has integrated the disaster component. The authors rightly discuss current public external policies that can affect the decisions of both private investors and local governments (federal or state share of the cost of the local infrastructure, subsidized insurance, federal relief, tax break for uninsured), but the risk aversion to major disasters is never discussed even though it is clearly a critical element in making these decisions.

A generalization of the problem can be done by integrating the exposure to natural hazard in the area as one of the variables. The results of the revised model might then show what has

been observed in reality: there often exists a technology adoption/network/critical-mass of private capital (K_{min}) to be secured before the government would invest (G_{min}) that will guarantee that the infrastructure would resist a specific type of disaster (e.g. levee can resist a Category 3 hurricane). The more capital there is, the more resilient the infrastructure. Likewise, the more resilient the infrastructure, more capital is needed. The demand is likely not to be linear as each investor's willingness to pay depends on their risk-aversion and expected return on investment. Permits to elicit information could then have an additional function: Revealing the difference in risk perception between governments and different categories of potential investors.

3. What Can Government Learn from the Private Sector of Insurance?

I now turn to the main proposition of this paper: for government to learn more from the private sector. And with whom would it be a better start than insurance? Indeed, in most industrialized countries, insurance constitutes an important mechanism by which people and firms manage risk. This is certainly true in the aftermath of disasters in industrialized countries where insurance market penetration is often significant. But, the way insurance really works in disaster situations often remains obscure to the general public. How many know, for example, that the insurance sector today is the largest industry in the world? This sector is generating $3.4 trillion in yearly global revenues; that is more than the U.S. federal budget ($2.6 trillion) and more than twice the size of the oil industry.

I would like to end my remarks with some considerations drawn from the operation of private insurance which has proven to be a resilient industry. Indeed only one insurer, Poe Financial, went bankrupt as a direct effect of the unprecedented 2005 hurricane season in the United States. There are not many industries in which firms would suffer repeated unprecedented shocks in just five years and still remain standing. Insurers have learned how to manage their exposure, selecting the risks they want to cover (to a certain extent allowed by state regulations), and diversifying these risks by types of risk and geographic areas.

In some cases, insurers opt not to offer coverage against some risks and locations if these additional risks would not yield a net positive profit over a pre-specified time horizon. It is thus important to recognize that insurance coverage will always be limited and that no matter how far disaster insurance risk is diversified there will always be some unavoidable residual risk that needs to be borne by someone. Most likely it will be borne by government (current and future generations of taxpayers). The question hence becomes how much? As government actions will impact local behaviors, how can one make the whole system more balanced so those who decided to live in exposed areas pay the price of their choice of living.

I would like to highlight two principles that might serve as guidance in the reflection on the future of disaster insurance and mitigation in the U.S. They are based on results driven by an ongoing research program the Wharton Risk Center is conducting in conjunction with Georgia State University and the Insurance Information Institute in partnership with 15 large insurers and reinsurers, trade associations, and the federal government.

- ***Principle 1: Risk-based Premiums -*** *Insurance premiums (whether public or private coverage) should, to the extent possible, reflect the underlying risk associated with the events against which coverage is bought in order to provide a clear signal to individuals and businesses of the dangers they face when locating in hazard-prone areas and encourage them to engage in cost-effective mitigation measures to reduce their vulnerability to disasters.*

Highly subsidized premiums or premiums artificially compressed by regulations, without clear communication on the actual risk facing individuals and businesses, encourage development of hazard-prone areas in ways that are costly to both the individuals who locate there (when the disaster strikes) as well as others who are likely to incur some of the costs of bailing out victims following the next disaster (either at a state level through ex post residual market assessments or through federal taxes in the case of federal relief or tax breaks[ix]) . Risk-based rates also encourage investment in risk mitigation measures that are cost-effective.

- ***Principle 2: Integrating Affordability Issues -*** *Any special treatment given to lower income residents in hazard-prone areas who cannot afford the cost of living in those locations should come from general public funding and not through insurance premium subsidies.*

In developing an insurance program that stands any chance of being implemented, it is also necessary to recognize the tension between setting premiums that reflect risk and the financial ability of residents in hazard-prone areas to buy coverage. This was a major issue in the development of the National Flood Insurance Program (NFIP) in 1968. There was great concern that if flood insurance rates were risk-based, then many residents in hazard-prone areas would be charged extremely high premiums for flood coverage so they were given a rate that was highly subsidized. There was no economic incentive for them to mitigate their homes because they did not receive any premium discounts for doing so. Based on the experience of the NFIP, one should not provide subsidized premiums to those residing in hazard-prone areas.

Instead, either the state or federal government should offer some type of subsidy or grant that enables lower income residents to purchase insurance at a risk-based premium. For instance, it has been suggested that those residents could be given an *insurance voucher* that would be used specifically to buy homeowners coverage in a similar spirit as the food stamp program today. The magnitude of the voucher would be based on the income and assets of the resident.

It would also be important to distinguish between residents who have been living in the areas for a long time, who made the decision to move there at a time where the knowledge about the risk might have been limited, from those who are now building new houses in locations well-known to be highly exposed to disaster because they know they can benefit from subsidized insurance rates (e.g. the development of Florida as a home for retirees)[x].

Business Opportunities: Enhancing Mitigation through New Financial Products[xi]

Mitigation is thus critical. But, here again there is evidence that many residents do not invest in mitigation measures because of the belief that disasters will not happen to them and the upfront cost of mitigating their property which only provides an uncertain return on investment. One way to overcome this challenge is for residents in hazard-prone areas to be provided with special loans

to invest in cost-effective mitigation measures and in return be charged a lower insurance premium reflecting the reduced damage to their property from a future catastrophe. Ideally, banks, who provide mortgages, would work together with insurers, who cover the property, to jointly develop a mortgage product that is attractive to homeowners.

This is a promising proposal as long as homeowners know that they will receive a premium discount for investing in mitigation. Furthermore, banks will have greater incentives to provide home mitigation loans if they know that the housing GSEs – Fannie Mae, Freddie Mac, and Ginnie Mae – would guarantee them, as they do now for conventional mortgage loans. This presumably would happen automatically for purchasers of new or existing homes, provided that the purchasers otherwise meet down payment requirements and the total mortgage loans are below the applicable ceilings. Indeed, to facilitate the guarantees on such loans, GSEs can raise their ceiling modestly to allow for such home mitigation loans. As for existing homeowners who want to take out home mitigation loans, the GSEs can approve a separate loan program for this purpose (allowing extended maturities, such as 20 years), so that banks can extend these loans knowing that they can be sold easily in the secondary market (Kunreuther and Michel-Kerjan, 2006).

Another way would be to work through the internal revenue service to offer some types of *mitigation tax refund*. When an individual files his revenue taxes, he would have the opportunity to show a proof of his investment in pre-certified mitigation measures to protect his property and would get a certain tax refund for that. Ideally, mitigation loans and mitigation tax refunds would complement each other.

4. What is Likely to Happen Tomorrow?

For many years now, these catastrophes have been labeled as “low-probability, high consequence” events. At a country level, the past five years have demonstrated that these catastrophes are not of low probability anymore.

The time has come for economists, industry leaders, and policymakers to rethink federal disaster policy in the United States. The new scale of the future disaster we are contemplating

will require much more than what was done before with a new business and political model to address this new era. While there have been many discussions and hearings, lessons from the past indicate, unfortunately, that it might take several other strong signals as those we have seen in the last five years before necessary long-term reform is made. The tendency to go back to business as usual is real.

This brings us back to what Balthazard Marie Emerigon [1716-1785], a leading European authority on commercial law during the eighteenth and early nineteenth centuries, said so well in his time: Insurers have learned the hard way to act "with due consideration for the dangers into which blind fortune and their own recklessness may lead them." While private insurance also presents some limitations, the 2005 hurricane season demonstrated that there are private sector lessons from which governments can learn and some features of which they can adopt in a disaster public policy context.

And as the ratio between "disaster time" over "normal time" increases, our government will also have to learn how do to do it differently. The insurance and finance industry, and more generally the private sector, because it also has so much at stake, has a lot to contribute in this improvement process. This is certainly a promising path to consider so when the next large-scale disaster strikes the country is ready for prime time.

Notes

[i] U.S. House of Representatives, *A Failure of Initiative: Final Report of the Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina, U.S*, February 2006 (Washington, DC: GPO, 2006).

[ii] A more detailed discussion of the ideas discussed here is provided in Auerswald, Branscomb, LaPorte and Michel-Kerjan (2006).

[iii] For a discussion by the author on the creation of new insurance markets in the aftermath of 9/11, see Michel-Kerjan and Pedell (2006) and Kunreuther and Michel-Kerjan (2004).

[iv] To put these figures into perspective, an average year of insured losses due to natural catastrophes in the 1970s and beginning of the 1980s was about 3 to 5 billion dollars worldwide (2005 price; see Figure 1). At a local level, Allstate, Louisiana's second-largest insurer, has paid more than $2 billion in homeowners claims for Katrina, wiping out over 50 years of Louisiana-based profits in a few days. http://www.2theadvocate.com/news/business/2656936.html

[v] In the Louisiana parishes affected by Katrina the percentage of homeowners with flood insurance ranged from 57.7 percent in St. Bernard's to 7.3 percent in Tangipahoa. Only 40 percent of the residents in Orleans parish had flood insurance. A recent RAND study conducted for the NFIP revealed that only about 50

percent of single family homes in special flood hazard areas are covered by flood insurance despite the subsidized rate for existing homes in flood prone areas. See Dixon, Clancy, Seabury and Overton (2006).

[vi] For example, Louisiana, Mississippi, and Texas do not mandate that local governments enforce the state building codes nor that they prepare comprehensive plans that would be consistent with such policies. Devastation due to the 2005 hurricane season does not come as a big surprise in this context. See Burby (2006).

[vii] The Samaritan's dilemma was introduced by Nobel laureate James Buchanan (1976). The basic idea is that the government (the Good Samaritan) wants to help victims after a major loss. While such an attitude is likely to generate public approval after a disaster it has potentially negative effects on potential victims' behavior prior to the event. Indeed, it creates moral hazard problems by encouraging risk-taking behavior (including not purchasing insurance) by those who feel they will be financially protected by the government action after an event. That is the Samaritan's dilemma.

[viii] There is also evidence that the flood risk maps that are used to set up the NFIP's Community Rating System that determine the level of subsidy on policies covered by the NFIP are inadequate in several areas and would need to be significantly updated.

[ix] Note that the current *casualty and theft loss federal tax deduction* allows individuals to deduct a portion of their uninsured property damage from natural disasters from income when calculating their federal taxes. This constitutes a form of free insurance that benefits those who decided to go uninsured at the expense of other taxpayers. If the full loss deduction exceeds income, it is even possible to spread this on over income past (tax refund) and future federal taxes. I thank Benjamin Shiller for discussions on this question.

[x] According to the US census, the population of Florida has increased significantly over the past 50 years: 2.8 million inhabitants in 1950, 6.8 million in 1970, 13 million in 1990, and a projected 19.3 million population in 2010

[xi] This section is based on Kunreuther and Michel-Kerjan (2006).

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