No. 08-05
March 2008

WORKING PAPER

THE MARKET FOR HURRICANE MITIGATION: Regulatory or Market Failure?

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MERCATUS CENTER
GEORGE MASON UNIVERSITY

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Financial support for this research was provided by the Mercatus Center's Global Prosperity Initiative.

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Abstract

Losses from hurricane catastrophes have accelerated in recent years, with seven of the top nine hurricanes ranked by insured losses occurring during 2004 and 2005. Hurricane losses have affected the availability of insurance in coastal states and contributed to enormous growth in state residual wind markets. Of particular policy concern is the possibility that homeowners, businesses and insurance companies are not investing in the efficient amount of mitigation to reduce hurricane losses. This paper examines potential barriers to the adoption of efficient mitigation and reviews specific state insurance regulation and legislation that impedes and encourages mitigation. Premium discounts and hurricane deductibles, which are waived if property owners invest in mitigation, provide incentives for mitigation, but mitigation discounts mandated by legislators potentially could represent disguised insurance subsidies. Irrationalities in decision making like low probability event bias, myopia, and inertia might make it difficult for insurers to convince property owners to invest in mitigation. But this is not different in type from the problem entrepreneurs face in general in making consumers aware of the value of products. Restrictions on contractual mechanisms insurance companies can use to encourage mitigation, like requiring mitigation as a condition for renewal of coverage or funding mitigation after a disaster through long term loans or contracts, could prevent insurers from using effective incentives for mitigation, and could reduce the market supply of insurance in coastal areas.

1. Introduction

The rapid increase in weather-related catastrophe losses, particularly from hurricanes, has attracted the attention of numerous researchers and policy makers. Hurricane Katrina was the costliest natural disaster in U.S. history, with $41.1 billion in insured losses (in dollars when the hurricane occurred), and has received the greatest attention. But six of the other top nine costliest hurricanes in the U.S. occurred in 2004-05, including Wilma (3rd, $10.3 billion), Charley (4th, $7.5 billion), and Ivan (5th, $7.1 billion). Hurricanes and tropical storms were the leading cause of catastrophe losses in the U.S. between 1987 and 2006.[1] The mounting hurricane losses and related insurance availability issues have spurred interest in proposals before Congress for national catastrophe insurance.

Construction engineers have made great progress in understanding how winds damage structures and they have developed many ways of building stronger structures. Many of these innovations have been incorporated in the wind load provisions of revisions of the International Building Code and International Residential Code, which have been adopted in whole or in part by 43 states nationally. Researchers and industry experts emphasize improved construction techniques and other mitigation measures as important in containing the growth of hurricane losses.[2] Of even greater importance are the concerns of experts that the United States does not invest enough in mitigation and strengthening the built environment.

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[1] These statistics are from the "Catastrophes" and "Hurricanes" statistics pages of the Insurance Information Institute's website, at http://www.iii.org/media/facts/.

[2] A partial list of the studies emphasizing building codes and mitigation in controlling catastrophe losses include Kunreuther (1996, 1998), Burby (1998), Mileti (1999) and Ryland

> As the nation faces up to the challenges of rebuilding in the aftermath of Hurricane Katrina, it also needs to face up to something it has long avoided: the need to help homeowners and business people construct buildings and retrofit existing structures in ways that will help resist future severe storms and other natural calamities. (Ryland 2006, p.223)

The failure to invest in cost-effective mitigation or loss-reduction measures leads to inefficiency, or the total cost of hurricanes (the sum of damage incurred and expenditures to reduce or avoid damage) being greater than necessary.

Broadly speaking, two types of explanations have been offered for the alleged inefficiency in mitigation. One set of explanations contends that individuals fail to invest in mitigation due to deficiencies in decision making under risk, particularly low probability, high consequence risks. People might ignore a low probability risk, or optimistically believe they can avoid losses, or suffer from myopia and excessively discount future losses from natural hazards, or exhibit status quo bias. The other set of explanations focuses on public policies, including insurance regulation and building code enforcement. Asymmetric information exists in evaluating and verifying the status of construction techniques or mitigation measures. Building codes can inhibit the diffusion of innovation (Oster and Quigley 1977) and are problematic to enforce (Mileti 1999), and insurance regulation might inhibit mitigation.

This paper examines the role that insurance policy plays in creating positive or negative incentives for mitigation. Insurance plays an important role in managing and containing risk, in part through spreading risk and providing risk takers with an accurate signal of the cost of their activity. But insurance also plays an important role in providing people with knowledge and

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(2006).

incentives to make hazardous activities less dangerous. Insurers help make air travel, the shipment of hazardous materials, and our homes safer places. By making the price, coverage and even availability of insurance conditional on construction practices, insurance companies should provide homeowners and businesses with an incentive to live safely in coastal areas vulnerable to hurricanes.

Regulated insurance markets currently provide incentives for mitigation in two main ways: hurricane deductibles and premium discounts. Several aspects of regulation appear troublesome from the standpoint of efficient mitigation, namely restrictions on insurers' ability to make various types of mitigation a condition of coverage and politically mandated premium discounts, which could constitute disguised insurance subsidies. In addition this paper describes several different types of contractual procedures which could enhance mitigation incentives. If status quo bias and a tendency to ignore the potential for hurricanes make homeowners and businesses reluctant to prepare in advance, insurance companies need to be given broad entrepreneurial freedom to devise contracts that can alert policyholders and spur them to action.

2. The Potential Problems in the Adoption of Mitigation

The value of mitigation derives from the amount of loss prevented when a hurricane or other hazard occurs. Stronger buildings do not reduce the probability of a loss, which depends on the occurrence of a hurricane, but do reduce damage, and so most types of mitigation comprises self-insurance in the framework of Ehrlich and Becker (1972).[3] Homeowners and businesses would need to compare the expected utility from the reduced loss with the cost of

[3] The exception would be when mitigation reduces the amount of loss to zero.

mitigation. Several factors represent challenges in the adoption of efficient mitigation measures.

One impediment to efficient mitigation is low probability event bias. Homeowners might underestimate the underlying probability of a hurricane, or they may not be able to interpret such a probability properly (Camerer and Kunreuther 1989, Kunreuther and Pauly 2004). In the limiting case, people may act as if the probability of a hurricane is zero and totally ignore the risk, in which case the perceived value of mitigation is zero. In the more general case, the systematic bias in the perception of the probability of the hazard event reduces the value of mitigation, resulting in underinvestment and a lower quality of the built environment.

A second challenge for efficient mitigation is excessive discounting of the future, or a time horizon problem (Kunreuther and Kleffner 1992, Camerer and Kunreuther 1989). Strengthened construction will reduce expected loss over a long period. The useful life of mitigation differs for different measures; roofs for instance may need to be replaced periodically, while secure walls to the foundation could last throughout the life of a home. People may not fully value benefits over the entire life of a structure or mitigation measure due to myopia or an excessively high discount rate. When residents compare a fixed extra expenditure versus lower premiums over time, they focus on the upfront cost and cannot make a decision based on present value. The full value of future benefits may not enter into the calculation of today's decision maker if they do not plan to live in the home through the entire useful life of the mitigation measure. If the remaining benefits cannot be captured in the form of a higher sales price, the remaining value of mitigation ends up being an external benefit (Kunreuther and Kleffner 1992).

A third challenge is in verifying the presence of mitigation in the home or building. This asymmetric information argument, often offered in support of building codes (Oster and Quigley 1977), only applies to some types of mitigation or strengthened construction. For example, it is

basically impossible to ascertain the direction and spacing of nails, the proper installation of hurricane straps or clips, or the anchoring of walls to the foundation after construction is complete. Yet these factors affect the structural integrity of a building. Often poor construction is only revealed during a post event damage survey. This verification problem might prevent insurance companies from offering discounts for these types of mitigation (Kunreuther 1996), and consequently homeowners may not be willing to pay extra for these measures.

A fourth problem involves interactions with insurance companies. With full insurance, any mitigation measure provides benefits to the insurance company but not the homeowner. Deductibles or premium reductions are necessary to provide the homeowner with an incentive to incur a cost to install a loss reduction mechanism (Ehrlich and Becker 1972). In a hurricane, losses will often exceed a standard deductible, so a premium discount might be necessary to provide homeowners with an incentive to invest in mitigation. This problem can be related to the verification issue, since a main reason insurers do not offer a discount is the potential moral hazard.

Finally interactions with disaster relief can impede mitigation. With disaster assistance, residents may be able to have some portion of damage paid for by others, either the government or private charities. Residents know that some hurricane losses will be passed on to others through disaster relief, reducing the value of mitigation. For instance, if low interest loans are available after a disaster, or grants, or if loans are readily forgiven, it might be cheaper for a household to not spend money to avoid damage which somebody else will pay for.[4]

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[4] Note that even if the property damage ends up being paid by a third party, the home owner would still face considerable inconvenience and disruption to life due to the damage. Consequently, the value of mitigation does not vanish even with very generous disaster

Insurance is a highly regulated industry, and regulation must be added into the above list of factors. Forms, rates, allowable investments and agents are all regulated. Every state except Illinois regulates premiums, some through a prior approval system in which insurance companies must get approval from regulators before they can use rates, and in the remainder of cases through a file and use system in which regulators can review and eventually disallow a premium. Generally insurance companies must get approval to allow discounts for mitigation features. Any regulatory, price setting process will be politicized, and can provide a means for businesses to restrict competition. In a regulated, politicized process, other insurance companies can object to discounts proposed by rival insurers. In general, economic regulation has been shown to protect high cost, inefficient producers threatened by price cutting by more efficient rivals. Some insurers might fear that premium discounts for mitigation are competitive price cuts in disguise. In a regulated system, insurance companies have the ability to interfere with each others' pricing plans in a way not possible in an unregulated market.

An element of regulation which could impede efficient mitigation is the use of below-market insurance premiums for high risk properties. Below-market premiums reduce the incentive of both insurers and property owners to mitigate. If regulated premiums are below market rates for high-risk properties, insurers will not to write insurance in these areas. Consequently insurers will not take actions like offering discounts for mitigation which might increase the number of policies written in high risk areas.[5] In addition, below market premiums

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assistance.

[5] The exact impact of mitigation discounts with below-market base premiums can be quite complex. If an insurer can use discounts to assemble the best-constructed homes in high-risk areas, an insurer may still offer discounts. If company A insured 5% of homes in a high risk area and cannot due to regulation reduce the number of policies they write in the area, they could

will reduce the benefits to property owners from mitigation. With subsidies in insurance, some portion of the losses from hurricanes, and thus the benefits of mitigation, are shifted to third parties. And any available premium discount will translate into fewer dollars saved per year if applied to an already below market premium.

3. The Market Value of Mitigation

The efficiency of insurance incentives for mitigation depends on the public's receptiveness to mitigation. If homeowners ignore hazard risks, response to premium discounts for mitigation may be quite modest. As discussed above, many scholars doubt whether the public places value on mitigation. If true, then regulatory mandates might be necessary to force homeowners to adopt efficient mitigation measures.

A growing body of evidence, however, demonstrates that people do perceive the value of mitigation and are thus willing to pay for it. Markets specifically value hurricane mitigation. Simmons, Kruse and Smith (2002) tested for a market price premium for homes with hurricane shutters in a Texas Gulf coast city. If homeowners did not value mitigation, then homes equipped with shutters should not sell at a premium. In a hedonic price model, Simmons, Kruse and Smith found that homes with shutters in high wind risk areas sold at a statistically significant 5% premium relative to other homes, and that the premium would cover the cost of shutters for the median priced home.

Two recent studies found real estate market premia for tornado shelters and saferooms as well. Simmons and Sutter (2007a) found a 3 to 4% premium for homes in Oklahoma City with a

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perhaps end up insuring the 5% of homes in the area with hurricane shutters by offering discounts, and this could reduce the company's expected loss.

shelter. The magnitude of the premium for their median priced home exceeds the cost of an underground shelter and is almost sufficient to pay for a saferoom in a new home. Simmons and Sutter (2007b) found that 59% of manufactured home parks in Oklahoma offered community shelters and that lots in these parks rented at a 5% premium. The premium would approximately cover the cost per resident of a community shelter.[6] Two contingent value studies found a willingness to pay for tornado shelters in single family homes of approximately $2,500 (Ewing and Kruse 2006, Ozdemir 2005), consistent with observed house premia. Indeed, Ewing and Kruse (2006) found that residents' willingness to pay for a shelter increased by $600, or 25% of shelter value, if the shelter had been certified by the National Storm Shelter Association, indicating that in addition to placing value on mitigation, residents place value on quality assurances.

Price premia for mitigation are important for two reasons. First, as mentioned, they provide convincing evidence that people do not totally ignore low probability hazard risks. Second, premia help overcome a potential time horizon problem. If hurricane shutters have a 30 year useful life, a homeowner who plans to live at the residence for say only another 5 years would be unable, in the absence of a premium when selling the home, to benefit from the remaining 25 years of reduced losses. By capitalizing the remaining benefits of durable mitigation into the selling price, a price premium provides homeowners the proper incentive to

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[6] The finding for manufactured homes is particularly significant because researchers contend that market failure is worse for mitigation in rental housing markets. For example, Tierney (2006, p.113) states, "In contrast with homeowners, renters are dependent on their landlords to carry out activities that can reduce codes, and carrying out specific disaster loss reduction measures. Since undertaking such actions costs money, landlords will generally not do so voluntarily." This paper focuses on mitigation by homeowners, but rental properties comprise a significant proportion of property at risk for hurricanes and protection of this property will also

invest in mitigation.

Several related studies document the impact of natural hazard risks on real estate prices, providing further evidence that residents do not generally ignore hazard risks.. Carbone, Hallstrom and Smith (2006) and Hallstrom and Smith (2005) demonstrate that homes in storm surge-vulnerable portions of Miami-Dade and Lee counties in Florida increased in price at a slower rate than homes further inland following Hurricane Andrew. Shilling, Benjamin and Sirmans (1985), MacDonald, Murdock and White (1987) and Spreyer and Ragas (1991) each found that homes located in flood plains in three different Louisiana cities sold at approximately a 6% discount relative to homes out of the flood plain. Brookshire et al. (1985) and Beron et al. (1997) found that homes in seismic zones as designated by the state of California sold at a discount, and that the size of the discount declined after the 1989 Loma Prieta earthquake.

4. Insurance Company Entrepreneurship and Risk Perception Biases

Suppose that homeowners underestimate the probability of a catastrophic event and consequently undervalue mitigation. In addition, suppose that status quo bias is pervasive and makes many homeowners reluctant to make changes to their insurance or invest in mitigation if possible. In such a world, homeowners may be in danger of passing up opportunities to reduce their expected cost of homeownership. Miscalculation, misperception, myopia, or status quo bias would create a potential profit opportunity if someone, namely the insurance company, could alert homeowners to the potential for mitigation.

Convincing others of the value of an offered opportunity is part of the task of entrepreneurship. Kirzner (1973, pp.162-3) writes that

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be important.

> ... the function of the producer-entrepreneur is not merely to present the consumer with a particular buying opportunity, but to present it to him so he cannot fail to "notice" its availability. ...[T]he product itself simply *does not exist* for the consumer until its existence and usefulness have been brought to his attention. It follows that the entrepreneur's task is not completed when he makes information available to the consumer. He must also get the consumer to notice and absorb that information. It is therefore not surprising at all to discover that information that might be provided in a modest two-line newspaper announcement (that might be read by millions) is instead emblazoned in color on giant billboards, embellished by all kinds of vivid, but superficially irrelevant illustrations.

Homeowners who fail to adopt seemingly efficient mitigation measures are essentially the consumers who Kirzner argues have not been made aware of a useful product. A homeowner's doubt about any specific mitigation measure is more understandable when placed in the context of all of the threats various businesses and interest groups tout that require immediate action. Homeowners may be myopic, skeptical creatures of habit, but so are consumers generally, and businesses often have to overcome inertia and status quo bias.

Insurers need to devise clever, innovative ways to make homeowners *aware* of the "existence and usefulness" of mitigation. We cannot say ex ante what types of contractual devices or incentives might succeed with homeowners. Indeed, the market is a discovery process, meaning a mechanism for uncovering knowledge that does not currently exist (Hayek 1978). As a consequence, it is highly problematic to restrict methods which insurance companies might wish to employ in order to convince homeowners about the benefits of mitigation. Premium discounts would be one mechanism for alerting homeowners. But if

discounts proved insufficient, insurers may need to be more creative. We can speculate about some contract provisions which might overcome inertia.

Because of the effect of myopia on decision-making, Kunreuther (1996) suggests allowing homeowners to fund mitigation using long term loans. One option would add the cost of mitigation to the purchase price of a home so mitigation costs can be included in the mortgage. If financed over an extended period of time, homeowners could compare the annualized cost of mitigation with the reduction in annual insurance premiums. Instead of comparing a $2500 upfront cost with $300 lower annual homeowners insurance premiums, residents would compare say a $15 month payment with a $300 reduction in annual premium. If the problem is framed in this fashion, homeowners might decide that mitigation is a worthwhile investment.

Interest in mitigation is often great in the immediate aftermath of a hurricane. In addition to the dollar loss involved, property damage often involves additional inconveniences for households. For example, homeowners needing to replace a roof or garage door might want to upgrade to better materials or a reinforced garage door to prevent the same loss from occurring again a couple of years later. Yet due to the expenses involved with a hurricane, including evacuation expenses, paying a deductible, and uninsured losses (e.g., replacing spoiled food or dining out during a power outage), households may be strapped for cash and unable to take on additional costs to upgrade. And insurance typically only pays to repair a home to its status prior to the loss. After all, insurance does not exist to replace a home's damaged two car garage with a three car garage. Insurance companies, however, may find it advantageous to let policy holders apply their deductible toward mitigation. For example, suppose that a home has a $5,000 deductible and has suffered $20,000 in damage. Repairs could, however, be made with superior

materials which would reduce losses in a future hurricane by say $10,000. But the superior materials might cost $3,000, increasing the cost of repairs to $23,000. After paying the deductible and other expenses, the household may not have an extra $3,000 to pay for the higher quality materials. In this case an insurer might wish to let the household apply the deductible to cover the extra costs.

Insurers might also wish to share some of the cost of mitigation in exchange for a multi-year contract with a homeowner. In this case, the homeowner would forego a premium discount after mitigating the property in exchange for help with the upfront cost. Such an agreement could represent a profit opportunity for the insurance company, particularly when the return on mitigation is very high and mitigation could pay for itself (in expected value terms) in just a few years. The contractual innovation here would be to require a multi-year contract from the policy holder in exchange for payment of the upfront cost by the insurer. Customers, however, already enter into multi-year agreements for cell phones and automobile leases, and so might also be willing to make a multi-year commitment on insurance. A mitigation measure requiring a long term agreement in excess say of five years would be difficult to cover. Over a long enough time horizon, the premium might need to be adjusted, say in light of escalation of construction costs or new evidence on building vulnerabilities. Home owners might be concerned about being captive to rising premiums without the right to comparison shop. But the most efficient mitigation measures could be funded in this way.[7]

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[7] Another possibility is bundling of insurance, the structure, and mitigation by the builder. If, due to myopia or inertia, homeowners simply cannot be alerted to efficient mitigation opportunities, a builder could include mitigation. This likely could be done for condominiums and shopping centers by the developer/operator. But the approach could be extended to single family homes in a planned development as well.

Insurers may wish to cooperate on projects to demonstrate the benefits of mitigation, particularly in building a new community where all homes are built to high standards. A demonstration neighborhood could be significant in realizing the full benefits of building stronger homes. Hurricane wind damage is often a product of wind-blown debris, and poorly built homes often become the source of debris which damages better constructed homes nearby. Demonstration projects can serve an important role in making homeowners aware of building options, and thus serve as a form of advertising. But insurers benefit as a group from raising public awareness of and interest in mitigation. If State Farm, for instance, campaigned to raise awareness about hurricane straps and shutters, all companies writing insurance in the area would benefit. Thus regulators should be receptive to cooperative efforts among insurance companies to increase general interest and awareness in mitigation among homeowners.

5. A Review of Regulatory Treatment of Mitigation

5.1. Hurricane Deductibles

Deductibles are the amount of damage policy holders must pay out-of-pocket for a loss before the insurance policy covers the loss. Deductibles are designed to reduce small claims that would be costly to process relative to the payment and to combat moral hazard. Moral hazard refers to actions a policy holder takes day-to-day which affect the probability of a loss, say double checking that the stove is turned off before leaving the house. If the policy holder has to pay some of the loss (or all with small losses), she has an incentive to undertake these actions to avoid loss. Large deductibles (up to 15%) have long been a feature of earthquake insurance policies. In recent years hurricane deductibles have become increasingly common; the deductibles can be as large as 5% (Connecticut explicitly caps hurricane deductibles at 5%).

Hurricane deductibles are so named because they only apply when a named tropical storm or hurricane (depending on the state) makes landfall. The larger deductible reduces an insurance company's potential loss in the event of a hurricane, and can reduce the amount of a premium for the policy holder (who is of course buying less compensation with the large deductible).

Deductibles generally encourage mitigation, but their incentive effect is questionable. The important consideration for deductibles as a mitigation incentive is whether the reduction in damage due to mitigation occurs beyond the margin of the deductible. If a $200,000 home with a 5% deductible suffered 20% damage in a hurricane, total damage would exceed the 5% deductible, resulting in a $30,000 paid loss for the insurer. Suppose that mitigation could avoid 25% of the damage this home would suffer in a hurricane. In this instance damage with mitigation is $30,000, but this still exceeds the deductible and thus only the insurance company's payment is reduced here. A second drawback of large deductibles is that they to some extent undermine the very reason for insurance by leaving the policy holder with a sizable reduction in wealth following a hurricane. To offset this, South Carolina's Omnibus Coastal Property Reform Act of 2007 allowed individuals to create Catastrophe Savings Accounts to set aside pre-tax dollars to cover hurricane deductibles.

To create an incentive for mitigation, deductibles are reduced if homeowners invest in mitigation. In New Jersey, five mitigation elements are defined, including construction to current state building codes, hurricane shutters, and impact-resistant glass and doors. Homes in the most exposed coastal zip codes in the state have a $1,500 all-peril deductible and a 5% hurricane deductible. If a property in this zone meets all five mitigation goals, the 5% hurricane deductible is waived and the $1,500 all-peril deductible applies in the event of a hurricane.

One potential limitation of deductibles as a mitigation incentive arises if people are

myopic and excessively discount the future, as discussed in Section 2. The benefit of mitigation for households will occur in the future, not having to pay up to 5% of the value of their home in out-of-pocket expenditures after a hurricane. Households would have to pay up-front now for mitigation. Although deductibles tied to mitigation provide an incentive for mitigation, low probability event decision biases may render the incentive ineffective in practice.

5.2. Premium Discounts

Avoiding having to pay a large deductible in the event of a hurricane does not allow (generally) the policy holder to benefit immediately from mitigation. A reduction in the premium creates immediate benefits to a policy holder from investing in mitigation. The premium reduction can reflect the expected reduction in damage due to mitigation and represents a natural way of passing the damage reduction on to policy holders. Premium reductions are often given for homes built to the existing state building code. The Texas Windstorm Insurance Association, the state hurricane insurance pool, offers premium discounts of 19% to 33% for building code compliance. Discounts can also be given for specific mitigation measures like hurricane shutters, wind-resistant glass and doors, and secondary water resistance. Premium discounts can become complicated since the marginal value of a mitigation feature might depend on the other types of mitigation a property has, as well as the exact location, elevation and surroundings of a home. Florida has an extremely complicated set of premium discounts.

Two factors are relevant to premium discounts for mitigation. One, whether the discounts are mandated by politicians and regulators or voluntarily offered by insurers, will be discussed presently. A second factor is regulatory approval of discounts. State regulators must approve the discounts proposed by insurance companies, and state insurance commissions

generally require insured to justify the proposed reductions. For instance, in South Carolina,

> When calculating the discount or credit the *insurer must be able to demonstrate* a correlation between the reduction in premium and the reduction in risk associated with the mitigation measures. The insurer may include the structure's age, location, construction method and materials used in calculating the discount. ... The Department will use available studies providing data and information on estimated loss reduction for wind-resistant building features to evaluate the discounts offered by insurers. (South Carolina Department of Insurance Bulletin 2007-15; emphasis added)

In essence regulators are empowered to second guess and check the homework of insurers. An insurance company must be able to convince themselves *and* convince regulators of the value of mitigation. Reliance on existing studies of loss injects conservatism into the discount approval process - insurers may not be able to demonstrate all that they know about losses. If one insurer proposes larger discounts for, say, reinforced garage doors or strengthened soffits, because this insurer is convinced that these are the keys to reducing hurricane wind damage, these discounts will appear excessive compared to those proposed by other insurers. Also the process presumes that regulators are as knowledgeable about construction engineering and wind damage as the insurance companies. Yet state insurance commissions often have modest staffs, and commissions have differing attitudes toward the use of risk models in premium setting. Second guessing by a less informed party is a little like Monday morning quarterbacking, except that Monday morning quarterbacks do not have the power to disapprove play calls by a football coach, while regulators can. Furthermore, if an insurer makes an error and offers, say, a 15% discount for a measure where only a 10% discount is justified, the insurance company bears the

loss. So insurers already have a profit incentive not to provide excessively generous discounts.

The regulation of insurance at the state level implies essentially that this same justification for mitigation permission discounts would have to be successfully made to regulators in each hurricane exposed coastal state. The time and resources needed to secure approval in each state could interfere with efforts to advertise or market mitigation incentives nationwide. As has been noted previously, regulatory policy can discourage insurer interest in mitigation:

> Insurance is a highly regulated industry, with rate changes and new policies generally requiring the approval of state insurance commissioners. The development of premium schedules which provide rate reductions for the adoption of certain mitigation measures requires administrative time and energy, both to develop and make a case to the state insurance commissioners (Kunreuther 1996, p.180).

One proviso about discounts based on building codes must be noted. Typically for discounts (or deductible waivers), homes built after a code went into effect are assumed to be built to the code and are eligible for the discounts. Building code enforcement is not automatic, and enforcement efforts vary across communities. The Insurance Services Office rates building code enforcement by local communities for insurers. According to these ratings many communities are not doing a good job enforcing local building codes. Consequently building code related discounts may be overly generous. Note that South Carolina's Omnibus Coastal Property Insurance Reform Act of 2007 allows insurers to take a community's building code enforcement score into account in determining premium discounts.

5. 3. Mandated Discounts for Mitigation

Regulators or state lawmakers sometimes *require* or mandate discounts for mitigation. Florida adopted such an approach after implementation of the statewide Florida Building Code in 2001. Louisiana and South Carolina passed similar legislative mandates in 2007. Florida commissioned an engineering study to document the expected benefit of mitigation measures included in the building code (Shimberg Center and ARA 2002). Insurance companies were then required to submit rates with discounts for mitigation which were reviewed by state regulators, who either accepted the discounts proposed or imposed their own discounts. The current set of discounts are very complicated, depending on exact mitigation features, location, elevation, and other factors. The complexity of the current system of mandated discounts can be seen on the state's interactive insurance rate webpage.

Politically-mandated discounts for mitigation differ from discounts voluntarily offered by insurers. If insurance companies choose to offer discounts for various mitigation features, the insurers must believe that expected cost savings justify the discount. While insurers might overestimate the expected cost savings due to a particular mitigation measure, insurer-initiated discounts will be based on expected damage reductions. Politically-mandated discounts need not be proportional to expected loss reductions; indeed, they could be a means of disguising below market premiums. Within the limit, the actuarially fair rate might be charged as a base premium for high-risk properties, but regulators could require excessive discounts for mitigation. The mandated discount, for instance, could exceed the expected loss reduction, with say a 20% discount being mandated for a measure which reduced loss by 10%. Or features like "wind resistant" doors, windows, or garage doors could be defined so inclusively as to include all regular doors and windows. Disguising premium subsidies as mitigation discounts raise the

transaction costs of detecting and opposing insurance subsidies for other state residents.[8] In this regard, consider the elaborate system of discounts in Florida. A construction engineer might have difficulty determining if all of the numerous mandated discounts actually involved subsidization.

Clearly policy holders must share the expected loss reduction to have an incentive to invest in mitigation. In the absence of some mechanism—a deductible, co-pay or premium discount—mitigation by homeowners amounts to altruism on behalf of increased insurance companies. The driving force behind mandated discounts is likely skepticism about whether insurers would actually lower premiums once homeowners invested in mitigation. The "greedy" insurance companies might be expected to keep all the gains for themselves. Yet the evidence shows that competitive pressures work to contain premium growth and lead to rate reductions despite regulation. Overall premiums written by the U.S. insurance industry are forecast to decline slightly in 2008, after remaining unchanged in 2007 (Insurance Information Institute 2007). The average cost of auto insurance fell nationally in three years out of ten between 1996 and 2005. Competition will lead to the savings from mitigation being passed on to consumers.

This analysis of mandated premium discounts must be tempered if regulated premiums are below the rates at which insurance companies would voluntarily write policies in high-risk coastal areas. Since companies lose money (in expected value terms) on policies written in high-risk areas, insurers would not be interested in offering discounts for mitigation. The first insurer to offer an actuarially justified discount for mitigation would likely increase their market share;

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[8] Disguising the form of the premium subsidy would represent a form of transactions cost augmentation, which could reduce opposition to the subsidy. On transactions cost augmentation generally, see Twight (1988).

normally this is the competitive pressure which passes cost savings on to customers. But if the base premium is too low, the insurer increases losses, not profits, by offering a discount. Premium discounts may need to be mandated in this case to provide an incentive for adoption of loss reduction measures which could reduce hurricane losses.

5.4. Connecticut and Hurricane Shutters

In the aftermath of Katrina, insurers and policy makers have seemingly become aware of the possibility of a major hurricane striking the New York City area, with the potential to cause tens of billions of dollars in damage. The area can be struck, as it has in the past, by major hurricanes. The 1938 Long Island Express for instance was a category 3 storm which killed over 550 persons and caused nearly $5 billion in damage in today's dollars when adjusting for inflation, even though Long Island at the time was largely rural. New York has $1.9 trillion in hurricane exposed property, which ranks 2nd nationally, while New Jersey ranks 5th with $506 billion and Connecticut 6th at $405 billion.

Insurance companies have undertaken a number of measures to reduce their hurricane exposure in the Northeast and to encourage mitigation by property owners. In Connecticut, some companies warned policy holders that their policies would not be renewed unless they installed hurricane shutters. As discussed above, hurricane shutters can provide important protection from wind-borne debris. Nonetheless the Connecticut state legislature passed a law to prevent insurers from making installation of shutters a condition for coverage, while the Connecticut Department of Insurance had already halted these actions.

An insurance company might require hurricane shutters or other mitigation as a condition of coverage for at least two reasons. First, the reduced loss might make writing a policy much

more attractive to insurers. Insurance companies might have better expected loss estimates for a property with hurricane shutters than without. That is, not only would the expected level of damage be lower with shutters, the variance of the loss could be lower as well. Ambiguity is an important factor in the pricing of insurance, with underwriters typically setting a significantly higher premium for risks which are uncertain (Kunreuther et al. 1995). The reduced variance of loss with shutters could increase the willingness of some insurance companies to write policies in high risk coastal areas.[9]

Second, the threat of policy cancellation or nonrenewal might be a valuable antidote to inertia or status quo bias. Homeowners might simply not give installation of hurricane shutters serious consideration otherwise. An information sheet included with new annual policy declarations might fail to alert the homeowner to the opportunity. Cancellation would necessarily provoke a policy holder into some action, even if only to find a new insurer. In a tight insurance market where policy holders have heard news stories about the difficulties encountered by homeowners when trying to find new coverage, the threat of cancellation might be just the incentive needed to induce a policy holder to install shutters, or at least carefully weigh the cost of shutters and the savings.[10]

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[9] Insurers may only wish to write policies for properties with mitigation if regulated maximum premiums are below the market level for regular properties but would be below expected damage for strengthened structures.

[10] If insurers tended to back off the threats to cancel policies if shutters were not installed, this would be evidence that the threats of cancellation were being used as a device to alert homeowners to mitigation options, in the manner described by Kirzner.

7. Market-Based Construction Quality Certification: The *Fortified ... for safer living* Program

Ultimately, building stronger homes and businesses involves quality certification. *Someone* must provide their assurance that the structure is built in the specified manner to reduce expected hurricanes losses. Traditionally the public sector has provided the assurance through building codes and the building inspection process. A home or business built in a jurisdiction with a building code is guaranteed to be built to code by the local government. Unfortunately, government's can be deficient on their guarantee of building to code. An estimated 25% of losses in Hurricane Andrew were attributed to poor enforcement of the South Florida Building Code (Mileti 1999, p.). Currently only 4 cities nationwide have the top rating of 1 for residential construction in the Insurance Services Office's Building Code Enforcement Grading Schedule (5 cities for commercial construction).[11]

The public sector's poor performance in assuring compliance with building codes is perhaps not surprising given a public agency's lack of financial stake in quality certification. Holcombe (1997, pp.93-106) makes the argument that market based quality certification, while not perfect, will generally outperform government quality certification. The value of an organization which markets quality certification depends on the decisions it makes, and particularly instances of product rejection or inadequate service. Rejection is not happily received; shutting down a firm that fails to comply with various codes for safe operation imposes costs on the owners and employees. Government regulators generally do not benefit personally from a reputation for quality certification, while they must play the villain and deliver the bad

[11] For details on the Building Code Effectiveness Grading Schedule and state summary of

news. Holcombe contends (p.103):

> The government will never lose profits from being a poor regulator; in fact, the opposite is likely to be true. If information that the government is doing a poor job of regulating an industry begins to circulate, typically there is a call for the government to do more regulation, which probably means bigger budgets for the regulatory agency. ... [L]apses in regulation can actually benefit a government regulatory agency because of the knee-jerk reaction to ask the government to do more to take care of us when a government failure becomes apparent. In contrast, if a private sector regulatory agency had the same lapse, its reputation would be damaged, its profits would decline, and it might be forced out of business.

Market-based organizations can provide an alternative mechanism for certifying the quality of construction and mitigation against hurricanes. The certification could serve as an alternative to public sector enforcement of building codes, or could be a way to certify construction practices that exceed existing building codes. One such effort is the *Fortified ... for safer living* program of the Institute for Business and Home Safety (IBHS). The program is designed to encourage the employment of construction and mitigation measures to reduce losses from a variety of natural hazards, including hurricanes. IBHS has developed design standards for *Fortified* homes (described in IBHS 2007). The program includes mandatory provisions and strongly-recommended provisions, for wind, hail, freezing weather, and flooding. For hurricanes, the *Fortified* program requires construction to windloads 20 mph in excess of the windloads typically incorporated into building codes. A home buyer or builder looking to build a *Fortified* home submits the design to IBHS, which assigns an approved inspector to ensure that

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rantings see www.isomitigation.com/bcegs/1000/bcegs1001.html.

the builder builds to the standards. At least four inspections are conducted during construction. Upon completion, IBHS awards a certificate to the homeowner if the home is accepted into the program. Builders are allowed to advertise that they build homes to the *Fortified* program requirements.

The *Fortified* homes program is relatively new, and thus its value in the market is still being established. To date about 100 homes have been constructed in 14 states, including all of the coastal states from Texas to North Carolina. Premium discounts of up to 25% for *Fortified* homes are available from the Mississippi Windstorm Underwriting Association and 10% from the South Carolina beach plan. In addition, American National offers a 25% premium reduction in Louisiana. The program currently offers certified inspectors in four hurricane prone states, Alabama, Florida, Louisiana, and Mississippi. More than 20 builders and Habitat for Humanity have built homes to the *Fortified ... for safer living* standards.[12]

8. Conclusions and Recommendations

Although we cannot prevent hurricanes, much has been learned about strengthening the built environment to reduce damage from hurricanes. Not all mitigation measures will be worth employing from an economic perspective, but the prospect of inefficiency in mitigation looms large given the potential for hurricanes to devastate an entire region and stress insurance and reinsurance markets. Efficient mitigation faces a number of challenges, including potentially low probability event bias, myopia, and status quo bias. The existence of these problems might suggest the need for regulatory mandates to force the adoption of otherwise overlooked

[12] Peter Hamer, Institute for Business and Home Safety, personal communication,

mitigation measures. But evidence suggests that myopia, inertia, and bias can be overcome through private means since mitigation does have value in markets. Conversely, the public sector has done a relatively poor job enforcing building codes, which incorporate many of the construction techniques which could reduce hurricane damage.

Providing sufficient incentives to alert policy holders to beneficial mitigation opportunities will prove challenging for insurers and insurance regulators. The difficulty of the task suggests the value of affording insurers considerable discretion to craft contractual arrangements that induce policy holders to undertake mitigation. Insurers may wish to share the upfront cost of mitigation in exchange for a long term commitment, or take advantage of receptiveness toward mitigation in the aftermath of a hurricane to rebuild a stronger built environment. Restrictions on contractual mechanisms insurers can employ, as highlighted by Connecticut's prohibition on making mitigation mandatory for policy renewal, can be quite counterproductive. We cannot know what mechanisms might prove successful in overcoming inertia and bias. Regulation might end up prohibiting the use of a valuable technique. Also insurers should not face a large burden to justify premium discounts they might wish to employ to encourage mitigation. Regulatory approval of individual discounts increases the cost to insurers of offering mitigation incentives and implies that regulators know better how to price mitigation than insurers do, even though some state insurance commissions have very modest staffing levels and resources.

The success of insurance companies in marketing mitigation can affect the insurer's willingness to write insurance in high-risk coastal areas. Conceivably a poorly-built home or business might comprise too ambiguous a risk for insurers to underwrite. An insurer might only

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want to underwrite manageable risks, say, buildings protected by shutters or secondary water resistance. If regulators prevent the insurer from selecting types of risks they feel comfortable underwriting, the insurer may choose to exit the market altogether. State run residual markets for wind coverage, hurricane or wind pools, have expanded enormously in the last several years, and policy makers in coastal states have voiced concern over the availability of insurance. Policy makers should carefully reexamine restrictions on mitigation provisions in insurance contracts which could be reducing the market supply of insurance.

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