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The Perverse Effects of Subsidized Weather Insurance

Kyle D. Logue
University of Michigan, klogue@umich.edu
Omri Ben-Shahar
University of Chicago Law School, omri@uchicago.edu

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Omri Ben-Shahar and Kyle D. Logue

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SUBSIDIZED WEATHER INSURANCE

Omri Ben-Shahar and Kyle D. Logue[*]

Abstract

This Article explores the role of insurance as a substitute for direct regulation of risks posed by severe weather. In pricing the risk of human activity along the predicted path of storms, insurance can provide incentives for efficient location decisions as well as for cost-justified mitigation effort in building construction and infrastructure. Currently, however, much insurance for severe weather risks is provided and heavily subsidized by the government. The Article demonstrates two primary distortions arising from the government's dominance in these insurance markets. First, the subsidies are allocated differentially across households, resulting in a significant regressive redistribution, favoring affluent homeowners in coastal communities. The Article provides some empirical measures of this effect. Second, the subsidies induce excessive development (and redevelopment) of storm-stricken and erosion-prone areas. While political efforts to scale down the insurance subsidies have so far failed, by exposing the unintended costs of government-subsidized insurance this Article contributes to reevaluation of the social regulation of weather risk.

INTRODUCTION

Catastrophes due to severe weather are perhaps the costliest accidents humanity faces.[1] While we are still a long way from having technologies that would abate the destructive force of storms, there is much we could do to reduce their impact. True, we cannot regulate the weather. But through smart governance and well designed incentives, we can influence human exposure to the *risk* of bad weather. We may not be able to control high winds or storm surges, but we can encourage people to build sturdier homes with stronger roofs far from flood plains. We call weather-related catastrophes "natural disasters," but the losses due to severe weather are the result of a combination of natural forces and often imprudent and shortsighted human decisions induced by questionable government policies.[2]

Regulating weather risk is an increasingly urgent social issue. There is little doubt that the frequency and magnitude of weather-related disasters are rising over time.[3] Although the precise combination of causes may be debated—emissions of greenhouse gases? natural climatic cycles? increased concentration of populations in coastal areas?[4]—the

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[1] As of 2008, of the twenty mostly costly insured catastrophes in the world, eighteen were weather related. The other two were the 9/11 and the Northridge Earthquake. HOWARD C. KUNREUTHER & ERWANN O. MICHEL-KERJAN, AT WAR WITH THE WEATHER: MANAGING LARGE-SCALE RISKS IN A NEW ERA OF CATASTROPHES 28-29 (2009).

[2] *See, e.g.*, WORLD BANK, NATURAL HAZARDS, UNNATURAL DISASTERS: THE ECONOMICS OF EFFECTIVE PREVENTION 23 (2010) ("[N]atural disasters, despite the adjective, are not 'natural.' Although no single person or action may be to blame, death and destruction result from human acts of omission—not tying down the rafters allows a hurricane to blow away the roof—and commission—building in flood-prone areas. Those acts could be prevented, often at little additional expense.")

[3] *See, e.g.*, Adam B. Smith & Richard W. Katz, *US Billion-Dollar Weather and Climate Disasters: Data Sources, Trends, Accuracy & Biases*, 67 NAT. HAZARDS 387 (2013) (evaluating data on insured losses published at NAT'L OCEANIC & ATMOSPHERIC ADMIN., BILLION-DOLLAR WEATHER/CLIMATE DISASTERS (2013), *available at* http://www.ncdc.noaa.gov/billions/events). This study estimates the measure of total losses at $1.1 trillion for the period from 1980 to 2011. *Id.* at 388.

[4] For an argument that, although climate change is undeniably occurring and is affected by human influence (mainly through carbon emissions), the relationship between climate change and severe weather has been overstated, see the work of Professor Roger Pielke Jr., summarized and referenced in *An Obama Advisor Is Attacking Me for Testifying that Climate Change Hasn't Increased Extreme Weather,* THE NEW REPUBLIC (Mar. 5, 2014), http://www.newrepublic.com/article/116887/does-climate-change-cause-extreme-weather-i-said-no-and-was-attacked. For evidence that at least one cause is increasing population density around the coasts, see sources cited *infra* note 8.

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trend is undisputed. Hurricane Katrina in 2005 and Hurricane Sandy in 2012 brought unprecedented property damage to the Gulf states and to the coastal northeastern states;[5] and in 2013 Typhoon Haiyan, which devastated the Philippines, eliminating entire villages and killing thousands, may have been the strongest tropical cyclone to hit land in recorded history.[6] Beyond anecdotes, the trend is clear: weather-disaster losses are rising.[7]

As the magnitude and frequency of weather patterns seem to pose a higher risk than ever, a large and growing fraction of humanity's physical assets is located in harm's way.[8] Thus, the combination of severe natural forces and increased human exposure pose one of the major public policy challenges of our era: how to regulate behavior so as to reduce this risk.

There are many ways that societies can reduce the risk of increasingly large and potentially devastating storms. Our thesis in this article is simple: the most effective way to prepare for storms is through insurance. But not in the obvious way commonly understood—of insurance as a form of post-disaster relief. Rather, we mean insurance as a form of private regulation of safety—a contractual device controlling and incentivizing behavior *prior to the occurrence of losses.*

This argument—that insurance can create incentives for risk mitigation—might surprise some of our readers. Like many, they have been schooled in the paradigm that insurance creates moral hazard. Insurance may be good as a form of post-disaster relief and risk shifting,

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[5] Christopher F. Schuetze, *2012: The Year of Extreme Weather*, N.Y. TIMES IHT RENDEZVOUS BLOG (Jan. 14, 2013, 9:48 AM), http://rendezvous.blogs.nytimes.com/2013/01/14/2012-the-year-of-extreme-weather/. In 2012, there were eleven weather and climate disaster events in the U.S. with losses exceeding $1 billion. These eleven events cumulatively caused approximately $116 billion in damages and 113 deaths, making 2012 the second costliest year since 1980). In 2005, total damages equaled $198 billion. NAT'L OCEANIC & ATMOSPHERIC ADMIN., BILLION-DOLLAR WEATHER/CLIMATE DISASTERS (2013), *available at* http://www.ncdc.noaa.gov/billions/summary-stats.

[6] *Typhoon Haiyan: Worse Than Hell*, THE ECONOMIST, Nov. 16, 2013.

[7] See, e.g., Smith & Katz, *supra* note 3, at 4 (using NOAA data); Peter Hoeppe, *Why are Cities Particularly Affected by Climate Change?*, GENEVA ASSOC. *available at* https://www.genevaassociation.org/media/907365/ga_6th_eecr_seminar_hoeppe.pdf.

[8] NAT'L OCEANIC & ATMOSPHERIC ADMIN., NATIONAL COASTAL POPULATION REPORT: POPULATION TRENDS FROM 1970 TO 2020 3 (2013) (showing the higher rate of population density growth in coastal regions than national rate); Brenden Jongman et al., *Global Exposure to River and Coastal Flooding*, 22 GLOBAL ENVTL. CHANGE 823, 829 (2012) (showing relative changes in population exposed to coastal flooding over changes in total population, 1970–2010).

but the downside is that it dulls the insured party's incentive to mitigate losses.

We think that the application of the moral hazard theory to insurance has been overstated. We have written an article dedicated to debunking the myth that insurance necessarily creates moral hazard.[9] We showed that insurers of all sorts of risks use a variety of contractual tools to create counter-incentives and prompt policyholders to reduce risks. While it is true that in some settings the presence of insurance coverage can induce inefficient precautions, the opposite can also be true: through powerful incentives provided in the insurance contract, people who purchase insurance often do not fall prey to the moral hazard distortion, and may even take more efficient precaution relative to the uninsured. This general observation, based on empirical examination of insurance contracts, holds also for weather-related risks: the insurance relationship could prompt policyholders to take a more, rather than less, care. Deploying their superior access to risk data and prediction methods, and pressured by competition to keep premiums affordable, insurers prompt policyholders to mitigate their exposure to severe weather. An entire community's preparedness for severe weather is importantly shaped and potentially improved by the aggregation of insurance contracts held by the community's members.

But in the U.S., insurance is denied its potential role as an efficient regulator of pre-storm conduct. It does not induce rational precautions by individuals, cost-justified community development by localities, or efficient infrastructure investment. American insurance fails to achieve these straightforward and enormously important roles for a reason that can be stated in one sentence: *insurance policies for weather related losses are not priced to reflect the real risk*. As a result of government intervention in property insurance markets, through either rate regulation or direct government provision of subsidized insurance, private markets no longer generate prices signals regarding the cost of living in severe weather regions. The cost of insurance is suppressed, thus failing to alert private parties who purchase property insurance to the true risk of living dangerously. It allows these private parties to (rationally) assume excessive risk, and dump the cost of living in the path of storms on others. Indeed, much of the development of storm-stricken coastal areas is due to insurance subsidies, and would likely not have happened at the same magnitude otherwise.[10]

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[9] *See* Omri Ben-Shahar & Kyle D. Logue, *Outsourcing Regulation: How Insurance Reduces Moral Hazard*, 111 MICH. L. REV. 197 (2012).

[10] The Article here builds on the work of numerous researchers who have long studied the subject of catastrophic weather risks, some of whom have reached conclusions similar to the ones that we reach—including the observation that

Public debates over subsidized weather insurance often choose ignore or downplay the over-development and excessive risk distortion, because they regard government's intervention in weather insurance markets has an important upside that trumps any efficiency distortion. Government intervention is in property insurance markets is justified and even necessary because—so goes the argument—it makes insurance for severe weather affordable. Insurance subsidies are necessary to help support low income and working class people who might otherwise be unable to afford insurance and would therefore not be able to buy or remain in their homes. Subsidizing weather insurance is "our moral duty to the poorest people and working people and lower middle income people,"[11] preventing "working families who are doing everything they can to put food on the table" from losing their homes.[12] The subsidy, in other words, is thought to promote a redistribution that benefits economically weak populations.

We have long suspected that this justification is false. Our suspicion rested on the puzzling differential treatment of hurricanes versus tornados. These two types of severe storms cause similar aggregate magnitude of property destruction,[13] but federal subsidies apply to flood losses caused by hurricanes, not to wind losses caused by tornadoes. This was puzzling because hurricane victims live closer to water than tornado victims, and it is generally known that living close to water is a privilege of the affluent. This pattern, of subsidies going only to some classes of victims of severe weather but not to all, seemed inconsistent with the affordability-of-insurance rationale.

To explore this suspicion we looked at the data and report it here. We examined insurance data from the government run insurance program in Florida, which subsidizes homeowners insurance in the state

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publicly provided catastrophe insurance and relief payments can undermine efficient incentives to minimize weather-related harms. Howard Kunreuther in particular is a pioneer in this field. *See, e.g.,* Howard Kunreuther, *Mitigating Disaster Losses through Insurance*, 12 J. RISK & INS. 171 (1996). See also KUNREUTHER & MICHEL-KERJAN, *supra* note 1; PAYING THE PRICE: THE STATUS AND ROLE OF INSURANCE AGAINST NATURAL DISASTER IN THE UNITED STATES (Howard Kunreuther & Richard J. Roth, Sr., eds. 1998); Martin F. Grace & Robert W. Klein, *The Perfect Storm: Hurricanes, Insurance, and Regulation*, 12 RISK MGMT. & INS. REV. 81 (2009); and J. David Cummins, *Should the Government Provide Insurance for Catastrophes?*, 88 FED. RES. BANK OF ST. LOUIS REV. 337 (2006).

[11] Barney Frank

[12] (S. Heidi Heitkamp).

[13] Cite annual costs of hurricanes and tornadoes

most vulnerable to severe weather impact. We find strong correlation between subsidy and wealth. Our data shows that wealthier households receive higher subsidies in the form of underpriced insurance. And the magnitudes of the wealth effects are surprisingly large.

Our study, and in particular our findings regarding the correlation between wealth and subsidy, are intended to shed light on recent legislative activity, which, unfortunately, only made things worse. In the aftermath of Hurricane Sandy and the enormous bill that FEMA – the agency that administers the federal subsidies for flood insurance—had to foot, Congress enacted with bipartisan support the Biggert Waters Flood Insurance Reform Act of 2012. It intended to scale back the subsidies and had the potential to provide better incentives for human preparedness to floods.

But Congress did not let this laudable new statute live long enough to do any good. Immediately after it was enacted, subsidy recipients, now scheduled to lose their subsidies, protested, and Congress quickly reacted—again, with a rare showing of bipartisan consensus—enacting what amounts to almost a full repeal of the 2012 reform. The Homeowner Flood Insurance Affordability Act of 2014 restored the federal subsidies and cross-subsidies for flood insurance. Our results show that the rhetorical premise invoked by supporters of this act—that hard working low-income people need it to keep their homes—is misguided. The beneficiaries of weather insurance subsidies are *not* low income folks. This finding is consistent with some prior work on the distributional consequences of government-provided flood insurance at the national level.[14]

We begin our analysis with a brief conceptual section that explains how property insurance can operate as a regulator of weather risk—what tools insurance contracts use to improve the severe weather preparedness of their policyholders. Section II then reviews (again, briefly) the features of government-provided insurance for severe weather, focusing on two programs: the National Flood Insurance Program, and Florida's state owned Citizens Insurance. Section III is the heart of our article (and readers are more than welcome to skip I and II and head directly to where our incremental contribution lies). It presents

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[14] J. Scott Holladay & Jason A. Schwartz, *Flooding the Market: The Distributional Consequences of the NFIP*, Pol'y Br. No. 7, N.Y.U. Inst. for Pol'y Integrity (2010), at 4, (http://policyintegrity.org/documents/FloodingtheMarket.pdf.) But see Okmyun Bin, John A. Bishop, & Carolyn Kousky, *Redistributional Effects of the National Flood Insurance Program*, 000(00) PUBLIC FINANCE REVIEW 1 (2012) (reaching the opposite conclusion).

and defends our two normative claims: Government insurance creates (i) unfair pooling of risk, favoring affluent policyholders, and (ii) it leads to inefficient preparedness, locating far too many assets in the predictable path of storms.

I.   REGULATION OF WEATHER RISK BY INSURANCE

Weather risks can be reduced by direct command-and-control government regulation, mandating standards of pre-disaster conduct. Common examples include the adoption of building codes that require structures to be resistant to severe storms and other harsh conditions, or zoning restrictions that stop people from moving into the predicted path of storms. Private insurance contracts are a different type of regulation. Lacking the authority to mandate conduct, insurance companies create *contractual* incentives for insureds to engage in precautionary behaviors that cost less than the risk they reduce.

Whereas command is the ultimate regulatory lever of a government agency, insurers use price. The insurance company's way of creating incentives to reduce risk is to award lower prices to policyholders who face lower expected harms. Providing a menu of differentiated premiums induces individuals and firms to behave in ways that qualify for the insurance discounts. Auto insurers, for example, provide premium discounts for those who drive safer cars, less often, and accident-free. Life insurers charge lower premiums for not smoking or scuba diving. And property insurers discount homes that face lower risk of loss due to severe weather.

In some areas of insured activity, insurers may not have the proper information to provide accurate discounts in return for policyholders' safety investment (although monitoring technologies increasing make such information available). [15] But asymmetric information is generally not a problem in regards to weather insurance. On the contrary, property insurers, both private and public, typically have much of the risk-relevant information on weather hazards, information far superior to that which homeowners have.

An insurance policy that is priced according to risk features can become a powerful regulator of behavior. Differentiated premium make it more costly for people to forgo safety investments. Policyholders are

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[15] *See* Georges Dionne et al., *Adverse Selection in Insurance Contracting*, *in* HANDBOOK OF INSURANCE 231 (Georges Dionne ed., 2013); Alma Cohen & Peter Siegelman, *Testing for Adverse Selection in Insurance Markets*, 77 J. RISK & INS. 39 (2010).

free to decide whether or not to install storm windows or roof anchors; no insurance broker is going to tell them that they must. But in regions in which these installations are cost-effective, the premium discounts would more than offset the cost.

One nice feature of this form of safety regulation is avoiding the crude trade-off inherent in command-and-control mandates. There is no need for the regulator to make an up-or-down binary choice whether to permit or prohibit some action. Instead, insurers build into the prices of their contracts the expected risk reduction associated with each safety investment, and then policyholders are allowed to self-select. Zoning regulations, for example, may require homes to be built at particular elevations, or may mandate the use of stilts or pilings, to maximize the chances that the homes will survive a storm surge. Insurance regulation, by contrast, does not mandate but instead provides a menu of options—premium discounts to homes that invest in different degrees of precautions. Some, but not all, policyholders may choose to make the investments. The sorting that results from this menu approach to regulation avoids the over- (or under-) inclusiveness of government-mandated, across-the-board, all-or-nothing safety requirements.

Differentiated risk-based premiums affect not only the investment in precautions but also the level of the insured's activity. In the context of weather insurance, this activity-calibrating effect is enormously important. A crucial element of humanity's preparedness for severe weather is the determination where to live, and in particular, where *not* to live. If the cost of exposure to severe weather is fully captured by the insurance rate, and thus fully borne by homeowners, they would make optimal location decisions (prompted by their mortgage lenders who require them to purchase full insurance). The leisure value of oceanfront living would be traded off against the full cost of such living, which should include the full insurance cost.

The main tool for insurance regulation of severe weather preparedness is the homeowners' insurance policy, which, with the exception of flood damage (discussed below), covers most storm-caused losses (primarily wind damage). The main factor that determines the premium differentials across policies is location: areas with most storm activity face the highest premiums. Location pricing depends both on historical data as well as prediction models, demographic trends, and construction practices. [16] Premiums may be reduced dramatically

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[16] *See* Cassandra R. Cole, David A. Macpherson & Kathleen A. McCullough, *A Comparison of Hurricane Loss Models*, 33 J. INS. ISSUES 31 (2010); Aarti Dinesh, *How Catastrophe Experts Model Hurricane-Induced Storm* Surge, INSURANCE JOURNAL (July 1, 2013), http://www.insurancejournal.com/magazines/features/2013/07/01/296787.htm.

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according to particular construction specifications. [17] For example, hurricane loss models used by insurance companies estimate that a home with a hip (pyramid shaped) roof tend to sustain four percent less damage than a home with a roof with gable ends. [18] In fact, flood insurance sold by private insurers depends on so many risk and mitigation factors that the rating sheet used by brokers to determine premiums is thirty pages long.[19]

The potential of regulation by insurance is, of course, limited by various transactions costs. Some information is not worth sorting, even for the insurance industry. Some safety investments are not incentivized because they have long-term or external social value not captured by the insured. With homeowners' insurance, for example, most policies are sold not on new construction but on existing buildings, at a time when various structural safety investments can no longer be made and thus can no longer be regulated by the policies. But buyers of new homes would take into account the overall cost of purchasing the asset, including insurance costs (and future insurance costs affecting the resale value), thus internalizing the risk and its mitigation costs into the decision of the land developer. Nevertheless, and despite the relative information efficiency of insurance markets, regulation by insurance is limited by the information available at the time of new construction.

In the context of weather risks, private insurance also enhances the regulatory benefits of municipal building codes. Since storm resistance depends to a large extent also on municipal building codes, the private insurance industry rates the different localities' home-building standards and how well they are enforced. These building-code=effectiveness ratings are used by individual insurers to vary their

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[17] For example, at least four states permit property insurers to discount premiums if the insured property is certified according to standards created by the insurance industry's research center, the Insurance Institute for Business and Home Safety. *FORTIFIED Home™: Hurrican Financial Incentives*, INSURANCE INSTITUTE FOR BUSINESS & HOME SAFETY, http://www.disastersafety.org/wp-content/uploads/FORTIFIED-Home-Incentives_IBHS.pdf (listing Alabama, Georgia, Mississippi, and North Carolina as states allowing or requiring incentive programs by insurers based on IBHS certification); *see also FORTIFIED Overview*, INSURANCE INSTITUTE FOR BUSINESS & HOME SAFETY https://www.disastersafety.org/fortified-main/ (last visited Dec. 29, 2014) (explaining the IBHS certification process).
[18] Cole, Macpherson & McCullough, supra note __ at 38.
[19] U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-13-568, FLOOD INSURANCE: IMPLICATIONS OF CHANGING COVERAGE LIMITS AND EXPANDING COVERAGE 15 (2013), *available at* http://www.gao.gov/assets/660/655719.pdf [hereinafter GAO-13-568, FLOOD INSURANCE].

premiums across the rated districts.[20] For example, the rating may vary with the type of foundation the jurisdiction mandates for building in the floodplain, how it addresses post-disaster reconstruction permits, the funding it allocates to building code enforcement, how it trains its inspectors, and the standards it uses to review design of new construction.[21] This puts pressure on state and local governments to tighten their building codes and their enforcement of those codes.

II. GOVERNMENT-PROVIDED WEATHER INSURANCE

The previous part examined the tools that insurance markets use to regulate behavior before weather disasters strike, with the primary tool being insurers' ability to rate risks—to charge relatively high premiums for properties located in high-risk areas or properties that lack state-of-the-art weather mitigation features. We now turn to examine how government-provided weather insurance works, and how it differs from private insurance.

Why, you might wonder, is the government involved in weather insurance in the first place? Why not leave all weather risk insurance to the private market? There are several rationales commonly offered to justify governments acting as insurers of weather risk.

First, it is sometimes argued that truly catastrophic weather events are sufficiently rare that property owners systematically underestimate the risk.[22] According to this behavioral account, purchasers of weather insurance do not fully appreciate the risk of severe weather and are therefore unwilling to pay actuarially fair premiums that insurers' require to provide coverage.

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[20] *See Rating the States: An Assessment of Residential Building Code and Enforcement Systems for Life Safety and Property Protection in Hurricane-Prone Regions*, INSURANCE INSTITUTE FOR BUSINESS & HOME SAFETY *available at* http://www.disastersafety.org/wp-content/uploads/ibhs-rating-the-states.pdf.

[21] *See Building Code Effectiveness Grading Schedule (BCEGS®) Questionnaire* (ISO Properties, Inc. 2004)*, available at* http://www.isrb.com/pubs/BCEGS%20Questionnaire.pdf.

[22] *See* Joshua Aaron Randlett, Comment, *Fair Access to Insurance Requirements*, 15 OCEAN & COASTAL L.J. 127 (2010) (describing private insurers' withdrawal from coastal Massachusetts markets, leaving residents with only a state agency from which to purchase property insurance); *see also* HOWARD C. KUNREUTHER ET AL., INSURANCE & BEHAVIORAL ECONOMICS 113–16 (2013) (describing the demand anomaly of failure to protect against low-probability, high-consequence events)

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Second, the problem may lie not with the demand for, but rather with the supply of flood coverage. Weather calamities may be too large or correlated to be insured through private markets. Or they may be too difficult to predict and price in accordance with prevailing actuarial practices. This would be consistent with assertions from insurance industry analysts that, at least during periods of tight markets, there is often insufficient insuring capacity, even within reinsurance markets.[23]

Third, government provision of weather insurance may be necessary for affordability (redistributive) reasons. Even if policyholders were seeking to purchase and insurers were willing to provide actuarially priced weather disaster insurance, many policyholders simply could not afford such coverage, especially in areas where the risk is large and thus costly to insure.[24]

These rationales purport to provide the theoretical basis for government-provided weather-risk insurance. What form it should take is a separate question. In the remainder of this Part, we briefly discuss two programs, in which the government acts like an insurance company: issuing (or subsidizing the issuance of) actual insurance contracts, charging premiums, and paying coverage to its premium-paying clients. To be sure, the government also insures weather risk through post-disaster relief, through the Disaster Relief Fund,[25] providing benefits to victims who suffer qualifying losses, paid for not by collecting premiums but though tax revenue.[26] The relief includes relatively small grants (up to $30,0000)[27] or loans.[28] The government also provides some disaster

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[23] *See generally* KUNREUTHER & MICHEL-KERJAN, supra note __, at 189-195 (discussing question of reinsurance capacity).

[24] *See* Richard A. Derrig et. al, *Catastrophe Management in a Changing World*, 11 RISK MANAGEMENT & INS. REV. 269, 272 (2008).

[25] *See Disaster Relief Fund: Monthly Report*, FED. EMERGENCY MGMT. AGENCY, http://www.fema.gov/disaster-relief-fund (last updated Dec. 9, 2014); *Public Assistance: Local, State, Tribal, and Non-Profit*, FED. EMERGENCY MGMT. AGENCY, http://www.fema.gov/public-assistance-local-state-tribal-and-non-profit (last updated July 24, 2014). The federal government covers only 75 percent of disaster-related expenses, while states have to contribute the remaining 25 percent. *See* 42 U.S.C. § 5174(g) (2013). States, however, can petition to increase the federal share as high as 100 percent.

[26] The Disaster Relief Fund was created by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C §§ 5121–5208 (2013). According to the Stafford Act, each state, through its governor, must request assistance from the President. *Id.* at § 5170. As part of this request, the state must assert that the state has an emergency plan that has been implemented, but that the state's plan is not sufficient to meet the need resulting from the disaster.

[27] *See generally Disaster Loan Program*, U.S. SMALL BUSINESS ADMINISTRATION, http://www.sba.gov/content/disaster-loan-program (last visited Nov. 5, 2014). Federal disaster declarations occur with some frequency. Between 2004 and 2011,

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relief by subsidizing private disaster-aimed charity, through the charitable contributions deduction. But although charitable disaster relief can grow very large, it is dwarfed by government relief and by subsidized government insurance,[29] to which we now turn.

1. The National Flood Insurance Program

Prior to the adoption of federally provided flood policies, flood risks were covered through private insurance contracts sold by commercial insurance companies. But they were not part of the basic homeowners insurance policy; instead, they had to be purchased as an added coverage, priced separately. Because, as we explained above, many property owners opted not to purchase the flood coverage, the federal government disaster relief fund was called upon for flood relief when the big floods eventually hit. The National Flood Insurance Program (NFIP) was created to provide relief from flood losses in a way that minimized the financial burden on federal taxpayers.

Through the NFIP, the federal government sells flood insurance policies to residential and commercial property. Although NFIP policies are marketed largely through private insurance companies, they are fully underwritten by the federal government.[30] Coverage under NFIP flood

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the President received state requests for 629 disaster declarations, of which 539 (or 86 percent) were approved.

[28] 42 U.S.C. § 5174(h) (2013) (setting maximum disaster relief award at $25,000 per disaster, adjusted annually for inflation). In addition to repairs and reconstruction, FEMA will cover temporary housing as well as, disaster-related medical, clothing, fuel, moving and storage, and even burial expenses. *Disaster Assistance Available from FEMA*, FED. EMERGENCY MGMT. AGENCY, http://www.fema.gov/disaster-assistance-available-fema (last visited Nov. 5, 2014).

[29] For example, hurricane Katrina, which was the most expensive disaster in U.S. history, led to charitable relief of roughly $2.5 billion. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-06-297T, HURRICANES KATRINA AND RITA: PROVISION OF CHARITABLE ASSISTANCE (2005), *available at* http://www.gao.gov/new.items/d06297t.pdf. The federal disaster relief, by comparison, for the 2005 hurricane season, exceeded $100 billion. MATT FELLOWES & AMY LIU, BROOKINGS INSTITUTION, FEDERAL ALLOCATIONS IN RESPONSE TO KATRINA, RITA AND WILMA: AN UPDATE (2006), *available at* http://www.brookings.edu/~/media/research/files/reports/2006/8/metropolitanpolic y%20fellowes/20060712_katrinafactsheet.pdf. By further comparison, private insurance coverage for Katrina totaled $41.1 billion. Robert P. Hartwig & Claire Wilkinson, *Hurricane Katrina: The Five Year Anniversar*y 2 (Ins. Info. Inst. 2010), *available at* http://www.iii.org/sites/default/files/1007Katrina5Anniversary.pdf.

[30] GAO, FLOOD INSURANCE, *supra* note 19, at 4. There is a small private insurance market that provides coverage for home values in excess of the ceiling under the NFIP. *Id.*

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policies is statutorily capped at $350,000 for homeowners and $1 million for commercial property owners.[31]

NFIP policies are subsidized, which means that the premiums collected are not sufficient to cover flood claims, and the deficit is passed on to the Treasury Department. As a result, the U.S. taxpayer is currently the reinsurer of truly catastrophic flood risks. And because NFIP policies are cheaper than flood insurance sold in the private market, they have come to dominate the flood risk market.[32]

In addition to providing affordable flood coverage, the NFIP seeks to incentivize flood mitigation. To participate in the program and to entitle their residents to buy subsidized NFIP policies, communities are required adopt and enforce a floodplain management ordinance to reduce future flood risks to new construction. In these areas, new construction and substantial improvements must conform to NFIP's building standards. For example, the lowest floor of a structure must be elevated to or above the "base flood elevation" — the level at which there is a 1 percent chance of flooding in a given year.

While the rates charged by NFIP to its policyholders are based on flood maps that reflect the likelihood of floods in the different regions,[33] the maps are often out of date.[34] Even when the maps are

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[31] *Id*. at 9.

[32] According to a RAND study published in 2006, 49 percent of all SFHs in SFHAs had NFIP policies and another 1 to 3 percent had private policies. LLOYD DIXON, NOREEN CLANCY, SETH A. SEABURY & ADRIAN OVERTON, RAND, THE NATIONAL FLOOD INSURANCE PROGRAM'S MARKET PENETRATION RATE: ESTIMATES AND POLICY IMPLICATIONS (2006), *available at* http://www.rand.org/content/dam/rand/pubs/technical_reports/2006/RAND_TR300 .sum.pdf.

[33] *National Flood Insurance Program*, FED. EMERGENCY MGMT. AGENCY, http://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping (last updated Oct. 23, 2014); *Flooding and Flood Risks: Understanding Flood Maps*, NAT'L FLOOD INS. PROGRAM, https://www.floodsmart.gov/floodsmart/pages/flooding_flood_risks/understanding_ flood_maps.jsp(last visited Nov. 6, 2014).

[34] CONG. BUDGET OFFICE, PUB. NO. 4008, THE NATIONAL FLOOD INSURANCE PROGRAM: FACTORS AFFECTING ACTUARIAL SOUNDNESS 14 (), *available at* http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/106xx/doc10620/11-04- floodinsurance.pdf; *see also* Theodoric Meyer, *Using Outdated Data, FEMA is Wrongly Placing Homeowners in Flood Zones*, PROPUBLICA (July 18, 2013, 12:07 PM) http://www.propublica.org/article/using-outdated-data-fema-is-wrongly- placing-homeowners-in-flood-zones. Changes made by Biggert-Waters were supposed to improve the updating process. *Id*.; Scott Gabriel Knowles, *Biggert-Waters and NFIP: Flood Insurance Should Be Strengthened*, Slate (March 23, 2014, 11:47 PM),

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updated, there are cross-subsidies among insureds within the system and a substantial percentage of property owners in high-risk areas are deliberately asked to pay well below actuarial rates.[35] The maps are politicized: attempts by FEMA to update them and base the premiums on more actuarially sound calculus meets political influence.[36] As a result, currently the NFIP is operating at a massive deficit, estimated in 2014 to be around $24 billion.

In response to this budget deficit and the concern that it might grow, lawmakers in 2012 enacted the so-called Biggert-Waters Flood Insurance Reform Act.[37] Biggert-Waters sought to gradually eliminate the underfunding of the NFIP and curb the disturbing cross-subsidies built into the program. For example, Biggert-Waters was going to phase out the subsidies entirely for certain "repetitive loss properties," second homes, business properties, homes that have been substantially improved or damaged, and homes sold to new owners. Biggert-Waters permitted much faster NFIP annual rate increases (25 percent annually, up from previous 10 percent cap), and required all premiums to be based on "average historical loss years," including catastrophic loss years. One of the most controversial aspects of the new law was the elimination of grandfathering for the many older buildings in high-risk areas.

However, the backlash from property owners along coastal areas, where resulting premium increases were the greatest, was swift and effective.[38] In some areas, there were reports of homeowners' premiums rising tenfold.[39] The concern expressed by many lawmakers, on behalf of their angry constituents, was that unless Biggert-Waters was repealed or at least delayed, they wouldn't be able to remain in their homes or continue their small businesses. Thus, before Biggert-Waters was able to take effect, Congress passed in 2014 the Homeowner Flood Insurance

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http://www.slate.com/articles/health_and_science/science/2014/03/biggert_waters_and_nfip_flood_insurance_should_be_strengthened.html.

[35] RAWLE O. KING, CONG. RESEARCH SERV., R42850, THE NATIONAL FLOOD INSURANCE PROGRAM: STATUS AND REMAINING ISSUES FOR CONGRESS 19–20 (2013).

[36] *See* Bill Dedman, *FBI Investigates FEMA Flood Map Changes After NBC News Report*, NBC NEWS (Mar. 27, 2014), http://www.nbcnews.com/news/investigations/fbi-investigates-fema-flood-map-changes-after-nbc-news-report-n62906.

[37] Pub. L. No. 112-141 §§ 100201–100261, 126 Stat. 405, 916–79 (2012).

[38] Jenny Anderson, *Outrage as Homeowners Prepare for Substantially Higher Flood Insurance Rates*, N.Y. TIMES, July 29, 2013, at A12.

[39] Thomas Ferraro, *U.S. Senate Passes Bill to Delay Hikes in Flood Insurance Rates*, REUTERS (Jan. 30, 2014), http://www.reuters.com/article/2014/01/30/us-usa-insurance-flooding-idUSBREA0T1WK20140130.

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Affordability Act (HFIAA)[40], which significantly weakened the changes made by Biggert-Waters. The political pressure to repeal Biggert-Waters was so successful that even Representative Maxine Waters voted in support of repealing her own bill. As a result, the 2014 Act imposed tighter limits on yearly premium increases, reinstated the NFIP grandfathering provision, and preserved the discounted premiums for sold properties. The new law also called on FEMA to keep premiums at no more than 1 percent of the value of the coverage.

2. *Florida's Citizens Property Insurance Corporation*

The other example of large-scale government-sold insurance for weather risk is Florida's Citizens Property Insurance Corporation (Citizens)—a state owned company that specializes in wind-damage (and other, multiple-peril) coverage for homeowners and businesses in Florida. Wind damage, of course, is the largest element of weather risk covered by these policies, since flood damage, the other major weather peril, is already covered almost exclusively by the NFIP. Indeed, Citizens provides the vast majority of the wind insurance for properties on the coast of Florida; and in many high-risk coastal areas, Citizens is the only insurer in Florida offering wind policies. The company collects premiums that are used to pay the losses covered under the policies, but, as with the NFIP, the premiums are far below what is necessary to cover the full risk.[41]

At first glance, Citizens appears to price its wind coverage in the same way private insurers do. Citizens begins by evaluating the risk of wind damage in particular areas, which consist of 150 geographic rating territories. Citizens then gives each territory a particular rate that takes into account weather patterns, construction methods, and past losses in that area. These wind rates are set with the use of sophisticated computer modeling techniques, informed by data about hurricane patterns, and adjusted periodically based on new information and updated experience. These base rates are then used by Citizens to determine the individualized premium charged for individual policies.

This rating methodology is identical to the approach followed by private insurers, with one big difference. Citizens' premiums do *not*

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[40] Pub. L. No. 113-89, 128 Stat. 1020 (2014).

[41] FLA. COUNCIL OF 100 & FLA. CHAMBER OF COMMERCE, INTO THE STORM: FRAMING FLORIDA'S LOOMING PROPERTY INSURANCE CRISIS 1 (2010), *available at* http://www.flchamber.com/wp-content/uploads/IntotheStorm_FramingFLLoomingPropertyInsuranceCrisis_January r2010.pdf.

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reflect the actuarial risk associated with each insured property.[42] Several reasons help to explain the gap between true-risk and charged premiums. First, state regulations place limits on the extent to which premiums can be increased, even when premiums are priced below actual risks. Second, there is some cross-subsidization among the 150 territories at the level of rate-setting.[43] Third, and most significantly, Citizens does not face the same budgetary constraints that private insurers do. If it falls short—if the premiums collected are not enough to pay for the wind damage it covers—Citizens can invoke an "assessment" process to cover the shortfall. As a result, some of the catastrophic wind risk posed by hurricanes is shifted from Citizens' policyholders to Florida taxpayers.

Under the assessment process, Citizens can secure emergency funding for catastrophic losses that exceed its own reserves, as well as its various sources of reinsurance, by imposing a tax not only on all Citizens' policyholders but also on all insurance policyholders (including homeowners and car owners, among others) within the state. Part of this assessment/tax is collected up front, and part is spread out over a number of years, until the deficit is paid.[44] The net effect is that the premiums actually charged by Citizens to a policyholder for a given piece of property often do not reflect the full actuarial risk associated with that insured property. Moreover, as we show in detail below, the subsidies are not allocated equally among Citizens' policyholders.

III. THE PERVERSE EFFECTS OF SUBSIDIZED WEATHER INSURANCE

Part I reviewed the tools available to insurers in regulating weather risk. We saw that through differentiated premium, private insurance has the capacity to perform a social function that is regulatory in nature: better preparedness on the part policyholders and better decision making with respect to building location. Part II then explained

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[42] In Citizens' rate filings with the Florida Office of Insurance Regulation, the difference between the rate that would need to be charged to fully cover the risks insured by Citizens and the rate currently being charged is called the "indicated rate change." Because of legislative and regulatory caps on the amount of annual premium increases, Citizens does not request actual rate increases equal to the indicated rate changes, at least not with respect to wind risk, where the gap between the actual rates and the indicated rates are the largest. Telephone interview with Daniel Sumner, General Counsel and Chief Legal Officer, Citizens Property Insurance Company (July 19, 2013) [hereinafter Sumner Interview].
[43] Sumner Interview.
[44] *Assessments*, CITIZENS PROP. INS. CORP., https://www.citizensfla.com/about/CitizensAssessments.cfm (last visited Nov. 7, 2014).

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that much of the insurance for severe weather risk in the U.S is provided by the government, through a variety of federal and state programs.

How well does government insurance perform as a regulator of weather risk? In particular, how does it fare relative to the performance of private insurance? Would it be better to outsource the regulatory role of severe weather preparedness to private insurance markets?

Given the underdeveloped private market for weather insurance, which is largely the result of the existence of government insurance, we cannot line up the two institutions nose-to-nose and compare. Instead, we identify elements that are unique to government-provided insurance and evaluate their effects. These effects can then be compared with hypothetical private insurance patterns, given what is known about private insurance operation in other markets.

The analysis below examines the government's insurance performance along two normative metrics: fairness and efficiency. Section A examines the distributive effects of government insurance and tries to answer a question often left unasked: who are the beneficiaries of the implicit subsidies inherent in government insurance? Is it a progressive redistributive scheme? Section B examines the productive efficiency aspects of government insurance: how does it affect investment incentives? How does it affect total welfare?

A. Distributive Effects

> *Now, is this a bailout for the rich people?*
> -- Representative Bill Cassidy (R-LA)[45]

1. *Insurance Cross-Subsidies: Who are the beneficiaries?*

Private insurance covers only premium-paying policyholders. That is how insurance markets work: risk-averse parties pay premiums to a privately managed fund that is contractually bound to cover certain specified losses if they occur. In a competitive environment, the premiums insurers collect (minus administrative costs) must roughly equal the amount of the payouts. It follows that private insurance cannot pay claims of victims who have not paid into the insurance pool. It also cannot systematically undercharge some policyholders, because that would require an offsetting systematic overcharge of others. Those who are overcharged can be cherry-picked by competitors who can offer them better terms. In private insurance, most of the redistribution occurs

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[45] 160 CONG. REC. H60 (daily ed. Jan 8, 2014) (statement of Rep. Cassidy) ("Now, is this a bailout for rich people? The people in Louisiana who will benefit from reforming our current process . . . are working people. . . . These are not rich people insuring their vacation homes").

within the pool of policyholders and only ex post—namely, from lucky non-victims to unlucky victims. Although all real-world private insurance pools involve some cross-subsidization from the less risky to the more risky, in the ideal case, if premiums are set according to the risk data, there is no ex ante cross-subsidy—no policyholder pays for an expected benefit that others enjoy disproportionately.

By contrast, because government insurance is partially funded by general tax revenues, there is no actuarial budget constraint. In fact, government relief programs and insurance plans are *specifically intended* to create systematic transfers favoring residents of disaster areas. And unlike private insurance, government sold insurance can contain a systematic and intended discount to make its policies more affordable, and the deficit can be covered through the government's general budget. Indeed, the unique feature of government insurance compared with private insurance, and the primary reason for establishing it, is precisely the creation of an ex ante cross-subsidy scheme.

Such cross-subsidies obviously conflict with actuarial conceptions of fairness—charging every person who is covered by an insurance policy a premium equal to that person's expected benefits under the policy ("to each according to her benefit"). Actuarial fairness has an intuitive appeal, for example, when differences in risks are the result of individuals' voluntary choices. It seems fair that smokers should pay higher life and health insurance premiums than non-smokers, and that aggressive drivers pay higher auto insurance premiums.

The cross-subsidy embodied in government insurance is an intended feature despite its violation of actuarial fairness, because it is thought to be fair and progressive. In the aftermath of Hurricane Katrina, for example, Representative Barney Frank promoted increased funding to the NFIP because of "our moral duty to the poorest people and working people and lower middle income people."[46] More recently, when Congress reinstated the subsidized flood insurance rates in 2014 (after a previous bill sought to scale down the subsidies), the bill was pitched as a program favoring struggling homeowners. It garnered bipartisan support (approved with a vote of 72-22 in the Senate) because cuts in subsidies "burdened lower- and middle-class homeowners and small businesses."[47] As the House voted down an amendment to the bill

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[46] 151 CONG. REC. H7760 (daily ed. Sept. 8, 2005) (statement of Rep. Barney Frank); *see also* Rep. Rick Lazio, Letter to the Editor, *Flood Fund Aids Working-Class Homeowners*, N.Y. TIMES, Nov. 18, 1993, A26.

[47] 160 CONG. REC. H56 (daily ed. Jan. 8, 2014) (statement of Rep. Marino) (calling for a blanket repeal of Biggert-Waters); *Id.* at H61 (statement of Rep. Scalise) (claiming that the increased premiums will fall disproportionately on hardworking "middle class families" who have never been flooded due to their own community-

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that would have removed retroactive reimbursements of high premiums to the owners of coastal vacation homes, [48] representatives invoked progressive sentiments by alluding to anecdotal stories of the suffering of lower-class, middle-class, and senior citizens as a result of the previously enacted premium hikes. The subsidies, one Congressman said, will prevent working families, who are "doing everything they can to put food on the table," from losing their homes. [49] As one of the Bill's champions explained,

> "This is not about the millionaires in mansions on the beach. . . These are middle class, working people living in normal, middle class houses doing their best to raise their kids, contribute to their communities and make a living."[50]

These insurance subsidy schemes are appealing because the risk differences are thought to be arbitrary, not the result of voluntary choice. People suffering high risk of weather disasters are hardly at fault, their losses are often devastating, and their insurance premiums are financially crushing. Thus, when polled, even people who are not affected by flood insurance premium subsidies (but who, perhaps unbeknownst to them, pay taxes to fund them) strongly support the subsidies. In one survey, only 15% of unaffected Florida citizens supported the premium increases. [51] The affordability concern, bolstered by a strong intuition that the beneficiaries of the subsidies are lower-middle income families, trumps the amorphous conception of actuarial fairness as a way to achieve distributive justice.

The cross-subsidy created by government-sold insurance follows, then, a distinct logic: it moves from people lucky enough to live in safe areas ("the affluent") to the less lucky residents living in low lying areas in storms' paths ("the poor"). But this conjecture, that subsidized

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organized flood-safety measures); *Id.* at H2102 (daily ed. Mar. 4, 2014) (statement of Rep. Ros-Lehtinen) (claiming that the astronomical premiums are pushing the family budgets of working-class families to their breaking point);, *Id.* at E309 (daily ed. Mar. 5, 2014) (statement of Rep. Castor) ("If this bill passes we will keep middle class families in their homes, bring relief to our local economy and provide needed reliability to middle class friends and neighbors.").

[48] *Id.* at S1627 (daily ed. Mar. 13, 2014) (statement of Sen. Lee).

[49] *See, e.g.*, *Id.* at S581 (daily ed. Jan. 29, 2014) (Statement of Sen. Heitkamp).

[50] *Id.* at S1631 (daily ed. Mar. 13, 2014) (statement of Sen. Landrieu).

[51] Jeff Harrington, *Poll: Opposition to Flood Insurance Rate Hikes is Strong*, TAMPA BAY TIMES, Dec 24, 2013, http://www.tampabay.com/news/business/banking/poll-opposition-to-flood-insurance-rate-hikes-is-strong/2158508.

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weather insurance benefits the less affluent, has not been fully tested.[52] We believe that it is wrong and that the opposite is true: the subsidy accrues primarily to the affluent. This for a simple reason: those who need flood insurance most are the habitants of properties build in proximity to the coast, where severe weather strikes most forcefully. Because properties adjacent to the coast are in general (putting weather risk to one side) more desirable and more expensive, the beneficiaries of the subsidies are not the poor but the affluent.[53]

If in fact the high-risk beachfront owners are, all else equal, wealthier, they are less deserving of means-based government subsidies. Moreover, any form of government-subsidized insurance—disaster relief or contractual policies—is funded through general tax revenues, coming from middle income taxpayers living mostly inland in lower-valued homes (or, as we saw, from assessments on drivers buying auto insurance). To the extent that high-income owners of beachfront property are the primary beneficiaries of this government insurance scheme, and to the extent that the cross-subsidy is disproportionately funded by the

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[52] Relatively few studies of the distributional effects of government-provided weather insurance have been done. They focused on premiums collected and claim payments in connection with the NFIP program, and have come to a different conclusion. One study concluded that "[t]axpayer-subsidized NFIP claims …represent a significant wealth transfer from middle-income counties to relatively wealthy and poor counties." J. Scott Holladay & Jason A. Schwartz, *Flooding the Market: The Distributional Consequences of the NFIP*, POL'Y BR. NO. 7, N.Y.U. INST. FOR POL'Y INTEGRITY at 5 (2010), available online at http://policyintegrity.org/documents/FloodingtheMarket.pdf. Another study found "no evidence that the NFIP disproportionally advantages richer counties." Bin et al, *supra* note __. Both studies looked at county level NFIP premium, payout, and income data, and thus were not able to pick up within county effects: Are the rich within a county subsidizing the poor within a county, or the reverse? Our study includes individual insurance-policy level data, thus capturing redistributive effects with greater precision. .

[53] Holladay & Schwartz made a similar prediction:

> Beach front communities typically exhibit strong income gradients moving inland from the beach. The most expensive homes are those directly on the beach, followed by homes with a view of the ocean, then those within walking distance of the ocean, and finally those homes without easy access to the water. The value of property can often drop quickly with increased distance from the ocean. This income gradient is highly correlated and inversely related to the risk of flooding in those regions.

Holladay and Schwartz, *supra* note __, at 5, citing Christopher Major, The Beach Study: An Empirical Analysis of the Distribution of Coastal Property Values (2003) and CONG. BUDGET OFFICE, PUB. NO. 2807, VALUE OF PROPERTIES IN THE NATIONAL FLOOD INSURANCE PROGRAM (2007), *available at* http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/82xx/doc8256/06-25-floodinsurance.pdf [hereinafter CBO, VALUE OF PROPERTIES].

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less affluent inland-residing taxpayers and policyholders, it represents a regressive form of redistribution. And, as a matter of public choice, the more the government has to bail out its under-capitalized insurance fund, the less tax revenue remains to spend on other, more progressive programs.

We wish to test the regressive redistribution hypothesis, and we do so in two ways. First, we examine the distribution of subsidies under Florida's Citizens insurance. We begin with this scheme because we have data about actual prices and subsidies, which allows us to measure directly the direction of the redistribution. Second, we return to the NFIP and point to some indirect evidence regarding the direction of redistribution. Together, these observations suggest that government weather insurance has unappreciated but substantial regressive effects.

2. *Redistribution under Florida's Citizens Property Insurance*

> *The state subsidized the well-to-do who live near the beach at the expense of the less-well-to-do who don't.*
> — Michael Lewis, New York Times[54]

a. <u>Citizens' data and some initial observations</u>

Citizens sells wind-peril insurance policies to homeowners in every part of Florida. As mentioned, the policies are priced according to the wind territory in which the insured property is located, of which there are 150. Prices are adjusted annually and have to be approved by the state Office of Insurance Regulation. Statutory and regulatory caps limit the extent to which Citizens can raise its rates in any given year.

As discussed above, Citizens' actual insurance premiums are known—and intended to be—different than the "true risk" premiums (those representing an actuarially accurate methodology). For every calendar year, Citizens publishes charts listing, for each individual policy, the actual premium and the true risk hypothetical premium, allowing a straightforward calculation of the subsidy each policy receives. In 2012, there were 527,250 individual policies. This is the "policy level data." In addition, because policies are rated and priced based on the risk territory in which they are sold, and because all policies within a given territory enjoy the same proportional subsidy, some of the

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[54] Michael Lewis, *In Nature's Casino*, N.Y. TIMES MAGAZINE, Aug. 26, 2007, at 51, *available at*
http://www.nytimes.com/2007/08/26/magazine/26neworleans-t.html.

information can be analyzed by comparing patterns across territories. For that, we used aggregated "territory-level data."[55]

  To get a general sense of the subsidy picture, we looked initially at the territory-level data. Here, in publicly available rate filings, Citizens publishes summaries for each of the 150 risk territories, showing the total sum of premiums paid by policyholders in that territory, as well as the "indicated" rate change, that is, how much more (or less) the company would have needed to charge policyholders in that territory to break even actuarially. Here is an example:[56]

Territory Name	Wind Premium	Indicated Rate Change
Monroe	$38,582,378	126.5%
Hillsborough, Exc. Tampa	$19,496,173	25.9%
Pinellas – Saint Petersburg	$29,059,878	14.7%
Broward (Excl. Hllwd & Ft. Ldrdle)	$70,297,604	-12.5%
Broward (Wind 47)	$27,847,251	57.3%
Broward (Wind 48)	$21,530,419	17.3%

  In Monroe territory, for example, where some of the south Florida keys are located, the premiums actually collected by Citizens total $38,582,378, but they fall short of Citizens' estimate of the expected risk. To be precise, an increase of 126.5% in the premium charged to each policy in that territory would be necessary to cover the shortfall. In Tampa's suburbs or in Saint Petersburg, the shortfall in premiums is more modest, 25.9% and 14.7%, respectively. Many of the highly populated Florida areas, such as Broward County where Ft. Lauderdale is located, are divided into several risk territories. As the chart above shows, some of these territories, like the one labeled Wind 47, receive a substantial subsidy (57.3% above the actual cost); others,

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[55] The data on which the following charts and statistics are based were supplied to the authors by Citizens Property Insurance Company in response to a public data request. The data were compiled by Citizens for the purpose of its September 30, 2012, rate-filing with the Florida Office of Insurance Regulation (specifically, from Florida Office of Insurance Regulation filing number 13-13048), and they include a range of facts about every homeowners' policy of a particular sort (HO3 policies covering wind risk) issued by Citizens in the relevant period. The information for each policy includes the premium actually charged for the policy, the "indicated premium" for the policy, the location of the insured property by zip code, and the amount of coverage, among other things. We will cite these data generally as "Citizens 2012 Wind Risk Data." Copies of the data are available with the authors and can be secured separately from Citizens through a public data request.
[56] Citizens 2012 Wind Risk Data, *supra* note 55.

like Wind 48, receive a modest subsidy (17.3%); and some are actually overcharged and receive a negative subsidy.[57]

Since there are 150 territories and they vary greatly by the amount of subsidies they receive, we wanted to see if any pattern might be discerned. To that end, we created a map of Florida by risk territories and colored each territory according to the magnitude of the subsidy it receives. The darker the shade of green, the higher the subsidy represented on the map:

Figure 3 Here

Figure 3 shows a remarkable but predictable pattern. Coastal territories, almost without exception, enjoy large percentage subsidies, whereas inland territories receive smaller subsidies, if they receive any subsidy at all. A similar relationship can be seen when we zoom in and look at densely populated South Florida:

Figure 4 Here

The pattern is even clearer here: the subsidies are larger in territories very close to the water. Figures 1 and 2 also help us begin to speculate about a possible relation between subsidy and wealth, since water proximity is often a feature attracting wealthy home buyers.[58] To visualize this, we plotted on the subsidy maps the location of the highest and lowest wealth concentrations. Red dots mark territories in which the median home value is at least three standard deviations above the statewide median.[59] Blue dots mark areas more than one standard deviation below median home value. No surprise: wealthy households are located in the high subsidy (deep green) territories. Poor households are located more often in the low- or no-subsidy territories.

These maps reflect the territory-based data, comparing the treatment of the 150 different insurance risk territories. Eventually, we would like to test if the distribution of subsidies is indeed correlated with the distribution of wealth. To do so, we needed more information about policyholders' wealth. We used two sources:

(i) *Household Value*: Citizens' policy-level data do not include home values, but they do list the zip codes of the insured properties. Thus, we were able to use publicly available information about median

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[57] *Id.*

[58] CBO VALUE OF PROPERTIES, *supra* note 53, at 9–10 (figures showing that homes close to water are more expensive).

[59] We used four different sizes to indicate 3-4, 4-5, 5-6, and 6+ standard deviations above statewide median.

household value within the zip code in which the insured property is located.[60]

(ii) *Coverage Limit*: Citizens' policy level data include an entry for the amount of insurance purchased under each policy. Since insurance law does not allow the purchase of coverage exceeding the value of the property, we can use the coverage amount as an estimate of the lower bound of the property's value. This will help us test whether people who own lower-valued homes receive a greater or smaller insurance subsidy.[61]

To further visualize the relation between subsidy and wealth, we used the zip-code-level household value data. For each zip code, we know the median household value, and we computed the average dollar value subsidy for all Citizens' policies issued in that zip code, taken from Citizens policy-level data. When we did this for all 904 Florida zip codes, we got the following scatter plot:

Figure 5 Here

The trend line is positive, suggesting that zip codes with higher valued homes receive higher per-policy subsidies.

A similar picture emerges if we look at policy level data and ask whether high-value policies (those attached to high-value homes) receive a higher or lower subsidy. We divided Citizens' policies into five quintiles according to the policy coverage amount. For each quintile, we calculated the average subsidy. Again, we see a clear picture: higher quintiles of wealth get a higher absolute subsidy:

Figure 6 Here

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[60]   *See   American   FactFinder*,   U.S.   CENSUS   BUREAU, http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml (last visited Jan. 6, 2015) (entering "B25077: MEDIAN VALUE (DOLLARS)" into the "topic or table name" search field and any given location into the "state, county or place (optional)" search field will yield the desired median household value).

[61] In the year from which our data were taken (2012), there was no upper limit on the value of properties or the amount of coverage in Citizens' policies. In 2014, however, the Florida legislature adopted a limit. Specifically, under current law, Citizens is only permitted to provide coverage for a dwelling up to a replacement cost of $1 million in 2014, with this limit going down by $100,000 per year each year until 2017, where the cap would remain at $700,000. However, if policyholders can demonstrate that they are not able to find coverage in the private market for policies in the range between $700,000 and $1 million, then the $1 million cap will apply, rather than the lower phased in caps in later years. *See* FLA. STAT. § 627.351(6)(a)(3) (2014).

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b. Empirical Analysis

In order to measure the disproportionate benefit of the insurance subsidy to the affluent, we used Citizens' policy level data. For each policy, we looked at two measures of subsidy. First, we looked at the straightforward "absolute subsidy" which is the difference between the premium charged and the hypothetical premium reflecting full risk. Since Citizens reports the "indicated rate change" necessary to bring the actual premium to the full risk level, this absolute subsidy for each policy is simply the premium charged for that policy times the indicated rate change for that policy.

But the absolute subsidy may tell an incomplete story. A $300 subsidy for a low-coverage policy of, say, $50,000, may be a relatively more significant factor than a $500 subsidy for a high-coverage policy of $500,000. We therefore wanted to measure the relative subsidy each policy is getting. To do this, we created a synthetic benchmark in which the subsidy pool (the total amount of subsidy for all policies within the dataset) is divided pro rata across the policies, under the (counterfactual) assumption that all policies receive the same indicated rate change—the same percent discount. We denoted this benchmark as a "unit subsidy," with all policies receiving exactly one unit. We then compared this unit-subsidy benchmark with the actual percent discount each policy received. This created a distribution of "percent subsidies," some receiving more than the unit benchmark, others receiving less. We measured whether this "percent subsidy" distribution was correlated with household wealth. Wealth, recall, is measured in our estimates in two different ways: coverage limit under the policy and median zip code household value.

We estimated two regression models:

$$LogAbsoluteSubsidy_i = \alpha + \beta\, LogWealth_i + \varepsilon_i$$

$$PercentSubsidy_i = \alpha + \beta\, LogWealth_i + \varepsilon_i$$

The first model examines how increase in wealth correlates with the absolute subsidy. A one percent increase in wealth is associated with a β percent increase in the absolute subsidy. If β is positive, there is positive correlation between wealth and subsidy and the government's program is regressive. Table 1 presents our findings.

The results are statistically significant and demonstrate a significant correlation between wealth and subsidy. Column (1) in Table 1 shows that a one percent increase in the Coverage variable is

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associated with a 1.052 percent increase in the subsidy. Simply put, if property A is worth twice as much as property B, and thus the owner of property A purchases coverage that is 100 percent greater than the coverage purchased by the owner of property B, the owner of A enjoys on average a 105 percent higher absolute subsidy. Columns (2)–(4) repeat this test, and obtain the same result, with fixed effects for policy, standard errors clustered by territory, and both. Column (5) uses a different independent variable to measure wealth – the average household value within the insured home's zip code ("Log HH Value"). The wealth coefficient is smaller, 0.484 percent (predictably, given the use of average wealth measures).[62]

The second model examines the relation between wealth and our generated synthetic variable of "percent subsidy." The results are presented in table 2.

Again, the subsidy is strongly correlated with wealth. A one percent increase in household value is associated with either a 0.847 percent or 0.571 percent increase in percent subsidy, depending on how we measure wealth, and the results are again highly significant.

c. Discussion

The results reported above show that the wind insurance subsidies within policies sold by Citizens Property Insurance Company accrue disproportionately to affluent households, and the magnitude of this regressive redistribution is substantial. While we are unable to measure directly the wealth of policyholders, we showed that people who buy higher coverage (namely, who own more expensive homes), or, alternatively, people who live in wealthier zip codes, receive larger subsidies, both in absolute magnitude and as a percent of their premium.

The estimates we derived for the correlation between wealth and subsidy probably understate the true magnitude of the pro-affluent advantage. First, one of our measures of wealth—policy coverage limit—is capped by Citizens' rules, which means that we are not measuring the true wealth of the people who buy maximal coverage, and are therefore deriving downward-biased correlations. Second, Citizens' report of the subsidies—the indicated rate changes—understates the subsidies' true magnitude. Citizens does not take into account some of the costs of providing insurance—costs that private insurers would incur in running an insurance scheme. Specifically, when Citizens calculates the amount of the indicated rate change, it does not build into it the cost of reinsurance—an insurance reserve necessary to protect it against the

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[62] Column (6) repeats this test adding fixed effect by policy. Both columns (5)-(6) standard errors are clustered by zip code.

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risk of pricing errors or unexpected spikes in losses. Citizens does not need require such a reserve, because of its power in effect to tax the citizenry or to assess all insurance purchasers in the state of Florida.

We have not tried to identify the causal story underlying this correlation, nor are we interested in its direction. Causation may go either way: greater wealth may help people secure greater subsidies; or greater subsidies may help people move into more expensive homes. We are not interested in causation because the troubling feature of the system has nothing to do with any causal theory. The problem is the large positive *correlation* between wealth and subsidy, a correlation that conflicts with the goals and underlying rhetoric justifying the program.

3. *Redistribution under the NFIP*

As we saw in Part II, the NFIP insures over 5 million properties, up to $350,000 per residential property. The program is not designed to be financially balanced. In fact, subsidized rates were thought by lawmakers to be an inducement for communities to participate in the program and adopt flood mitigation requirements for buildings and floodplains management.

Although in most years the NFIP collects enough premiums to cover each year's claims, a few catastrophic events more than wipe out the NFIP's reserves. Currently, in 2014, the NFIP's debt exceeds $24 billion. Present rate-setting practices are "unlikely to be able to cover the program's claims, expenses, and debt, exposing the federal government and ultimately taxpayers to ever-greater financial risks, especially in years of catastrophic flooding."[63]

As a result of the discounts, people insured by the NFIP pay only a fraction of the full-risk premium. In 2006, FEMA estimated this fraction to be 35–40 percent. The subsidy is, on average, close to two-thirds of the economic cost. An average premium charged by the NFIP was $721, but would cost between $1800–$2060 if priced to cover full risk.[64] In the highest flood risk areas, the fraction of full risk paid by policyholders is even lower.[65]

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[63] U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-09-12, FLOOD INSURANCE: FEMA'S RATE SETTING PROCESS WARRANTS ATTENTION 4–5 (2008), *available at* http://www.gao.gov/assets/290/283035.pdf [hereinafter GAO-09-12, FLOOD INSURANCE].

[64] CBO, VALUE OF PROPERTIES, *supra* note 53, at 3.

[65] PRICEWATERHOUSECOOPERS LLP, STUDY OF THE ECONOMIC EFFECTS OF CHARGING ACTUARIALLY BASED PREMIUM RATES FOR PRE-FIRM STRUCTURES 5-5 (1999), *available at* http://www.fema.gov/media-library-data/20130726-1602-20490-9031/finalreport.pdf

A 2007 report by the Congressional Budget Office (CBO) found that "properties covered under the NFIP tend to be more valuable than other properties nationwide." At the time, the median value of a home in the U.S. was $160,000; the median value estimated for homes insured by the NFIP ranged from $220,000 to $400,000. The CBO found that "much of the difference is attributable to the higher property values in area that are close to water."[66] There are 130 million homes in the U.S, but only a small fraction of them receive subsidized NFIP policies. Of those who do, nearly 80 percent are located in counties that rank in the wealthiest quintile.[67]

Despite the image—often invoked in political debates over flood insurance [68] —of the subsidy going to struggling middle-class homeowners who have lived for generations in floodplains, the reality is different. "40 percent of the subsidized coast properties in the sample are worth more than $500,000; 12 percent are worth more than $1 million." [69] These are far higher proportions than in the rest of the country. For inland properties (the great majority of which do not purchase flood insurance) only 15 percent are worth more than $500,00 and only 3 percent more than $1million.

The myth of the subsidized struggling homeowner is further dispelled by another striking fact: 23 percent of subsidized coastal properties are not the policyholders' principal residence—they are either vacation homes or year-round rentals. Indeed, these subsidized second homes in coastal areas are generally higher in value than the subsidized principal residences in the same coastal areas ($634,000 versus $530,000).[70] Thus, even among the group of beneficiaries who live along the coast and who disproportionately enjoy the subsidy, second-homers are the bigger gainers from the subsidy. 47 percent of the subsidized homes that are not principal residences are worth more than $500,000 (and 15 percent worth more than $1 million).[71]

Another indication that wealthier households enjoy the NFIP subsidy is the fraction of homes that purchase the maximum coverage. Low-value homes owned by lower income residents do not need (and are ineligible for) the maximum coverage; high-value homes do. In 2002,

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[66] CBO, VALUE OF PROPERTIES, *supra* note 53, at 2; see also Holladay & Schwartz, *supra* note __. But see Bin et al., *supra* note __ (looking at NFIP premiums and payout data and concluding that program overall reduces certain measure of inequality).

[67] Eli Lehrer, *Doing the Wrong Thing*, 19 WKLY. STANDARD, no. 14, 2013, at 20.

[68] *Supra* notes 46–50.

[69] *Id.*

[70] *Id.* at 10.

[71] *Id.* at 11.

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only 11 percent of NFIP policies were at maximum limit. By 2012, the fraction increased to 42 percent, with most of these high-coverage homes located in the Gulf Coast and Eastern Coast states. For example, in New York (with a median home value of $285,300), 65 percent of its policyholders had the maximum coverage. In contrast, in West Virginia (a median home value of $99,300), only 7 percent of its policyholders had maximum coverage.[72]

Finally, the benefit to coastal areas, which tend to have higher property value, accrues in another less direct way. Participation in the NFIP requires communities to develop floodplain management plans. Such investments reduce flood risk and increase the land available for new construction. In effect, the "NFIP, by serving as a backstop for those risks, favors development in communities with floodplains, by shifting some of those risks onto taxpayers."[73]

B. Investment Distortions

In Section A we asked whether government insurance produces the desirable distributive effects aspired by its political proponents, of improving affordability among lower income residents of floodplains. We saw that the opposite is true—that the benefits of the program flow disproportionately to the affluent. We now turn to examine another troubling distortion of the existing government insurance programs: the effect on total welfare.

1. Regulation of Location

In choosing the location of development (and redevelopment), people have to estimate the perils of particular sites. Coastal areas are attractive for many salient reasons, which feature prominently in buyers' calculations. The downside—exposure to severe storms—is recognized in the abstract, but hard to quantify.

Insurance, if priced accurately, provides an important service of quantifying the risk and helping people trade it off against the upsides. This is a general (desirable) feature of insurance, operating in effect like a Pigouvian tax in internalizing an otherwise overlooked cost.[74] Knowing the expected cost of exposure to weather disaster, people are more likely to make an informed cost-benefit calculation in choosing locations. Subsidized insurance rates destroy the information value of full-risk premiums, thus suppressing the true cost of living in severe weather

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[72] GAO-13-568, FLOOD INSURANCE, *supra* note 19, at 10–12.

[73] Holladay & Schwartz, *supra* note __.

[74] *See* Ben-Shahar & Logue, *supra* note 9, at 229–31.

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zones, and creating an excessive incentive to populate attractive but dangerous locations. It is a moral hazard problem occurring at the dimension of the activity level.

We saw that the NFIP charges subsidized premiums *deliberately* to make insurance affordable.[75] This intent was punctuated by the enactment of the so-called Homeowner Flood Insurance Affordability Act of 2014, which scaled back premium increases that intended to eliminate the subsidies. But there are additional, unintentional causes for the inaccurate premiums set by the NFIP. First, the data it relies on in drawing flood maps is outdated. Despite the efforts to update and modernize the maps, the long lapses between such adjustments are indicative of the inadequate political or financial incentives to run an actuarially accurate system. For example, Hurricane Sandy exposed the inadequacy of FEMA's old flood maps and led to an updating of high-risk areas. Under the new maps, "a $429 annual premium on a structure previously outside the high-risk zone could well rise to $5000 to $10,000 for the same amount of coverage if it is inside the high-risk area."[76]

Second, the NFIP charges subsidized premiums because it allows certain properties to maintain their previous historically low rates, despite data showing a greater risk. FEMA does not even collect data on these grandfathered properties to measure their financial impact on the program and does not even keep track of how many of these properties there are. Further, the agency sets flood insurance rates on a nationwide basis using rough averages, which means that many factors relevant to flood risk are not specifically accounted for in rating individual properties. Normally such crude averaging would lead to adverse selection and unraveling, as low-risk properties should prefer to exit and join separate pools with actuarially fair policies, rather than subsidize other neighborhoods. But if the government subsidy is deep enough, it can offset this effect. Finally, as a government report conceded, "FEMA's rate-setting process also does not fully take into account ongoing and planned development, long-term trends in erosion, or the effects of global climate change, although private sector models are incorporating some of these factors."[77]

Underpricing of flood insurance in coastal areas has long been associated with (and likely contributed to) excessive private development of flood zones. As the same Congressional report concluded, "FEMA . . . is unable, through its rate-setting process, to inform policyholders of the risk to their property from erosion. Consequently, in some cases flood

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[75] *See supra* Parts II.B.1, III.A.1., III.A.3.

[76] Lloyd Dixon et al, RAND, Flood Insurance in New York City Following Hurricane Sandy xvii (2013).

[77] GAO-09-12, Flood Insurance, *supra* note 63, at 4.

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insurance rates may send a false signal that understates the risk exposure faced by current policyholders or prospective development."[78] And in writing about Florida's Citizens wind insurance scheme, writer Michael Lewis explains that Florida "sold its citizens catastrophe insurance at roughly one-sixth the market rates, thus encouraging them to live in riskier places than they would if they had to pay what the market charged."[79]

Whether climate change is indeed causing a more severe pattern of catastrophic storms may still be debated.[80] It is clear that the costs of hurricanes, for example, have increased dramatically over the past generation. But strikingly, much of the upward trend in storm loss data, after careful adjustment for societal factors, can be explained not by weather fluctuations but rather by increased concentration of property in dangerous areas, namely—by human decisions to locate more densely in the storms' paths. "The major cause of trends in losses related to weather and climate extremes is societal factors: the growth of wealth with more valuable property at risk, increasing density of property, and demographic shifts to coastal areas and storm-prone areas that are experiencing increasing urbanization."[81]

Indeed, according to the U.S. Census Bureau the number of people living in coastal areas in Florida increased by ten million people, almost *fourfold*, between 1960 and 2008. Coastal exposure now represents 79 percent of all property exposure in Florida, with an insured value of $2.8 trillion (in 2012).[82] Major hurricanes did nothing to stop this migration. It is estimated that since Hurricane Andrew struck the Florida coast in 1992, development more than doubled the property value on its path. The $25 billion in total economic losses in 1992 "would have resulted in more than twice that amount—$55 billion— were it to have occurred in 2005, given current asset values" (even

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[78] *Id.* at 20.

[79] Lewis, *In Nature's Casino*, *supra* note 54.

[80] *See* debate summarized in Roger Pielke Jr., *An Obama Advisor Is Attacking Me for Testifying that Climate Change Hasn't Increased Extreme Weather,* THE NEW REPUBLIC (Mar. 5, 2014) http://www.newrepublic.com/article/116887/does-climate-change-cause-extreme-weather-i-said-no-and-was-attacked.

[81] Stanley A. Changnon et al., *Human Factors Explain the Increased Losses from Weather and Climate Extremes*, 81 BULL. AM. METEOROLOGICAL SOC'Y 437 (2000).

[82] *Florida Hurricane Insurance: Fact File*, INS. INFO. INST. (Oct. 2014), http://www.iii.org/article/florida-hurricane-insurance-fact-file.html.

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holding constant the value of building material, real estate, and other societal changes).[83]

The effects of climate change on weather patterns are only beginning to be understood, but private insurers are rushing to take these emerging patterns into account, adjusting premiums in light of near future projections, and studying potential industry-wide impacts and strategies to proactively address the rising risk.[84] FEMA, on the other hand, "has done little to develop the kind of information needed to understand the long-term exposure of NFIP to climate change for a variety of reasons. NFIP's risk management processes adapt to near-term changes in weather as they affect existing data. As a result, NFIP is designed to assess and insure against current—not future—risks and currently does not have the information necessary to adjust rates for the potential impacts of events associated with climate."[85] If, indeed, climate change poses increased risks of flood and erosion to low lying coastal zones, the failure of government insurance to price the risk into present policies exacerbates the overdevelopment problem.

An independent report of erosion rates and their financial impact found that over the next sixty years, erosion may claim one out of four houses within 500 feet of the U.S. shoreline, as the following picture illustrates:[86]

Figure 7 Here

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[83] U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-07-285, CLIMATE CHANGE: FINANCIAL RISKS TO FEDERAL AND PRIVATE INSURERS IN COMING DECADES ARE POTENTIALLY SIGNIFICANT 25 (2007).

[84] Alberto Monti, *Climate Change and Weather-Related Disasters: What Role for Insurance, Reinsurance, and Financial Sectors?*, 15 HASTINGS W.-N.W. J. ENVTL. L & POL'Y 151 (2009); Eugene Linden, *A Climate Risk Deluge*, L.A. TIMES, June 17, 2014, at A15, *available at* www.latimes.com/opinion/op-ed/la-oe-linden-insurance-climate-change-20140617-story.html; Jessie G. Rountree, Risky Business: Recommendations for the Insurance Industry to Contribute to Greater Disaster Risk Reduction and Climate Change Adaptation (May 16, 2014) (unpublished Master's Thesis, University of San Francisco) (on file with the University of San Francisco Scholarship Repository), *available at* http://repository.usfca.edu/cgi/viewcontent.cgi?article=1021&context=capstone; Evan Mills, *Responding to Climate Change: The Insurance Industry Perspective*, LAWRENCE BERKLEY NAT'L LABORATORY, http://evanmills.lbl.gov/pubs/pdf/climate-action-insurance.pdf.

[85] GAO-09-12, FLOOD INSURANCE, *supra* note 63, at 22.

[86] H. JOHN HEINZ CTR. FOR SCI., ECON., & ENV'T, EVALUATION OF EROSION HAZARDS xxxiv (2000).

However, the NFIP does not map erosion hazard and does not incorporate it into the insurance rate. As a result, rates are set at approximately half of actuarially accurate rates. "Despite facing higher risk, homeowners in erosion-prone areas currently are paying the same amount for flood insurance as are policyholders in non-eroding areas."[87] Not only will erosion claims have to be subsidized, but present insurance rates are also "misleading to users" because they do not inform homeowners of the erosion risk. As a result, the report finds that development in erosion areas is excessive. "In the absence of insurance and other programs to reduce flood risk, development density would be about 25 percent lower in the highest-risk zones than in areas less susceptible to damage from coastal flooding."[88]

The effect of the government insurance subsidy on homeowners' location decisions can be further captured by the following finding. In some of the areas closest to the shoreline, annual rates have to be set at a whopping $11.40 per $100 of coverage to meet the risk projections—over 10 percent of property value each year! At the same time, a survey of homeowners found that participation in insurance schemes with such high premiums would be "quite low"— about half of flood policyholders are only willing to pay up to $1–$2/year per $100 of coverage.[89]

Not surprisingly, given the substantial subsidy provided by NFIP insurance and the increased development along coastal areas, the number of policies issued by the NFIP increased in the past generation from 1.9 million to over 4.6 million.[90] Some of these policyholders have lived in the area long before the NFIP. But many are newcomers, representing a repopulation enterprise facilitated by distorted insurance contracts. Many of these newcomers would not have moved to their present high-risk location, or would not have paid the same top dollar, in the absence of subsidized premiums. Indeed, one of the major complaints of existing homeowners against the Biggert-Waters Act of 2012 (which, recall, dramatically scaled back the NFIP subsidies) was their inability to afford the new premiums and how the new premiums were scaring away potential buyers and making mortgage loans unaffordable.[91]

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[87] *Id.*, at xxi.

[88] *Id.*, at xl.

[89] *Id.*, at xlv.

[90] GAO-07-285, CLIMATE CHANGE, *supra* note 83, at 27.

[91] *See, e.g.*, Josh Boatwright, *Flood Rate Fears Sink Condo Sales*, ST. PETERSBURG TRIBUNE, http://tbo.com/pinellas-county/flood-rate-fears-sink-sales-20131221/ ("stories of skyrocketing flood insurance premiums on older properties scared away many buyers"); Kathleen Lynn, *North Jersey Homeowners Trapped in Flood Zones Looking for Help from Feds*, NORTHJERSEY.COM (Feb. 25, 2014) http://www.northjersey.com/real-estate/rising-flood-insurance-premiums-make-

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2. *Regulation of Precautions*

Insurance contracts affect not only the scope of activity, but also the level of care taken by policyholders. Auto insurance, for example, can induce people to drive more carefully (through experience rating); environmental liability insurance can induce firms to install spill prevention measures; and fire insurance can induce proprietors to invest in sprinklers.[92] How does government insurance of weather risk perform as a risk mitigation mechanism? Historically, not very well. As discussed above, the flood maps used by FEMA to administer the NFIP are notoriously out of date. And even when they are up to date, the premiums are heavily subsidized for many properties in the highest risk areas, giving little incentive to install loss reducing measures.

This situation seemed to be changing after the enactment of Biggert-Waters in 2012, as rapid premium increases began to induce behavioral changes on the part of property owners. Under the new maps that were to be used, the affordability of insurance depended upon, among other things, how high one's home was built above certain expected flood levels. Homeowners rebuilding in New York, New Jersey, and Connecticut following Hurricane Sandy were induced to invest in stilts, raising their homes above the base flood elevation.[93] Whether this trend will continue now that Biggert-Waters has been cut back remains to be seen.

Compared to flood mitigation, the role of government insurance in encouraging wind mitigation is perhaps more encouraging, although it is difficult to know for certain. In Florida, for example, Citizens provides discounts to any of its policyholders who can demonstrate that the property they are insuring meets a list of highly detailed design specifications.[94] Indeed, in Florida all insurers—private and public—are required by statute to provide such discounts.[95] Because wind mitigation discounts in Florida are a matter of statutory mandate, it is impossible to determine what sorts of wind mitigation discounts a private insurer,

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homes-impossible-to-sell-1.735866?page=all ("Many homeowners want to sell, but flood insurance costs have scared away buyers").

[92] *See* Ben-Shahar & Logue, *supra* note 9, at 220–26.

[93] Tara Siegel Bernard, *Rebuilding After Sandy, but With Costly New Rules*, N.Y. TIMES, May 11, 2013, at B1 ("Consider a single-family home in a zone with a moderate to high risk of a flood, that has a flood policy with $250,000 of coverage: if the home is four feet below the base flood elevation, the homeowner would pay an annual premium of about $9,500, according to FEMA. But if the home was elevated to the base, the premium would cost $1,410. Hoist the home three feet higher, and the premium would drop to $427.").

[94] See supra sources cited in note __.

[95] FLA. STAT. § 627.711 (2014).

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absence such a mandate, would be willing to provide. A similar picture can be seen in other coastal states.[96] For this reason, it is difficult to document a "care level" advantage on the part of private insurers with respect to coastal wind mitigation.

It is easy to see, however, the considerable "activity level" advantage that private insurance has over government insurance of coastal weather risk. If private insurers were permitted to charge what the market would bear for coastal weather risk (and were not limited by state insurance regulators), the prices would be considerably higher than they currently are, especially for the riskiest communities living close to water. This claim is supported by anecdotal evidence.[97] It is supported by the short experience of rate hikes under the Biggert-Waters Act, which "scared the bejesus out of people." [98] And it is supported by Citizens data, where the subsidies for coastal wind insurance reflect the difference between what Citizens actually charges for such risks and what an actuarially accurate insurance premium would be.

IV. RESPONDING TO CONCERNS ABOUT MARKET FAILURES IN PRIVATE WEATHER INSURANCE

Insurance for weather risk is subsidized by the government. Either through disaster relief or through individually purchased insurance policies, people living in the zone of disaster pay only a fraction of the expected cost. It is a subsidy program with great political support, resting on a popular belief that it is both fair and efficient. This article showed that both perceptions are wrong. In delivering a subsidy that private insurance does not give, government insurance inflicts two distortions: regressive redistribution and inefficient investment in residential property. These distortions are not inherent to the function of insurance. They can be attenuated, and perhaps solved, by a return to private insurance markets.

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[96] THE TRAVELERS INSTITUTE, HIGHLIGHTS AND LESSONS LEARNED FROM A NATIONAL SYMPOSIUM SERIES ON COASTAL INSURANCE, *available at* https://www.travelers.com/about-us/spotlight/docs/TRV_Coastal_Wind_Zone_Web.pdf.

[97] State Farm, for example, recently sought approval from the Louisiana insurance regulator for a premium increase of 16%, but was forced to settle for an 8.7% increase. Ted Griggs, *State Farm Hurricane Deductible Jumps to 5%*, THE ADVOCATE, (July 19, 2014) http://theadvocate.com/news/9671144-123/state-farm-hurricane-deductible-jumps.

[98] Dan Burley, *Flood Insurance Rates Skyrocket for Some in Beaufort County*, BEAUFORT GAZETTE (Oct. 12, 2013), http://www.islandpacket.com/2013/10/12/2735480/flood-insurance-rates-skyrocket.html.

In the course of developing this argument—the comparative performance of government versus private insurance—one cannot overlook the primary rationale for government takeover of weather risk insurance: market penetration. The argument is straightforward: when insurance is provided through a relief fund or with significant subsidies, coverage can extend beyond what private insurance markets provide, and resolve the markets failures of private insurance. Weather risk, it is alleged, is one such circumstance. In this section, we examine the concern for market failures in the provision of private insurance.

One possible concern with private insurance for weather risk is underinsurance. Due to cognitive failures, homeowners buy too little coverage.[99] For example, it is estimated that only 20% of homeowners in high flood risk areas in New York City who are not required to purchase insurance actually purchase coverage, even at subsidized rates.[100] However, severe weather is an odd area for such an argument to be made. Surely people notice reports about weather disasters. If anything, they tend to be overly salient relative to other insured risks (thus triggering a salience bias). Indeed, it is estimated that for every person who dies in a storm, 140 people must die from famine to receive the same expected media coverage.[101]

What is less surprising, perhaps, is the failure of homeowners to recognize that standard homeowners insurance policies exclude flood-caused damage. Since much of the destruction due to severe weather is flood-related, it is excluded and offered as a separate contractual add-on. Notwithstanding mandated disclosures that alert people and remind them to purchase separate flood insurance, it is questionable whether such warnings appended to complex preprinted insurance policies could successfully inform people.[102] The resulting gap in coverage is a market failure that government insurance can step in to correct. And yet, a more modest intervention can resolve this problem. Instead of being the provider of insurance, the government can simply mandate flood insurance in areas where some costs are otherwise shifted to the public (as it does for homes with federally guaranteed mortgage loans). The

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[99] *See* Michael Faure & Veronique Bruggeman, *Catastrophic Risks & First-Party Insurance*, 15 CONN. INS. L. J. 1, 14–27 (2008).

[100] Dixon et al., *supra* note 76, at xv.

[101] Thomas Eisensee & David Stromberg, *News Droughts, News Floods, and U.S. Disaster Relief*, 122 QUAR. J. ECON. 693, 723 (2007).

[102] *See* Daniel R. Petrolia, Craig E. Landry & Keith H. Coble, *Risk Preferences, Risk Perceptions, and Flood Insurance*, 89 LAND ECON. 227 (2013); Carolyn Kousky, *Learning From Extreme Events: Risk Perceptions After the Flood*, 86 LAND ECON. 395 (2010). *Cf.* Risa Palm & Michael Hodgson, *Earthquake Insurance: Mandated Disclosure and Homeowner Response in California*, 82 ANNALS ASS'N AM. GEOGRAPHERS 207–22 (1992).

mandate would usher people to insurance markets, without the need for government subsidy of policies.

An alternative to mandating the purchase of flood or wind insurance at the consumer level would be to mandate that all property policies include coverage for flood damage. Currently, insurers insert exclusions for flood- or hurricane-caused damage, and these exclusions would be prohibited. Such lumping of flood coverage into the standard homeowners policy would counteract problems of cognitive failure on the part of insurance purchasers, create demand for weather-related coverage (which would cause investment capital to flow into the weather-reinsurance market), and eliminate the social costs of litigating over whether a particular loss is caused by wind or water or whatever.[103] And to the extent that the price of such inclusive policies would become unaffordable to low-income homeowners, targeted means-tested subsidies or vouchers could be offered.[104]

A potential limitation of private insurance as weather-risk regulation involves the standard time period over which property insurance is written. Property policies in the U.S. are sold and priced on an annual basis, which means the property insurer is obligated to cover losses sustained to the insured property during the year of coverage. As a result, individual property insurers may have insufficient incentives to invest in identifying the most effective risk-reducing strategies, as some portion of the benefits of these investments will redound to the benefit of future insurers.[105] This effect is reduced when insurers pool resources industry-wide to engage in weather-risk research. It could also be counteracted if property insurance policies were sold as long-term (ten-year or even twenty-year) contracts, similar to home mortgages, which "run with the property."[106] That insurers do not presently offer multi-year polices is of course not evidence that such policies are inefficient, given the cross-time collective action problem already mentioned, and the usurpation of the market by government provided policies.

Another concern with private insurance for weather risk is the capacity to insure mega-disasters. Weather-related risks are commonly regarded as only partially insurable because of the problem of risk correlation. It is conventional wisdom that private insurance markets will

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[103] Kunreuther & Michel-Kerjan, *supra* note 1, at 366-38 (Proposing long term property insurance policies as a way to avoid volatility in premiums across years).

[104] Carolyn Kousky and *Addressing Affordability in the National Flood Insurance Program*, 1 Journal of Extreme Events 1450 (2014).

[105] Ben-Shahar & Logue, supra note __, at 230-31.

[106] Others have written about the possibility of using long-term property policies to improve risk-reduction benefits of property insurance markets. See Kunreuther & Michel-Kerjan, *supra* note 1, at 361-65.

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fail to perform their risk-spreading function when the insured risks are correlated with each other—when too many of the members of the insurance pool face the same risk and incur their loss in the same circumstances.[107] That a number of insurers became insolvent in the aftermath of major hurricanes reinforces the notion that the most extreme cases of severe weather are just too big for private insurance to handle alone.

But is that in fact true? Is extreme weather risk actually uninsurable through private markets? At least since the 1990s, after the Northridge Earthquake and Hurricane Andrew disasters exposed the inadequacy of capital that was then being deployed in catastrophe reinsurance markets, concerns have been expressed about the "capacity" of private markets to handle the once-in-a-generation disaster.[108] In theory, it is not clear why even the largest storms should not be insurable, given the amount of capital available in the world to provide a hedge against such risks. Even large correlated risks on the local or national level are uncorrelated and manageable, in terms of risk spreading, on a global level. This is what reinsurance markets do: they take the risks insured by individual insurance companies around the world, pool them together, and then distribute them across investors worldwide. So why are so few assets allocated to catastrophe reinsurance markets?

A range of explanations have been offered for the apparent shortage of reinsurance capital, including tax incentives, agency costs, and exploitation of market power.[109] At the same time, insurance markets have responded with a wave of financial innovation designed to increase the market's supply of catastrophic reinsurance capacity.[110]

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[107] *See, e.g.*, George L. Priest, *The Government, the Market, and the Problem of Catastrophic Loss*, 12 J. Risk & Uncertainty 219, 222 (1996) ("The law of large numbers will not apply…if the risks faced by members of the pool are not statistically independent to some degree.").

[108] *See, e.g.,* Dwight M. Jaffee & Thomas Russell, *Catastrophe Insurance, Capital Markets, and Uninsurable Risks,* 64 J. Risk & Ins. 205 (1997); The Financing of Catastrophe Risk (Kenneth Froot ed., 1999).

[109] *See, e.g.*, Jaffee & Russell, *supra* note 108, at 209–16 (arguing that various "institutional factors," such as accounting, tax, and takeover risk, make insurers reluctant to accumulate the liquid capital necessary to provide full catastrophic risk coverage); Kenneth A. Froot, *Introduction*, *in* The Financing of Catastrophe Risk 1, *supra* note 108 (discussing a range of factors that inhibit the accumulation of capital to provide catastrophic reinsurance).

[110] *See, e.g.,* David C. Croson & Howard C. Kunreuther, *Customizing Indemnity Contracts and Indexed Cat Bonds for Natural Hazard Risks,* 1 J. Risk & Fin. 24 (2000); J. David Cummins, *CAT Bonds and Other Risk-Linked Securities: State of the Market and Recent Developments,* 11 Risk Mgmt. & Ins. Rev. 23 (2008); Neil A. Doherty, *Financial Innovation in the Management of Catastrophe Risk,* 10 J.

One of the most promising developments in building capital reserves for mega-catastrophes has occurred in securities markets—the development of the catastrophic bond ("cat bond").

Cat bonds are tradable debt securities issued by insurers. They are sold to investors in capital markets and promise a generous interest rate. What distinguishes these bonds from regular debt instruments is that the payment of interest and the repayment of principal are contingent upon the non-occurrence of some catastrophe-related trigger.[111] Thus, if a mega-storm occurs that triggers the cat bond, the insurer who issued the bonds is relieved from the obligation to redeem the bond. The insurer is in effect able to use the principal to cover storm-related losses. Thus, as the use of cat bonds has been expanding rapidly over the past two decades, the capacity for the private insurability of extreme weather risks continues to expand as well.[112] In the absence of publicly provided catastrophe insurance this expansion would have likely been greater.

If the creation of adequate private insuring capacity for weather-related disasters is in fact caused by persistent market failures, there are government interventions that, unlike the NFIP, deploy market incentives to reduce risk. Congress could, for example, adopt a federal reinsurance regime for severe storms similar to the one system it created for catastrophic terrorism risks in the wake of the September 11 attacks. Under the Terrorism Risk Insurance Act (TRIA), the first $27.5 billion of losses from a given act of terrorism (rising to $37.5 billion by 2020) is insured through private insurance markets, with the federal government provide providing 85% (falling to 80%) of the coverage above that

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APPLIED CORP. FIN. 84 (1997); Jaffee & Russell, *supra* note 108; Martin Nell & Andreas Richter, *Improving Risk Allocation Through Indexed Cat Bonds,* 29 GENEVA PAPERS ON RISK & INS. 183 (2004).

[111] U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-02-941, CATASTROPHE INSURANCE RISKS: THE ROLE OF RISK-LINKED SECURITIES AND FACTORS AFFECTING THEIR USE (2002); *see also* Lewis, *In Nature's Casino*, *supra* note 54.

[112] The current amount of capital devoted to cat bond risks is roughly $19 billion. *2013 On Track for Record if Q4 Cat Bond Issuance Similar to Recent Years: WCMA*, ARTEMIS (Nov. 6, 2013), http://www.artemis.bm/blog/2013/11/06/2013-on-track-for-record-if-q4-cat-bond-issuance-similar-to-recent-years-wcma. However, some insurance experts expect as much as $100 billion of new capital to be added to the existing $510 billion of global reinsurance capital over the next 10 years, much of which growth will come from new cat bonds and other "insurance-linked securities." AON BENFIELD, REINSURANCE MARKET OUTLOOK: POST CONVERGENCE—THE NEXT USD100 BILLION 3 (2013), *available at* http://thoughtleadership.aonbenfield.com/Documents/20130905_ab_analytics_re_market_outlook_external.pdf.

threshold up to a cap of $100 billion.[113] Proponents of TRIA argue that the retentions built into such a regime provide considerable incentive for insurers to compete on price, while eliminating the downside uncertainty associated with the truly cataclysmic disasters. The hope is that the gradually decreasing federal reinsurance will encourage the flow of private capital into the terrorism-insurance business. Something similar could be done with catastrophic weather risk.[114]

V. CONCLUSION

We concluded that insuring capacity is not an insurmountable problem for private insurance of weather risk. However, affordability may well be. In areas subject to severe weather, private insurance is offered, but priced at full risk it is expensive, and for many unaffordable. True, without insurance these homeowners would also be unable to rebuild their property if lost, and insuring it might be a rational cost-minimizing choice. But it is still a luxury that many cannot afford (and, as explained above, were not factoring in when moving to the area). Means-tested subsidies may be designed only for the truly needy,[115] but short of a mandate to insure, many residents of hazard-prone area would remain uninsured against weather devastation. What would happen in these communities after a disastrous storm?

Collectively-provided disaster relief is the common response. Major disasters have a way of arousing a strong urge to support the victims. Such catastrophes generate an extraordinary amount of media attention and trigger a demand by the public to lend a collective hand—paid for by taxpayers—to the unlucky few, culminating in special legislative action to appropriate funds, such as the one following the September 11th attacks.[116]

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[113] Terrorism Risk Insurance Act of 2002 (Pub. L. 107–297, 116 Stat. 2322), Nov. 26, 2002; Terrorism Risk Insurance Extension Act of 2005 (Pub. L. 109-144, 119 Stat. 2660), Dec. 22, 2005; Terrorism Risk Insurance Program Reauthorization Act of 2007 (Pub. L. 110-160, 121 Stat. 1839), Dec. 26, 2007; and Terrorism Risk Insurance Program Reauthorization Act of 2015 (Pub. L. 114-1, 129 Stat. 3), Jan. 12, 2015.

[114] The danger, of course, is that if the private-market retentions are not set high enough, there could still be a moral hazard effect on building-design decisions and, perhaps more crucially, on location decisions. This effect would be minimized by leaving weather-disaster risks entirely to the private market. For a somewhat skeptical take on the original Terrorism Risk Insurance Act, see Saul Levmore & Kyle Logue, *Insuring Against Terrorism—and Crime*, 102 MICH. L. REV. 268 (2003).

[115] Carolyn Kousky and Howard Kunreuther, *Addressing Affordability in the National Flood Insurance Program*, 1 Journal of Extreme Events 1450 (2014).

[116] Air Transportation Safety and System Stabilization Act, Pub. L. No. 107-42, 115 Stat. 229 (2001); *see generally* Levmore & Logue, *supra* note __.

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When the magnitude of destruction caused by weather disasters is exceptionally high relative to past trajectories—when they reach more victims at greater scale and cause deeper misery than prior patterns predict—ad hoc relief is set in motion. Hurricanes Katrina and Sandy are examples of such events, exceptional in the magnitude and scope of harm and destruction they inflicted on entire communities.[117] The corresponding federal disaster relief for the 2005 hurricane season and for Hurricane Sandy totaled $109 billion and $66 billion, respectively.[118]

The emergence of ad-hoc funds for relief from disasters is a testament to the collective's conviction that shifting the loss from the direct victims is a way to mitigate the overall devastating impact of a disaster. For one, the loss is thus borne by a broader pool of payers, unable to drain the high marginal utility regions of people's welfare functions. Moreover, with the geographical concentration of victims, disasters have a "super-additive" impact, destroying not only the sum of the individual properties or lives, but entire communities. Thus, unlike more routine loss events (such as those that fall below the disaster declaration threshold), relief for truly catastrophic disasters is not regarded as a bailout of the irresponsibly uninsured.[119]

If disaster relief is an irresistible instinct of a decent society, it is a social insurance scheme that people—especially if uninsured through ordinary means—can rely on. It matters not that many of the victims could have purchased insurance (does the Coast Guard refrain from rescuing a drowning vessel that failed to equip itself with adequate life boats?) This social insurance can be eliminated if people buy insurance policies. Hence, the government's subsidy of such policies can be understood as an attempt to shift from funding completely free ex post relief to funding a cost-sharing scheme.

[117] *See* sources cited *supra* note **Error! Bookmark not defined.** and accompanying text.

[118] FELLOWES & LIU, *supra* note 29. NAT'L OCEANIC & ATMOSPHERIC ADMIN., BILLION-DOLLAR WEATHER/CLIMATE DISASTERS (2013), *available at* http://www.ncdc.noaa.gov/billions/summary-stats. In addition, special tax subsidies were enacted to directly benefit the victims of large disasters. Personal casualty loss deductions are normally capped at 10% of the taxpayer's adjusted gross income; that limitation was eliminated for the hurricane victims. *See generally* U.S. TREASURY DEP'T, PUB. NO. 4492, INFORMATION FOR TAXPAYERS AFFECTED BY HURRICANES KATRINA, RITA, AND WILMA (2006).

[119] This "disaster paradigm," in which relief is justified on the grounds that the need is the result of a collective and systemic catastrophe, over which individuals had no control, traces its roots back to the country's early days. *See generally* MICHELE LANDIS DAUBER, THE SYMPATHETIC STATE: DISASTER RELIEF AND THE ORIGINS OF THE AMERICAN WELFARE STATE (2013).

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We can end this article with a call for ending government-run weather insurance, replacing it with more selective policies of need-based subsidies.[120] This would eliminate the inefficient incentives to develop and redevelop coastal land, as well as the regressive redistribution. But where is the sense in such naïve proposal? Congress did enact a law to eliminate the flood insurance subsidies—a bipartisan law remarkably passed in the peak days of partisan gridlock—only to quickly toss it out in an even more widely supported bill. Insurance affordability, it turns out, is one of the most effective political calls to arms, resulting here in a premium scheme that will likely remain in place for decades. We can only contribute to clarifying its enormous social cost.

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[120] Carolyn Kousky and Howard Kunreuth, *Addressing Affordability in the National Flood Insurance Program*, 1 Journal of Extreme Events 1450 (2014); literature on means-bases subsidies.
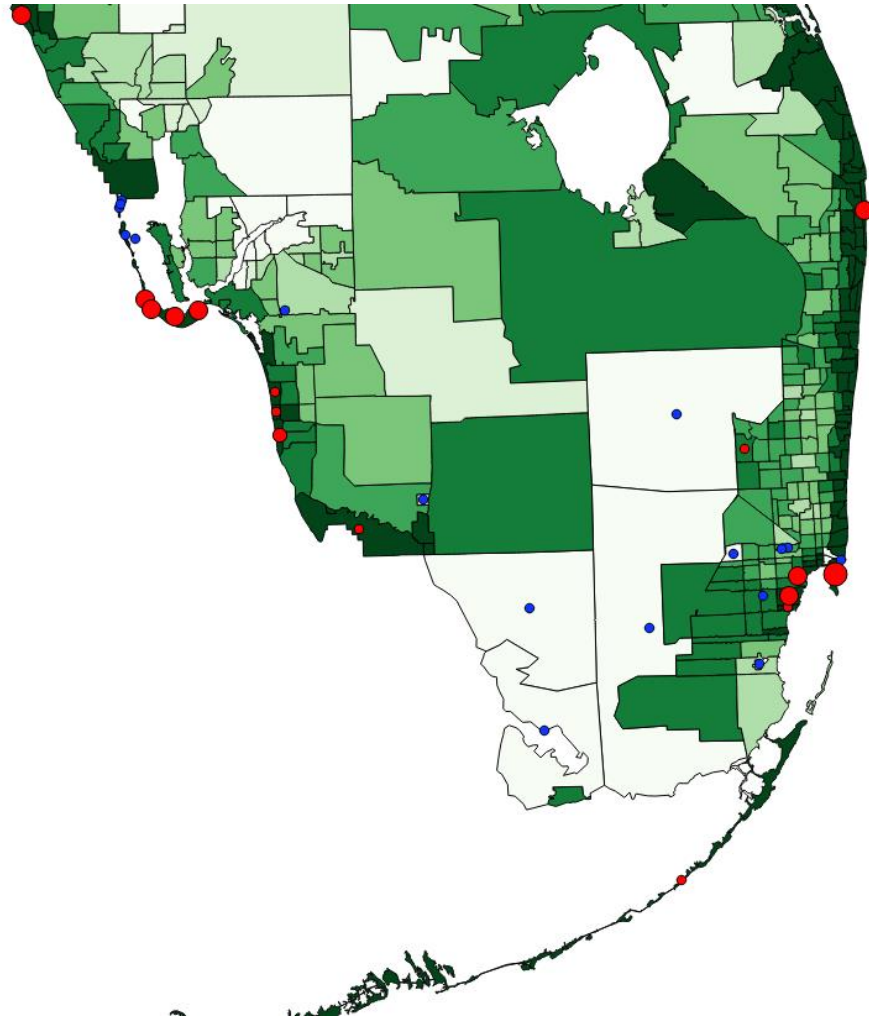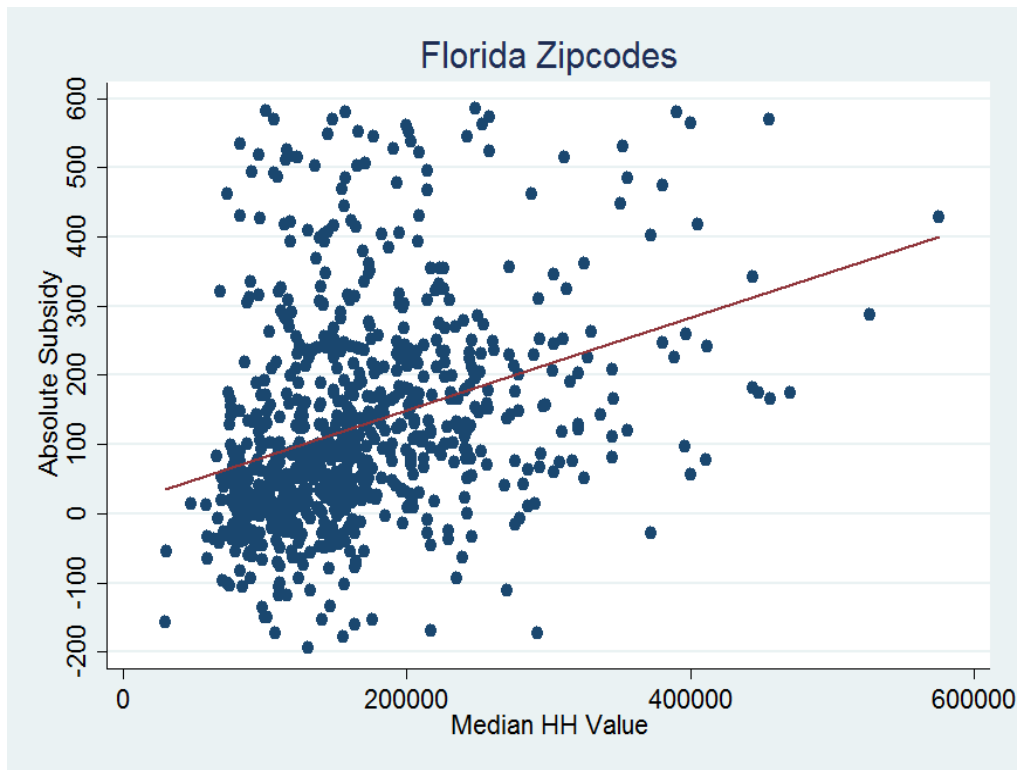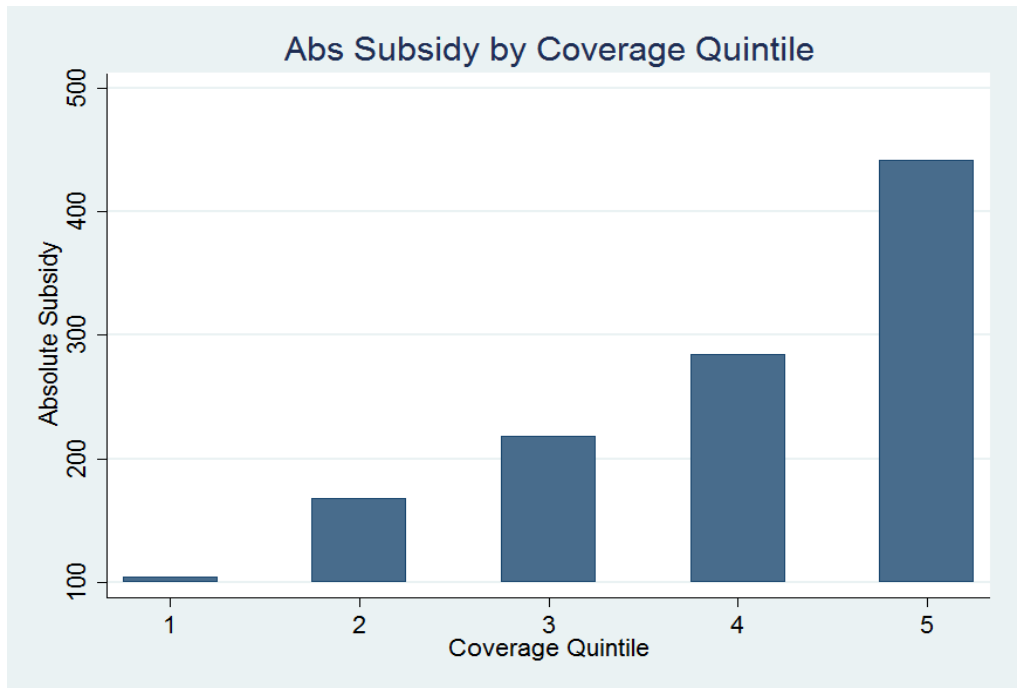
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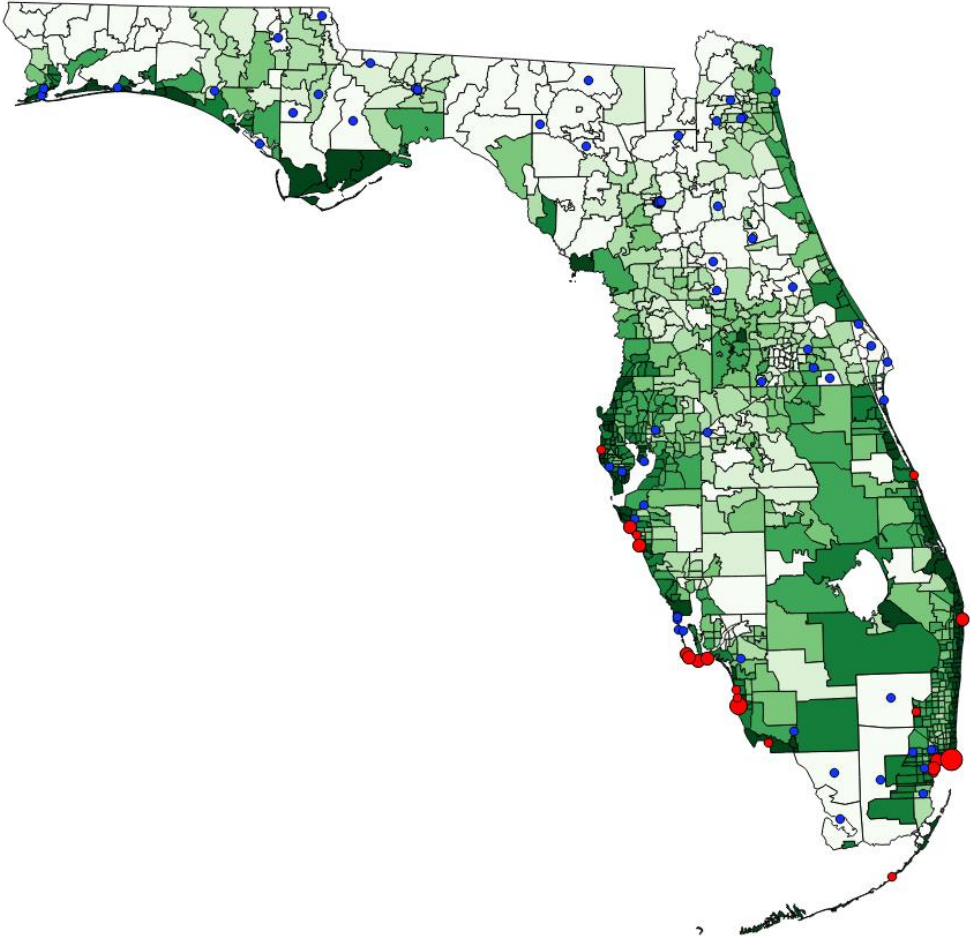
Figure 4

Figure 5

Figure 6

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Figure 7

Source: *Evaluation of Erosion Hazards*, Heinz Center, 2000

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Table 1

Table 1: Regressions using Log Absolute Subsidy

	(1) Log Coverage	(2) w/ Policy FE	(3) w/ Territory SE Cluster	(4) w/ Policy FE (Terr Cluster)	(5) Log HH Value (ZIP Cluster)	(6) w/ Policy FE (ZIP Cluster)
log_coverage	1.052***	1.052***	1.052***	1.052***		
	(252.20)	(252.22)	(13.64)	(13.64)		
_Iptype_1		0.108*		0.108*		-0.0118
		(2.56)		(2.56)		(-0.05)
log_hh					0.484***	0.484***
					(4.05)	(4.05)
_cons	-7.645***	-7.647***	-7.645***	-7.647***	-0.675	-0.675
	(-150.40)	(-150.42)	(-8.13)	(-8.14)	(-0.47)	(-0.47)
N	339046	339046	339046	339046	339038	339038

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2

Table 1: Regression with % Subsidies

	(1) Log Coverage	(2) w/ Policy FE	(3) w/ Territory SE Cluster	(4) w/ Policy FE (Terr Cluster)	(5) Log HH Value (ZIP Cluster)	(6) w/ Policy FE (ZIP Cluster)
log_coverage	0.847***	0.796***	0.847***	0.796***		
	(126.81)	(117.87)	(8.04)	(7.51)		
_Iptype_1		0.806***		0.806*		0.945***
		(46.64)		(2.36)		(3.55)
log_hh					0.571***	0.484***
					(4.19)	(3.60)
_cons	-8.320***	-7.914***	-8.320***	-7.914***	-4.890**	-4.090*
	(-101.61)	(-96.30)	(-6.45)	(-6.26)	(-2.93)	(-2.51)
N	527250	527250	527250	527250	527236	527236

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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Readers with comments should address them to:

Professor Omri Ben-Shahar
        omri@uchicago.edu

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