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UNDER THE WEATHER:
GOVERNMENT INSURANCE AND THE REGULATION OF
CLIMATE RISKS

Omri Ben-Shahar and Kyle D. Logue^{*}

Abstract

This Article explores the role of insurance as 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.

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INTRODUCTION

Humanity has figured out all too well how to change the weather unintentionally.¹ But it is still a long way from learning how to engineer the weather deliberately. We do not know how to steer damaging storms away from populated areas, how to moderate the torrential rains that produce damaging floods, or how to end droughts. The technology to mitigate severe weather, especially large storms, is still science fiction.²

What we can do, however, is weather the storm. Using the tools of prediction and rational planning, we can regulate human exposure to the *risk* of bad weather. Using historical data and predictive models, scientists and policymakers can anticipate weather patterns and take steps to reduce weather-related harms. Our society may not be able to control the wind, the rain, or lightning, but we can build sturdier homes on higher ground with stronger roofs and lightning rods. By directing airplanes and ships away from dangerous storms, or by building dams and levies, we are regulating behavior in the shadow—under the cloud—of disobedient weather patterns.

The term “natural disaster” is thus a misnomer. All weather catastrophes are the result of a combination of natural forces and human policies. Although the natural forces component is uncontrollable, the devastating outcomes can be mitigated by appropriate human policies.

¹ The vast majority of scientists who study the subject regard the data as sufficient to show that climate change is happening and that it is largely anthropogenic. See U.S. GLOBAL CHANGE RESEARCH PROGRAM, CLIMATE CHANGE IMPACTS IN THE UNITED STATES: THE THIRD NATIONAL CLIMATE ASSESSMENT (Jerry M. Melillo et al. eds., 2014); *Consensus: 97% of climate scientists agree*, NAT’L AERONAUTICS & SPACE ADMIN, <http://climate.nasa.gov/scientific-consensus> (last visited Dec. 2, 2014).

² Between 1962 and 1983, a joint project between the U.S. Navy and the U.S. Department of Commerce undertook a massive experiment to determine if cloud seeding technology, which had shown success in altering rainfall levels, could be used to reduce the intensity of hurricanes. Termed Project STORMFURY, the idea was to seed the clouds outside of the eye of the hurricane to create wind patterns that would cut against the direction of the hurricane, reducing its intensity. It didn’t work. H. E. Willoughby, D. P. Jorgensen, R. A. Black, & S. L. Rosenthal, *Project STORMFURY, A Scientific Chronicle, 1962-1983*, 66 BULL. AM. METEOR. SOC’Y 505 (1985); see also STEVEN M. HUNTER, U.S. BUREAU OF RECLAMATION, OPTIMIZING CLOUD SEEDING FOR WATER AND ENERGY IN CALIFORNIA (2007), available at <http://www.energy.ca.gov/2007publications/CEC-500-2007-008/CEC-500-2007-008.PDF>; Ross Hoffman, *Controlling Hurricanes*, SCI. AM., Oct. 2004, at 68. See generally Tracy D. Hester, *Remaking the World to Save It: Applying U.S. Environmental Law to Climate Engineering Projects*, 38 ECOLOGY L. Q. 851 (2011).

That weather-related disasters continue to impose major losses is a result of often imprudent or shortsighted human choices.³

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.⁴ Although the precise combination of causes may be debated—emissions of greenhouse gases? natural climatic cycles? increased concentration of populations in coastal areas?⁵—the 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;⁶ and in 2013 Typhoon Haiyan, which

³ 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.”)

⁴ 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. Similarly, as a result of the severe drought in 2012, crop insurance payouts in the U.S. that year were the largest ever, exceeding the previous year’s payouts—which also had been a record—by a considerable margin. Payouts totaled \$11.581 billion for damage in 2012, \$10.843 billion in 2011, and \$4.251 billion in 2010. Jeff Wilson, *U.S. Crop-Insurance Claims Rise to Record After 2012 Drought*, Bloomberg, Jan. 15, 2013, available at <http://www.bloomberg.com/news/2013-01-15/u-s-crop-insurance-claims-rise-to-record-after-2012-drought-2-.html>.

⁵ 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 9.

⁶ 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/>. According to NOAA, owing to Hurricane Sandy (\$66 billion) and the year-long drought (\$30 billion), 2012 was an extraordinarily bad year for weather-related disasters in the U.S., though arguably not the worst. 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

devastated the Philippines, eliminating entire villages and killing thousands, may have been the strongest tropical cyclone to hit land in recorded history.⁷ Beyond anecdotes, the trend is clear: weather-disaster losses are rising in the U.S. (Figure 1)⁸ and worldwide (Figure 2).

As the magnitude and frequency of weather patterns seem to pose a risk higher than ever, a large and growing fraction of humanity's physical assets is located in harm's way.⁹ 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. One approach is to address the root causes of climate change. Another approach is to adopt rules and practices that reduce the harm that unavoidable climatic patterns cause. We refer to this latter approach as the *regulation of weather risk*.

Regulation of weather risk can take various forms. For example, to improve the durability of construction under severe weather conditions, local governments can adopt more demanding building codes and stricter standards of floodplains management. To reduce exposure to weather-caused harm, the government can beef up zoning regulations or invest in community infrastructure, diverting development away from high-risk areas or improving flood resistance in developed areas.

The focus of this article is on a different form of regulation of severe weather risk: *regulation through insurance*. Insurance is not commonly regarded as a form of command-and-control regulation. Rather, it is widely recognized as the primary tool to provide relief after damaging weather events, shifting losses *after they occur*. But insurance is also an important—and in the weather context, a potentially crucial—device in controlling and incentivizing behavior *prior to the occurrence of losses*.

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>.

⁷ *Typhoon Haiyan: Worse Than Hell*, THE ECONOMIST, Nov. 16, 2013.

⁸ See sources cited *supra* note 4.

⁹ 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).

Buying insurance is more than participating in a risk-spreading pool, waiting for the lightning to strike. It is also a transaction in which policyholders are incentivized, in various direct and indirect ways using contractual tools that we identify, to adopt loss mitigation measures. 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 harm.¹⁰ 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.

Looking at insurance providers, private or governmental, as *regulators of weather risk*, the article asks two sets of questions. First, how does weather insurance mitigate the expected costs of weather-related disasters? Second, does the regulatory impact of insurance change in systematic ways when the government becomes the provider of weather insurance?

In addressing the first question, we reconcile two basic but conflicting insights. At one end stands the widely accepted idea that having insurance dulls the insured party's incentive to mitigate losses. This idea, commonly referred to as "moral hazard," has been well-studied in the literature on the economics of insurance. The theory of moral hazard suggests that, while insurance may be useful and efficient as a form of post-disaster relief, it destroys the incentives for pre-disaster loss mitigation.

In opposition to the moral hazard conjecture stands a different prediction—not nearly as well studied or well understood—that insurance contracts reduce, rather than aggravate, risk. Anticipating that storms may be coming and recognizing that insured property owners might capitulate to the moral hazard, insurance providers include in their contracts powerful counter-incentives. These contractual mechanisms prompt policyholders to improve their preparedness and reduce the exposure of their property to weather-related losses, potentially to a greater extent than they would have done in the absence of insurance.

In addressing the first question—if and how insurance mitigates the costs of weather disasters—we focus on several contractual tools insurers use to improve policyholders' incentives, including incentives to build sturdier homes. But our focus is ultimately on the most important aspect of weather preparedness: how insurance affects people's decisions *where* to live.

¹⁰ See Omri Ben-Shahar & Kyle D. Logue, *Outsourcing Regulation: How Insurance Reduces Moral Hazard*, 111 MICH. L. REV. 197 (2012).

Recognizing the ways in which insurance can regulate weather risk, the article turns to address the second fundamental question: who should provide the insurance and act as the regulator of weather risk—private insurance companies or the government? While in theory the ownership and administration of the insurance mechanism need not affect the optimal content and design of insurance contracts, we show that in practice it makes a great difference. Unlike private insurance, government provision of weather insurance is less subject to market discipline and to the strict methods of actuarial pricing, and is more likely to be influenced by political considerations, redistributive preferences, and affordability concerns. We identify the primary features of government-provided weather insurance and show that it is priced dramatically differently than private insurance contracts, that it is purchased by different pools of policyholders, that it creates a different pattern of within-pool cross subsidies, and—most importantly—that it is responsible for different *ex ante* mitigation and preparedness incentives among homeowners and community developers.

This Article demonstrates that regulation of weather risk through government provided insurance in the U.S. is often inferior to regulation that might be implemented through private insurance markets. It is inferior in two ways. First, it is less efficient. When people and firms are insured by the government through contracts that fail to produce good incentives, they choose property locations too close to paths that devastating storms normally travel, and are thus too vulnerable to harm. And when their homes and businesses are in fact destroyed, they often rebuild in the same place—and in the same way—largely because government insurers do not insist otherwise.

Government insurance can be inferior in another way: it is unfair. Almost all insurance schemes create cross-subsidies, whereby some participants in the pool are over-charged and thus subsidize others who are undercharged. The unfairness we identify has to do with the troubling direction of the cross-subsidy that government-provided weather insurance in the U.S. creates: homeowners who enjoy the largest insurance cross-subsidies are those who need them least. That is, the subsidy moves from the poor to the affluent, rather than the reverse. The government, in other words, turns out to be a regressive regulator of weather risk. Using unique data from Florida's state insurance company, we estimate the magnitude of the benefit that wealthy homeowners enjoy.

This Article is structured as follows. The first two Sections are descriptive. Section I examines the regulatory tools that insurers have to improve the preparedness of their policyholders. Section II examines the specific features of government-provided insurance, focusing on three

programs that are relevant to weather risk: post-disaster relief, the National Flood Insurance Program, and Florida's state owned Citizens Insurance that sells wind insurance policies. Section III then presents the normative claims of the article: Government insurance creates unfair pooling of risk and leads to inefficient preparedness.

I. REGULATION OF WEATHER RISK BY INSURANCE

Weather risk—like any risk—can be mitigated or prevented by enacting rules that change people's behavior prior to disaster. Common examples are the adoption of building codes and the use of zoning restrictions at the local level. Building standards reduce the vulnerability of structures to storms and harsh conditions. Zoning restrictions stop people from moving into (or urge them to move out of) the predicted path of future storms.

Insurers, whether public or private, do not usually exercise such direct means of control over the decisions of property owners and developers. Instead, insurance is a *contract* that, if well drafted, creates incentives for insureds to engage in precautionary behaviors that cost less than the risk they reduce. Insurance contracts can operate as ex ante regulation, setting guidelines for conduct before loss occurs and requiring adherence to these guidelines as a condition for coverage or for premium discounts.¹¹ Insurance contracts can also operate as ex post regulation, determining the eligibility of claims and the magnitude of recovery after loss occurs.

Interested in the ways insurers regulate behavior ex ante to improve storm preparedness, we examine the regulatory tools at their disposal. In this section, we lay out the conceptual framework of regulation by insurance, but draw no distinction between private and public weather insurance. Later, in Part II, we provide a comparative institutional analysis of public and private insurance systems, examining how each utilizes these regulatory tools.

A. The Price of Weather: Underwriting Differentiated Premiums

Price is the ultimate regulator of conduct. At the front end of the insurance transaction, insurers' most basic tool for creating incentives to reduce risk is the setting of differentiated premiums. Insurers charge lower premiums to policyholders who face lower expected harm, thus

¹¹ Some government programs provide a form of insurance that does not follow the standard contractual model of insurance coverage. Examples of such "social insurance" include Medicare, Social Security, and state unemployment insurance.

inducing people to behave in ways that qualify for the discounts. Auto insurers, for example, provide discounts for driving safer cars, driving less often, and driving accident-free. Life insurers charge lower premiums for not smoking or scuba diving. And property insurers discount theft and fire coverage if policyholders install security systems and smoke detectors.

In many areas of insured activity, the assessment of expected harms—and whether the investment in their reduction is cost-justified—is a complicated, data-driven enterprise. Sometimes expected losses depend on unobservable idiosyncratic factors best known by the policyholders, making it difficult for insurers to price policies accurately, which in turn gives rise to adverse selection.¹² 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.

If insurance premiums vary according to the risk attributed to the specific property, the insurance policy can become a powerful regulator of behavior. Differentiated premium regulate behavior not by mandating particular conduct or safety measure as, say, building codes do. Rather, they regulate behavior by pricing different conduct choices, making it more costly for people to choose high-risk courses of action. Policyholders are 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 they are given an incentive to choose some safety measures, because they incur both the cost of installation and—through the premium discount—the benefit of risk-reduction.

Differentiated insurance premiums operate in much the same way as government-set Pigouvian taxes. By taxing conduct that imposes external costs and harm to others, the government forces actors to take those costs into account and either reduce their level of activity or find ways to mitigate the harms.¹³

Thus, in contrast to traditional command-and-control rulemaking, where the regulator has to decide whether to mandate a particular safety measure or not (which in turn requires the regulator to compare the total

¹² 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).

¹³ See, e.g., HARVEY S. ROSEN, *PUBLIC FINANCE* (10th ed. 2013). For further discussion of how differentiated insurance premiums replicate the Pigouvian tax approach, see Ben-Shahar & Logue, *supra* note 10, at 229–31.

benefit of that safety measure with its total cost), insurance regulation can avoid the crude trade-off inherent in binary choice and market-wide mandates. That is, the insurance regulator needs only to price the expected risk reduction associated with each safety investment and let policyholders self select. Clients for whom the premium reduction is more valuable than the necessary investment in the safety measure would make the investment; others would not. Zoning regulations, for example, may require homes to be built at particular elevations, or may mandate the use of stilts or pilings to survive storm surges. Insurance regulation, by contrast, does not mandate but provides a menu of options—premium discounts to homes that invest in different degrees of precautions. The sorting under this menu approach avoids the inefficiency of mandated, across-the-board, all-or-nothing safety requirements.

Differentiated risk-based premiums can affect not only the level of precautions, but also the level of the insured's activity. This is a general, trivial effect of prices: they separate people into those who purchase and those who don't. 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.

Thus, differentiated premiums are the primary tool available for insurers to affect the ex ante safety decisions of their insureds. But to work effectively, insurers must have the know-how to adjust premiums in accordance with fine-tuned categories of risk, and they must have the incentive to do so accurately. We now turn to examine these.

B. Pricing of Weather Insurance Policies

Because the primary risk associated with severe weather is the risk of property damage, private weather risk insurance is sold mostly through property insurance policies, including homeowners' and commercial property insurance. Homeowners' policies, for example, cover damage to the structure of a home resulting from all but a few excluded causes. Therefore, with the exception of flood damage (discussed below), most storm-caused damage is covered. The largest storm-related risk insured by homeowners' and commercial property policies is the risk of wind damage.

Wind risk varies enormously by location. As a result, the portion of a property insurance premium corresponding to the risk of wind damage is highly contingent on the location of the property. For example, the largest homeowners' insurance premium increases in recent years have been in the states with the most damage from storms, Oklahoma (because of its location in "Tornado Alley"¹⁴) and Florida (hurricanes).¹⁵ Insurers are experts in storm and wind patterns, in part because of the decades of information that have been gathered in the process of underwriting weather coverage and adjusting weather claims. In addition, insurers have come as close to being experts in predicting the future of weather risks as science will permit. They are pioneers in their efforts to use mathematical modeling to take into account not only weather predictions but also demographic trends and construction practices.¹⁶ For example, insurance models may estimate that a home with a hipped roof (pyramid shape) would sustain four percent less damage than a home with a roof with gable ends.¹⁷ Based on such estimates, property insurance prices are adjusted each renewal period, usually each year, to reflect the latest information regarding overall weather-related risks. According to one source, for example, 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.¹⁸

Weather insurance premiums are also individualized to particular property owners. Factors that affect insurance pricing include, as mentioned, location, but not only general region of the country, for example, the plains of Oklahoma as compared to the hills of Tennessee. Also important is the property's specific location within a given region.

¹⁴ "Tornado Alley" is a nickname given to the area in the southern plains region of the U.S., including northern Texas, Oklahoma, Kansas, and Nebraska. *Tornado Alley*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., <http://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornado-climatology/tornado-alley> (last visited Nov. 4, 2014).

¹⁵ *Top 5 States for Auto, Home Insurance Rate Hikes in 2013: Perr&Knight*, INSURANCE JOURNAL (Mar. 12, 2014), <http://www.insurancejournal.com/news/national/2014/03/12/323043.htm>.

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>.

¹⁷ *Id.*, at 38.

¹⁸ 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].

In addition, the price of a homeowners' policy on the coasts of can be reduced dramatically if the insured buys, builds, or renovates a property according to particular construction specifications.¹⁹ There is little doubt that property insurance location-based pricing, by raising the cost of owning or renting property on the shoreline, has affected the location decisions, design choices, and construction methods in storm-prone areas.

C. Developing and Implementing Weather Safety Tools

Property insurers invest considerable resources in researching and developing techniques for minimizing the risk of weather damage to homes and businesses. Large insurers have their own development operations, and the industry as a whole invests collectively through organizations such as the Insurance Institute for Business and Home Safety (IBHS).²⁰ Fashioned after the model of the Insurance Institute for Highway Safety (IHS), famous for its research into auto safety and especially its crash-testing and safety rating of new automobiles,²¹ the IBHS researches how best to construct buildings to minimize various types of damage, especially damage from severe weather.

One innovative research technique at IBHS, as yet unmatched by government regulators, is the high wind test facility at the IBHS Research Center in South Carolina. At this Center, IBHS is able to

¹⁹ 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™: Hurricane 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). In addition, Florida requires insurers to provide wind mitigation discounts, up to 83% of premiums, based on a very detailed set of construction criteria. See, e.g., *Notice of Premium Discounts for Hurricane Loss*, FLORIDA OFFICE OF INSURANCE REGULATION, <http://www.floir.com/sitedocuments/oir-b1-1655.pdf> (last visited Dec. 29, 2014) (explaining to Florida insurance purchasers how wind mitigation premium discounts are calculated); *Windstorm Loss Reduction Credits*, FLORIDA OFFICE OF INSURANCE REGULATION, <http://www.floir.com/siteDocuments/OIR-B1-1699.xls> (last visited Dec. 29, 2014) (spreadsheet showing actual credit amount for each specific construction criterion.)

²⁰ INSURANCE INSTITUTE FOR BUSINESS & HOME SAFETY, <https://www.disastersafety.org> (last visited Nov. 4, 2014).

²¹ *Safety Ratings*, INSURANCE INSTITUTE FOR HIGHWAY SAFETY, <http://www.iihs.org/iihs/ratings> (last visited Nov. 4, 2014).

generate realistic wind hazards, including winds up to 130 mph.²² This facility has permitted IBHS to study a range of alternative construction methods to determine which methods best withstand high winds. As a result of this testing technology, IBHS has developed a program of construction certification that grades structures according to their ability to resist high winds, with certifications from bronze, to silver, to gold.²³ The ratings are used in a number of states, where insurance regulators either permit or require insurers to calculate premium discounts on the basis of such ratings.²⁴

Insurers, it turns out, have a financial stake not only in identifying effective construction innovations, but also in seeing those innovations implemented by policyholders. It is only when new and improved risk reduction construction methods are actually used that weather-related insurance claims are reduced, thereby enabling insurers to compete more robustly for business with lower premiums. To encourage adoption among policyholders, insurers as mentioned use premium discounts. And to encourage adoption by policymakers, insurers rate the different localities' home-building standards. To accomplish this, IBHS collects information regarding the building codes in different communities and how well those codes are being enforced by local governments. This information is then used to generate building code effectiveness ratings, which individual insurers may then use to price their coverage within the rated districts.²⁵ The indirect effect of these ratings is to put pressure on state and local governments to tighten their building codes and their enforcement of these building codes.

It is important to note that the building code effectiveness rating is done in coordination with industry-owned Insurance Services Office (ISO)²⁶—the bureau that collects data and shares it within the industry to

²² *Research Center*, INSURANCE INSTITUTE FOR BUSINESS & HOME SAFETY, http://www.disastersafety.org/wp-content/uploads/RSC_overview_IBHS.pdf.

²³ *IBHS Fortified Home Hurricane Program: Bronze, Silver and Gold: An Incremental, Holistic Approach to Reducing Residential Property Losses in Hurricane-Prone Areas*, INSURANCE INSTITUTE FOR BUSINESS & HOME SAFETY, available at http://www.disastersafety.org/wp-content/uploads/ATC-FORTIFIED_IBHS.pdf (last visited Dec. 29, 2014).

²⁴ See sources cited *supra* note 19.

²⁵ 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>

²⁶ The ISO, among other functions, assesses the building codes in effect in a particular community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. *Building Code Effectiveness Grading Schedule (BCEGS®)*, ISOMITIGATION.COM,

assist in the pricing of policies. Through this process, building code enforcement and insurance policy pricing are coordinated across the entire industry and linked to the best available information regarding loss prevention.²⁷ For example, in rating local building codes, the ISO-IBHS methodology collects data on 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.²⁸

In sum, the business of insurance is as much about risk management as it is about pooling of risk. The design of insurance pools requires accurate risk rating and pricing, prompting insurers to make their products sensitive to the various mitigation efforts and activity choices of their clients. The combination of access to information and competitive pressures to offer affordable premiums generate a framework in which insurers act as private regulators of weather risk.

II. GOVERNMENT-PROVIDED WEATHER INSURANCE

The previous part examined the tools that providers of insurance contracts 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. In this part we focus in particular on government-provided weather risk insurance, describing three existing institutions: federal disaster relief, the National Flood Insurance Program, and Florida's Citizens Property Insurance Corporation.

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

<http://www.isomitigation.com/bcegs/0000/bcegs0001.html> (last visited Nov. 4, 2014).

²⁷ See *id.*

²⁸ See *Building Code Effectiveness Grading Schedule (BCEGS®) Questionnaire* (ISO Properties, Inc. 2004), available at <http://www.isrb.com/pubs/BCEGS%20Questionnaire.pdf>.

underestimate the risk.²⁹ 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. Indeed, only 20 percent of all U.S. homes are covered by flood insurance, despite the fact that floods can cause losses that household would be unable to recover from absent insurance.³⁰

Second, the problem may lie not with the demand for, but rather with the supply of flood coverage. It is sometimes argued that weather calamities are simply too large—or correlated—to be insured through private markets. Insurers may not want to be in the market for severe weather insurance because they cannot absorb the risk through their conventional pooling methods.

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.³¹

These rationales purport to provide the theoretical basis for government-provided weather-risk insurance. What form the government-provided insurance should take is a separate question. In the remainder of this Part, we discuss several different models of government-provided weather insurance. In the first—direct government relief for disaster losses—there is no contractual element. In the other two programs (flood and wind insurance), the government acts like an insurance company: issuing (or subsidizing the issuance of) actual insurance contracts, charging premiums, and paying coverage only to its premium-paying clients. As we discuss these existing arrangements, we continue to revisit the underlying rationales for government intervention and examine their validity.

²⁹ 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); Michael A. Brown, Note, *Anything but a Breeze: Moving Forward Without NFIP Program*, 37 B.C. ENVTL. AFF. L. REV. 365 (2010); 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); cf. Munich Re, *Natural Catastrophes 2010: Analyses, Assessments, Positions*, TOPICS GEO, Feb. 2011, at 6 (describing how volcanic eruptions are “an underestimated risk”).

³⁰ See *Flood Insurance*, http://en.wikipedia.org/wiki/Flood_insurance.

³¹ See Richard A. Derrig et. al, *Catastrophe Management in a Changing World*, 11 RISK MANAGEMENT & INS. REV. 269, 272 (2008).

A. Government Disaster Relief

The broadest form of federally provided weather risk insurance is disaster relief. Federal disaster relief provides benefits to all parties who suffer qualifying losses, up to statutory or regulatory limits, with no requirement of buying insurance or paying premiums. The Federal Emergency Management Agency (FEMA) operates the Disaster Relief Fund³² to rebuild infrastructure and to provide relief to individuals and private businesses. Because the Disaster Relief Fund does not collect insurance premiums in advance, it operates as a form of social insurance, whereby relief payments are funded by tax revenues.³³

The Fund provides grants to individuals and households of up to \$30,000 to cover uninsured losses resulting from any single emergency that is declared a disaster by the President.³⁴ As losses often far exceed

³² 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.

³³ 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.

³⁴ 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, the President received state requests for 629 disaster declarations, of which 539 (or 86 percent) were approved. Because Presidential disaster declarations are made one state at a time, many of declarations are attributable to single storms that affected multiple states. For example, of the 539 declarations issued, roughly half of the FEMA payouts (\$40 billion of the total \$80 billion) were for Katrina-related losses alone. U.S. GOV’T ACCOUNTABILITY OFFICE, GAO-12-838, *FEDERAL DISASTER ASSISTANCE: IMPROVED CRITERIA NEEDED TO ASSESS A JURISDICTION’S CAPABILITY TO RESPOND AND RECOVER ON ITS OWN* 14 (2012), available at <http://www.gao.gov/assets/650/648162.pdf>. For Hurricane Sandy, FEMA payouts one year after the event totaled more than \$1.4 billion in individual assistance and \$2.4 billion in SBA loans, as well as \$7.9 billion in NFIP payouts to flood policy holders and \$3.2 billion to fund emergency work, debris removal, and repair and replacement of infrastructure. See *Hurricane Sandy: Timeline*, FED. EMERGENCY MGMT. AGENCY, <http://www.fema.gov/hurricane-sandy-timeline> (last visited Nov. 5, 2014).

these grants, the Fund also provides loans—up to \$200,000 for households and \$2 million for businesses—to cover the uninsured costs of repairing or replacing damaged property.³⁵

Another form of disaster relief comes from charitable contributions to aid disaster victims. These originate from private donors and not from the government, but they are heavily subsidized by federal tax policy—most notably the charitable contribution deduction. Not surprisingly, the magnitude of charitable disaster aid is largest shortly after the occurrence of highly unusual catastrophes that elicit public sympathy. Examples of post-disaster spikes in charitable contributions include major earthquakes and tsunamis,³⁶ as well as devastating storms such as Katrina and the Joplin, Missouri and Tuscaloosa, Alabama tornadoes.³⁷ However, although charitable disaster relief can grow very large, it tends to be (perhaps always is) dwarfed by government relief as well as by private insurance payouts.³⁸

The U.S. government has attempted to increase the role of charitable disaster relief by introducing new tax subsidies. Contributions to disaster victims through qualified charities have always been tax

³⁵ 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).

³⁶ See MOLLY F. SHERLOCK, CONG. RESEARCH SERV., R41036, CHARITABLE CONTRIBUTIONS FOR HAITI'S EARTHQUAKE VICTIMS (2010), available at <http://fas.org/sgp/crs/misc/R41036.pdf>; Danshera Cords, *Charitable Contributions for Disaster Relief*, 57 CATH. U. L. REV. 427, 447–50 (2008); Britt Reiersgord, *Technology and Disaster: The Case of Haiti and the Rise of Text Message Relief Donations* (University of Denver Case-Specific Briefing Paper, 2011), available at <https://www.du.edu/korbel/cric/humanitarianbriefs/brittreiersgord.pdf>.

³⁷ See Daniel J. Smith & Daniel Sutter, *Response and Recovery After the Joplin Tornado*, 18 INDEP. REV. 165 (2013).

³⁸ 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/metropolitanpolicy%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 Anniversary 2* (Ins. Info. Inst. 2010), available at <http://www.iii.org/sites/default/files/1007Katrina5Anniversary.pdf>.

deductible, in the same way that all charitable contributions are tax deductible within limits. More recently, however, legislation has been enacted specifically to increase the tax subsidy for disaster-related giving.³⁹ Under these new laws, for example, whereas charitable contribution deductions are generally capped at 50 percent of adjusted gross income for individuals, there is no such limitation for contributions to disaster relief.

B. Government-Provided Contractual Insurance

The government is also in the business of selling weather-risk insurance, filling in for a real or perceived gap in the supply of private insurance. Unlike freely provided disaster relief, government-sold insurance contracts need not burden taxpayers. Indeed the presence of widespread insurance coverage can reduce budget stress on ex post relief funds. We focus the discussion below on two specific government insurance programs: the Federal flood insurance and the Florida wind insurance plans.

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, though not entirely, through private insurance companies, they are fully underwritten by the federal government.⁴⁰ Unlike private insurance policies generally, which provide varying levels of coverage amounts depending on risk and demand, coverage under NFIP flood policies is statutorily capped at \$350,000 for homeowners (\$250,000 for the residence itself and another \$100,000 for contents) and

³⁹ Katrina Emergency Tax Relief Act of 2005, Pub. L. No. 109-73, 119 Stat. 2016; Gulf Opportunity Zone Act of 2005, Pub. L. No. 109-135, 119 Stat. 2577.

⁴⁰ GAO, FLOOD INSURANCE, *supra* note 18, at 4. There is a small private insurance market that provides coverage for home values in excess of the ceiling under the NFIP. *Id.*

\$1 million for commercial property owners (\$500,000 each for buildings and contents).⁴¹

Also unlike private property insurance markets, where rates are set primarily by market forces, with NFIP flood policies FEMA sets and adjusts the rates. If the premiums collected in a given year exceed the amount needed to cover flood claims, the excess is passed on to the Treasury Department. Otherwise, if the amount of loss claims exceeds premiums collected, the NFIP has the authority to (and does) borrow from the Treasury to cover claims. In such cases, the NFIP is obligated to pay back over time, perhaps by raising rates. As a result, the U.S. taxpayer is currently the reinsurer of truly catastrophic flood risks. NFIP policies were, and still are, underpriced in comparison with the actual risks. Because of this fact (about which we will have more to say below), NFIP policies have come to dominate the flood risk market.⁴²

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.

To further mitigate the problem of flood insurance coverage gaps, Congress decided to make the purchase of NFIP policies mandatory for properties that are in certain flood zones and that are subject to federally regulated mortgages.⁴³ Such mandatory flood insurance is intended to protect the value of the collateral that home lenders and guarantors rely

⁴¹ *Id.* at 9.

⁴² According to a RAND study published in 2006, almost all of the flood policies on single family homes (SFHs) in special flood hazard areas (SFHAs) were NFIP policies. Specifically, the study found that 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. The primary exception is flood risk policies sold on very expensive houses, the value of which exceeds the maximum amount insurable under the NFIP.

⁴³ The flood insurance mandate was first added as part of the Flood Disaster Protection Act of 1973, Pub. L. No. 93-234, § 102, 87 Stat. 975, 979 (codified at 42 U.S.C § 4012a). It was strengthened by the Flood Insurance Reform Act of 1994, Pub. L. No. 103-325, §§ 501–584, 108 Stat. 2160, 2255–87.

on when issuing a home mortgage loan.⁴⁴ (Why the purchase of flood insurance needs to be mandated is not clear. Private lenders, who stand to lose their collateral if it is uninsured, are surely sophisticated enough to add flood insurance to the often lengthy list of insurance coverages they require from borrowers).

Unlike private insurers, the NFIP cannot reject applicants. It also does not have the flexibility to adjust premiums to match the full risk. These two factors create an adverse selection problem—insured properties are more likely to expect losses exceeding their premiums. Because of these adverse selection problems and the underpricing of flood coverage in the most risk-prone areas, the NFIP is operating at a massive deficit, estimated in 2014 to be around \$24 billion. Moreover, given recent legislative events (discussed below) there appears to be no prospect of that debt being repaid any time soon, or that the chronic underpricing problem would be alleviated.⁴⁵

The rates charged by NFIP to its policyholders are based on flood maps that are created and maintained by FEMA.⁴⁶ Those maps are based on FEMA’s statistical studies of river flows, rainfall, storm tides, and hydrologic factors.⁴⁷ The maps themselves identify, among other things, “special flood hazard areas” (SFHAs), in which there is roughly a 1 percent chance of flood each year and a 25 percent chance of flood

⁴⁴ The flood insurance mandate has not been well enforced, for reasons discussed below. Also, there used to be a federal mandate that crop insurance be purchased, but this general mandate was repealed in 1996. 7 U.S.C. § 1519, *repealed by* Pub. L. No. 104-127, § 196(j), 110 Stat. 888, 950 (1996).

⁴⁵ GOV’T ACCOUNTABILITY OFFICE, GAO-14-297R, OVERVIEW OF GAO’S PAST WORK ON THE NATIONAL FLOOD INSURANCE PROGRAM 1 (2014), *available at* <http://www.gao.gov/assets/670/662438.pdf>. FEMA is authorized to borrow from the Treasury Department when NFIP payouts exceed collected premiums. Since the hurricanes of 2005, this borrowing limit has been increased from \$2 billion to \$30 billion. *Id.* at 9. The Biggert-Waters Act, discussed in the text below, required FEMA to put forward a plan by January of 2013 for repaying this debt. That has not happened. In fact, FEMA is not even collecting enough in flood insurance premiums to cover the interest payments on the debt. *Id.* at 9–11 (discussing FEMA’s troubled debt with Treasury).

⁴⁶ *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).

⁴⁷ NAT’L FLOOD INS. PROGRAM, *supra* note 49.

over the course of 30 years—the length of most home mortgages.⁴⁸ These are the areas in which mortgage lenders are supposed to mandate coverage and where the flood insurance rates are supposed to be the highest.

There are at least three serious problems with the NFIP's use of flood maps in pricing policies. First, the maps themselves are often out of date, which produces two types of errors—some properties wrongly being deemed flood-free and others wrongly deemed flood-prone.⁴⁹ Second, even when the maps are updated, there are cross-subsidies among insureds within the system. FEMA itself admits that a substantial percentage of property owners in high-risk areas were paying well below actuarial rates.⁵⁰ While a 2012 reform intended to correct this actuarial discrepancy, legislation in 2014 essentially postponed such reform indefinitely, and probably killed it. Third, even if the FEMA maps are updated and the rates are made more actuarially sound, political influence will continue to interfere in the process of characterizing particular areas as flood-prone.⁵¹

In response to years of complaints about and studies documenting the inefficiencies inherent in the NFIP, lawmakers in 2012 responded by enacting the so-called Biggert-Waters Flood Insurance Reform Act (BW).⁵² BW sought to gradually eliminate the underfunding of the NFIP and curb the disturbing cross-subsidies built into the program. For

⁴⁸ *Flood Zones*, FED. EMERGENCY MGMT. AGENCY, <http://www.fema.gov/floodplain-management/flood-zones> (last updated July 24, 2014).

⁴⁹ 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), http://www.slate.com/articles/health_and_science/science/2014/03/biggert_waters_and_nfip_flood_insurance_should_be_strengthened.html.

⁵⁰ RAWLE O. KING, CONG. RESEARCH SERV., R42850, THE NATIONAL FLOOD INSURANCE PROGRAM: STATUS AND REMAINING ISSUES FOR CONGRESS 19–20 (2013).

⁵¹ *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>.

⁵² Pub. L. No. 112-141 §§ 100201–100261, 126 Stat. 405, 916–79 (2012).

example, BW 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. BW 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.⁵³ In some areas, there were reports of homeowners’ premiums rising tenfold.⁵⁴ The concern expressed by many lawmakers, on behalf of their angry constituents, was that unless BW was repealed or at least delayed, they wouldn’t be able to remain in their homes or continue their small businesses. Thus, before BW was able to take effect, Congress passed in 2014 the Homeowner Flood Insurance Affordability Act (HFIAA)⁵⁵, which significantly weakened the changes made by BW. The political pressure to repeal BW 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

⁵³ Jenny Anderson, *Outrage as Homeowners Prepare for Substantially Higher Flood Insurance Rates*, N.Y. TIMES, July 29, 2013, at A12.

⁵⁴ 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>.

⁵⁵ Pub. L. No. 113-89, 128 Stat. 1020 (2014).

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.⁵⁶

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. The areas consist of 150 geographic rating territories. Citizens gives each territory a particular rate that takes into account weather patterns, construction methods, and past losses in that area. Citizens sets the wind rates 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* reflect the actuarial risk associated with each insured property.⁵⁷ 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.⁵⁸ 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

⁵⁶ 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_January2010.pdf.

⁵⁷ 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].

⁵⁸ Sumner Interview.

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.⁵⁹ 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.

* * *

In sum, through a variety of programs, the government insures weather risk. Some of these programs rely on largely the same actuarial methodology as used by private insurers: coverage only for premium-paying policyholders, rating the risk according to historical loss and claims data, and differentiation of premiums through feature rating that is sensitive to the policyholders' idiosyncratic risk and mitigation. Other programs provide relief more universally, to all victims of disaster. Whether it is through the selling of insurance policies or through disaster relief, government insurance relies on more than the collected premium to fund coverage, and is heavily supported by taxpayers.

We now turn to evaluate the success of government insurance as an ex ante regulator of weather risk, and compare it to the tools utilized by private insurance.

III. THE DISTORTIONS OF GOVERNMENT WEATHER INSURANCE

Part I introduced the basic question we are asking in this article: What are the tools available to insurers in regulating weather risk? How does insurance induce policyholders to install safety measures and to choose safer locations for habitation? We saw that insurance has the capacity to perform the same social function as public regulation like zoning and building codes, operating before severe weather occurs to induce better preparedness.

Insurance can be provided either by private organizations or by the government. In Part II we explained that much of the insurance for severe weather risk in the U.S is provided by the government, through a variety of programs, some resembling the structure of private insurance and others offering purely ex post relief. We also explained that private

⁵⁹ *Assessments, CITIZENS PROP. INS. CORP.*, <https://www.citizensfla.com/about/CitizensAssessments.cfm> (last visited Nov. 7, 2014).

weather insurance markets have declined largely because of the government's provision of lower-priced alternatives.

We are now ready to apply the conceptual framework of Part I (how insurance regulates) to the existing environment described in Part II (government insurance for flood and wind). This will help us answer a normative question: 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, we cannot line up the two institutions neck-to-neck 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)⁶⁰

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

⁶⁰ 160 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").

would require an offsetting systematic overcharge of others. Those overcharged, however, would be cherry-picked by competitors who can offer them better terms. In private insurance, any redistribution occurs within the pool of policyholders and only ex post—namely, from lucky non-victims to unlucky victims. As long as 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 such actuarial budget constraint. In fact, government relief programs and insurance plans are specifically intended to create systematic transfer 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.⁶¹

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."⁶² 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

⁶¹ See generally, e.g., KENNETH S. ABRAHAM, *DISTRIBUTING RISK* (1986); Robert J. Pokorski, *Principles of Insurance and Risk Classification*, in *THE POTENTIAL ROLE OF GENETIC TESTING IN RISK CLASSIFICATION* 44 (American Council of Life Insurance ed., 1989); Tom Baker, *Health Insurance, Risk and Responsibility After the Patient Protection and Affordable Care Act*, 159 U. PA. L. REV. 1577, 1597–600 (2011); but see generally Deborah A. Stone, *The Struggle for the Soul of Health Insurance*, 18 J. HEALTH POL., POL'Y & L. 271 (1993).

⁶² 151 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.

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.”⁶³ As the House voted down an amendment to the bill that would have removed retroactive reimbursements of high premiums to the owners of coastal vacation homes,⁶⁴ 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.⁶⁵ 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.”⁶⁶

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

⁶³ 160 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-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.”); *Id.* at E320 (daily ed. Mar. 6, 2014) (statement of Rep. Capuano) (“[The Bill] will do nothing to keep premiums affordable for the small businesses . . . churches, schools, and non-profits.”); *Id.* at H1601 (daily ed. Feb. 5, 2014) (statement of Rep. Kilmer) (claiming that the premium increases have already hurt his district “struggl[ing] with double-digit unemployment”).

⁶⁴ *Id.* at S1627 (daily ed. Mar. 13, 2014) (statement of Sen. Lee).

⁶⁵ *See, e.g., Id.* at S581 (daily ed. Jan. 29, 2014) (Statement of Sen. Heitkamp).

⁶⁶ *Id.* at S1631 (daily ed. Mar. 13, 2014) (statement of Sen. Landrieu).

increases.⁶⁷ 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 flood insurance benefits the less affluent, has not been tested. 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.⁶⁸

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,⁶⁹ 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 less affluent inland-residing taxpayers and policyholders, we argue that 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.

⁶⁷ 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>.

⁶⁸ 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].

⁶⁹ *See, e.g.*, Letter from Janet Napolitano, Sec’y of Dep’t of Homeland Security, to Rep. Barney Frank (Apr. 24, 2009) (“The [Obama] administration is asking for debt forgiveness because the size of the current debt creates an unstable financial situation for the NFIP and the subsidized insurance premium structure does not and will not allow the NFIP to collect enough to service the debt or repay it.”).

We wish to test our 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 Times⁷⁰

a. Citizens’ data and some initial observations

Citizens wind-peril insurance policies are sold to homeowners in every part of Florida. The policies are priced according to the wind territory in which the insured property is located. There are 150 such territories. 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 their risk territory, and because all policies within a given territory enjoy the same proportional subsidy, some of the information can be analyzed by comparing patterns across territories. For that, we used aggregated “territory level data.”⁷¹

⁷⁰ 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>.

⁷¹ 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, which 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),

To get a general sense of the subsidy picture, we looked initially at the territory 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) it ought to charge policyholders in that territory to break even actuarially. Here is an example:⁷²

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, and an increase of 126.5% in the premium charged to each policy in that territory would be necessary to cover this 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, like Wind 48, receive a modest subsidy (17.3%); and some are actually overcharged and receive a negative subsidy.⁷³

Since there are 150 territories and they vary greatly by the amount of subsidies they receive, we wanted to see if any pattern might

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.

⁷² Citizens 2012 Wind Risk Data, *supra* note 71.

⁷³ *Id.*

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 perhaps predictable, pattern. Coastal territories, almost without exception, enjoy large percentage subsidies, whereas inland territories receive smaller subsidies, if they receive any subsidy at all. As 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 conjecture a possible relation between subsidy and wealth, since water proximity is often a feature attracting wealthy home buyers.⁷⁴ 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.⁷⁵ 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 household value within the zip code in which the insured property is located.⁷⁶

⁷⁴ CBO VALUE OF PROPERTIES, *supra* note 68, at 9–10 (figures showing that homes close to water are more expensive).

⁷⁵ We used four different sizes to indicate 3-4, 4-5, 5-6, and 6+ standard deviations above statewide median.

⁷⁶ 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).

(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.⁷⁷

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

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

⁷⁷ 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).

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:

$$\text{LogAbsoluteSubsidy}_i = \alpha + \beta \text{LogWealth}_i + \varepsilon_i$$

$$\text{PercentSubsidy}_i = \alpha + \beta \text{LogWealth}_i + \varepsilon_i$$

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 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).⁷⁸

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 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

⁷⁸ Column (6) repeats this test adding fixed effect by policy. Both columns (5)-(6) standard errors are clustered by zip code.

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."⁷⁹

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.⁸⁰ In the highest flood risk areas, the fraction of full risk paid by policyholders is even lower.⁸¹

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

⁷⁹ 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].

⁸⁰ CBO, VALUE OF PROPERTIES, *supra* note 68, at 3.

⁸¹ 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>

area that are close to water.”⁸² 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.⁸³

Despite the image—often invoked in political debates over flood insurance⁸⁴—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.”⁸⁵ 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).⁸⁶ 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).⁸⁷

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, 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.⁸⁸

⁸² CBO, VALUE OF PROPERTIES, *supra* note 68, at 2.

⁸³ Eli Lehrer, *Doing the Wrong Thing*, 19 WKLY. STANDARD, no. 14, 2013, at 20.

⁸⁴ *Supra* notes 62–66.

⁸⁵ *Id.*

⁸⁶ *Id.* at 10.

⁸⁷ *Id.* at 11.

⁸⁸ GAO-13-568, FLOOD INSURANCE, *supra* note 18, at 10–12.

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.”⁸⁹

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.⁹⁰ 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 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.⁹¹ This intent was punctuated by the

⁸⁹ 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, available online at <http://policyintegrity.org/documents/FloodingtheMarket.pdf>.

⁹⁰ See Ben-Shahar & Logue, *supra* note 10, at 229–31.

⁹¹ See *supra* Parts II.B.1, III.A.1., III.A.3.

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."⁹²

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."⁹³

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 insurance rates may send a false signal that understates the risk exposure faced by current policyholders or prospective development."⁹⁴ 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

⁹² LLOYD DIXON ET AL, RAND, FLOOD INSURANCE IN NEW YORK CITY FOLLOWING HURRICANE SANDY xvii (2013).

⁹³ GAO-09-12, FLOOD INSURANCE, *supra* note 79, at 4.

⁹⁴ *Id.* at 20.

riskier places than they would if they had to pay what the market charged.”⁹⁵

Whether climate change is indeed causing a more severe pattern of catastrophic storms may still be debated.⁹⁶ 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.”⁹⁷

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).⁹⁸ 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 holding constant the value of building material, real estate, and other societal changes).⁹⁹

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

⁹⁵ Lewis, *In Nature’s Casino*, *supra* note 70.

⁹⁶ 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>.

⁹⁷ Stanley A. Changnon et al., *Human Factors Explain the Increased Losses from Weather and Climate Extremes*, 81 BULL. AM. METEOROLOGICAL SOC’Y 437 (2000).

⁹⁸ *Florida Hurricane Insurance: Fact File*, INS. INFO. INST. (Oct. 2014), <http://www.iii.org/article/florida-hurricane-insurance-fact-file.html>.

⁹⁹ 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).

strategies to proactively address the rising risk.¹⁰⁰ 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.”¹⁰¹ 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:¹⁰²

Figure 7 Here

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.”¹⁰³ 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

¹⁰⁰ 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>.

¹⁰¹ GAO-09-12, FLOOD INSURANCE, *supra* note 79, at 22.

¹⁰² H. JOHN HEINZ CTR. FOR SCI., ECON., & ENV’T, EVALUATION OF EROSION HAZARDS xxxiv (2000).

¹⁰³ *Id.*, at xxi.

about 25 percent lower in the highest-risk zones than in areas less susceptible to damage from coastal flooding.”¹⁰⁴

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.¹⁰⁵

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.¹⁰⁶ 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.¹⁰⁷

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.¹⁰⁸ How does government insurance of weather risk perform

¹⁰⁴ *Id.*, at xl.

¹⁰⁵ *Id.*, at xlv.

¹⁰⁶ GAO-07-285, CLIMATE CHANGE, *supra* note 99, at 27.

¹⁰⁷ 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-homes-impossible-to-sell-1.735866?page=all> (“Many homeowners want to sell, but flood insurance costs have scared away buyers”).

¹⁰⁸ See Ben-Shahar & Logue, *supra* note 10, at 220–26.

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.¹⁰⁹ 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.¹¹⁰ Indeed, in Florida all insurers—private and public—are required by statute to provide such discounts.¹¹¹ 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, absent such a mandate, would be willing to provide. A similar picture can be seen in other coastal states.¹¹² 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

¹⁰⁹ 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.”).

¹¹⁰ See *supra* sources cited in note ____.

¹¹¹ FLA. STAT. § 627.711 (2014).

¹¹² 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.

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.¹¹³ It is supported by the short experience of rate hikes under the Biggert-Waters Act, which “scared the bejesus out of people.”¹¹⁴ 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. CONCLUSION: THE END OF GOVERNMENT WEATHER INSURANCE?

Government insurance for weather risk is subsidized. 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.

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 these concluding remarks, we examine the concern for market failures in the provision of private insurance.

¹¹³ 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>.

¹¹⁴ 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>.

One possible concern with private insurance for weather risk is underinsurance. Due to cognitive failures, homeowners buy too little coverage.¹¹⁵ 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.¹¹⁶ 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.¹¹⁷

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.¹¹⁸ 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 mandate would usher people to insurance markets, without the need for government subsidy of 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 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

¹¹⁵ See Michael Faure & Veronique Bruggeman, *Catastrophic Risks & First-Party Insurance*, 15 CONN. INS. L. J. 1, 14–27 (2008).

¹¹⁶ Dixon et al., *supra* note 92, at xv.

¹¹⁷ Thomas Eisensee & David Stromberg, *News Droughts, News Floods, and U.S. Disaster Relief*, 122 QUAR. J. ECON. 693, 723 (2007).

¹¹⁸ 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).

circumstances.¹¹⁹ 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.¹²⁰ 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.¹²¹ 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.¹²²

¹¹⁹ 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.”).

¹²⁰ 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).

¹²¹ See, e.g., Jaffee & Russell, *supra* note 120, 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 120 (discussing a range of factors that inhibit the accumulation of capital to provide catastrophic reinsurance).

¹²² 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. APPLIED CORP. FIN. 84 (1997); Jaffee & Russell, *supra* note 120; Martin Nell & Andreas Richter, *Improving Risk Allocation Through Indexed Cat Bonds*, 29 GENEVA PAPERS ON RISK & INS. 183 (2004).

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.¹²³ 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.¹²⁴ In the absence of publicly provided catastrophe insurance this expansion would have likely been greater.

If insuring capacity is not an insurmountable problem for private insurance of weather risk, 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). Imagine, then, communities in which many residents are uninsured against weather devastation. What would happen in these communities after a disastrous storm?

Collectively-provided disaster relief is the common response. We described in Part II the federal statutory framework for disaster relief. But this organized relief framework merely provides structure and uniformity, and perhaps bolsters, what would otherwise be a spontaneous

¹²³ 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 70.

¹²⁴ 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_mark_et_outlook_external.pdf.

action on part of society. 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. The September 11th attacks, for example, were unprecedented not only in their magnitude, but also in the way they defied a sense of normality and the expectations of public safety. It is therefore understandable that such an event resulted in the enactment of the most generous victim compensation fund in American history.¹²⁵

The emergence of such ad-hoc funds for relief from disasters not covered by existing statutes 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 paid out for truly catastrophic disasters is not regarded as a bailout of the irresponsibly uninsured.¹²⁶

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.¹²⁷ The corresponding federal disaster relief for the 2005 hurricane season and for Hurricane Sandy totaled \$109 billion and \$66 billion, respectively.¹²⁸

¹²⁵ Air Transportation Safety and System Stabilization Act, Pub. L. No. 107-42, 115 Stat. 229 (2001); *see generally* Saul Levmore & Kyle Logue, *Insuring Against Terrorism—and Crime*, 102 MICH. L. REV. 268 (2003).

¹²⁶ 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).

¹²⁷ *See sources cited supra* note 36 and accompanying text.

¹²⁸ FELLOWES & LIU, *supra* note 38. 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

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.

We can end this article with a call for ending government-run weather insurance, replacing it with pinpointed need-based subsidies. 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.

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).

Source: Smith & Katz, *supra* note 4, at 4 (using NOAA data). Costs are adjusted to 2011 dollars using the Consumer Price Index

Source: 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.

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

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

Table 1

Table 1: Regressions using Log Absolute Subsidy						
	(1)	(2)	(3)	(4)	(5)	(6)
	Log Coverage	w/ Policy FE	w/ Territory SE Cluster	w/ Policy FE (Terr Cluster)	Log HH Value (ZIP Cluster)	w/ Policy FE (ZIP Cluster)
log_coverage	1.052*** (252.20)	1.052*** (252.22)	1.052*** (13.64)	1.052*** (13.64)		
_lptype_1		0.108* (2.56)		0.108* (2.56)		-0.0118 (-0.05)
log_hh					0.484*** (4.05)	0.484*** (4.05)
_cons	-7.645*** (-150.40)	-7.647*** (-150.42)	-7.645*** (-8.13)	-7.647*** (-8.14)	-0.675 (-0.47)	-0.675 (-0.47)
<i>N</i>	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)	(2)	(3)	(4)	(5)	(6)
	Log Coverage	w/ Policy FE	w/ Territory SE Cluster	w/ Policy FE (Terr Cluster)	Log HH Value (ZIP Cluster)	w/ Policy FE (ZIP Cluster)
log_coverage	0.847*** (126.81)	0.796*** (117.87)	0.847*** (8.04)	0.796*** (7.51)		
_lptype_1		0.806*** (46.64)		0.806* (2.36)		0.945*** (3.55)
log_hh					0.571*** (4.19)	0.484*** (3.60)
_cons	-8.320*** (-101.61)	-7.914*** (-96.30)	-8.320*** (-6.45)	-7.914*** (-6.26)	-4.890** (-2.93)	-4.090* (-2.51)
<i>N</i>	527250	527250	527250	527250	527236	527236

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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