



ARTICLE

The Perverse Effects of Subsidized Weather Insurance

Omri Ben-Shahar* & Kyle D. Logue**

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

* Leo and Eileen Herzel Professor of Law, University of Chicago.

** Wade H. and Dores M. McCree Collegiate Professor of Law, University of Michigan. The Authors are grateful to Kevin Jiang, Michael Lockman, Morgen Miller, and John Muhs for research assistance. Helpful comments on earlier drafts were provided by Kenneth S. Abraham, Ronen Avraham, Brian Galle, Sean Hecht, Jim Hines, William Hubbard, Ariel Porat, Daniel Schwarcz, and workshop participants at the University of Chicago, Tel Aviv University, and the 2015 Annual Meeting of the American Law and Economics Association. Ben-Shahar acknowledges financial support from the Coase-Sandor Institute for Law and Economics at the University of Chicago Law School, and Logue recognizes financial support from the Cook Fund at the University of Michigan Law School.

Table of Contents

Introduction..... 573

I. Regulation of Weather Risk by Insurance 580

II. Government-Provided Weather Insurance..... 584

 A. The National Flood Insurance Program 586

 B. Florida’s Citizens Property Insurance Corporation 590

III. The Perverse Effects of Subsidized Weather Insurance..... 592

 A. Distributive Effects..... 593

 1. Insurance cross-subsidies: who are the beneficiaries?..... 593

 2. Redistribution under Florida’s Citizens Property Insurance Corporation 597

 a. Citizens’ data and some initial observations 597

 b. Empirical analysis..... 605

 c. Discussion..... 608

 3. Redistribution under the NFIP 609

 B. Investment Distortions..... 611

 1. Regulation of location..... 611

 2. Regulation of precautions..... 616

IV. Responding to Concerns About Market (and Government) Failures in Private Weather Insurance..... 619

Conclusion..... 624

Introduction

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

Regulating weather risk is an increasingly urgent social issue. There is little doubt that the frequency and magnitude of weather-related disasters are rising over time.³ Although the precise combination of causes—including emissions of greenhouse gases, natural climatic cycles, and the increased concentration of populations in coastal areas—may be debated,⁴ the trend is undisputed.⁵ Hurricane Katrina in 2005 and Hurricane Sandy in 2012 brought unprecedented property damage to the Gulf states and to the coastal

-
1. As of 2008, of the twenty most costly insured catastrophes in the world, eighteen were weather related. The other two were the 9/11 attacks and the Northridge Earthquake. HOWARD C. KUNREUTHER & ERWANN O. MICHEL-KERJAN, *AT WAR WITH THE WEATHER: MANAGING LARGE-SCALE RISKS IN A NEW ERA OF CATASTROPHES* 5, 6 tbl.1.1 (2009).
 2. See, e.g., WORLD BANK & UNITED NATIONS, *NATURAL HAZARDS, UNNATURAL DISASTERS: THE ECONOMICS OF EFFECTIVE PREVENTION* 23 (2010) (“[N]atural disasters, despite the adjective, are not ‘natural.’ Although no single person or action may be to blame, death and destruction result from human acts of omission—not tying down the rafters allows a hurricane to blow away the roof—and commission—building in flood-prone areas. Those acts could be prevented, often at little additional expense.”).
 3. See, e.g., Adam B. Smith & Richard W. Katz, *US Billion-Dollar Weather and Climate Disasters: Data Sources, Trends, Accuracy and Biases*, 67 *NAT. HAZARDS* 387, 388-89 (2013) (evaluating data on insured losses published in *Billion-Dollar Weather and Climate Disasters: Table of Events*, NAT’L OCEANIC & ATMOSPHERIC ADMIN., <http://www.ncdc.noaa.gov/billions/events> (last visited Mar. 3, 2016)). The measure of total losses is an estimated \$1.1 trillion for the period from 1980 to 2011. *Id.* at 388 fig.1.
 4. For an argument that, although climate change is undeniably occurring and is affected by human influence (mainly through carbon emissions), the relationship between climate change and severe weather has been overstated, see the work of Roger Pielke Jr., summarized in Roger Pielke Jr., *An Obama Advisor Is Attacking Me for Testifying that Climate Change Hasn’t Increased Extreme Weather*, *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 of increased weather-disaster losses is increasing population density around the coasts, see sources cited in note 11 below.
 5. See sources cited *supra* notes 3-4.

northeastern states, respectively;⁶ and in 2013, Typhoon Haiyan, which devastated the Philippines—eliminating entire villages and killing thousands—may have been the strongest tropical cyclone to hit land in recorded history.⁷ Beyond anecdotes, the trend is clear: weather-disaster losses are rising.⁸ And the most ominous harbinger of the trend is the expected rise in sea levels. Higher sea levels would lead to a massive increase in the storm surges that accompany severe hurricanes.⁹ What in the past would have qualified as “100-year storms” (one percent chance of occurrence annually) would become “10-year storms” (ten percent chance of occurrence annually).¹⁰

Even as the magnitude and frequency of weather patterns seem to pose a higher risk than ever, a large and growing fraction of humanity’s physical assets is located in harm’s way.¹¹ While it is clear that the costs of hurricanes have increased dramatically and are likely to increase even more in the future, much of the upward trend in storm-loss data can be explained not by weather fluctuations but by increased concentration of property in dangerous areas, namely by human decisions to locate more densely in the storms’ paths.¹² Thus, the combination of severe natural forces and increased human exposure poses one of the major public policy challenges of our era: how to regulate behavior so as to reduce this risk.

There are many ways that societies can reduce the risk of increasingly large and potentially devastating storms. Our thesis in this Article is simple: the most effective way to prepare for storms is through insurance. But not in the

-
6. See Smith & Katz, *supra* note 3, at 388 fig.1 (illustrating that the frequency and loss total from severe storms increased over the last several years); *Billion-Dollar Weather and Climate Disasters: Summary Stats*, NAT’L OCEANIC & ATMOSPHERIC ADMIN., <http://www.ncdc.noaa.gov/billions/summary-stats> (last visited Mar. 3, 2016).
 7. *Typhoon Haiyan: Worse than Hell*, ECONOMIST (Nov. 16, 2013), <http://www.economist.com/news/asia/21589916-one-strongest-storms-ever-recorded-has-devastated-parts-philippines-and-relief>.
 8. See, e.g., Smith & Katz, *supra* note 3, at 388-89; Peter Hoeppe, *Why Are Cities Particularly Affected by Climate Change?*, PowerPoint Presentation at Geneva Ass’n Sixth Extreme Events & Climate Risk Seminar (Oct. 23, 2014), https://www.genevaassociation.org/media/907365/ga_6th_eecr_seminar_hoeppe.pdf.
 9. See Claudia Tebaldi et al., *Modelling Sea Level Rise Impacts on Storm Surges Along US Coasts*, 7 ENVTL. RES. LETTERS, Apr.-June 2012, at *10, <http://iopscience.iop.org/article/10.1088/1748-9326/7/1/014032/pdf>.
 10. *Id.* at *7.
 11. NAT’L OCEANIC & ATMOSPHERIC ADMIN., NATIONAL COASTAL POPULATION REPORT: POPULATION TRENDS FROM 1970 TO 2020, at 3, 5 (2013) (showing the higher rate of population density growth in coastal regions than in the nation overall); Brenden Jongman et al., *Global Exposure to River and Coastal Flooding: Long Term Trends and Changes*, 22 GLOBAL ENVTL. CHANGE 823, 826, 829 tbl.1 (2012) (showing relative changes in population exposed to coastal flooding over changes in total population from 1970 to 2010).
 12. Stanley A. Changnon et al., *Human Factors Explain the Increased Losses from Weather and Climate Extremes*, 81 BULL. AM. METEOROLOGICAL SOC’Y 437, 441 (2000).

obvious manner, where insurance operates as a form of postdisaster relief. Rather, we argue that insurance contracts should operate as a form of private regulation of safety, incentivizing precautionary behavior *prior to the occurrence of losses*. We argue that a well-functioning private market for insurance can accomplish two fundamental objectives that are currently ill served. First, private insurance can induce optimal—which is to say, more prudent—investments during the development of communities. Second, private insurance can impose the cost of severe weather on homeowners who live in destruction-prone areas, eliminating an array of subsidies and discounts that they currently enjoy. We demonstrate that these existing subsidies most help those who need them least: namely, affluent homeowners living near the waterfront.

The idea that insurance can create efficient incentives for risk mitigation might surprise some of our readers. Like many, they have been schooled in the paradigm that insurance creates moral hazard.¹³ Insurance may be good as a form of postdisaster relief and risk shifting, but the downside, we were taught, is that it dulls the insured party's incentive to mitigate losses. We think, however, that the application of the moral hazard theory to insurance has been overstated. We have written an article dedicated to debunking the myth that insurance necessarily creates moral hazard.¹⁴ Insurers use a variety of contractual tools to prompt policyholders to reduce risks. While it is true that in some settings the presence of insurance coverage can reduce the motivation of policyholders to reduce risk, the opposite can also be true: through powerful incentives provided in the insurance contract, people who purchase insurance often do not fall prey to the moral hazard distortion, and may even take more efficient precautions relative to the uninsured.¹⁵

The main way in which insurance induces efficient precaution is through graduated or differentiated premiums. If the price of insurance coverage is adjusted according to the riskiness of each individual policyholder, it operates like a private Pigouvian tax, internalizing the costs that might otherwise have

13. Much has been written about the moral hazard problem of insurance and ways to mitigate it. *See generally* KENNETH J. ARROW, *ESSAYS IN THE THEORY OF RISK-BEARING* (1971); Bengt Hölmstrom, *Moral Hazard and Observability*, 10 *BELL J. ECON.* 74 (1979). For the relevance of insurance-caused moral hazard to law, see KENNETH S. ABRAHAM, *DISTRIBUTING RISK: INSURANCE, LEGAL THEORY, AND PUBLIC POLICY* 14-15 (1986); and Tom Baker, *On the Genealogy of Moral Hazard*, 75 *TEX. L. REV.* 237, 274 (1996).

14. Omri Ben-Shahar & Kyle D. Logue, *Outsourcing Regulation: How Insurance Reduces Moral Hazard*, 111 *MICH. L. REV.* 197 (2012) (examining how insurance contracts create incentives for safety precautions).

15. *See, e.g.*, Victor P. Goldberg, *The Devil Made Me Do It: The Corporate Purchase of Insurance*, 5 *REV. L. & ECON.* 541, 543 (2009) (noting that insurance providers provide risk management services that can be value enhancing); Haitao Yin et al., *Risk-Based Pricing and Risk-Reducing Effort: Does the Private Insurance Market Reduce Environmental Accidents?*, 54 *J.L. & ECON.* 325, 326-27 (2011) (finding that risk-based pricing incorporated in private insurance contracts can reduce the moral hazard problem).

been externalized by the activity.¹⁶ Moreover, in contexts in which insurers have better information about risks than their insureds (and they often do because they utilize far more sophisticated data collection and analysis methods), such premium differentials help not only to internalize cost but also to inform insureds of risks that they otherwise might not be aware of or fully appreciate.¹⁷ And insurers have a strong incentive to use such premium differentials because of the power of competition: if one insurer fails to discount its coverage accurately, some other insurer may step in and steal its customers.¹⁸

The accuracy of risk-adjusted, cost-internalizing insurance premiums in the weather context, as in any other insurance market, affects both the care level and the activity level of policyholders.¹⁹ Such premiums encourage efficient construction methods because sturdier homes are cheaper to insure. And they influence the original locational decisions by signaling to potential buyers the true cost of living in the path of storms. As a result, 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.

Unfortunately, in the United States, insurance is denied its potential role as an efficient regulator of prestorm conduct. It does not induce rational precautions by individuals, cost-justified community development by localities, or efficient infrastructure investment. American insurance fails to achieve these straightforward and enormously important roles for a reason that can be stated in one sentence: *Insurance policies for extreme weather-related losses—especially for floods and for coastal wind damage associated with hurricanes—are not priced to reflect the real risk.*²⁰ Rather, insurance policies for such risks are

16. Ben-Shahar & Logue, *supra* note 14, at 207. A Pigouvian tax is a tax paid by actors whose conduct creates a negative externality, and if set at the level of the external cost, would correct inefficient behavior by private parties. *See, e.g.,* Agno Sandmo, *Pigouvian Taxes*, NEW PALGRAVE DICTIONARY ECON. (2008), http://www.dictionaryofeconomics.com/article?id=pde2008_P000351.

17. Ben-Shahar & Logue, *supra* note 14, at 205-08 (describing practice by insurers of differentiated premiums).

18. *Id.* at 204.

19. *See generally* STEVEN SHAVELL, *ECONOMIC ANALYSIS OF ACCIDENT LAW* 5 (2007) ("Injurers and victims will each have (at least potentially) two kinds of decisions to make: a decision whether, or how much, to engage in a particular *activity*; and a decision over the degree of *care* to exercise when engaging in an activity."); Ben-Shahar & Logue, *supra* note 14, at 208 & n.26 (explaining that, in the context of auto insurance, the miles driven represent the activity level while speed and safety represent the level of care).

20. CONG. BUDGET OFFICE, PUB. NO. 4008, *THE NATIONAL FLOOD INSURANCE PROGRAM: FACTORS AFFECTING ACTUARIAL SOUNDNESS* 6 (2009) (describing how the National Flood Insurance Program's (NFIP) explicit subsidies and implicit cross-subsidies "lower the cost of living in high-risk properties" and "undermine the incentives for policyholders to carry out mitigation measures").

sold or subsidized by the government in a way that produces what are often called “cross-subsidies.” This means that some parties pay more than their actual risk so that other parties (those who face the greatest and costliest risks) can pay less than their actual risk.

Thus, as a result of government intervention in property insurance markets, through either rate regulation or direct government provision of subsidized insurance, private markets no longer generate price signals regarding the cost of living in severe-weather regions. The cost of insurance for relatively high-risk property owners is suppressed, thus failing to alert private parties who purchase property insurance to the true risk of living dangerously. Such cross-subsidies allow private parties to (rationally) assume excessive risk and dump the cost of living in the path of storms on others. Indeed, much of the development of storm-stricken coastal areas is due to insurance subsidies and would likely not have happened at the same magnitude otherwise.²¹

Public debates over government-subsidized weather insurance often choose to ignore or downplay overdevelopment and excessive risk distortion because they regard government’s intervention in weather insurance markets as an important upside that trumps any efficiency distortion. Government intervention in property insurance markets is justified and even necessary because—so goes the argument—it makes insurance for severe weather

21. The Article here builds on the work of numerous researchers who have long studied the subject of catastrophic weather risks, some of whom have reached conclusions similar to the ones that we reach; Howard Kunreuther in particular is a pioneer in this field. See Howard Kunreuther, *Mitigating Disaster Losses Through Insurance*, 12 J. RISK & UNCERTAINTY 171, 184 (1996) (noting that private insurers can take steps to create disaster mitigation incentives); see also, e.g., KUNREUTHER & MICHEL-KERJAN, *supra* note 1, at 8-9; J. David Cummins, *Should the Government Provide Insurance for Catastrophes?*, 88 FED. RES. BANK ST. LOUIS REV. 337, 358 (2006) (observing that the NFIP is not priced actuarially accurately and that flood insurance should be actuarially priced); Martin F. Grace & Robert W. Klein, *The Perfect Storm: Hurricanes, Insurance, and Regulation*, 12 RISK MGMT. & INS. REV. 81, 83, 106-07 (2009) (concluding that Florida’s expansion of government underwriting of catastrophe risk has undermined private markets, and noting that the state role in constraining private insurers’ ability to raise rates in response to increased hurricane risks can be counterproductive); Sean B. Hecht, *Climate Change and the Transformation of Risk: Insurance Matters*, 55 UCLA L. REV. 1559, 1585-1604 (2008) (arguing that insurance has historically provided, and often has the potential to provide, incentives for mitigation specifically in the weather context); Howard Kunreuther, *Introduction* to PAYING THE PRICE: THE STATUS AND ROLE OF INSURANCE AGAINST NATURAL DISASTER IN THE UNITED STATES 1, 2-6 (Howard Kunreuther & Richard J. Roth, Sr. eds., 1998) (providing an overview of the problems of government and private insurance for disasters). This Article addresses the ways in which private insurance can provide more efficient weather mitigation incentives as well as a fairer allocation of the burden of insuring extreme weather risks than do current government insurance programs. As detailed later in the Article, we present, in particular, new evidence regarding the inefficiency and distributive unfairness of both the NFIP and state-based programs, such as Florida’s Citizens Property Insurance Corporation.

affordable. Insurance subsidies are necessary to help support low-income and working class people who might otherwise be unable to afford insurance and would therefore not be able to buy or remain in their homes. Subsidizing weather insurance is “our moral duty to the poorest people and working people and lower middle income people,”²² preventing “working folks” who are “doing everything they can to put food on the table” from losing their homes.²³ The subsidy, in other words, is thought to promote a redistribution that benefits economically weak populations.

We have long suspected that this justification is false. Our suspicion rested on the puzzling differential treatment of hurricanes versus tornadoes. These two types of severe storms cause similar aggregate magnitudes of property destruction,²⁴ but federal subsidies apply to flood losses caused by hurricanes, not to wind losses caused by tornadoes.²⁵ This was puzzling because hurricane victims live closer to water than do tornado victims, and it is generally known that living close to water is a privilege of the affluent. By contrast, a disproportionate amount of the harm caused by tornadoes occurs in connection with manufactured or mobile homes, which tend to be owned by people of lesser means.²⁶ This pattern of subsidies going only to some classes of victims of severe weather but not to all, seemed inconsistent with the affordability-of-insurance rationale or with any intuitive equitable justification.

22. 151 CONG. REC. 19,751 (2005) (statement of Rep. Frank).

23. 160 CONG. REC. S581 (daily ed. Jan. 29, 2014) (statement of Sen. Heitkamp).

24. See LLOYD’S, TORNADOES: A RISING RISK? 4, 19 (2013), <http://www.lloyds.com/~-/media/Lloyds/Reports/Emerging%20Risk%20Reports/Tornadoes%20final%20report.pdf> (“In the US, annual aggregate losses from severe thunderstorms including tornadoes have, on average, accounted for more than half of all catastrophe losses since 1990.” (capitalization altered)). Over a longer term, between 1980 and 2011, 43% of windstorm losses were attributable to severe thunderstorms and tornadoes, compared with 50% for hurricanes. *Id.* at 4, 25.

25. See *infra* Parts II.A, II.B.

26. See, e.g., KEVIN M. SIMMONS & DANIEL SUTTER, ECONOMIC AND SOCIETAL IMPACTS OF TORNADOES 6 (2011) (identifying mobile homes as one of the four “major vulnerabilities” for tornadoes); *Severe Weather 101: Frequently Asked Questions About Tornadoes*, NAT’L SEVERE STORMS LAB., <http://www.nssl.noaa.gov/education/svrwx101/tornadoes/faq> (last visited Mar. 3, 2016) (“Mobile homes are, in general, much easier for a tornado to damage and destroy than well-built houses and office buildings.”); see also *Facts About Manufactured Housing*, CORP. FOR ENTER. DEV., http://cfed.org/programs/innovations_manufactured_homes/about_manufactured_housing/facts_about_manufactured_housing (last visited Mar. 3, 2016) (noting that, based on 2009 census data, the median household income for those living in manufactured homes is roughly sixty percent of the national average). Moreover, Wyoming, Kentucky, Arkansas, South Dakota, and Louisiana—states in the notorious “Tornado Alley”—are each within the top fifteen states in terms of numbers of mobile homes. Jillian MacMath, *Misconception: Mobile Homes Are Hit by Tornadoes More Often*, ACCUWEATHER (Apr. 15, 2012, 10:05 AM ET), <http://www.accuweather.com/en/weather-news/mobile-home-vs/61830>.

To explore this suspicion, we looked at the data and report them here. We examined insurance data from the government-run insurance program in Florida, which subsidizes homeowners' insurance in the state most vulnerable to severe-weather impact.²⁷ We found a surprisingly strong positive correlation between subsidy and wealth.²⁸ Our data show that wealthier households receive higher subsidies in the form of underpriced insurance. And the magnitudes of the wealth effects are unquestionably large. We also surveyed a host of data resources regarding the federal flood insurance program, and they support the same conclusion: the primary beneficiaries of that federal program are relatively well-off homeowners.

Our study, and in particular our findings regarding the correlation between wealth and subsidy, are intended to shed light on recent legislative activity, which was initially heading in the right direction but unfortunately ended up making things worse. In the aftermath of Hurricane Sandy and the enormous bill that the Federal Emergency Management Agency (FEMA)—the agency that administers the federal subsidies for flood insurance—had to foot, Congress enacted with bipartisan support the Biggert-Waters Flood Insurance Reform Act of 2012.²⁹ Congress intended to scale back the federal subsidies, and the Act had the potential to provide better incentives for human preparedness for floods, especially for decisions to locate homes near water.

But Congress did not let this laudable new statute live long enough to do any good. Immediately after it was enacted, subsidy recipients, now scheduled to lose their discounts, protested, and Congress quickly reacted—again, with a rare showing of bipartisan consensus—enacting an almost full repeal of the 2012 reform. The Homeowner Flood Insurance Affordability Act of 2014 restored the federal subsidies and cross-subsidies for flood insurance.³⁰ Our results show that the rhetorical premise invoked by supporters of this Act—that hard-working low-income people need it to keep their homes—is misguided. The beneficiaries of weather insurance subsidies largely are *not* low-income folks. This finding is consistent with some prior work on the distributional consequences of government-provided flood insurance at the national level.³¹

27. See generally *About Us*, CITIZENS PROP. INS. CORP., <https://www.citizensfla.com/web/public/about-us> (last visited Mar. 3, 2016).

28. See *infra* Part III.A.1.

29. Pub. L. No. 112-141, tit. II, subtit. A, 126 Stat. 916 (codified as amended at 42 U.S.C. §§ 4001-130 (2014)).

30. Pub. L. No. 113-89, §§ 3-4, 128 Stat. 1020, 1021-22 (codified as amended at 42 U.S.C. §§ 4014(g), 4015). See generally Jennifer Wiggins, *Flood Money: The Challenge of U.S. Flood Insurance Reform in a Warming World*, 119 PENN. ST. L. REV. 361 (2014) (explaining the political context that resulted in the enactment of Biggert-Waters and the 2014 retrenchment, as well as arguing in favor of reduced cross-subsidies in the NFIP).

31. J. Scott Holladay & Jason A. Schwartz, *Flooding the Market: The Distributional Consequences of the NFIP* 4 (N.Y.U. Sch. of Law, Inst. for Policy Integrity, Policy Brief footnote continued on next page

We begin our analysis in Part I with a brief conceptual discussion that explains how property insurance can operate as a regulator of weather risk, explaining what tools insurance contracts use to improve the severe-weather preparedness of their policyholders. Part II then reviews (again, briefly) the features of government-provided insurance for severe weather, focusing on two programs: the National Flood Insurance Program (NFIP) and Florida's state-owned Citizens Insurance. Part III is the heart of our Article (and readers are more than welcome to skip Parts I and II and head directly to where our incremental contribution lies). It presents and defends our two normative claims: government insurance (i) creates unfair pooling of risk, favoring affluent policyholders, and (ii) leads to inefficient preparedness, locating far too many assets in the predictable path of storms. Part IV addresses some of the concerns about market failures and government failures that can inhibit private insurance as a form of weather-risk regulation.

I. Regulation of Weather Risk by Insurance

Weather risks can be reduced by direct command-and-control government regulation, mandating standards of predisaster conduct. Common examples include the adoption of building codes that require structures to be resistant to severe storms and other harsh conditions, or zoning restrictions that stop people from moving into the predicted path of storms.³² Private insurance contracts are a different type of regulation. Lacking the authority to *mandate* conduct, insurance companies create *contractual incentives* for insureds to engage in precautionary behaviors that cost less than the risk they reduce.

Whereas command is the ultimate regulatory lever of a government agency, insurers use price. The insurance company's way of creating incentives to reduce risk is to award lower prices to policyholders who face lower expected harms. Providing a menu of differentiated premiums induces individuals and firms to behave in ways that qualify for the insurance discounts. Auto insurers, for example, provide premium discounts for those who drive safer cars, less often, and accident free. Life insurers charge lower premiums for not smoking or scuba diving. And property insurers discount homes that face lower risk of loss due to severe weather.³³

In some areas of insured activity, insurers may not have the proper information to provide accurate discounts in return for policyholders' safety

No. 7, 2010), <http://policyintegrity.org/documents/FloodingtheMarket.pdf>. *But see* Okmyung Bin et al., *Redistributional Effects of the National Flood Insurance Program*, 40 PUB. FIN. REV. 360, 362 (2012) (reaching the opposite conclusion).

32. *See* KUNREUTHER & MICHEL-KERJAN, *supra* note 1, at xvi (noting the need for "well-enforced building codes, tax rebates, [and] zoning ordinances" to help encourage pre-accident mitigation).

33. *See* Ben-Shahar & Logue, *supra* note 14, at 231.

investment (although monitoring technologies increasingly make such information available).³⁴ 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.³⁵ They have a better understanding of how severe weather affects different types of construction.³⁶

An insurance policy that is priced according to risk features can become a powerful regulator of behavior. Differentiated premiums make it more costly for people to forgo safety investments. 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 in regions in which these installations are cost effective, the premium discounts would more than offset the cost.

One attractive feature of this form of safety regulation is avoiding the crude tradeoff inherent in command-and-control mandates. There is no need for the regulator to make an up-or-down binary choice whether to permit or prohibit some action. Instead, insurers build into the prices of their contracts the expected risk reduction associated with each safety investment, and then policyholders are allowed to self-select. Zoning regulations, for example, may require homes to be built at particular elevations, or may mandate the use of stilts or pilings, to maximize the chances that the homes will survive a storm surge. Insurance regulation, by contrast, does not mandate, but instead provides a menu of options—premium discounts to homes that invest in different degrees of precautions. Some, but not all, policyholders may choose to make the investments. The sorting that results from this menu approach to

34. See Alma Cohen & Peter Siegelman, *Testing for Adverse Selection in Insurance Markets*, 77 J. RISK & INS. 39, 76-77 (2010); Georges Dionne et al., *Adverse Selection in Insurance Contracting*, in HANDBOOK OF INSURANCE 231, 232 (Georges Dionne ed., 2d ed. 2013).

35. Both private insurance companies and the government, including the National Oceanic and Atmospheric Administration, use sophisticated mathematical models to predict severe-weather patterns. See generally Cassandra R. Cole et al., *A Comparison of Hurricane Loss Models*, 33 J. INS. ISSUES 31 (2010) (assessing alternative models used by insurers and regulators); *Updated AIR Hurricane Model for U.S. Features Storm Surge Module*, INS. J. (June 29, 2015), <http://www.insurancejournal.com/news/national/2015/06/29/373284.htm> (assessing recent changes in hurricane models).

36. The property insurance industry invests in research in this area through their collectively owned and run Insurance Institute for Business and Home Safety. See *About IBHS*, INS. INST. FOR BUS. & HOME SAFETY, <https://www.disastersafety.org/research-center> (last visited Mar. 3, 2016). In addition, the property insurance industry (especially the reinsurers) and insurance regulators have increasingly come to rely on sophisticated modeling techniques to predict the frequency, magnitude, number, and location of hurricanes. See, e.g., Charles S. White & Paul E. Budde, *Perfecting the Storm: The Evolution of Hurricane Models*, CONTINGENCIES, Mar./Apr. 2001, at 25. These models are updated regularly. See, e.g., *Updated AIR Hurricane Model for U.S. Features Storm Surge Module*, *supra* note 35.

regulation avoids the over- or underinclusiveness of government-mandated, across-the-board safety requirements.

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

The main tool for insurance regulation of severe-weather preparedness is the homeowners' insurance policy, which—with the exception of flood damage—covers most storm-caused losses (primarily wind damage). The main factor that determines the premium differentials across policies is location: areas with the most storm activity face the highest premiums.³⁷ Location pricing depends on historical data as well as prediction models, demographic trends, and construction practices.³⁸ Premiums may be reduced dramatically according to particular construction specifications.³⁹ For example, hurricane loss models used by insurance companies estimate that a home with a hip (pyramid-shaped) roof tends to sustain four percent less damage than a home with a roof with gable ends (triangular walls supporting slopes of a pitched roof, which could be peeled off under wind pressure).⁴⁰ In fact, flood insurance

37. See, e.g., *Homeowners Insurance*, TEX. DEP'T INS. (Feb. 2015), <http://www.tdi.texas.gov/pubs/consumer/cb025.html> (noting that premiums will likely be higher in areas with higher storm activity); see also Gina Roberts-Grey, *How Are Home Insurance Rates Determined?*, INVESTOPEDIA (July 23, 2014), <http://www.investopedia.com/articles/personal-finance/072314/how-are-home-insurance-rates-determined.asp> (noting that weather-related claims drive up rates and cause the most claims).

38. See Cole et al., *supra* note 35, at 37-38; Cas. Actuarial Soc'y, *Demographic Shifts Impacting Underwriting, Pricing*, INS. J. (June 2, 2009), <http://www.insurancejournal.com/news/national/2009/06/02/101024.htm>; Aarti Dinesh, *How Catastrophe Experts Model Hurricane-Induced Storm Surge*, INS. J. (July 1, 2013), <http://www.insurancejournal.com/magazines/features/2013/07/01/296787.htm>.

39. 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 (IBHS). Ins. Inst. for Bus. & Home Safety, FORTIFIED Home™: Hurricane Financial Incentives (n.d.), 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*, INS. INST. FOR BUS. & HOME SAFETY, <https://disastersafety.org/fortified> (last visited Mar. 3, 2016) (explaining the IBHS certification process).

40. Cole et al., *supra* note 35, at 37-38.

sold by private insurers depends on so many risk and mitigation factors that the rating sheet used by some brokers to determine premiums is thirty pages long.⁴¹

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

In the context of weather risks, private insurance also enhances the regulatory benefits of municipal building codes. Since storm resistance depends to a large extent on municipal building codes, the private insurance industry rates the different localities' homebuilding standards and how well they are enforced.⁴² These building-code-effectiveness ratings are used by individual insurers to vary their premiums across the rated districts.⁴³ For example, the rating may vary with the type of foundation the jurisdiction mandates for building in the floodplain, how the jurisdiction addresses postdisaster reconstruction permits, the funding it allocates to building code enforcement, how it trains its inspectors, and the standards it uses to review designs of new construction.⁴⁴ This puts pressure on state and local governments to tighten their building codes and their enforcement of those codes.

41. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-13-568, FLOOD INSURANCE: IMPLICATIONS OF CHANGING COVERAGE LIMITS AND EXPANDING COVERAGE 15 (2013), <http://www.gao.gov/assets/660/655719.pdf>.

42. *See, e.g.*, INS. INST. FOR BUS. & HOME SAFETY, RATING THE STATES: AN ASSESSMENT OF RESIDENTIAL BUILDING CODE AND ENFORCEMENT SYSTEMS FOR LIFE SAFETY AND PROPERTY PROTECTION IN HURRICANE-PRONE REGIONS (2011), <http://www.disastersafety.org/wp-content/uploads/ibhs-rating-the-states.pdf> (listing and assessing residential building codes in the Atlantic and Gulf Coast states).

43. *Id.* at 4 (indicating that the "Building Code Effectiveness Grading Schedule," which was developed by the insurance industry, is used for insurance underwriting purposes).

44. *See* Idaho Surveying & Rating Bureau, Inc., Building Code Effectiveness Grading Schedule Questionnaire (2006), <http://www.isrb.com/pubs/BCEGS%20Questionnaire.pdf>.

II. Government-Provided Weather Insurance

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

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

First, it is sometimes argued that truly catastrophic weather events are sufficiently rare that property owners systematically underestimate the risk.⁴⁵ According to this behavioral account, purchasers of weather insurance do not fully appreciate the risk of severe weather and the cost of potential damage, and are therefore unwilling to pay actuarially fair premiums that insurers require to provide coverage.

Second, the problem may lie not with the demand for, but rather with the supply of, coverage for severe-weather risks. Weather calamities may be too large or correlated to be insured through private markets. Or they may be too difficult to predict and price in accordance with prevailing actuarial practices. This would be consistent with assertions from insurance industry analysts that, at least during periods of tight markets, there is often insufficient insuring capacity, even within reinsurance markets.⁴⁶

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,

45. See Robert J. Meyer, *Why We Under-Prepare for Hazards*, in ON RISK AND DISASTER: LESSONS FROM HURRICANE KATRINA 153, 154 (Ronald J. Daniels et al. eds., 2006); Matthias Webber, *Foreword* to SWISS RE, FLOOD—AN UNDERESTIMATED RISK 5, 5 (2012), http://www.biztositasizemle.hu/files/201209/flood_&%238211%3B_an_underestimated_risk.pdf (“[I]t is more difficult to insure floods than many other hazards, not least because many people are not aware of their risk exposure.”); see also HOWARD C. KUNREUTHER ET AL., INSURANCE AND BEHAVIORAL ECONOMICS: IMPROVING DECISIONS IN THE MOST MISUNDERSTOOD INDUSTRY 113-15 (2013) (describing the demand anomaly of failure to protect against low-probability, high-consequence events).

46. See KUNREUTHER & MICHEL-KERJAN, *supra* note 1, at 189-95 (discussing the questions of reinsurance capacity and the supply of insurance). “Reinsurance” is coverage purchased by insurance companies to manage their portfolio of risks, in case their reserves become insufficient. While certain catastrophe risks, such as hurricane risks, might be uninsurable by relatively small insurance companies, especially those who write a large number of policies in the affected region, they are made insurable through reinsurance markets, which aggregate such risks into larger, international pools.

especially in areas where disaster risk is large and thus costly to insure.⁴⁷ Some fraction of these people could not have anticipated the high insurance costs, especially if weather-risk patterns have changed and grown over time.

These rationales purport to provide the basis for government-provided weather insurance. For example, according to the Government Accountability Office, the original 1968 legislation that enacted the flood insurance subsidies was meant, among other things, “to provide flood insurance in flood-prone areas to property owners who otherwise would not be able to obtain it.”⁴⁸ And the original statute itself suggested a rationale to make “flood insurance coverage available on reasonable terms and conditions to persons who have need for such protection.”⁴⁹

In the remainder of this Part, we discuss two public programs that implement such subsidies, the NFIP and the Florida Citizens’ Property Insurance Corporation. In these programs, the government acts like an insurance company by issuing (or subsidizing the issuance of) actual insurance contracts, charging premiums, and paying coverage to its premium-paying clients. To be sure, the government also insures weather risk by offering postdisaster relief through the Disaster Relief Fund, providing benefits to victims who suffer qualifying losses, paid for not through premiums but through taxes.⁵⁰ The relief includes relatively small grants (up to \$25,000) or

47. See Richard A. Derrig et al., *Catastrophe Management in a Changing World: The Case of Hurricanes*, 11 RISK MGMT. & INS. REV. 269, 272 (2008).

48. U.S. GOV’T ACCOUNTABILITY OFFICE, *supra* note 41, at 7.

49. National Flood Insurance Act of 1968, Pub. L. No. 90-448, tit. XIII, § 1302, 82 Stat. 572, 573 (codified as amended at 42 U.S.C. § 4001 (2014)).

50. *Disaster Relief Fund: Monthly Report*, FED. EMERGENCY MGMT. AGENCY, <http://www.fema.gov/disaster-relief-fund> (last updated Oct. 9, 2015); *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 June 4, 2015). The federal government covers only 75% of disaster-related expenses, while states have to contribute the remaining 25%. See 42 U.S.C. § 5174(g). The Disaster Relief Fund was created by the Disaster Relief and Emergency Assistance Amendments of 1988, Pub. L. No. 100-707, tit. I, sec. 106(a)(3), § 403(c)(3), 102 Stat. 4689, 4698 (codified as amended at 42 U.S.C. § 5170b(c)(3)). According to the Stafford Act, each state, through its governor, must request assistance from the President. Robert T. Stafford Disaster Relief and Emergency Assistance Act, Pub. L. No. 93-288, § 301, 88 Stat. 143, 146 (1974) (codified as amended at 42 U.S.C. § 5170). As part of this request, the state must assert that it 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. Federal disaster declarations occur with some frequency. Between 2004 and 2011, the President received state requests for 629 disaster declarations, of which 539 (or eighty-six percent) were approved. See 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), <http://www.gao.gov/assets/650/648162.pdf>.

loans.⁵¹ The government also provides some disaster relief by subsidizing private disaster-aimed charity through the charitable contributions deduction. But although charitable disaster relief can grow very large, it is dwarfed by government relief and by subsidized government insurance,⁵² to which we now turn.

A. The National Flood Insurance Program

Prior to the adoption of federally provided flood policies, what little insurance existed for flood-risk coverage was provided through private insurance contracts sold by commercial insurance companies.⁵³ 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 big floods eventually hit. The NFIP was created in 1968 to provide relief from flood losses in a way that minimized the financial burden on federal taxpayers.⁵⁴

-
51. 42 U.S.C. § 5174(h) (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. See *Disaster Assistance Available from FEMA*, FED. EMERGENCY MGMT. AGENCY, <https://www.fema.gov/disaster-process-disaster-aid-programs> (last updated Oct. 3, 2015, 3:59 PM).
52. For example, the hurricane season of 2005 was the most expensive natural disaster stretch in U.S. history and led to charitable relief of roughly \$2.5 billion. See *To Review the Response by Charities to Hurricane Katrina: Hearing Before the Subcomm. on Oversight of the H. Comm. on Ways & Means*, 109th Cong. 21 (2006) (statement of Cynthia M. Fagnoni, Managing Director, Education, Workforce and Income Security, U.S. Government Accountability Office). By comparison, the federal disaster relief for the 2005 hurricane season exceeded \$100 billion. Matt Fellowes & Amy Liu, Brookings Inst., *Federal Allocations in Response to Katrina, Rita and Wilma: An Update* (2006), 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, Ins. Info. Inst., *Hurricane Katrina: The Five Year Anniversary 2* (2010), <http://www.iii.org/sites/default/files/1007Katrina5Anniversary.pdf>.
53. See Adam F. Scales, *A Nation of Policyholders: Governmental and Market Failure in Flood Insurance*, 26 MISS. C. L. REV. 3, 7 & n.7 (2006).
54. The National Flood Insurance Act of 1968, Pub. L. No. 90-448, tit. XIII, 82 Stat. 572 (codified as amended at 42 U.S.C. §§ 4001-129), created the NFIP. The 1968 Act followed a period of severe flooding, including damage caused by Hurricane Betsy and heavy flooding on the Mississippi River, all in 1965. Edward T. Pasterick, *The National Flood Insurance Program*, in *PAYING THE PRICE: THE STATUS AND ROLE OF INSURANCE AGAINST NATURAL DISASTERS IN THE UNITED STATES* 125, 126 (Howard Kunreuther & Richard J. Roth, Sr. eds., 1998). In a 1966 report, the Secretary of Housing and Urban Development proposed a system of government-provided flood insurance to replace general public assistance. It was in response to this report that Congress created the NFIP two years later. See *id.* at 127.

Through the NFIP, the federal government sells flood insurance policies to residential and commercial property owners. Although NFIP policies are marketed largely through private insurance companies, they are fully underwritten by the federal government.⁵⁵ Coverage under NFIP flood policies is statutorily capped at \$350,000 for homeowners and \$1 million for commercial property owners.⁵⁶

NFIP policies are subsidized,⁵⁷ which means that the premiums collected are not sufficient to cover flood claims, and the deficit is passed on to the Treasury Department. As a result, the U.S. taxpayer is currently the reinsurer of truly catastrophic flood risks. And because NFIP policies are cheaper than flood insurance sold in the private market, they have come to dominate the flood-risk market.⁵⁸

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 to 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 the NFIP's building standards. For example, the lowest floor of a structure must be elevated to, or elevated above, the "base flood elevation"—the level at which there is a one percent chance of flooding in a given year.⁵⁹

55. U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 41, at 4. There is a small private insurance market that provides coverage for home values in excess of the NFIP's ceiling. *Id.* However, many carriers do not offer excess flood insurance policies, especially in the hardest hit areas. *See, e.g.,* Britton Wells, *Excess Flood Insurance—When the Federal Plan Isn't Sufficient*, INS. J. (Aug. 7, 2006), <http://www.insurancejournal.com/magazines/features/2006/08/07/72126.htm>.

56. *See* U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 41, at 9.

57. *National Flood Insurance Program Reform—Frequently Asked Questions*, FED. EMERGENCY MGMT. AGENCY, <http://www.fema.gov/region-vi-arkansas-louisiana-new-mexico-oklahoma-texas/national-flood-insurance-program-reform> (last updated Jan. 25, 2013, 9:15 AM).

58. According to a RAND study published in 2006, 49% of all single-family homes in Special Flood Hazard Areas had NFIP policies and another 1% to 3% had private policies. *See* LLOYD DIXON ET AL., RAND, *THE NATIONAL FLOOD INSURANCE PROGRAM'S MARKET PENETRATION RATE: ESTIMATES AND POLICY IMPLICATIONS*, at xvi (2006), http://www.rand.org/content/dam/rand/pubs/technical_reports/2006/RAND_TR300.sum.pdf.

59. *See The National Flood Insurance Program: Review and Reauthorization: Hearing Before the Subcomm. on Hous. & Cmty. Opportunity of the H. Comm. on Fin. Servs.*, 108th Cong. 136 (2003) (statement of JayEtta Z. Hecker, Director, Physical Infrastructure, U.S. Government Accountability Office); U.S. GOV'T ACCOUNTABILITY OFFICE, *GAO-09-12, FLOOD INSURANCE: FEMA'S RATE-SETTING PROCESS WARRANTS ATTENTION 6* (2008), <http://www.gao.gov/assets/290/283035.pdf>.

While the rates charged by NFIP to its policyholders are based on flood maps that reflect the likelihood of floods in the different regions,⁶⁰ the maps are often out of date.⁶¹ Even when the maps are updated, there are cross-subsidies among insureds within the system, and a substantial percentage of property owners in high-risk areas are deliberately asked to pay well below actuarial rates.⁶² The maps are politicized: attempts by FEMA to update them and base the premiums on more actuarially sound calculus meet political influence.⁶³ As a result, currently the NFIP is operating at a massive deficit, estimated in 2013 to be around \$24 billion.⁶⁴

In response to this budget deficit and the concern that it might grow, lawmakers in 2012 enacted the so-called Biggert-Waters Flood Insurance Reform Act.⁶⁵ Biggert-Waters sought to gradually eliminate the underfunding of the NFIP and curb the disturbing cross-subsidies built into the program. For example, Biggert-Waters was going to phase out entirely the subsidies for certain “repetitive loss properties,” second homes, business properties, homes that have been substantially improved or damaged, and homes sold to new

60. *National Flood Insurance Program*, FED. EMERGENCY MGMT. AGENCY, <http://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping> (last updated Sept. 21, 2015); see *Understanding Flood Maps*, NAT'L FLOOD INS. PROGRAM, https://www.floodsmart.gov/floodsmart/pages/flooding_flood_risks/understanding_flood_maps.jsp (last updated Jan. 21, 2016).

61. CONG. BUDGET OFFICE, PUB. NO. 4008, *THE NATIONAL FLOOD INSURANCE PROGRAM: FACTORS AFFECTING ACTUARIAL SOUNDNESS 14* (2009), <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, 1:07 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. Scott Gabriel Knowles, *Flood Zone Foolishness*, SLATE (Mar. 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.

62. See RAWLE O. KING, CONG. RESEARCH SERV., R42850, *THE NATIONAL FLOOD INSURANCE PROGRAM: STATUS AND REMAINING ISSUES FOR CONGRESS 19-20* (2013) (stating that there is debate over whether rates truly reflect the risk and therefore charging the full amount would impair development in the highest-risk areas).

63. See Bill Dedman, *FBI Investigates FEMA Flood Map Changes After NBC News Report*, NBC NEWS (Mar. 27, 2014, 5:50 AM ET), <http://www.nbcnews.com/news/investigations/fbi-investigates-fema-flood-map-changes-after-nbc-news-report-n62906> (describing how many oceanfront properties mysteriously benefitted from FEMA's redrawing of the flood maps, raising suspicion of political influence).

64. *Implementation of the Biggert-Waters Flood Insurance Act of 2012: One Year After Enactment: Hearing Before the Subcomm. on Econ. Policy of the S. Comm. on Banking, Hous. & Urban Affairs*, 113th Cong. 48-49 (2014) (statement of W. Craig Fugate, Administrator, Federal Emergency Management Agency).

65. Biggert-Waters Flood Insurance Reform Act of 2012, Pub. L. No. 112-141, tit. II, subtit. A, 126 Stat. 916 (codified as amended at 42 U.S.C. §§ 4001-130 (2014)).

owners.⁶⁶ Biggert-Waters permitted much faster NFIP annual rate increases (25% annually, up from the previous 10% cap)⁶⁷ and required all premiums to be based on average historical loss years, including catastrophic loss years.⁶⁸ This was aimed at improving the actuarial soundness of the expected-loss calculation. One of the most controversial aspects of the new law was the elimination of grandfathering for the many older buildings in high-risk areas.⁶⁹

However, the backlash from property owners along coastal areas, where resulting premium increases were the greatest, was swift and effective.⁷⁰ In some areas, there were reports of homeowners' premiums rising tenfold.⁷¹ The concern expressed by many lawmakers, on behalf of their angry constituents, was that unless Biggert-Waters was repealed or at least delayed, they wouldn't be able to remain in their homes or continue their small businesses.⁷² Thus, before Biggert-Waters was able to take effect, Congress passed the Homeowner Flood Insurance Affordability Act of 2014,⁷³ which significantly weakened the changes made by Biggert-Waters. The political pressure to repeal Biggert-Waters was so successful that even Representative Maxine Waters voted in support of repealing her own bill.⁷⁴ As a result, the 2014 Act imposed tighter limits on yearly premium increases, reinstated the NFIP grandfathering provision, and preserved the discounted premiums for properties even after being sold.⁷⁵ The new law also called on FEMA to keep premiums at no more than one percent of the value of the coverage.⁷⁶

66. Fed. Emergency Mgmt. Agency, Biggert Waters Flood Insurance Reform Act of 2012: Impact of National Flood Insurance Program (NFIP) Changes 1-2 (2013), http://www.fema.gov/media-library-data/20130726-1909-25045-0554/bw12_sec_205_207_factsheet4_13_2013.pdf.

67. *Id.* at 1.

68. *Id.*

69. See Fed. Emergency Mgmt. Agency, Biggert Waters Flood Insurance Reform Act of 2012: The NFIP's *Specific Rate Guidelines* 3 (2013), https://www.fema.gov/media-library-data/20130726-1920-25045-7258/fact_sheet_specific_rate_guidelines.pdf.

70. Jenny Anderson, *Outrage as Homeowners Prepare for Substantially Higher Flood Insurance Rates*, N.Y. TIMES (July 28, 2013), <http://nyti.ms/16dM8FU>.

71. Thomas Ferraro, *U.S. Senate Passes Bill to Delay Hikes in Flood Insurance Rates*, REUTERS (Jan. 30, 2014, 4:36 PM EST), <http://reut.rs/1dbzfMd>.

72. *Id.*

73. Pub. L. No. 113-89, 128 Stat. 1020 (codified as amended at 42 U.S.C. §§ 4001-33 (2014)).

74. *Rep. Waters, Author of Flood Reform Act, Calls for Delay in Implementation*, INS. J. (Sept 30, 2013), <http://www.insurancejournal.com/news/national/2013/09/30/306602.htm>.

75. Fed. Emergency Mgmt. Agency, Homeowner Flood Insurance Affordability Act: Overview 1-3 (2014), http://www.fema.gov/media-library-data/1396551935597-4048b68f6d695a6eb6e6e7118d3ce464/HFIAA_Overview_FINAL_03282014.pdf.

76. § 7, 128 Stat. at 1023.

B. 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.⁷⁷ 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.⁷⁸ The company collects premiums that are used to pay the losses covered under the policies, but, as with the NFIP, the premiums are far below what is necessary to cover the full risk.⁷⁹

At first glance, Citizens appears to price its wind coverage in the same way private insurers do. Citizens begins by evaluating the risk of wind damage in particular areas, which consist of 150 geographic rating territories. Citizens then gives each territory a particular rate that takes into account weather patterns, construction methods, and past losses in that area.⁸⁰ These wind rates are set with the use of sophisticated computer modeling techniques, informed by data about hurricane patterns, and adjusted periodically based on new information and updated experience. These base rates are then used by Citizens to determine the individualized premium charged for each individual policy.⁸¹

This rating methodology is identical to the approach followed by private insurers, with one big difference. Citizens' premiums collected from consumers do *not* reflect the actuarial risk associated with each insured property.⁸² Several

77. The details regarding the Florida property insurance market generally, the wind insurance market in particular, and how Citizens prices its policies, as well as the regulatory environment in which the company operates, derive from numerous discussions the Authors had over several years with Brian Donovan, Chief Actuary at Citizens. See Telephone Interviews with Brian Donovan, Chief Actuary, Citizens Prop. Ins. Co. [hereinafter Donovan Discussions].

78. *Id.*

79. Fla. Council of 100 & Fla. Chamber of Commerce, *Into the Storm: Framing Florida's Looming Property Insurance Crisis 1* (2010), http://www.flchamber.com/wp-content/uploads/IntotheStorm_FramingFLLoomingPropertyInsuranceCrisis_Januayr2010.pdf.

80. Telephone Interview with Daniel Sumner, Gen. Counsel & Chief Legal Officer, Citizens Prop. Ins. Co. (July 19, 2013) [hereinafter Sumner Interview].

81. *Id.*

82. 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

footnote continued on next page

reasons help to explain the gap between true risk premiums 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.⁸³ 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, which effectively shifts some of the catastrophic wind risk posed by hurricanes 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 of 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.⁸⁴ 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.

This gap in funding has repeatedly been at the center of political controversy in Florida since the formation of Citizens in 2002. Following 2004, for example, when four major storms hit Florida (causing damages in excess of \$25 billion), and 2005, the year of Katrina (causing damages in excess of \$93 billion),⁸⁵ Citizens found itself deep in debt, owing nearly \$5 billion, which then had to be recovered through insurance assessments.⁸⁶ Legislation was then passed in 2007 expanding Citizens’ portion of the market by lowering the threshold for policy issuance, prompting some insurance industry representatives at the time to complain about the possibility of storm costs being externalized to taxpayers.⁸⁷ Concerns about underfunding, caused by

least not with respect to wind risk, where the gap between the actual rates and the indicated rates are the largest. *Id.*

83. *Id.*

84. *Assessments*, CITIZENS PROP. INS. CORP., <https://www.citizensfla.com/web/public/assessments> (last visited Mar. 3, 2016).

85. STUART HINSON, NAT’L OCEANIC & ATMOSPHERIC ADMIN. ET AL., 2005 ANNUAL SUMMARIES: FLOOD/FLASH FLOOD; LIGHTNING; TORNADO; HURRICANE 4-5 (William Angel ed., 2005), <http://www.ncdc.noaa.gov/IPS/sd/sd.html> (to locate, in the “Select Publication” field, select “2005-ANNUAL,” then follow temporary link to download).

86. See Fla. Council of 100 & Fla. Chamber of Commerce, *supra* note 79, at 2.

87. Steven Tuckey, *Florida Lawmakers Expand Citizens Cover*, PROP. CASUALTY 360 (May 14, 2007), <http://www.propertycasualty360.com/2007/05/14/florida-lawmakers-expand-citizens-cover>. The law was intended to make it easier for Citizens to compete with the private market by allowing consumers to purchase a Citizens policy if a policy

footnote continued on next page

below-actuarially accurate premiums, have persisted, leading in 2012 to Governor Scott's well-publicized (albeit misguided) claim that Citizens had roughly \$500 billion in insured debt and only \$6 billion in reserves.⁸⁸

III. The Perverse Effects of Subsidized Weather Insurance

Part I reviewed the tools available to insurers in regulating weather risk. It demonstrated that through differentiated premiums, private insurance has the capacity to perform a social function that is regulatory in nature: incentivizing better preparedness on the part of policyholders and better decisionmaking with respect to building location. Part II then explained that much of the insurance for severe-weather risk in the United States is provided by the government, through a variety of federal and state programs.

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

Given the underdeveloped private market for weather insurance, which is largely the result of the existence of government insurance,⁸⁹ we cannot line up the two institutions nose-to-nose and compare. Instead, we identify elements that are unique to government-provided insurance and evaluate their effects. These effects can then be compared with hypothetical private insurance patterns, given what is known about private insurance operation in other markets.

The analysis below examines the government's insurance performance along two normative metrics: fairness and efficiency. Subpart 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? Subpart B

from a private insurer cost more than 15% (as opposed to the previous 25%) higher than the Citizens policy. The industry countered that "[t]he more Citizens' rates fail to reflect the risk at hand, the greater the financial crisis [that] will occur when a major storm hits." *Id.* (attributing opinion to William Sander, a regional manager for Property Casualty Insurers Association of America).

88. See Toluse Olorunnipa, *Rick Scott Said Citizens Has \$500 Billion in Risk Exposure but Less than \$10 Billion in Cash*, POLITIFACT (June 13, 2012, 11:03 AM), <http://www.politifact.com/florida/statements/2012/jun/13/rick-scott/rick-scott-said-citizens-has-500-billion-risk-expo>. This was an overstatement. To cause \$500 billion in damages, every home and business insured by Citizens, in sixty-seven counties, would have to be destroyed. A more serious estimate of the deficit at the time would amount to around \$1.5 billion, as a 100-year storm is projected to cause a maximum of \$21 billion in damage and Citizens' claims-paying ability, including its power to make assessments, was around \$19.5 billion. *See id.*

89. *See supra* Part II.

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 rich people?”

—Representative Bill Cassidy (R-LA)⁹⁰

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 that insurers collect (minus administrative costs) must roughly equal the amount of the payouts. It follows that private insurance cannot pay claims of victims who have not paid into the insurance pool. It also cannot systematically undercharge some policyholders because that would require an offsetting systematic overcharge of others. Those who are overcharged can be cherry-picked by competitors who can offer them better terms. In private insurance, most of the redistribution occurs within the pool of policyholders and only ex post—namely, from lucky nonvictims to unlucky victims. Although all real-world private insurance pools involve some cross-subsidization from the less risky to the more risky, in the ideal case, if premiums are set according to the risk data, there is no ex ante cross-subsidy—no policyholder pays for an expected benefit that others enjoy disproportionately.

By contrast, because government insurance is partially funded by general tax revenues, there is no actuarial budget constraint. In fact, government relief programs and insurance plans are *specifically intended* to create systematic transfers favoring residents of disaster areas. And unlike private insurance, government-sold insurance can contain a systematic and intended discount to make its policies more affordable, and the deficit can be covered through the government’s general budget. Indeed, the unique feature of government insurance compared with private insurance, and the primary reason for establishing it, is precisely the creation of an ex ante cross-subsidy scheme.⁹¹

90. 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 vacation homes.”).

91. U.S. GOV’T ACCOUNTABILITY OFFICE, *supra* note 59, at 7 (“Congress mandated the use of subsidized premiums to encourage communities to join the program and mitigate concerns that charging rates that fully and accurately reflected flood risk would be a burden to some property owners.”).

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 nonsmokers, and that aggressive drivers pay higher auto insurance premiums.

The cross-subsidy embodied in government insurance is an intended feature despite its violation of actuarial fairness because it is thought to be fair and progressive. In the aftermath of Hurricane Katrina, for example, Representative Barney Frank promoted increased funding to the NFIP because of “our moral duty to the poorest people and working people and lower middle income people.”⁹² More recently, when Congress reinstated the subsidized flood insurance rates in 2014 (after a previous bill sought to scale down the subsidies⁹³), the bill was pitched as a program favoring struggling homeowners. It garnered bipartisan support (approved with a vote of 72-22 in the Senate) because cuts in subsidies “burdened lower- and middle class homeowners and small businesses.”⁹⁴ 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,⁹⁵ 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 senator said, will prevent working families, who are “doing everything they can to put food on the table,” from losing their homes.⁹⁶ As one of the bill’s champions explained: “This is not

92. 151 CONG. REC. 19,751 (2005) (statement of Rep. Barney Frank); *see also* Rick Lazio, Letter to the Editor, *Flood Fund Aids Working-Class Homeowners*, N.Y. TIMES (Nov. 18, 1993), <http://nyti.ms/1UXyJcp> (explaining how the legislation works to protect working class homeowners rather than the wealthiest members of society).

93. *See supra* Part II (discussing the Biggert-Waters Flood Insurance Reform Act of 2012).

94. 160 CONG. REC. 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 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 H61 (statement of Rep. Scalise) (claiming that the increased premiums would fall disproportionately on hardworking “middle class families” who have never been flooded due to their own community-organized flood-safety measures) (daily ed. Jan. 8, 2014); *id.* at H56 (statement of Rep. Marino) (calling for a blanket repeal of Biggert-Waters).

95. *Id.* at H2141-42 (daily ed. Mar. 4, 2014) (recorded vote of House approving bill with retroactive reimbursements intact); *see also id.* at S1627 (daily ed. Mar. 13, 2014) (statement of Sen. Lee) (criticizing the lack of an amendment in the House-approved bill to remove retroactive reimbursements).

96. *Id.* at S581 (daily ed. Jan. 29, 2014) (statement of Sen. Heitkamp).

about 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.”⁹⁷

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.⁹⁸ 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 fifteen percent of unaffected Florida citizens supported premium increases.⁹⁹ 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 weather insurance benefits the less affluent, has not been fully tested.¹⁰⁰ We believe that it is wrong and that the opposite is true: the subsidy accrues primarily to the affluent. This is for a simple reason: those who need flood insurance most are the inhabitants of properties built in proximity to the coast, where severe weather strikes most forcefully. Because properties adjacent to the coast are in general (putting

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

98. NAT’L ASS’N OF INS. COMM’RS, DWELLING FIRE, HOMEOWNERS OWNER-OCCUPIED, AND HOMEOWNERS TENANT AND CONDOMINIUM/COOPERATIVE UNIT OWNER’S INSURANCE: DATA FOR 2012, at 33-34, 53-54, 71-72 (2015), http://www.naic.org/documents/prod_serv_statistical_hmr_zu.pdf (showing that, in 2012, average “all-risks” homeowners’ insurance policies in the two states with the highest hurricane risks, Florida and Louisiana, cost between 169% and 397% of the national average (HO-3: \$1034 national average, \$1742 in Louisiana, \$2084 in Florida; HO-5: \$989 national average, \$2688 in Louisiana, \$3922 in Florida)).

99. Jeff Harrington, *Poll: Opposition to Flood Insurance Rate Hikes Is Strong*, TAMPA BAY TIMES (Dec. 24, 2013, 11:10 PM), <http://www.tampabay.com/news/business/banking/poll-opposition-to-flood-insurance-rate-hikes-is-strong/2158508>.

100. Relatively few studies of the distributional effects of government-provided weather insurance have been done. They focused on premiums collected and claim payments in connection with the NFIP and have come to differing conclusions regarding the regressive effects. One study concluded that “[t]axpayer-subsidized NFIP claims . . . represent a significant wealth transfer from middle-income counties to relatively wealthy and poor counties.” Holladay & Schwartz, *supra* note 31, at 5. Another study found “no evidence that the NFIP disproportionately advantage[d] richer counties.” Bin et al., *supra* note 31, at 362. Both studies looked at county-level NFIP premium, payout, and income data, and thus were not able to pick up within-county effects: Are the rich within a county subsidizing the poor within a county, or the reverse? Our study includes individual-insurance-policy-level data, thus capturing redistributive effects with greater precision. See *infra* Part III.A.2.a.

weather risk to one side) more desirable and, on average, more expensive, the beneficiaries of the subsidies are not the poor but the affluent.¹⁰¹

If in fact the high-risk beachfront owners are, all else equal, wealthier, they are less deserving of means-based government subsidies. Moreover, any form of government-subsidized insurance—disaster relief or contractual policies—is funded through general tax revenues, coming from middle-income taxpayers living mostly inland in lower-valued homes (or, as we saw, from assessments on drivers buying auto insurance).¹⁰² 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, it represents a regressive form of redistribution. And, as a matter of public choice, the more the government has to bail out its undercapitalized insurance fund, the less tax revenue remains to spend on other, more progressive programs.

A possible counterargument to our regressivity hypothesis is that high-income property owners pay higher property taxes, which would offset the insurance cross-subsidy they receive. It is certainly true that coastal property owners in Florida pay higher taxes than inland property owners.¹⁰³ That is where the most valuable properties lie. However, counties impose higher taxes on higher-valued properties for other reasons, not for funding the insurance subsidy. For example, higher property taxes pay for better schools and better public services for the residents of the wealthy counties. So although affluent counties are collecting more taxes from their residents, the counties use it mostly in-county, with little or no progressive redistribution.¹⁰⁴ In addition, Florida's overall tax policy, beyond property taxes, is among the most regressive in the country.¹⁰⁵ Therefore, it is difficult to argue that overall tax

101. Holladay and Schwartz made a similar prediction:

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

Holladay & Schwartz, *supra* note 31, at 5.

102. See *supra* Part II.B (discussing the structure of Citizens as a whole).

103. See *Florida Property Taxes 2016*, TAX-RATES.ORG, <http://www.tax-rates.org/florida/property-tax> (last visited Mar. 3, 2016) (showing counties with the highest property tax payments are along the tip of Florida, where some of the largest insurance cross-subsidies exist).

104. See, e.g., Fla. Dep't of Revenue, Property Tax Oversight (rev. Jan. 2014), <http://dor.myflorida.com/dor/property/taxpayers/pdf/ptoinfographic.pdf> (showing that state property taxes are assessed and distributed at the county level).

105. CARL DAVIS ET AL., INST. OF TAXATION & ECON. POLICY, WHO PAYS?: A DISTRIBUTIONAL ANALYSIS OF THE TAX SYSTEMS IN ALL 50 STATES 4 (5th ed. 2015), <http://www.itep.org>
footnote continued on next page

burdens in Florida counteract the regressive cross-subsidy built into premiums for publicly provided wind-risk insurance.

To test the regressive redistribution hypothesis, we proceed in two ways. First, we examine the distribution of subsidies under Florida's Citizens insurance. We begin with this scheme because the data about actual prices and subsidies is readily available, and this 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 in that particular subsidy. Together, these observations suggest that government weather insurance has unappreciated, but substantial, regressive effects.

2. Redistribution under Florida's Citizens Property Insurance Corporation

"[Florida] subsidized the well-to-do who live near the beach at the expense of the less-well-to-do who don't."

—Michael Lewis, *New York Times*¹⁰⁶

a. Citizens' data and some initial observations

Citizens is the Florida state-owned insurance company that sells, among other types of coverage, wind-peril insurance policies to homeowners in every part of the state.¹⁰⁷ While there are other state-run insurance programs, we study Florida's Citizens because Florida is the state that faces the greatest hurricane risk, and therefore its insurance program is the largest and most important.¹⁰⁸ As mentioned, the policies are priced according to the wind territory in which the insured property is located, of which there are roughly 150.¹⁰⁹ Prices are adjusted annually and have to be approved by the state Office of Insurance Regulation.¹¹⁰ Statutory and regulatory caps limit the extent to which Citizens can raise its rates in any given year.¹¹¹

/pdf/whopaysreport.pdf (showing Florida's as the second most regressive state tax system in the country).

106. Michael Lewis, *In Nature's Casino*, N.Y. TIMES MAG. (Aug. 26, 2007), <http://nyti.ms/23SsmNz>.

107. Donovan Discussions, *supra* note 77.

108. Of the top ten cities at risk of hurricane damage, five are in Florida—the only state with more than one such city. Also, of the more than 6,500,000 homes along the Atlantic coastline and Gulf Coast region that are subject to severe hurricane risk, by far the state with the largest number (2,500,000) is Florida. Caitlin Bronson, *Top 10 Cities at Risk for Hurricane Damage*, INS. BUS. AM. (July 7, 2015), <http://www.ibamag.com/news/top-10-cities-at-risk-for-hurricane-damage-18950.aspx>.

109. Sumner Interview, *supra* note 80.

110. See Donovan Discussions, *supra* note 77.

111. *Id.*; see also FLA. STAT. § 627.351(6)(n)(6) (2015).

As discussed above, Citizens' actual insurance premiums charged are known—and intended—to be different than the “true risk” premiums (those representing an actuarially accurate methodology).¹¹² 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.¹¹³ In 2012, there were 527,250 individual policies.¹¹⁴ This is the “policy-level data.” In addition, because policies are rated and priced based on the risk territory in which they are sold, and because all policies within a given territory enjoy the same proportional subsidy, some of the information can be analyzed by comparing patterns across territories. For that, we used aggregated “territory-level data.”¹¹⁵

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

112. Donovan Discussions, *supra* note 77.

113. *Id.*

114. *See infra* note 115.

115. The data on which the following charts and statistics are based were supplied to the authors by Citizens Property Insurance Corporation in response to a public data request. The data were compiled by Citizens for the purpose of its September 30, 2012, rate filing with the Florida Office of Insurance Regulation (specifically, from Florida Office of Insurance Regulation filing number 13-13048), and they include a range of facts about every homeowners' policy of a particular sort (HO3 policies covering wind risk) issued by Citizens in the relevant period. The information for each policy includes the premium actually charged for the policy, the “indicated premium” for the policy, the location of the insured property by zip code, and the amount of coverage, among other things. “HO3” refers to the most common standard-form homeowners' insurance policy. William C. Spaulding, *Types of Homeowners' Insurance Policies*, THISMATTER.COM (2015), <http://thismatter.com/money/insurance/types/types-of-homeowners-insurance.htm>. For a sample HO3 policy, see Ins. Info. Inst., Homeowners 3—Special Form (1999), http://www.iii.org/sites/default/files/docs/pdf/HO3_sample.pdf (providing an example of some of the typical provisions of an HO3 policy). We will refer to these data generally as “Citizens 2012 Wind Risk Data.” Copies of the data are available from the Authors and can also be secured separately from Citizens through a public data request.

Table 1¹¹⁶

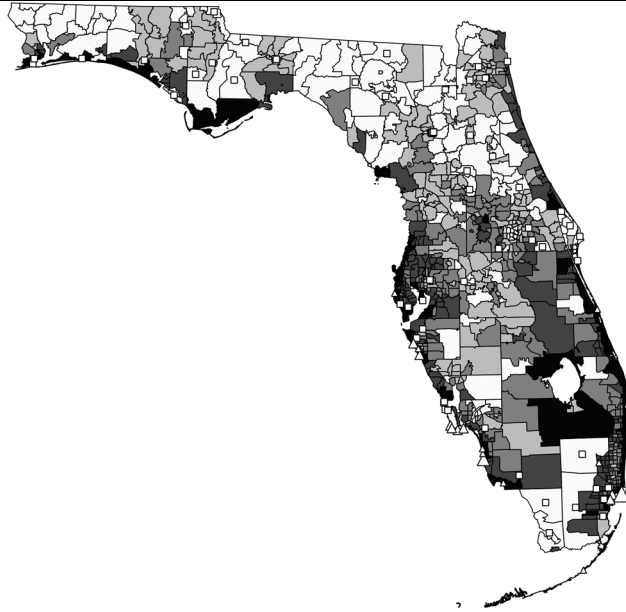
Territory Name	Wind Premium	Indicated Rate Change
Monroe	\$38,582,378	126.5%
Hillsborough (Excluding Tampa)	\$19,496,173	25.9%
Pinellas-Saint Petersburg	\$29,059,878	14.7%
Broward (Excluding Hollywood & Fort Lauderdale)	\$70,297,604	-12.5%
Broward (Wind 47)	\$27,847,251	57.3%
Broward (Wind 48)	\$21,530,419	17.3%

In Monroe territory, for example, where some of the southern Florida Keys are located, the premiums actually collected by Citizens total \$38,582,378, but they fall short of Citizens' estimate of the expected risk. To be precise, an increase of 126.5% in the premium charged to each policy in that territory would be necessary to cover the shortfall. In Tampa's suburbs and 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 Fort Lauderdale is located—are divided into several risk territories. As Table 1 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, like the one labeled "Broward" (but which contains only the more inland portions of the county) are actually overcharged—they do not receive any subsidy and in fact their premium helps cover the subsidy paid to neighboring properties.

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

116. Citizens 2012 Wind Risk Data, *supra* note 115.

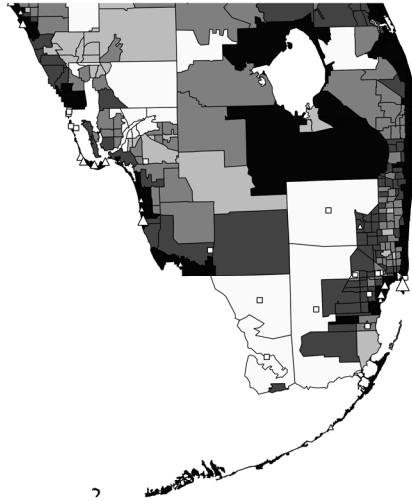
Figure 1*



* Map of Florida risk territories, based on Citizens 2012 Wind Risk Data. Shaded territories depict subsidized wind-risk insurance premiums. Darker shades depict larger percent subsidies.

Figure 1 shows a remarkable but predictable pattern. Coastal territories, almost without exception, enjoy large percentage subsidies, whereas inland territories receive smaller subsidies, if they receive any subsidy at all. A similar relationship can be seen when we zoom in and look at densely populated southern Florida in Figure 2.

Figure 2*



* Map of south Florida risk territories, based on Citizens 2012 Wind Risk Data. Shaded territories depict subsidized wind-risk insurance premiums. Darker shades depict larger percent subsidy.

The pattern is even clearer here: the subsidies are larger in territories very close to the water. Figures 1 and 2 also help us begin to speculate about a possible relation between subsidy and wealth, since water proximity is often a feature attracting wealthy home buyers.¹¹⁷ To visualize this, we plotted on the subsidy maps the location of the highest (represented on the maps by triangles) and lowest (represented on the maps by squares) wealth concentrations. The triangles mark territories in which the median home value is at least three standard deviations above the statewide median.¹¹⁸ The squares mark areas more than one standard deviation below median home value. No surprise: wealthy households are more often located in the high-subsidy (more deeply shaded on the maps) territories. Poor households are more often located in the low- or no-subsidy territories.

These maps reflect the territory-based data, comparing the treatment of the 150 different insurance risk territories. Next we wanted to see if the distribution of the subsidies was indeed correlated with the distribution of

117. See CONG. BUDGET OFFICE, VALUE OF PROPERTIES IN THE NATIONAL FLOOD INSURANCE PROGRAM 9 fig.1, 10 fig.2 (2007) (showing that homes close to water are more expensive).

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

wealth. To do so, we needed more information about policyholders' wealth. For this we used two metrics:

(i) *Home Value*: Home value is a good proxy for affluence because it is a significant component in people's net wealth, accounting for roughly twenty-five percent of the aggregate households' net worth in America.¹¹⁹ 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.¹²⁰ It is of course likely that less affluent households are blended into the pools that we count as wealthy (those in high-median-home-value zip codes), but this measure allows us to look at overall trends in average subsidy allocations.

(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.¹²¹ This will help us test whether people who own lower-valued homes receive a greater or smaller insurance subsidy.¹²²

119. Alfred Gottschalck et al., *Household Wealth in the U.S.: 2000 to 2011* (2011), <https://www.census.gov/people/wealth/files/Wealth%20Highlights%202011.pdf>.

120. See *American FactFinder*, U.S. CENSUS BUREAU, <http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml> (to locate, under "Advanced Search," enter "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, which will yield the desired median household value) (last visited Mar. 3, 2016).

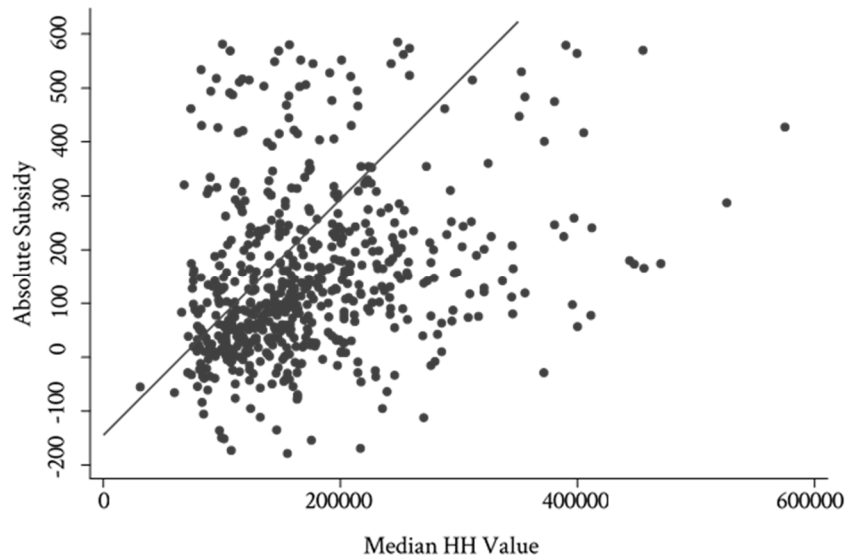
121. Using the policy coverage limit as a proxy for property value, and thus indirectly for affluence, assumes that people with higher-value homes purchase higher insurance coverage. While we do not have direct evidence that this assumption is valid, it relies on several observations. First, coverage limits are dictated by the size of the mortgage, and higher-value homes carry higher mortgages. Second, higher-value homes are owned by households with larger net worth and a more valuable portfolio of other assets, which are therefore more likely to be able to afford the insurance premiums. See Gottschalck et al., *supra* note 119 (showing that a substantial portion of aggregate U.S. households' net worth is comprised of home equity). Finally, the "indemnity principle" in insurance law does not allow policyholders to purchase coverage exceeding their actual losses, and so we can rule out that high-coverage policies are purchased by low-value homes. See, e.g., ROBERT H. JERRY, II, *UNDERSTANDING INSURANCE LAW* § 93[a], at 676 (3d ed. 2002).

122. 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, a limit adopted by the Florida legislature became effective. See Act of June 13, 2014, ch. 140, § 1, 2014 Fla. Laws 1893, 1894-95 (codified as amended at FLA. STAT. § 627.351(6)(a)(3) (2015)). 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 until 2017, when the cap will remain at \$700,000. *Id.* 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

footnote continued on next page

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 3*



* The relation between absolute insurance premium subsidy and median household value. Each observation on the graph represents a Florida zip code region (N=904).

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 insurance policies (those presumably attached to high-value homes) receive a higher or lower subsidy. Before we turn to the connection between the value of the homeowners' insurance policy and the size of the subsidy, let us first provide a rough picture of the range of coverage limits found in the data. As it turned out, the lowest coverage limit in the dataset (presumably for the policy covering the lowest-valued home in the dataset) was for \$29,200.¹²³

\$1 million and that there is "not a reasonable degree of competition," then the \$1 million cap will apply, rather than the lower phased-in caps in later years. *Id.*

123. We used the coverage limits for "Coverage A," which is for damage or loss to the house or "dwelling unit." See Ins. Info. Inst., *supra* note 115, at 3.

The highest coverage limit was for \$1,000,000. The mean was \$228,888. And the median was \$196,700. The policies broke down further as follows:

Table 2

Policy Value Percentile	Coverage Limits
1%	\$92,000
5%	\$113,600
10%	\$126,900
25%	\$152,400
50%	\$196,700
75%	\$262,000
90%	\$361,800
95%	\$463,900
99%	\$745,000

Thus, the smallest 1% of the policies had coverage limits of \$92,000 or less, the smallest 5% had coverage limits of \$113,600 or less, and so on. At the other end of the spectrum, the top 10% had coverage limits of \$361,800 or greater, and the top 1% had coverage limits of \$745,000 or greater.

To link these coverage limits, and thus (indirectly) home values, with the size of Citizens' subsidies, 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.¹²⁴

124. Each quintile had a high and a median coverage limit as follows:

Quintile 1: high, \$144,300; median, \$126,900;

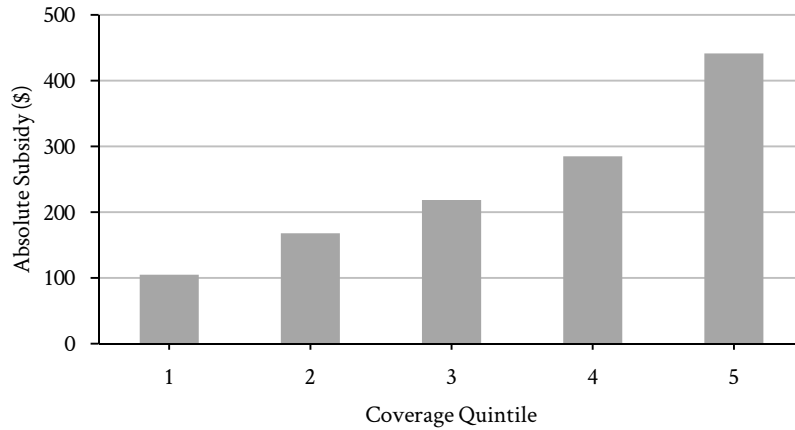
Quintile 2: high, \$177,900; median, \$160,800;

Quintile 3: high, \$217,600; median, \$196,700;

Quintile 4: high, \$283,300; median, \$246,000; and

Quintile 5: high, \$1,000,000; median, \$361,800.

Figure 4
Absolute Subsidy by Coverage Quintile



b. Empirical analysis

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

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

We estimated two regression models:

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

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

The first model examines how an 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.

Table 3
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)		
"Wind" Type Policy		0.108* (2.56)		0.108* (2.56)		-0.0118 (-0.05)
Log HH Value					0.484*** (4.05)	0.484*** (4.05)
Constant	-7.645*** (-150.40)	-7.647*** (-150.42)	-7.645*** (-8.13)	-7.647*** (-8.14)	-0.675 (-0.47)	-0.675 (-0.47)
N	339,046	339,046	339,046	339,046	339,038	339,038

t-statistics in parentheses

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

The results, which are statistically significant, demonstrate a significant correlation between wealth and subsidy. Column (1) in Table 3 shows that a one percent increase in the *Coverage* variable is associated with a 1.052% 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% greater than the coverage purchased by the owner of property *B*, the owner of *A* enjoys on average a 105% 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.¹²⁵ 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% (predictably, given the use of average wealth measures; such averages dilute the effect of high and low wealth, and with less variation we expect to get smaller effects).¹²⁶

The second model examines the relation between wealth and our generated synthetic variable of *Percent Subsidy*. The results are presented in Table 4.

Table 4
Regression with Percent 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)		
“Wind” Type Policy		0.806*** (46.64)		0.806* (2.36)		0.945*** (3.55)
Log HH Value					0.571*** (4.19)	0.484*** (3.60)
Constant	-8.320*** (-101.61)	-7.914*** (-96.30)	-8.320*** (-6.45)	-7.914*** (-6.26)	-4.890** (-2.93)	-4.090* (-2.51)
N	527,250	527,250	527,250	527,250	527,236	527,236

t-statistics in parentheses

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

125. “Fixed effects” are variables added to a regression to account for the possibility that some policy types may receive higher or lower subsidies regardless of the policyholder’s wealth (or other attributes). By including fixed effects for policy, the regression measures the relationship between wealth and subsidy while controlling for the fact that wealthier households may tend to hold different types of policies than less wealthy households. “Clustered standard errors” calculates standard errors in a way that relaxes the usual assumption that errors (such as measurement error) for all observations are uncorrelated with all other observations. Instead, it allows for observations within a grouping (such as territory; the grouping is called a “cluster”) to have errors that are correlated with each other. For example, clustering of errors by territory accounts for the possibility that the relationship between wealth and subsidy is different in some territories for unknown reasons.

126. Column (6) repeats this test adding fixed effect by policy. Both Columns (5) and (6)’s standard errors are clustered by zip code.

Again, the subsidy is strongly correlated with wealth. A 1% increase in household value is associated with either a 0.847% or 0.571% 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 presumably 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 of the correlation between wealth and subsidy probably understate the true magnitude of the proaffluent advantage. First, one of our measures of wealth—policy coverage limit—is capped by state law, 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 because 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.¹²⁷ Citizens does not need to require such a reserve because of its power, in effect, to tax the citizenry or to assess all insurance purchasers in the state of Florida.

We have not tried to identify the causal story underlying this correlation, nor are we interested in its direction. Causation may go either way: greater wealth may help people secure greater subsidies; or greater subsidies may help people move into more expensive homes. We are not interested in causation because the troubling feature of the system has nothing to do with any causal theory. The problem is the large positive *correlation* between wealth and subsidy, a correlation that conflicts with the goals and underlying rhetoric justifying the program.¹²⁸

We have not, of course, attempted to identify the precise incidence of the subsidy. Economic theory suggests that, even if the nominal beneficiaries of the subsidy are the relatively wealthy purchasers of homeowners' insurance, the

127. See Donovan Discussions, *supra* note 77.

128. For information on the goals and underlying rhetoric justifying the program, see text accompanying notes 92-99 above.

actual incidence of the subsidy would be split between the home buyers and the home sellers, with the precise effects depending on elasticities of the supply of and demand for housing in the relevant areas. The distinction between buyers and sellers is irrelevant for our purposes because we are interested in the overall magnitude of benefit to the *inhabitants* of coastal property, not how this benefit is divided between sequential owners.

3. Redistribution under the NFIP

As we saw in Part II, the NFIP insures nearly five million properties, up to \$500,000 per residential property.¹²⁹ 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.¹³⁰

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. As of 2014, the NFIP's debt exceeded \$24 billion and existing rate-setting practices were "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."¹³¹

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 between 35% and 40%.¹³² 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 and \$2060 if priced to cover full risk.¹³³ In the areas with the highest risk of floods, the fraction of full risk paid by policyholders is even lower.¹³⁴

A 2007 report by the Congressional Budget Office (CBO) found that "properties that carry flood insurance tend to be more valuable as a group."¹³⁵ At the time, the median value of a home in the United States was \$160,000; the median value estimated for homes insured by the NFIP ranged from \$220,000

129. See Summary of the NFIP June 2014 Program Changes 1 (2013), <http://www.nfipiservice.com/Stakeholder/FEMA2/Attachment%20A%20Summary%20of%20the%20NFIP%20June%202014%20Program%20Changes.pdf>.

130. See U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 59, at 7.

131. *Id.* at 27.

132. CONG. BUDGET OFFICE, *supra* note 117, at 3.

133. *Id.*

134. See PRICEWATERHOUSECOOPERS LLP, STUDY OF THE ECONOMIC EFFECTS OF CHARGING ACTUARIALLY BASED PREMIUM RATES FOR PRE-FIRM STRUCTURES 5-4, 5-5 fig.5.1 (1999), <http://www.fema.gov/media-library-data/20130726-1602-20490-9031/finalreport.pdf> ("For structures six feet or more below the [base flood elevation], premiums would likely rise from about \$590 to about \$6,800 as a result of subsidy elimination.").

135. CONG. BUDGET OFFICE, *supra* note 117, at 2, 6.

to \$400,000.¹³⁶ The CBO found that “[m]uch of the difference is attributable to the higher property values in areas that are close to water.”¹³⁷ There are 130 million housing units in the United States, but only a small fraction of them receive subsidized NFIP policies.¹³⁸ Of those that do, nearly eighty percent are located in counties that rank in the wealthiest quintile.¹³⁹

Despite the image—often invoked in political debates over flood insurance¹⁴⁰—of the subsidy going to struggling middle-class homeowners who have lived for generations in floodplains, the reality is different. As the CBO found, “40 percent of subsidized coastal properties in the sample are worth more than \$500,000; 12 percent are worth more than \$1 million.”¹⁴¹ 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 12% are worth more than \$500,000 and only 3% more than \$1 million.¹⁴²

The myth of the subsidized struggling homeowner is further dispelled by another striking fact: 23% of subsidized coastal properties are not the policyholders’ principal residence—they are either vacation homes or year-round rentals.¹⁴³ 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).¹⁴⁴ 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. Again according to the CBO, 47% of the subsidized homes that are not principal residences are worth more than \$500,000 (and 15% are worth more than \$1 million).¹⁴⁵

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% of NFIP policies

136. *Id.* at 2.

137. *Id.*; see also Holladay & Schwartz, *supra* note 31, at 375. *But see* Bin et al., *supra* note 31, at 10 (looking at NFIP premiums and payout data and concluding that the program overall reduces certain measures of inequality).

138. Eli Lehrer, *Doing the Wrong Thing*, WKLY. STANDARD (Dec. 16, 2013), <http://tws.io/1nSsdZt>.

139. *Id.*

140. For information on the goals and underlying rhetoric justifying the program, see text accompanying notes 92-99 above.

141. CONG. BUDGET OFFICE, *supra* note 117, at 2.

142. *Id.*

143. *Id.* at 9.

144. *Id.* at 10.

145. *Id.* at 11.

were at maximum limit.¹⁴⁶ By 2012, the fraction increased to 42%, with most of these high-coverage homes located in the Gulf Coast and along the East Coast.¹⁴⁷ For example, in New York (with a median home value of \$285,300), 65% of its policyholders had the maximum coverage.¹⁴⁸ In contrast, in West Virginia (a median home value of \$99,300), only 7% of its policyholders had maximum coverage.¹⁴⁹

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.¹⁵⁰ In effect, “[t]he NFIP, by serving as a backstop for those risks, favors development in communities with floodplains, by shifting some of those risks onto taxpayers.”¹⁵¹ Development in floodplains becomes more affordable, and private markets then naturally divert development investments to areas with high property values.¹⁵² These communities are thus more likely to be eligible for NFIP participation.

B. Investment Distortions

In Part III.A above, we asked whether government insurance produces the desirable distributive effects aspired for by its political proponents—improving affordability among lower-income residents of storm-prone areas. 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 societal welfare and the waste of resources they entail.

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.

146. U.S. GOV’T ACCOUNTABILITY OFFICE, *supra* note 41, at 10-12.

147. *Id.*

148. *Id.*

149. *Id.*

150. Holladay & Schwartz, *supra* note 31, at 4.

151. *Id.*

152. *See id.*

Insurance, if priced accurately, provides an important service of quantifying the risk and helping people trade it off against the upsides.¹⁵³ This is a general (desirable) feature of insurance, operating in effect like a Pigouvian tax in internalizing an otherwise-overlooked cost.¹⁵⁴ Knowing the expected cost of exposure to weather disasters, 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.¹⁵⁵ This intent was punctuated by the enactment of the so-called Homeowner Flood Insurance Affordability Act of 2014, which scaled back premium increases that intended to eliminate the subsidies. But there are additional, unintentional causes for the inaccurate premiums set by the NFIP. First, the data it relies on in drawing flood maps are 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' boundaries. Under the new maps, "[a] \$429 annual premium on a structure previously outside the high-risk zones could well rise to \$5,000 to \$10,000 for the same amount of coverage if it is inside the high-risk area."¹⁵⁶

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 or 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.¹⁵⁷ 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-

153. See Hecht, *supra* note 21, 1565-67 (making a similar point, especially in the connection with weather risk).

154. See Ben-Shahar & Logue, *supra* note 14, at 232-34.

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

156. LLOYD DIXON ET AL., RAND CORP., FLOOD INSURANCE IN NEW YORK CITY FOLLOWING HURRICANE SANDY 17 (2013).

157. See U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 59, at 12, 23, which recommends that FEMA adopt more precise rate-setting methodology to reflect risk "accurately."

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.”¹⁵⁸

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.”¹⁵⁹

This insight is increasingly appreciated even beyond the debate over FEMA’s subsidies. For example, in writing about Florida’s Citizens’ wind insurance scheme, Michael Lewis explains that Florida “sold its citizens catastrophe insurance at roughly one-sixth the market rates, thus encouraging them to live in riskier places than they would if they had to pay what the market charged.”¹⁶⁰

Indeed, according to the U.S. Census Bureau, the number of people living in coastal areas in Florida increased by ten million, almost *fourfold*, between 1960 and 2008.¹⁶¹ (Overall U.S. population grew by only 70% at the same time.¹⁶²) Coastal exposure now represents 79% of all property exposure in Florida, with an insured value of \$2.9 trillion (in 2013).¹⁶³ 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 in 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

158. *Id.* at 4.

159. *Id.* at 21-22.

160. Lewis, *supra* note 106.

161. The population of Florida increased from 4,951,560 in 1960 to 18,328,340 in 2008. Compare U.S. Census Bureau, No. 1960-565788/44, Number of Inhabitants: Florida 11-8 tbl.2 (n.d.), <http://www2.census.gov/prod2/decennial/documents/11085788v1p11ch2.pdf>, with U.S. Census Bureau, NST-EST2008-01, Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2008 (2008), http://www.census.gov/popest/data/historical/2000s/vintage_2008/state.html.

162. The U.S. population rose from 179,323,175 in 1960 to 304,059,724 in 2008, per U.S. Census Bureau estimates. Compare U.S. CENSUS BUREAU, POPULATION, HOUSING UNITS, AREA MEASUREMENTS, AND DENSITY: 1790 TO 1990 (1993), <http://www.census.gov/population/www/censusdata/files/table-2.pdf>, with U.S. Census Bureau, NST-EST2008-01, Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2008 (2008), http://www.census.gov/popest/data/historical/2000s/vintage_2008.

163. *Florida Hurricane Insurance: Fact File*, INS. INFO. INST. (Oct. 2015), <http://www.iii.org/article/florida-hurricane-insurance-fact-file>.

occurred in 2005, given current asset values.”¹⁶⁴ This is net of inflation—namely normalizing losses by holding constant the value of building material, real estate, and other societal changes, thus measuring the losses that would have occurred in 1992 if societal conditions were those of 2005.

The effects of climate change on weather patterns are only beginning to be understood, but private insurers are rushing to take these emerging patterns into account, adjusting premiums in light of near-future projections, and studying potential industry-wide impacts and strategies to proactively address the rising risk.¹⁶⁵ 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.¹⁶⁶

If, indeed, climate change poses increased risks of flood and erosion to low-lying coastal zones, the failure of government insurance to price that risk into present policies exacerbates the overdevelopment problem.

An independent report, published in the year 2000, of erosion rates and their financial impact found that over the next sixty years following the report, erosion may claim one out of four houses within 500 feet of the U.S. shoreline, as Figure 5 below illustrates.¹⁶⁷

164. 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), <http://www.gao.gov/assets/260/257686.pdf>.

165. See, e.g., Evan Mills, *Responding to Climate Change—The Insurance Industry Perspective*, in CLIMATE ACTION 100 (2007), http://www.unep.org/pdf/climate_action_book_lowres.pdf (stating how climate change could cause over a trillion dollars of losses to insurance companies in a single year and therefore is a huge problem facing insurers); 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, 159 (2009) (“Climate change . . . poses serious threats for the insurance and reinsurance sectors worldwide.”); Eugene Linden, Opinion, *How the Insurance Industry Sees Climate Change*, L.A. TIMES (June 16, 2014, 8:42 PM), <http://fw.to/8Qhns3D> (discussing how a major insurance company has taken steps to help protect itself from the threat of global warming); Jessie G. Rountree, *Risky Business: Recommendations for the Insurance Industry to Contribute to Greater Disaster Risk Reduction and Climate Change Adaptation* 27 (May 16, 2014) (unpublished M.A. thesis, University of San Francisco), <http://repository.usfca.edu/capstone/20> (proposing using risk-based premiums to reflect global warming’s likely impact in order to protect the insurance industry and influence consumer behavior).

166. U.S. GOV’T ACCOUNTABILITY OFFICE, *supra* note 59, at 22.

167. H. JOHN HEINZ III CTR. FOR SCI., ECON. & ENV’T, EVALUATION OF EROSION HAZARDS, at xxv (2000).

Figure 5¹⁶⁸



However, the NFIP does not map erosion hazard and does not incorporate it into the insurance rate. As a result, according to the report, 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.”¹⁶⁹ 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

168. Figure 5 is appropriated from *Evaluation of Erosion Hazards*. *Id.* at xxiii fig.S.1.

169. *Id.* at xxi box S.1.

risk.¹⁷⁰ As a result, the report finds that development in erosion areas is excessive. “In the absence of insurance and other programs to reduce flood risk, development density would be about 25 percent lower in the highest-risk zones than in areas less susceptible to damage from coastal flooding.”¹⁷¹

The effect of the government insurance subsidy on homeowners’ location decisions can be further captured by another of the report’s findings. In some of the areas closest to the shoreline, annual rates have to be set at \$11.40 per \$100 of coverage to meet the risk projections—over ten percent of property value each year.¹⁷² 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 willing to pay only up to “\$1-\$2/year per \$100 of coverage” for erosion insurance.¹⁷³

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 has increased since 1980 from 1.9 million to over 4.6 million as of 2005.¹⁷⁴ Since the population at large grew significantly, this growth in enrollment means that many current policyholders moved to the area only post-NFIP, attracted in part by the subsidized exposure to risk. 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 its price tag: the new premiums exceeded homeowners’ ability to pay and scared away potential buyers, making mortgage loans unaffordable.¹⁷⁵

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

170. *Id.* at xxxiv (“[B]ecause current flood maps do not incorporate erosion risk, they are not only incomplete but also misleading to users.”).

171. *Id.* at xl box S.5.

172. *Id.* at xlv.

173. *Id.* at xlv-xlv.

174. U.S. GOV’T ACCOUNTABILITY OFFICE, *supra* note 164, at 27.

175. See, e.g., Josh Boatwright, *Flood Rate Fears Sink Condo Sales*, ST. PETERSBURG TRIB. (Dec. 21, 2013, 9:05 AM), <http://www.tbo.com/pinellas-county/flood-rate-fears-sink-sales-20131221/> (“[S]tories 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. 26, 2014, 11:29 AM), <http://www.northjersey.com/real-estate/rising-flood-insurance-premiums-make-homes-impossible-to-sell-1.735866> (“Many homeowners want to sell, but flood insurance costs have scared away buyers.”).

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.¹⁷⁶ How does government insurance of weather risk perform as a risk mitigation mechanism? Historically, not very well. As discussed above, the flood maps used by FEMA to administer the NFIP are notoriously out of date.¹⁷⁷ 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.¹⁷⁸

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.¹⁷⁹ 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.¹⁸⁰ 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.¹⁸¹ Indeed, in Florida all insurers—private and public—are required by statute to provide

176. See Ben-Shahar & Logue, *supra* note 14, at 220-26.

177. See *supra* Part II.A.

178. See *supra* Part III.

179. See, e.g., Joanna M. Foster, *The Jersey Shore Rebuilds Higher After Superstorm Sandy*, THINK PROGRESS (Apr. 21, 2014, 4:13 PM), <http://thinkprogress.org/climate/2014/04/21/3429081/new-jersey-elevates-houses> (discussing the large number of houses that were rebuilt in an elevated fashion because of insurance discounts offered for elevated houses); Scott Gurian, *Explainer: Putting Biggert-Waters Flood Insurance Reform Act in Perspective*, NJ SPOTLIGHT (Nov. 12, 2013), <http://www.njspotlight.com/stories/13/11/11/explainer-putting-biggert-waters-flood-insurance-reform-act-in-perspective> (detailing some possible changes resulting from the legislation in the “What It Would Mean for Residents of the Shore” section).

180. Tara Siegel Bernard, *Rebuilding After Sandy, but with Costly New Rules*, N.Y. TIMES (May 10, 2013), <http://nyti.ms/15XAvVq> (“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.”).

181. See *Your Wind Inspection*, CITIZENS PROP. INS. CORP., <https://www.citizensfla.com/web/public/your-wind-inspection> (last visited Mar. 3, 2016) (linking in bottom right-hand column to actual wind mitigation inspection forms used by Citizens).

such discounts.¹⁸² 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.¹⁸³ For this reason, it is difficult to document a care-level advantage on the part of private insurers with respect to coastal wind mitigation.

It is easy to see, however, the considerable activity-level advantage that private insurance has over government insurance of coastal weather risk. If private insurers were permitted to charge what the market would bear for coastal weather risk (and were not limited by state insurance regulators), the prices would be considerably higher than they currently are, especially for the riskiest communities living close to water. Whereas wind and flood insurance premiums may not constitute a large fraction of the premium paid by most homeowners (and therefore privatization of those risks may have little incentive effect on many people), for those living in the riskiest areas—along the coast, for example—the story is very different. Fully privatized weather insurance would likely lead to dramatic changes in premiums, which might result in significant long-run effects on real estate development. This claim is supported by anecdotal evidence.¹⁸⁴ It is supported by the short experience of rate hikes under the Biggert-Waters Act, which “scare[d] the bejesus out of people.”¹⁸⁵ 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.

182. FLA. STAT. § 627.711(1) (2015).

183. See generally Travelers Inst., Highlights and Lessons Learned from a National Symposium Series on Coastal Insurance Issues (2009), https://www.travelers.com/about-us/spotlight/docs/TRV_Coastal_Wind_Zone_Web.pdf (discussing insurance symposia held in South Carolina, Texas, and Alabama and discussing the need in those states for market-based wind insurance reform).

184. State Farm, for example, recently sought approval from the Louisiana insurance regulator for an average statewide premium increase of 15.2%, but was forced to settle for an 8.7% increase. See Ted Griggs, *State Farm Hurricane Deductible Jumps to 5%*, ADVOCATE (July 8, 2014, 6:51 PM), <http://theadvocate.com/news/9671144-123/state-farm-hurricane-deductible-jumps>.

185. Dan Burley, *Flood Insurance Rates Skyrocket for Some in Beaufort County*, BEAUFORT GAZETTE (Oct. 12, 2013, 10:41 PM), <http://www.islandpacket.com/2013/10/12/2735480/flood-insurance-rates-skyrocket.html> (quoting local realty broker). Some reports suggested that flood insurance rates for some jumped from \$500 per year “into the \$5,000-, \$10,000- and even \$20,000-a-year range and higher.” Terrell Johnson, *Skyrocketing Flood Insurance Rates Bring Financial Chaos, Heartache to Coastal Homeowners Across U.S.*, WEATHER CHANNEL (Sept. 28, 2013, 3:08 PM EDT), <http://www.weather.com/science/environment/news/new-flood-insurance-rules-bring-chaos-heartache-coastal-homeowners-20130927>.

IV. Responding to Concerns About Market (and Government) Failures in Private Weather Insurance

Insurance for weather risk is subsidized by the government. Either through disaster relief or through individually purchased insurance policies, people living in the zone of disaster pay only a fraction of the expected cost of their decision where to live. It is a subsidy program with great political support, resting on a popular belief that the program is both fair and efficient. This Article has shown 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 in the function of insurance. They can be reduced, and perhaps eliminated, 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 insurance for certain types of extreme weather risk: market penetration.¹⁸⁶ 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 market failures of private insurance.¹⁸⁷ Weather risk, it is alleged, is one such circumstance. In this Part, we examine the concern about market failures in the provision of private insurance. In addition, we address potential governance failures that could inhibit the attempt to use a more market-based approach.

One possible concern with private insurance for weather risk is underinsurance. Perhaps because of cognitive failures, homeowners often buy too little property insurance coverage for their dwellings.¹⁸⁸ For example, it is estimated that only twenty-one percent of homeowners in high-flood-risk areas in New York City who are not subject to a flood insurance mandate under their mortgage contract actually purchase flood coverage, even at subsidized rates.¹⁸⁹ However, severe weather is an odd area for such a cognitive bias argument to be made. Surely people notice reports about weather disasters.

186. See Christopher Matthews, *Should the Federal Government Be Subsidizing Flood Insurance?*, TIME (Oct. 30, 2012), <http://business.time.com/2012/10/30/should-the-federal-government-be-subsidizing-flood-insurance> (positing that the federal government began the NFIP to fix a market failure caused by prohibitively high insurer premiums, and by taking control of the market they were able to offer insurance at an affordable price).

187. See Saul Levmore, *Coalitions and Quakes: Disaster Relief and Its Prevention*, 3 U. CHI. L. SCH. ROUNDTABLE 1, 28-29 (1996).

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

189. DIXON ET AL., *supra* note 156, at 16-17.

If anything, one would expect the risk of hurricane damage to be overly salient relative to other insured risks, thus triggering a salience bias in the other direction. Indeed, it is estimated that for every person who dies in a storm, more than 139 people must die from famine to receive the same expected media coverage.¹⁹⁰ Thus, it is hard to attribute a market failure in flood insurance to cognitive biases that arise from distorted assessments of information.

What is less surprising, perhaps, is the failure of homeowners to recognize that standard homeowners' insurance policies exclude flood-caused damage. That is, most homeowners may simply not realize that their homeowners' property coverage contains an exclusion for flood-caused losses, and that such coverage must be purchased separately as an add-on. Moreover, perhaps many homeowners are not aware of the extent to which weather-related damages tend to be attributed to flood.¹⁹¹ 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.¹⁹² The resulting gap in coverage is a market failure that government insurance can step in to correct.

And yet, a more modest intervention could also resolve this problem. Instead of being the provider of insurance, the government could 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 towards private insurance markets, without the need for government-subsidized policies; and if cognitive biases or systematic underestimation of the risk is the only problem, a coverage mandate may be all that is needed. Also, for reasons having to do with optimal tax theory, the mandate may not need to require full coverage; that is, given the existence of other nonadjusting taxes in the system, a mandate that calls for something less than full weather-risk coverage might be optimal.¹⁹³

190. Thomas Eisensee & David Strömberg, *News Droughts, News Floods, and U.S. Disaster Relief*, 122 Q.J. ECON. 693, 723 tbl.vii (2007).

191. See, e.g., Nat'l Flood Ins. Program, Fed. Emergency Mgmt. Agency, *How to Speak Flood*. (2015), <https://agents.floodsmart.gov/Agents/downloads/HowToSpeakFlood-AgentFieldGuide.pdf> (addressing common consumer misconceptions that NFIP agents may encounter).

192. See Daniel R. Petrolia et al., *Risk Preferences, Risk Perceptions, and Flood Insurance*, 89 LAND ECON. 227, 229 (2013); cf. Risa Palm & Michael Hodgson, *Earthquake Insurance: Mandated Disclosure and Homeowner Response in California*, 82 ANNALS ASS'N AM. GEOGRAPHERS 207, 211 (1992) (discussing studies showing that, despite mandated disclosure of fact that properties are in high-risk earthquake zone, most buyers did not purchase earthquake insurance). But see Carolyn Kousky, *Learning from Extreme Events: Risk Perceptions After the Flood*, 86 LAND ECON. 395, 419 (2010) ("Still, it is clear from this study that risk information does influence homeowners.").

193. We have argued before that the mandate to purchase insurance has much the same effect as a Pigouvian tax in the weather-risk context and in other contexts as well. See Ben-Shahar & Logue, *supra* note 14, at 232-34. Pigouvian taxes, as well as social-cost-internalizing insurance mandates, can have their own distortionary effects. Cf. A. Lans
footnote continued on next page

An alternative to mandating the purchase of flood or wind insurance at the consumer level would be to mandate that all property policies include (at least partial) coverage for flood damage. Currently, insurers insert exclusions for flood or hurricane damage, but these exclusions would be prohibited. Such lumping of flood coverage into the standard homeowners policy would counteract problems of cognitive failure on the part of insurance purchasers, create demand for weather-related coverage (which would cause investment capital to flow into the weather reinsurance market), and reduce the social costs of litigating over whether a particular loss is caused by wind or water.¹⁹⁴ And to the extent that the price of such inclusive policies would become unaffordable to low-income homeowners, targeted means-tested subsidies or vouchers could be offered.¹⁹⁵ Such subsidies are better administered through the tax system, where they are made transparent (and thus more subject to voter and policymaker scrutiny) and where they are administered by regulators whose primary expertise is the design and enforcement of subsidies. Such subsidies would also cost less because they would eliminate all non-need-based subsidies.

A potential limitation of private insurance as weather-risk regulation involves the standard time period over which property insurance is written. Property policies in the United States are sold and priced on an annual basis,¹⁹⁶ which means the property insurer is obligated to cover losses sustained to the insured property during the year of coverage. As a result, individual property insurers may have insufficient incentives to invest in identifying the most effective risk-reducing strategies, as some portion of the benefits of these investments will redound to the benefit of future insurers.¹⁹⁷ This effect is reduced when insurers pool resources industry-wide to engage in weather-risk research. It could also be counteracted if property insurance policies were sold as long-term (ten-year or even twenty-year) contracts, similar to home mortgages, which “run with the property.”¹⁹⁸ That insurers do not presently offer multiyear policies is of course not evidence that such policies are

Bovenberg & Lawrence H. Goulder, *Optimal Environmental Taxation in the Presence of Other Taxes: General-Equilibrium Analyses*, 86 AM. ECON. REV. 985, 994-95 (1996) (showing that in a world in which policymakers are constrained from optimizing all taxes simultaneously, the optimal Pigouvian tax will be less than the marginal social cost). The same would be true with respect to mandated insurance, suggesting that less than full coverage should be mandated.

194. See KUNREUTHER & MICHEL-KERJAN, *supra* note 1, at 338-43 (proposing long-term property insurance policies as a way to avoid volatility in premiums across years).

195. See *id.* at 336.

196. See *id.* at 121 (“Individuals normally purchase insurance on an annual basis . . .”).

197. Ben-Shahar & Logue, *supra* note 14, at 230-31.

198. Others have written about the possibility of using long-term property policies to improve risk-reduction benefits of property insurance markets. See KUNREUTHER & MICHEL-KERJAN, *supra* note 1, at 338-43.

inefficient, given the cross-time collective action problem already mentioned, and the usurpation of the market by government-provided policies.

Another concern with private insurance for weather risk is the capacity to insure megadisasters. 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 circumstances.¹⁹⁹ 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.²⁰⁰

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.²⁰¹ 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.²⁰² So why are so few assets allocated to catastrophe reinsurance markets?

199. 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.”).

200. For a discussion of insurance company insolvency resulting from Hurricane Andrew, see LYNNE MCCHRISTIAN, INS. INFO. INST., HURRICANE ANDREW AND INSURANCE: THE ENDURING IMPACT OF AN HISTORIC STORM 5 (2012), http://www.iii.org/sites/default/files/paper_HurricaneAndrew_final.pdf. See also *Catastrophe: Insurance Issues*, INS. INFO. INST. (Dec. 2015), <http://www.iii.org/issue-update/catastrophes-insurance-issues> (reporting that eleven insurance companies became insolvent after Hurricane Andrew).

201. See, e.g., Kenneth A. Froot, *Introduction to NAT'L BUREAU OF ECON. RES., THE FINANCING OF CATASTROPHE RISK* 1, 1-5 (Kenneth A. Froot ed., 1999); Dwight M. Jaffee & Thomas Russell, *Catastrophe Insurance, Capital Markets, and Uninsurable Risks*, 64 J. RISK & INS. 205, 205-06 (1997).

202. See TOM BAKER & KYLE D. LOGUE, INSURANCE LAW AND POLICY: CASES AND MATERIALS 588 (3d ed. 2013) (“Reinsurance is insurance for insurance companies.”); KUNREUTHER & MICHEL-KERJAN, *supra* note 1, at 174-78 (discussing the importance of reinsurance for insurance companies to manage risk); Steven Merkel, *What is Reinsurance?*, INVESTOPEDIA, <http://www.investopedia.com/ask/answers/08/reinsurance.asp> (last visited Mar. 3, 2016) (“Reinsurance occurs when multiple insurance companies share

footnote continued on next page

A range of explanations has been offered for the apparent shortage of reinsurance capital, including tax incentives, agency costs, and exploitation of market power.²⁰³ 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.²⁰⁴ One of the most promising developments in building capital reserves for megacatastrophes has occurred in securities markets—the development of the catastrophic bond (cat bond).

Cat bonds are tradable debt securities issued by insurers.²⁰⁵ 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 nonoccurrence of some catastrophe-related trigger.²⁰⁶ Thus, if a megastorm 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.²⁰⁷ In the absence of publicly provided catastrophe insurance, this expansion would have likely been greater.

risk by purchasing insurance policies from other insurers to limit the total loss the original insurer would experience in case of disaster.”).

203. See, e.g., Froot, *supra* note 201, at 1-19 (discussing a range of factors that inhibit the accumulation of capital to provide catastrophic reinsurance); Jaffee & Russell, *supra* note 201, 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).
204. 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, 29, 31-33 (2000); J. David Cummins, *CAT Bonds and Other Risk-Linked Securities: State of the Market and Recent Developments*, 11 RISK MGMT. & INS. REV. 23, 45 (2008); Neil A. Doherty, *Financial Innovation in the Management of Catastrophe Risk*, 10 J. APPLIED CORP. FIN. 84, 88-94 (1997); Jaffee & Russell, *supra* note 201, at 216-22; Martin Nell & Andreas Richter, *Improving Risk Allocation Through Indexed Cat Bonds*, 29 GENEVA PAPERS ON RISK & INS. 183, 183-86 (2004).
205. See KUNREUTHER & MICHEL-KERJAN, *supra* note 1, at 176-77.
206. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-02-941, CATASTROPHE INSURANCE RISKS: THE ROLE OF RISK-LINKED SECURITIES AND FACTORS AFFECTING THEIR USE 6, 20 (2002), <http://www.gao.gov/new.items/d02941.pdf>; see also Lewis, *supra* note 106.
207. 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 ten years, with much of this growth coming from new cat bonds and other “insurance-linked securities.” AON BENFIELD, REINSURANCE MARKET OUTLOOK: POST CONVERGENCE 3 (2013), http://thoughtleadership.aonbenfield.com/Documents/20130905_ab_analytics_re_market_outlook_external.pdf.

If the creation of adequate private insuring capacity for weather-related disasters is in fact inhibited by persistent market failures, there are government interventions that, unlike the NFIP, deploy market incentives to reduce risk. Congress could, for example, adopt a federal reinsurance regime for severe storms similar to the system it created for catastrophic terrorism risks in the wake of the 9/11 attacks. Under the Terrorism Risk Insurance Act (TRIA), the first \$27.5 billion of losses from a given act of terrorism (rising to \$37.5 billion by 2020) is insured through private insurance markets, with the federal government providing 85% (falling to 80%) of the coverage above that threshold up to a cap of \$100 billion.²⁰⁸ The best case for TRIA is that the retentions built into such a regime provide considerable incentive for insurers to compete on price, while eliminating the downside uncertainty associated with the truly cataclysmic disasters. The hope is that the gradually decreasing federal reinsurance will encourage the flow of private capital into the terrorism insurance business. Something similar could be done with catastrophic weather risk.²⁰⁹

Conclusion

Insuring capacity is not an insurmountable problem for private insurance of weather risk. However, affordability may well be. In areas subject to severe weather, private insurance is offered, but priced at full risk it is expensive and, for many, unaffordable. True, without insurance these homeowners would also be unable to rebuild their property if lost, and insuring it might be a rational cost-minimizing choice. But it is still a luxury that many cannot afford (and, as explained above, that many were not factoring in when moving to the area). Means-tested subsidies may be designed only for the truly needy,²¹⁰ but short of a mandate to insure, many residents of hazard-prone areas would remain uninsured against weather devastation. What would happen in these communities after a disastrous storm?

Collectively provided disaster relief is the common response. Major disasters have a way of arousing a strong urge to support the victims. Such

208. Terrorism Risk Insurance Program Reauthorization Act of 2015, Pub. L. No. 114-1, 129 Stat. 3; Terrorism Risk Insurance Program Reauthorization Act of 2007, Pub. L. No. 110-160, 121 Stat. 1839; Terrorism Risk Insurance Extension Act of 2005, Pub. L. No. 109-144, 119 Stat. 2660; Terrorism Risk Insurance Act of 2002, Pub. L. No. 107-297, 116 Stat. 2322, *reprinted as amended in* 15 U.S.C. § 6701 note (2014).

209. The danger, of course, is that if the private market retentions are not set high enough, there could still be a moral hazard effect on building design decisions and, perhaps more crucially, on location decisions. This effect would be minimized by leaving weather-disaster risks entirely to the private market. For a somewhat skeptical take on the original Terrorism Risk Insurance Act, see Saul Levmore & Kyle D. Logue, *Insuring Against Terrorism—And Crime*, 102 MICH. L. REV. 268, 301-06 (2003).

210. See KUNREUTHER & MICHEL-KERJAN, *supra* note 1, at 336.

catastrophes generate an extraordinary amount of media attention and trigger a demand by the public to lend a collective hand—paid for by taxpayers—to the unlucky few, culminating in special legislative action to appropriate funds, such as the ones following the 9/11 attacks.²¹¹

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 both the harm and destruction they inflicted on entire communities.²¹² The corresponding federal disaster relief for the 2005 hurricane season totaled \$109 billion and the aid for Hurricane Sandy totaled \$66 billion, respectively.²¹³ Similar ad hoc relief followed unprecedented tornados, like the one that hit Joplin, Missouri, in 2011.²¹⁴

The emergence of ad hoc funds for relief from disasters is a testament to the collective conviction that shifting the loss from the direct victims is a way to mitigate the overall devastating impact of a disaster. For one, the loss is thus borne by a broader pool of payers, unable to drain the high marginal utility regions of people's welfare functions. Moreover, with the geographical concentration of victims, disasters have a "super-additive" impact, destroying not only the sum of the individual properties or lives, but entire communities. Thus, unlike more routine loss events (such as those that fall below the disaster declaration threshold), relief for truly catastrophic disasters is not regarded as a bailout of the irresponsibly uninsured.²¹⁵

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 does not matter that many of the victims could have purchased insurance (does the Coast Guard refrain from rescuing a drowning

211. Air Transportation Safety and System Stabilization Act, Pub. L. No. 107-42, 115 Stat. 230 (2001), *reprinted in* 49 U.S.C. § 40101 note (2014); *see also* Levmore & Logue, *supra* note 209, at 276-77.

212. *See* sources cited *supra* note 6 and accompanying text.

213. Fellowes & Liu, *supra* note 52; *Billion-Dollar Weather and Climate Disasters*, *supra* note 6. In addition, special tax subsidies were enacted to directly benefit the victims of large disasters. Personal casualty loss deductions are normally capped at ten percent of the taxpayer's adjusted gross income; that limitation was eliminated for the hurricane victims. *See* INTERNAL REVENUE SERV., PUB. NO. 4492, INFORMATION FOR TAXPAYERS AFFECTED BY HURRICANES KATRINA, RITA, AND WILMA 5 (2006).

214. *See* Daniel J. Smith & Daniel Sutter, *Response and Recovery After the Joplin Tornado: Lessons Applied and Lessons Learned*, 18 INDEP. REV. 165, 169-84 (2013).

215. 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 17-26 (2013).

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 more selective policies of need-based subsidies.²¹⁶ 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 a naïve proposal? Congress did enact a law to eliminate the flood insurance subsidies—a bipartisan law remarkably passed in the peak days of political 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.

216. Carolyn Kousky & Howard Kunreuther, *Addressing Affordability in the National Flood Insurance Program*, 1 J. EXTREME EVENTS 1450, 1450 (2014).