

2016

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Recommended Citation

Peter Molk, *The Government's Role in Climate Change Insurance*, 43 B.C. Envtl. Aff. L. Rev. 411 (2016)

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THE GOVERNMENT'S ROLE IN CLIMATE CHANGE INSURANCE

PETER MOLK*

Abstract: There are no robust insurance markets for climate change insurance. While these markets would provide valuable loss-mitigation incentives, at the same time giving financial certainty to individuals and businesses that face staggering future liabilities, existing efforts have produced a fragmented set of private and public products that provide only piecemeal coverage. This Article examines the government's role in providing unified markets for insuring climate change risk. Although innovations in reinsurance markets suggest that private insurers could cover discrete risks associated with climate change, such as flood or wind loss, climate change's broader systemic risks present problems of scale and scope that public insurance is better positioned to handle. This Article draws lessons from existing insurance programs to show both why purely private insurance would be inappropriate for a robust climate change insurance market, as well as how a nationally provided insurance program could be designed to avoid past problems.

INTRODUCTION

Climate change is a problem with which society is just beginning to grapple. The phenomenon has been associated with increasing frequency and severity of natural disasters.¹ Hurricanes and wildfires have destroyed property and lives, and the danger is expected to rise.² So too are sea levels, and the list of cities facing submersion resembles a "who's who" of the Atlantic coast.³ A 2015 report by the Environmental Protection Agency puts the expected costs to U.S. coastal property alone at \$5 trillion; global costs factoring in the consequences of other damage sources are undoubtedly

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¹ See Melissa Denchak, *Are the Effects of Global Warming Really That Bad?*, NAT. RES. DEF. COUNCIL (Mar. 15, 2016), <https://www.nrdc.org/stories/are-effects-global-warming-really-bad> [<https://perma.cc/8BW4-TZAB>].

² See *id.*

³ See *Surging Seas: Risk Zone Map*, CLIMATE CENT., <http://ss2.climatecentral.org/#12/40.7298/-74.0070?show=satellite&projections=0-RCP85-SLR&level=5&unit=feet&pois=hide> [<https://perma.cc/8AZU-45YK>] (providing an interactive map demonstrating the effects of sea level rise on coastal cities).

higher.⁴ A key issue that naturally arises in the face of this imposing picture is how to mitigate exposure to these losses.

Insurance markets are an admirable candidate. Because insurance premiums reflect the insurer's expected cost from covering a risk, insurance serves a regulatory function that promotes loss mitigation by private individuals.⁵ If a house is highly susceptible to flood risk, insurers expect relatively high losses from covering that property, and individuals are charged a correspondingly high rate. The insurer's expected losses—and the concomitant insurance premium—decrease if the individual takes steps to reduce the risk, perhaps by building her house on stilts or deciding to site the house elsewhere at reduced exposure. Individuals therefore save money by reducing their risk exposure, and this desire to save on premiums will translate into reduced risk levels. Extending this analysis, we might think that society need not worry too greatly about the cost of climate change; private insurance markets and policyholders' responses to financial incentives will reduce much of its financial bite.

The problem, however, is that private insurance markets do not cover many of the risks associated with climate change. Flood losses, for example, are excluded under standard policies both in the United States and abroad. Wind losses in hurricane-prone states are covered if required by regulatory policy, or not at all. Crop losses are managed by the federal government, not private insurers. In fact, most any risk associated with climate change is excluded from private coverage.⁶

A common vein running through the non-covered climate change risks is their correlated nature. Losses from climate change are not statistically independent: if one home is lost to flooding, the odds are high that its neighbors suffer flood losses, as well. Correlated losses are more expensive for insurers to cover, and the conventional argument goes that the expense of covering these risks is so considerable that insurers choose instead to exclude them, leaving individuals to self-insure or hope for government relief.⁷ In that case, private insurance offers no relief from climate change risk, and the only realistic alternative is to have the government step in with a public program.

⁴ See ENVTL. PROT. AGENCY, CLIMATE CHANGE IN THE UNITED STATES: THE BENEFITS OF GLOBAL ACTION 7 (2015), http://www2.epa.gov/sites/production/files/2015-06/documents/cira_report.pdf [<https://perma.cc/S96S-4B6X>].

⁵ See, e.g., Omri Ben-Shahar & Kyle D. Logue, *Outsourcing Regulation: How Insurance Reduces Moral Hazard*, 111 MICH. L. REV. 197, 199–201 (2012).

⁶ See generally Jeffrey W. Stempel, *Rediscovering the Sawyer Solution: Bundling Risk for Protection and Profit*, 11 RUTGERS J.L. & PUB. POL'Y 170, 179–80 (2013) (discussing the segregation of insurance risks).

⁷ See *infra* notes 12–15 and accompanying text.

In Part I, this Article shows that this conventional explanation for insurers' failure to cover climate change risk is lacking, particularly in light of recent advancements in risk financial products.⁸ Both theory and evidence suggest that private insurers are capable of handling correlated risks, and their reluctance to do so is better explained by specific noncompetitive aspects of the insurance shopping marketplace.

The issue that then arises is whether it is desirable for private insurers to cover climate change risk that could justify regulatory intervention. Part II shows that in both an ideal world with no transaction costs and perfect markets as well as in a world more reflective of political realities, broad climate change risk appears better borne by a government system than by private insurers.⁹

Part III considers how best to approach such a public system.¹⁰ Designing a public insurance regime to be effective is a daunting challenge, and experience with prior attempts has shown the unexpected failures that can result. This Article offers some principles for government-led climate change insurance, drawing on the strengths and weaknesses of prior government-sponsored insurance efforts.

I. CAN PRIVATE INSURERS HANDLE THE RISK?

Before considering whether private insurance companies would be superior to a public program at covering climate change insurance, we must first address why they do not currently do so in the marketplace. Insurance companies already offer a variety of products, from the mundane like homeowners' policies to more specialized products like insurance for alien abductions.¹¹ Why not climate change insurance, or insurance for symptoms of climate change like floods, hurricanes, and the like?

The conventional explanation for private insurers' absence from this market is the difficulty insurers have in covering correlated risks. Indeed, several leading insurance law scholars point to this characteristic in explaining the void left by private insurers.¹² Correlated losses lead to lumpy claims where some years have large claim amounts and others have very little. Lumpy claims mean insurers must hold large reserves to handle those

⁸ See *infra* notes 11–26 and accompanying text.

⁹ See *infra* notes 27–59 and accompanying text.

¹⁰ See *infra* notes 60–74 and accompanying text.

¹¹ See Nathan Erb, *Unusual Insurance Policies*, GEICO (Sept. 29, 2014), <https://www.geico.com/more/saving/insurance-101/unusual-insurance-policies/> [<http://perma.cc/S3DX-ERS4>].

¹² KENNETH S. ABRAHAM, *INSURANCE LAW AND REGULATION* 258 (5th ed. 2010); Ronen Avraham, *The Economics of Insurance Law—A Primer*, 19 CONN. INS. L.J. 29, 102–04 (2012); Scott E. Harrington, *Rethinking Disaster Policy*, 23 REGULATION 40, 42 (2000).

bad years with high payouts.¹³ These reserves must be safe and liquid, so they cannot be used for financing other operations or invested in high yield projects.¹⁴ They also incur undesirable tax treatment.¹⁵ These factors combine to increase insurers' costs of covering correlated risks.

But of course insurers are not required to bear these costs stoically; they can and do pass these costs along to policyholders through increased premiums.¹⁶ The conventional argument therefore boils down to saying that the premiums that insurers must charge for correlated risks are so high that it is not even worth insurers' time and effort to offer them, because few if any potential policyholders would pay the price. Instead, insurers do not cover correlated losses, such as the risks posed by climate change, and individuals instead self-insure.

Given the massive markups that policyholders have been willing to pay for other insurance products, this explanation seems most unlikely. Policyholders pay premiums far exceeding expected losses in areas ranging from flight insurance to disease-specific life insurance to extended warranty insurance plans.¹⁷ Policyholders' risk aversion—and thus insurers' potential premium markups—should be at least as high for climate change risk as these other examples because of policyholders' poor diversification. Most homeowners, for example, have just one home, and standard economic theory predicts that they should therefore be willing to pay large premiums for insurance that protects the value of their largest asset from causes like floods. Surely a meaningful portion of individuals would pay for coverage rather than self-insure. The fact that they do not do so seems unlikely to be attributable simply to the correlated nature and expense of these risks for insurers.¹⁸

Nor is it clear that correlated risks like those from climate change present impossible problems to insurers that make covering them extremely costly. Although correlated risks can produce large aggregate losses in particularly unfortunate years, insurers increasingly write business across di-

¹³ Avraham, *supra* note 12, at 102.

¹⁴ *See id.*

¹⁵ *E.g.*, Harrington, *supra* note 12, at 42.

¹⁶ *See* Avraham, *supra* note 12, at 102–03.

¹⁷ Tom Baker & Peter Siegelman, "You Want Insurance with That?" *Using Behavioral Economics to Protect Consumers from Add-On Insurance Products*, 20 CONN. INS. L.J. 1, 2 (2013); Robert Eisner & Robert H. Strotz, *Flight Insurance and the Theory of Choice*, 69 J. POL. ECON. 355, 355 (1961); Eric J. Johnson et al., *Framing, Probability Distortions, and Insurance Decisions*, 7 J. RISK & UNCERTAINTY 35, 35–40 (1993).

¹⁸ Despite their poor diversification, many individuals appear largely unwilling to purchase coverage for low-probability losses. The large number of uninsureds in the wake of recent flood losses has vividly shown this point. For discussion of this apparent irrational response, see *supra* note 17 and accompanying text.

verse geographic and product lines.¹⁹ Even particularly devastating disasters therefore represent only a comparatively small portion of the insurer's risk portfolio.²⁰ Moreover, innovations in financial products have made it easier for insurers to cap their exposure to these risks, offloading excessive losses to diversified global financial markets or reinsurers.²¹ This too makes covering correlated losses more manageable for insurers. Finally, sequestering risky activities within limited liability subsidiaries provides an easy and low-cost means for insurers to guarantee that unexpectedly high correlated losses in one region and line do not spill over into other operations.²² Correlated losses therefore do not present insurmountable problems to insurers.

The point here is not that correlated losses are inexpensive to insure. Rather, private insurers are better equipped to bear those losses than are individuals, which furnishes the conditions necessary for a private market.²³ Yet if private insurers are comparatively better positioned than individuals to cover these risks, why are they not already routinely covered, perhaps as part of the standard homeowners' insurance package? To answer this question, we must focus on imperfections in the insurance marketplace. In a market where individuals receive specific policy terms only after already agreeing to coverage, customers' rational response is to comparison shop based solely on price and a rough sense of insurer quality.²⁴ In such a market, insurers attract more business by offering lower premiums while maintaining perceived quality. An effective way of accomplishing this is to cut back on low-salience, low-probability coverage terms that, while expensive for insurers to include, are not terms for which most policyholders would look or care about most of the time.²⁵ Eliminating these terms promotes savings

¹⁹ See Avraham, *supra* note 12, at 103.

²⁰ See *id.* at 38–39.

²¹ In addition to the growing capacity of reinsurers who act as insurance for insurance companies, insurance-linked securities like sidecars and catastrophe bonds allow insurers to diversify risk into the hands of individual investors, increasing the pool for potential diversification.

²² For example, State Farm has separate subsidiaries to conduct its high-risk California, Texas, and Florida property insurance operations. *State Farm Companies*, STATE FARM (2014), <https://www.statefarm.com/about-us/company-overview/company-profile/state-farm-companies> [<https://perma.cc/UQ96-HUTK>]. While the losses within the subsidiary become highly correlated, increasing the risk that the subsidiary faces, the losses to the larger organization are less risky because of the cap on losses afforded by limited liability.

²³ See *supra* notes 16–22 and accompanying text.

²⁴ See Daniel Schwarcz, *Reevaluating Standardized Insurance Policies*, 78 U. CHI. L. REV. 1263, 1265–66 (2011).

²⁵ Evidence suggests that consumers find only a few terms of standard form contracts to be relevant, and if terms that govern low-probability correlated risks are not among these, insurers can attract customers by excluding low-salience risks to reduce high-salience premiums, even if consumers would be willing to pay for low-salience risks to be covered. See Russell Korobkin, *Bounded Rationality, Standard Form Contracts, and Unconscionability*, 70 U. CHI. L. REV. 1203,

without significantly hurting the insurer's reputation, giving it a comparative advantage in the marketplace. The correlated risks we have been considering fit this description admirably. Absent a regulatory response requiring coverage for these events, therefore, it seems likely that private insurers will continue to offer coverage for climate change risks, if at all, only as specialized endorsement add-ons on a case by case basis rather than as part of the overall standard package purchased by most individuals. Most climate change risks will thus remain uncovered by private insurers.

Requiring insurers to provide coverage has been known to backfire in the past.²⁶ Before considering such a regulatory response, we must first examine whether private insurers are even the appropriate vehicles for covering these risks. The following Part assesses the comparative advantage of private versus public insurance, in general and for the risks posed by climate change specifically.

II. PUBLIC VERSUS PRIVATE INSURANCE

The comparative advantages of public versus private insurers rests on balancing which is in a better position to bear climate change risk, which would do a better job at pricing insurance premiums, and which would more likely lead to mitigation of future climate change losses. The three

1207, 1225–34 (2003). Exacerbating this situation, many policyholders believe that they are already covered for correlated losses as part of their homeowners' insurance. NAT'L ASS'N OF INS. COMM'RS, HOMEOWNERS, INSURANCE SURVEY 1 (2007), http://www.naic.org/documents/newsroom_homeowners_insurance_summary.pdf [<https://perma.cc/F7XS-8JU8>] (identifying that one third of respondents believed that they had coverage for earthquake and for flood losses, both of which are excluded under standard policies). Other policyholders are thought to underestimate the value of insurance for certain low probability catastrophic losses, which can explain the low take-up rates of subsidized flood insurance. See, e.g., HOWARD C. KUNREUTHER ET AL., INSURANCE & BEHAVIORAL ECONOMICS 113–18 (2013) (exploring a variety of behavioral explanations for individuals' underpricing catastrophic risks); Howard Kunreuther & Mark Pauly, *Neglecting Disaster: Why Don't People Insure Against Large Losses?*, 28 J. RISK & UNCERTAINTY 5, 5 (2004) (focusing on individuals' high costs to estimating accurately loss probabilities). Each of these situations pushes private insurers to eliminate catastrophic risk coverage.

²⁶ Prior mandates have promoted unanticipated behavior by both insurers and private individuals. See, e.g., Amy Monahan & Daniel Schwarcz, *Will Employers Undermine Health Care by Dumping Sick Employees?*, 97 VA. L. REV. 125, 174–88 (2011) (theorizing that the Affordable Care Act mandate's incentive may lead to undesirable health plan redesign by private employers); Suja A. Thomas & Peter Molk, *Employer Costs & Conflicts Under the Affordable Care Act*, 99 CORNELL L. REV. ONLINE 56, 56–58 (2013), <http://cornelllawreview.org/files/2013/10/99CLRO50-OCTOBER.pdf> [<https://perma.cc/H4SU-53ZL>] (analyzing the Affordable Care Act mandate's incentives for private employer-employee interactions); *The Valued Policy Law: Home View of the New-Hampshire Fire Insurance Law*, N.Y. TIMES, Sept. 13, 1885, at 4 (quoting PORTSMOUTH (N.H.) TIMES, Sept. 11, 1885) (describing private insurers' complete withdrawal from the home insurance market after a state-imposed coverage mandate).

often do not go hand in hand, which is one reason why resolving the issue of climate change insurance can be so difficult.

Let us first assume a theoretically ideal world, in which both public and private insurance markets function perfectly and without transaction costs. In such a world, a public insurance plan is in a better position to bear climate change risk than are private insurers because of its superior ability to diversify and manage lumpy claims. Governments have access to the same risk-spreading mechanisms identified in Part I as private insurers, but governments have an additional advantage. Unlike private insurers, a government can always rely on its taxing power to cover periods when claims exceed revenues, using the general federal fisc to cover insurance claim shortfalls.²⁷ The federal flood insurance program has done so for the past several years.²⁸ The functionally unlimited revenue pool means a government program need not hold large contingency reserves to cover the unexpectedly high loss years that correlated risks like climate change present; in bad years, the federally funded insurance program can borrow from other government revenue sources, while in good years it does not tie up resources in reserves.²⁹ If those sources begin to dry up, governments' compulsory taxing power can be employed to replenish them. A government's ability to better diversify losses and manage the unpredictable nature of climate change claims risk puts it in a better position to bear climate change risk than private insurers.

Consider next whether a public or private insurer would more accurately price premiums in an ideal world. Accurate pricing is an important mechanism to reduce exposure to climate change risk; when premiums respond to the risk of loss, private loss incentives are provided to individuals to mitigate or avoid exposure to that risk.³⁰ In a theoretical ideal world, there would be no difference between public and private insurers' risk modeling and pricing practices—all would use the best actuarial models—and therefore there would be no difference in their pricing accuracy. In the real world, of course, this may not hold true and is an issue that is returned to later in this Part.

²⁷ See U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-13-858T, NATIONAL FLOOD INSURANCE PROGRAM: CONTINUED ATTENTION NEEDED TO ADDRESS CHALLENGES 1 (2013), <http://www.gao.gov/assets/660/657939.pdf> [<http://perma.cc/D35C-7WBD>].

²⁸ See *id.* at 4. As of 2013, the national flood insurance program had borrowed approximately \$24 billion from the federal government to cover premium shortfalls. *Id.*

²⁹ See Neil Buchanan, *Good Deficits: Protecting the Public Interest from Deficit Hysteria*, 31 VA. TAX REV. 75, 83 (2011).

³⁰ See *supra* note 5 and accompanying text. See generally Peter Molk, *The Ownership of Health Insurers*, 2016 U. ILL. L. REV. (forthcoming) (discussing this in the context of health insurance).

Finally, let us examine whether public or private insurance would be more likely to lead to future loss mitigation and avoidance. As just discussed, in a theoretical ideal world, both public and private insurance would lead to identical *private* mitigation incentives for individuals through premium pricing. But private incentives go only so far in avoiding the types of risks posed by climate change, like hurricanes, wildfires, and rising sea levels. Public projects, including sea walls, fire brigades, and levies, can be very effective measures in combating these risks.³¹ For the full loss avoidance signals sent by insurance to be realized, the entity that bears the risk of loss—the insurer—needs to be the same one that can take steps to mitigate losses through facilitating these public projects.³² When the insurance is public, those incentives are aligned, as the government is both assuming the risk of climate change and is the entity that can institute public works projects. With private insurers, the incentives are fully aligned only if coordination among private insurers, governments, lobbyists, and private individuals can be achieved—possible in our theorized world, but unlikely in the real world and is an issue that is returned to later.

Assessing the three dimensions of success in our ideal world, public insurance comes out on top in risk-bearing ability and is ranked similarly to private insurers for both pricing accuracy and loss mitigation. In that world, public insurance would be the superior choice. But of course, we do not live in an idealized world. Does anything change when we relax assumptions and incorporate real world attributes? It turns out that here too, there is reason to believe that public insurance will be the better option.

If one looks at the real world, the argument for government insurance's superior ability to weather losses and therefore bear risk remains unchanged. Governments have access to the same financial markets as private insurers, while retaining the advantage of diversifying losses across time without holding large reserves.³³

The argument for private insurers' superiority at pricing risk, however, grows stronger at first blush. Private insurers face competitive market pressure to make money. This pressure encourages insurers to develop detailed risk assessment models—and therefore pricing mechanisms—that incorporate diverse factors material to risk levels, because insurers with superior

³¹ See Katherine M. Baldwin, *NEPA and CEQA: Effective Legal Frameworks for Compelling Consideration of Adaptation to Climate Change*, 82 S. CAL. L. REV. 769, 778–79 (2009) (discussing the need for communities to implement effective adaptive solutions to combat the risks posed by climate change).

³² For instance, if an insurer could reduce its losses by \$100 if it built a \$50 sea wall, yet it had no ability to erect the wall, efficient loss mitigation steps are not taken.

³³ See *supra* notes 27–29 and accompanying text.

pricing efficiency gain a competitive advantage by attracting low-risk policyholders while avoiding high-risk ones.³⁴ Better pricing models send more accurate loss mitigation signals to policyholders and promote more optimal loss avoidance.³⁵

Governments, on the other hand, face weaker pricing pressure.³⁶ Government-provided insurance would face no competitive pressure to price insurance policies accurately, and therefore a public plan's premiums would be less likely to reflect the underlying risk.³⁷ Indeed, in the context of flood insurance—overwhelmingly sold by the federal government—risk premiums are set almost exclusively by the property elevation and a rough estimate of regional factors, ignoring property-specific attributes that would alter flood risk exposure.³⁸ These weak pricing models translate into weak loss mitigation signals for policyholders.³⁹

Further undermining public insurers' pricing accuracy is their vulnerability to political pressure to reduce rates for high risk policyholders below actuarial levels.⁴⁰ Political economy models show that high salience costs disproportionately incurred by a politician's constituents will often result in preferential treatment for those constituents, even when an alternative course would be better for society.⁴¹ Recent attempts to realign the federal flood insurance program with actuarial pricing are a good example of this

³⁴ See Avraham, *supra* note 12, at 44–45.

³⁵ See U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-15-290, HIGH RISK SERIES: AN UPDATE 80 (2015), <http://www.gao.gov/assets/670/668415.pdf> [<https://perma.cc/RH9M-8836>] (explaining that federal crop insurance policyholders may receive inaccurate signals about their risk due to subsidies); Jeffrey R. Brown et al., *Federal Terrorism Risk Insurance 6* (Nat'l Bureau of Econ. Research, Working Paper No. 9271, 2002), <http://www.nber.org/papers/w9271.pdf> [<https://perma.cc/8N2Q-YQ75>] (discussing the signaling effect of pricing models in the context of federally backed terrorism insurance).

³⁶ See Ben-Shahar & Logue, *supra* note 5, at 235.

³⁷ See *id.*

³⁸ See TECHNICAL DOCUMENTATION OF NFIP ACTUARIAL ASSUMPTIONS AND METHODS: SUPPORTING RATES EFFECTIVE OCTOBER 1, 2013, at 3–7 (n.d.), https://www.fema.gov/media-library-data/a10327c71a76f7c88d7cf403dcf60f4f/Actuarial%20Methods%20and%20Assumptions%202013-09-04_508.pdf [<https://perma.cc/3LDT-7GVP>].

³⁹ See Ben-Shahar & Logue, *supra* note 5, at 246 (examining how the market interprets the correlation between insurance premiums and risk level); Mark J. Browne & Martin Halek, *Managing Flood Risk: The National Flood Insurance Program and Alternatives*, in PUBLIC INSURANCE AND PRIVATE MARKETS 143, 144 (Jeffrey R. Brown ed., 2010).

⁴⁰ Robert E. Litan, *Sharing and Reducing the Financial Risks of Future "Mega-Catastrophe"* 23 (Brookings Inst., Economic Studies Working Paper, 2005), <http://www.brookings.edu/views/papers/litan/20051111financialrisks.pdf> [<https://perma.cc/JYT8-4J7J>].

⁴¹ See, e.g., Barry R. Weingast, *Regulation, Reregulation, and Deregulation: The Political Foundations of Agency Clientele Relationships*, 44 LAW & CONTEMPORARY PROBLEMS 147, 159 (1981), <http://scholarship.law.duke.edu/cgi/viewcontent.cgi?article=3611&context=lep> [<https://perma.cc/RPC4-J9XP>].

behavior. Legislation to reform the prior system of pricing subsidies and require actuarial pricing passed in 2012.⁴² Once the rate changes began to go into effect in 2014, however, they were unwound despite the endorsements by most analysts of the reform. Actuarially fair rates meant large premium increases for disproportionately few policyholders, and their protests at these increases proved too hard to ignore.⁴³

Unfortunately, as this Article has shown, accurate premium pricing is what provides valuable private loss mitigation incentives.⁴⁴ If government-provided insurance premiums only poorly reflect the underlying risk, then important loss-avoidance price signals are not sent.⁴⁵ In fact, when public insurance premiums drift too far from their actuarial basis, exposure to risk is actually *encouraged*—a perverse outcome indeed.⁴⁶ We might therefore think that accurate pricing incentives driven by competitive forces are a distinct advantage of private insurers.

Because the issue is now being analyzed from a real world perspective, however, we must also look at political economy dynamics to question whether private insurers will have the freedom to implement their prices that may be better attuned to underlying risks. Insurance is a heavily regulated industry, with pricing subject to regulatory approval. Both past experience and theory suggest that this regulatory process will distort private insurers' pricing away from true risk levels, just as with public insurance.⁴⁷ The differential exposure to climate change risk implies disparate insurance premiums that would provoke backlash from policyholders.⁴⁸ This public backlash in the past has translated into regulator-imposed premium ceilings, which brings us back to the situation where at least some premiums no

⁴² Biggert-Waters Flood Insurance Reform Act of 2012, Pub. L. No. 112-141, 126 Stat. 916 (codified as amended at 42 U.S.C. §§ 4001–4130 (2014)).

⁴³ Homeowner Flood Insurance Affordability Act of 2014, Pub. L. No. 113-89, 128 Stat. 1020 (codified as amended at 42 U.S.C. §§ 4001–4033 (2014)); Jennifer Wriggins, *Flood Money: The Challenges of U.S. Flood Insurance Reform in a Warming World*, 119 PENN. ST. L. REV. 361, 410–21 (2014) (analyzing the factors leading to adoption and rollback of flood insurance reform).

⁴⁴ See *supra* notes 33–35 and accompanying text.

⁴⁵ George L. Priest, *Government Insurance Versus Market Insurance*, 28 GENEVA PAPERS ON RISK & INS. 71, 74–75 (2003); George L. Priest, *The Government, the Market, and the Problem of Catastrophic Loss*, 12 J. RISK & UNCERTAINTY 219, 232 (1996).

⁴⁶ The National Flood Insurance Program's subsidization of high flood risk zones has been identified as a cause of increasing flood risk exposure over time. See, e.g., Kenneth J. Bagstad et al., *Taxes, Subsidies, and Insurance as Drivers of United States Coastal Development*, 63 ECOLOGICAL ECON. 285, 287 (2007).

⁴⁷ See George Schieber & Akiko Maeda, *A Curmudgeon's Guide to Financing Health Care in Developing Countries*, in INNOVATIONS IN HEALTH CARE FINANCING 1, 100 (George J. Schieber ed., 1997).

⁴⁸ See *supra* notes 38–43 and accompanying text (discussing the case of flood insurance).

longer reflect underlying risk.⁴⁹ It is not difficult to find examples where this has occurred in the past. California voters, for example, famously led regulators to cap auto insurance rates in 1988.⁵⁰ Florida's regulator-imposed property insurance rates subsidize high risk homes along the coast.⁵¹ And so on.

Therefore, while private insurers may, if left to their own devices, more accurately match premiums to underlying risk levels than would a public insurer, the same forces that pressure a public plan to subsidize high risk premiums are poised to produce the same outcome under a system of private insurers. In other words, private insurers' advantage in pricing responsiveness is eaten away by political realities.

Finally, let us look at whether public or private insurers would do a better job of loss mitigation in the real world. To the extent that private insurance more accurately matches premiums to underlying risk, then private insurers do a better job of promoting individual-level loss mitigation steps.⁵² More so than other insurance lines, however, climate change risk is managed by large scale public good projects. Building codes, seawalls and levees, emissions standards, firebreaks, and a host of other projects like these could meaningfully reduce future losses due to climate change. When the benefits of lower risk levels entirely accrue to a single entity, as in the case of public insurance, investments in these projects are more likely.⁵³ But when the benefits are spread across multiple insurers, as would be the case with a private climate change insurance system, and when noncontributing insurers cannot be excluded from realizing these benefits, as is inherently the case with these public goods investments, there will be underinvestment in efficient loss mitigation measures.⁵⁴

Moreover, enacting these public works risk mitigation projects requires large scale coordination. In a world with no transactions costs, private parties could negotiate and coordinate to collect an assessment from all New Orleans residents or private insurers, acquire contiguous privately owned plots from private owners, and erect a water retention system. But in a real

⁴⁹ See *supra* notes 38–43 and accompanying text.

⁵⁰ For analysis of the effects of this intervention, see Dwight M. Jaffee & Thomas Russell, *Regulation of Automobile Insurance in California*, in *DEREGULATING PROPERTY-LIABILITY INSURANCE: RESTORING AND INCREASING MARKET EFFICIENCY* 195, 196 (J. David Cummins ed., 2002).

⁵¹ Omri Ben-Shahar & Kyle D. Logue, *The Perverse Effects of Subsidized Weather Insurance*, 4, 14 (U. Mich. Law Sch., Law & Econ. Working Papers, Paper No. 111, 2015), http://repository.law.umich.edu/cgi/viewcontent.cgi?article=1221&context=law_econ_current [<https://perma.cc/H7CE-6VRU>].

⁵² See Browne & Halek, note 39, at 144.

⁵³ See *supra* note 32 and accompanying text.

⁵⁴ For more on the subject of public goods, see ANDREU MAS-COLELL ET AL., *MICROECONOMIC THEORY* 359 (1995).

world with positive transaction costs, government compulsion—for instance, the power of eminent domain—may provide the only practical means of overcoming an inability to coordinate.⁵⁵ Many suggested climate change mitigation efforts, including emission standards, building standards, or even acquiring the land necessary for public works projects, could benefit from a government's ability to solve coordination difficulties in a world with transaction costs. Left to their own devices, private parties and private insurers cannot therefore engage in the same level of loss avoidance measures.

Further, when viewing the problem through the lens of the real world, we must also acknowledge the impacts from post-disaster relief programs sponsored by governments. It is inevitable that after natural disasters of the kind posed by climate change, public assistance is provided to the uninsured.⁵⁶ The aftermath of Hurricanes Katrina and Sandy, for example, brought publicly financed rebuilding subsidies for individuals, even though flood insurance policies would have provided coverage for these losses had they been purchased.⁵⁷ Of course, it is undesirable to render uninsured individuals destitute because they did not buy insurance. Relief programs like these, however, undermine the loss avoidance and mitigation incentives that both individuals and private insurers otherwise feel: individuals, because some or all of their loss is reimbursed through government relief, and private insurers, because a post-disaster insurance regime encourages individuals to forego private insurance coverage by making private insurance less necessary.⁵⁸

If the entity that provides the disaster relief is also the entity that provides the insurance, however, as is the case in a public insurance program, there will be closer to optimal levels of loss mitigation investment because the losses are all borne by the same entity. Therefore, from a societal perspective, a publicly provided insurance program would unify the loss mitigation incentives within a single entity and provide the strongest incentives for proper levels of loss avoidance. This stems from the public good attributes of many loss mitigation measures, which distinguish this situation from

⁵⁵ See R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 16 (1960).

⁵⁶ See CAROLYN KOUSKY & LEONARD SHABMAN, *THE REALITIES OF FEDERAL DISASTER AID: THE CASE OF FLOODS 2* (2012), <http://www.rff.org/files/sharepoint/WorkImages/Download/RFF-IB-12-02.pdf> [<https://perma.cc/S726-RYC5>]. It should be noted that although disaster aid has been more frequently issued in recent years, the amount an individual or business is eligible to receive is often quite limited. *Id.* at 4.

⁵⁷ See Rachel Cleetus, *Sandy Exposed Flood Insurance Failure*, AL JAZEERA AM. (Oct. 27, 2013), <http://america.aljazeera.com/articles/2013/10/27/sandy-exposed-floodinsurancefailure.html> [<https://perma.cc/6LP4-RRYS>].

⁵⁸ See *id.*

more familiar insurance lines that are served by private insurers like auto, home, or life insurance.⁵⁹

To summarize, in both a theoretically ideal and a more realistic world, publicly provided climate change insurance offers potential advantages over a private program. Only if it is assumed that a public program would have severe relative shortfalls in its pricing system might a private insurance program make sense. Part III, therefore, considers how to construct a public program, paying particular attention to how to ensure pricing responsiveness.

III. PUBLIC INSURANCE DESIGN

In designing a public insurance program, there are two basic options. The first is to have the program run entirely by a public entity. A second option is to partner a public program with participation by private insurers. This Part examines both.

A. Exclusively Public Insurance Programs

First consider an exclusively public insurance program. The advantage of such a program is its ability to capitalize fully on the comparative advantages offered by public insurance. But in practice, it is difficult to find instances of a purely public insurance program that exists without private partnership.

Florida's Citizens Property Insurance Corporation ("Citizens"), a purely public program, provides clues regarding why. Funded by premiums and the pockets of Florida's populace, Citizens provides property insurance coverage for high risk homes along the Florida coast.⁶⁰ The muted pricing incentives that a non-private entity faces have combined with interest group lobbying to produce a pricing scheme that systematically undervalues risk levels, particularly high risks.⁶¹ As we have seen, this has the perverse consequence of encouraging exposure to risks, rather than encouraging loss mitigation.

How could a public program be constructed to address the tendency to underprice high risks but still offer the benefits of public insurance? The key is to design a public program with accountability similar to what private markets offer for private insurers. One promising way is to harness the power of transparency. In the past, disclosure of pricing imbalances has prompted pricing reforms of public insurance programs, including Citi-

⁵⁹ See *supra* notes 52–54 and accompanying text.

⁶⁰ *About Us*, CITIZENS PROP. INS. CORP., <https://www.citizensfla.com/web/public/who-we-are> [<https://perma.cc/9R93-D8CB>].

⁶¹ See Ben-Shahar & Logue, *supra* note 51, at 12–15.

zens.⁶² In the absence of market discipline, the accountability provided by disclosure could be a useful substitute. To be meaningful, the disclosure must be made on a regular basis and quantify the severity of pricing imbalances. The latter could be accomplished by, for example, disclosing the percentage and distribution of policies offered at below-actuarial prices as well as the geographic distribution of the subsidies.⁶³ The prospect of the existence and magnitude of preferential subsidies becoming public—and the resulting backlash—would hopefully provide a substitute incentive to keep policies accurately priced.

B. Partnerships Between Public Programs and Private Insurers

A purely public program is not the only possibility. Several insurance programs try to combine advantages of both public and private insurance with the downsides of neither.⁶⁴ The attempts fall into two approaches. Under the first, the government prices policies and is financially responsible for paying out claims, but private insurers administer the program and sell policies.⁶⁵ The federal flood insurance and crop insurance programs are examples of this method.⁶⁶ Under the second approach, private insurers are responsible for pricing, selling, and administering policies, while the government commits to sharing some of the losses that are incurred.⁶⁷ The federally backed terrorism insurance is an example of this method.⁶⁸

The first approach offers little meaningful advantage over a pure public program. Administration by private insurers could potentially offer administrative efficiencies, but as a practical matter private insurers have little

⁶² Paul Owers & Donna Gehrke-White, *Citizens Customers Need More Facts About Private Insurers*, *Advocates Say*, FLA. SUN-SENTINEL (Sept. 26, 2012), http://articles.sun-sentinel.com/2012-09-26/business/fl-insurance-company-reviews-20120926_1_citizens-policies-private-insurers-citizens-customers [<https://perma.cc/3TGR-A3AU>] (describing Citizens reforms after accumulated pricing imbalances were publicized by Florida's governor). As mentioned earlier, the federally backed National Flood Insurance Program's pricing system was also overhauled after a buildup in accumulated deficits drew public attention, although much of these reforms were later unwound. *See supra* notes 27–28 and accompanying text.

⁶³ Steps have already been taken along this approach in some insurance markets. For example, upon request Citizens will disclose information quantifying the subsidies for its policies. *See* Ben-Shahar & Logue, *supra* note 51, at 20.

⁶⁴ *See infra* notes 65–68 and accompanying text.

⁶⁵ *See* EXEC. OFFICE OF THE PRESIDENT OF THE U.S., ANALYTICAL PERSPECTIVES: BUDGET OF THE UNITED STATES GOVERNMENT, FISCAL YEAR 2005, at 95–96 (2004), <https://www.gpo.gov/fdsys/pkg/BUDGET-2005-PER/pdf/BUDGET-2005-PER.pdf> [<https://perma.cc/NZ46-GFBQ>] (describing the collaborative efforts between the federal government and private insurers in the U.S. Department of Agriculture crop insurance program).

⁶⁶ *See id.*

⁶⁷ *See id.*

⁶⁸ *See id.* at 96–97.

incentive to invest in selling government-backed policies, reducing policy take-up rates and the insurance program's effectiveness.⁶⁹ These problems have been particularly severe with the National Flood Insurance Program. One reason that few people purchase flood insurance is because small payments to private insurers do not make it worthwhile for them to invest much time or effort in marketing the policies.⁷⁰ And irrespective of any saved administrative costs, a privately administered public program suffers from the same overarching non-responsive pricing problems as does a purely public program: private insurers administer policies, but the public insurer prices them.⁷¹

A public/private partnership approach where the government assumes some or all losses above a threshold is more promising. If the government commits to covering most or all losses beyond a certain point, then private insurers are more likely to enter the market as their cost of providing coverage decreases.⁷² Moreover, because private insurers are in charge of pricing, premiums' responsiveness to risk level is maintained while achieving the broader efficiencies of a competitive marketplace.

This solution too, however, is imperfect. When private insurers bear only a portion of losses, they face only a muted incentive to price premiums to reflect risk, and so insurance premiums' loss mitigation signals are dampened.⁷³ Moreover, to the extent that market imperfections currently encourage insurers to eliminate coverage for correlated losses of the type likely to be experienced from climate change, a government loss backstop is not going to provide meaningful change.⁷⁴ Instead, it seems likely that pri-

⁶⁹ Governments could increase commissions paid to private insurers, but doing so undermines the potential administrative efficiency gains.

⁷⁰ RAWLE O. KING, CONG. RESEARCH SERV., THE NATIONAL FLOOD INSURANCE PROGRAM: STATUS AND REMAINING ISSUES FOR CONGRESS 3 (2013), <https://www.fas.org/sgp/crs/misc/R42850.pdf> [<https://perma.cc/HKD7-VL97>] (estimating flood insurance take-up rates in New York and New Jersey at less than 30% in most regions affected by Hurricane Sandy despite mandate to the contrary).

⁷¹ Unless the private insurer is financially responsible for claims, it would make little sense to have them price premiums, because they would have little incentive to price premiums accurately. Instead, financial incentives would push them to underprice premiums. Similar dynamics in the mortgage market are believed to have contributed to the recent financial crisis. See KATHLEEN C. ENGEL & PATRICIA A. MCCOY, THE SUBPRIME VIRUS 149–223 (2011) (discussing the factors behind the failure of the subprime lending market).

⁷² A government commitment to cover losses not only means insurers must pay less for losses, but also may reduce the impact of correlated losses if the threshold is set to be triggered when correlated losses occur. See *supra* notes 12–15 and accompanying text (discussing how correlated losses lead to increased premiums).

⁷³ See *supra* note 5 and accompanying text (discussing the feedback between losses, premiums, and risk mitigation). If insurance premiums reflect only a portion of actual losses, then risk mitigation measures will similarly reflect only a portion of the optimal level.

⁷⁴ See *supra* notes 12–18 and accompanying text.

vate insurers would cover this risk only with the addition of a government mandate, which however desirable would severely test the mettle of even the most seasoned politician to implement.

In sum, a publicly provided insurance program would not be without its challenges. Recognizing a government insurance program's comparative disadvantages up front and intelligently designing around them could minimize these disadvantages. Both pure public programs and public/private partnerships have relative strengths, so the ultimate choice comes down to beliefs about the magnitude of these comparative advantages.

CONCLUSION

Climate change threatens substantial societal burdens, and mitigating those burdens is highly desirable. While much of the focus to date has been on legislative measures, climate change insurance could provide powerful mitigation signals and the financial certainty that is so important in our modern lives. Although it is likely that private insurers have the capacity to handle much of the risk involved, relying exclusively on private insurers is a second-best solution. Because the large scale risks involved are often best avoided with public good projects and the aid of government intervention, placing a climate change insurance product in government hands could be the best means to this end.