

A R T I C L E

Preventing Industrial Disasters in a Time of Climate Change: A Call for Financial Assurance Mandates

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I. Introduction

When Hurricane Katrina tore through southern Louisiana, it left more than downed trees and standing water in its wake: over one million gallons of oil coated the streets, homes, and businesses of the small city of Meraux, home of a Murphy Oil refinery. Katrina's fierce winds and storm surge had torn a massive tank off its foundations and carried it away on the floodwaters, gushing oil as it went.¹ The damage could have been far greater. Katrina was by no means a worst-case storm,² and luckily, only one of the refinery's many tanks ruptured—and it leaked less than a third of the oil it contained.³ Nonetheless, the spill devastated the surrounding area, causing hundreds of millions of dollars in damage to thousands of homes and businesses and choking nearby canals with oil.⁴ When reporters returned to the scene a year later, they found “abandoned houses and overgrown lawns,” and neighbors lamenting the loss of a community.⁵

This Article is adapted from Zachary Arnold, Preventing Industrial Disasters in a Time of Climate Change: A Call for Financial Assurance Mandates, 41 HARV. ENVTL. L. REV. 243 (2017). Copyright in the Environmental Law Review is held by the President and Fellows of Harvard College, and copyright in the article is held by the author.

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1. See MURPHY OIL SPILL FACT SHEET, EPA, 1 (2006), <https://perma.cc/8VQU-4YHA>.
2. See, e.g., *Katrina Was Category 3, Not 4*, CNN (Dec. 21, 2005, 9:23 AM), <https://perma.cc/J35Y-PQTP> (“When it slammed ashore on the Gulf Coast in August, Hurricane Katrina was a strong Category 3 storm, not a Category 4 as initially thought . . . New Orleans . . . likely escaped the storm's strongest winds.”).
3. See MURPHY OIL SPILL FACT SHEET, *supra* note 1.
4. See *\$330 Million Settlement Deal in Katrina Oil Spill*, NBC NEWS (Sept. 25, 2006, 7:43 PM), <https://perma.cc/779P-KW44>.
5. See *id.*

The Murphy Oil incident may be a sign of things to come. Consensus projections of climate change and its impacts suggest that over the next several decades, sea levels will rise, coastal flooding will become more and more prevalent, and hurricanes may become stronger and more frequent as ocean temperatures warm. In turn, industrial facilities along the coasts will become more and more likely to experience destructive floods and storms.

This trend has sobering implications. America's population and economy are disproportionately coastal. Rising sea levels, more powerful and frequent storms, and increased flooding threaten to wreak havoc on these facilities, causing grave harm to life, property, and natural resources in surrounding communities.⁶

Financial assurance mandates (FAMs) may help induce coastal industries to invest in adaptation. FAMs require companies to prove that they can pay for the liabilities they may incur—whether by drawing on their own resources or by bringing in a third party, such as an insurer or surety, to pick up the tab.

FAMs are familiar tools whose strengths have been demonstrated in practice as well as in theory. Federal, state, and local regulators use them to reduce the risk of catastrophes of all sorts, from nuclear incidents and oil spills to impacts resulting from abandonment of dangerous facilities. History shows that these measures can be effective and reasonable in cost.⁷ And crucially, because they are relatively

6. See, e.g., Scott Gurian, *New Jersey's Industrial Coast Remains Vulnerable to the Next Extreme Storm*, NJSPOTLIGHT (Dec. 8, 2015), <https://perma.cc/TA5L-U7LE>; David A. Graham, *The Mothers of All Disasters*, THE ATLANTIC (Sept. 2, 2015), <https://perma.cc/28YX-XQCW>; Eric Berger, *Models Show "Massive Devastation" in Houston*, HOUSTON CHRON. (Feb. 20, 2005, 6:30 AM), <https://perma.cc/SJ9J-UPA6>; Tom Fowler, *Houston-Area Facilities Say They're Prepared*, HOUSTON CHRON. (Sept. 21, 2005, 5:30 AM), <https://perma.cc/A37M-FXNH>.
7. James Boyd, *Financial Responsibility for Environmental Obligations: Are Bonding and Assurance Rules Fulfilling Their Promise?* 5–8 (Resources for the Future Discussion Paper 01-42, Aug. 2001), <https://perma.cc/9D9B-SHEP> (“In every regulatory context to date, private financial markets have developed to provide the insurance, bonds, and other financial instruments necessary to demonstrate assurance, and they provide these products at reasonable cost.”); ROBERT V. PERCIVAL ET AL., ENVIRONMENTAL REGULATION: LAW, SCIENCE, AND POLICY 145 (“[F]inancial assurance mandates in the Oil

simple to design and enforce, FAMs are particularly appropriate for use by state and local policymakers, making them well suited to an era of federal gridlock and geographically uneven climate impacts. For these reasons, policymakers should require many coastal firms to buy insurance for the harms their operations may cause to others as a result of the coastal impacts of climate change.

II. The Coastal Impacts of Climate Change and the Need for Industrial Adaptation

There is broad consensus that coastal climate adaptation efforts are both essential and underdeveloped.⁸ Many of America's vital industries are concentrated on the coasts, and their exposure to the floods and storms that climate change threatens poses grave risks for society at large.

First, extreme weather and flooding could cause huge economic losses by disrupting systemically important industries.⁹

Second, storms and flooding could cause environmental and public health catastrophes. The industrial facilities lining our coasts store and process dangerous substances, and when facilities are damaged, inundated, or hastily taken offline, these substances can and do escape.

Third, and relatedly, storm and flood hazards, and the potential liabilities and business risks they entail, could lead companies to simply abandon facilities, leaving unsecured and dangerous structures containing hazardous substances to blight the coasts—and, potentially, to cause releases and spills.

In theory, coastal industry should already have strong economic incentives to adapt, but it will probably underinvest in adaptation on its own. At its highest levels, corporate America generally understands that climate change is occurring and likely to accelerate in the future, and that it entails serious business risks.¹⁰ However, coastal businesses may not fully bear all of the relevant risks of climate change. In par-

ticular, corporations have a number of ways to “externalize” environmental damage. Lawsuits over environmental disasters entail tricky questions of causation and valuation. For example, if faced with environmental claims it cannot pay, a business may declare bankruptcy as a last resort, leaving claimants to haggle over whatever remains.¹¹

III. Approaches to Coastal Industrial Adaptation: The Role of Financial Assurance Mandates

A. The Typical Regulatory Strategies—Command-and-Control Mandates and Subsidies—Are Inadequate

To promote climate adaptation, many states and localities have imposed command-and-control regulations in the form of building codes and land use regulations.¹² These policies have a role to play in coastal industry adaptation, but their well-known disadvantages counsel against a primarily command-and-control approach to the issue. Command-and-control regulators must distinguish between acceptable and unacceptable conduct, requiring substantial information and expertise. Moreover, the “one size fits all” tendency of rulemaking can be inefficiently oblivious to variations among regulated entities. And without financial incentives to produce thoughtful rules and implement them with alacrity, regulators may prove sluggish—or worse, beholden to the very interests they are meant to control.¹³

Policymakers may choose instead to subsidize coastal adaptation, rather than (or in addition to) mandating that industries enact particular measures. But subsidies, like command-and-control regulation, have serious weaknesses. Subsidizing coastal industrial adaptation would funnel the general public's tax dollars to subsidy recipients, raising

Pollution Act of 1990 helped drive “a ‘sea change’ in the shipping industry's safety practices [and] a substantial reduction in the amount of oil spilled in U.S. waters.”); see also Haitao Yin et al., *Risk-Based Pricing and Risk-Reducing Effort: Does Private Insurance Reduce Environmental Accidents?*, REG. 36, 46 (Summer 2012) (explaining that Michigan's private insurance mandate for underground storage tanks significantly reduced spills and induced owners to close facilities likely to leak).

8. See, e.g., NAT'L OCEANIC & ATMOSPHERIC ADMIN., ADAPTING TO CLIMATE CHANGE: A PLANNING GUIDE FOR STATE COASTAL MANAGERS, 1, 16 (2010), <https://perma.cc/VZG5-9K9V>; John R. Nolon, *Land Use and Climate Change: Lawyers Negotiating Above Regulation*, 78 BROOK. L. REV. 521, 545 (2013).
9. See, e.g., HAL NEEDHAM ET AL., CTR. FOR CLIMATE & ENERGY SOLUTIONS, IMPACTS AND ADAPTATION OPTIONS IN THE GULF COAST 16–20 (2012), <https://perma.cc/43PU-SM3P>; Neena Satija et al., *Hell and High Water*, PROPUBLICA (Mar. 3, 2016), <https://perma.cc/9E8V-33L4>; see also MEG CRAWFORD & STEPHEN SEIDEL, WEATHERING THE STORM: BUILDING BUSINESS RESILIENCE TO CLIMATE CHANGE, CTR. FOR CLIMATE AND ENERGY SOLUTIONS 3 (July 2013), <https://perma.cc/DQX7-83Z5>.
10. CRAWFORD & SEIDEL, *supra* note 9, at ix (“[T]he vast majority of [Global 100] companies recognize risks from extreme weather and climate change, and many see these risks in the present or near term.”).

11. See James Boyd, *Financial Responsibility for Environmental Obligations: Are Bonding and Assurance Rules Fulfilling Their Promise?* 3–4 (Resources for the Future Discussion Paper 01-42, Aug. 2001), <https://perma.cc/9D9B-SHEP>; Joel M. Gross, *The Interface Between Bankruptcy and CERCLA: Where Does New Legislation Belong?*, 5 FORDHAM ENVTL. L. REV. 287, 293–94 (2011); See generally Milissa A. Murray & Sandra Franco, *Treatment of Environmental Liabilities in Bankruptcy*, ENVIRONMENTAL ASPECTS OF REAL ESTATE AND COMMERCIAL TRANSACTIONS 341 (James B. Witkin ed., 4th ed. 2011). For a vivid recent example, see Michael Wines, *Owners of Chemical Firm Charged in Elk River Spill in West Virginia*, N.Y. TIMES (Dec. 17, 2014), <https://perma.cc/R7SR-LQ9G>.
12. See generally JESSICA GRANNIS, ADAPTATION TOOL KIT: SEA-LEVEL RISE AND COASTAL LAND USE, GEO. CLIMATE CTR. (2011), <https://perma.cc/YH4L-RJFK> (describing a variety of relevant regulatory strategies).
13. See David A. Dana & Hannah J. Wiseman, *A Market Approach to Regulating the Energy Revolution: Assurance Bonds, Insurance, and the Certain and Uncertain Risks of Hydraulic Fracturing*, 99 IOWA L. REV. 1523, 1552–54 (2014) (describing industry capture of state and federal regulators through industry lobbying and pressure, groupthink, and “revolving door” personnel exchange).

issues of equity and political feasibility.¹⁴ Moreover, subsidies are essentially reverse command-and-control mandates; rather than specifying behavior to be punished, they specify behavior to be rewarded. And if subsidized adaptation measures do not fully mitigate risk (a likely proposition), subsidies could, on balance, have the perverse effect of maintaining or even increasing overall risk exposure.

B. Financial Assurance Mandates: A Brief Overview

FAMs require individuals or companies to prove their ability to meet potential liabilities, ensuring that if liability arises, the liable parties ultimately pay rather than those to whom they are liable.¹⁵

Individuals and businesses can comply with FAMs in various ways. The most familiar financial assurance mechanism is insurance: a commitment from a financially capable outsider to pay for any liability the potentially liable party may incur.¹⁶ In other contexts, surety bonds are commonly used, requiring a financially capable third party to pay a specified amount if certain conditions are fulfilled, such as a liability.

Insurance and bonds both use third parties to assure the availability of funds. Other financial assurance tools do not. For example, some FAMs require regulated entities to set money aside in anticipation of potential liability.¹⁷ Others allow regulated entities to “self-insure” by demonstrating to a regulator’s satisfaction that they are financially secure enough to be able to meet any future liability.¹⁸

C. The Virtues of Financial Assurance Mandates and the Superiority of Insurance

I. Insurance vs. Other Financial Assurance Tools

FAMs serve two essential functions. First, by requiring regulated individuals and businesses to have enough funds to fulfill their potential liabilities regardless of solvency, corporate form, or capitalization, FAMs ensure that victims or society at large do not have to bear financial burdens that the law allocates to those individuals and businesses alone.

Second, FAMs ensure cost internalization (by ensuring that regulated entities can pay, and can therefore be made to pay, any costs that materialize) and assign a clear and immediate value to those future costs: some companies with dangerous practices may find themselves unable to

find insurance at any price,¹⁹ and in other cases, insurers monitor their customers’ activities and vary premiums and underwriting standards accordingly.²⁰

2. Insurance vs. Command-and-Control Regulation

FAMs internalize the costs of harms and thereby reduce the risk that harms will occur in the first place. There are at least three reasons to think that insurers can be more effective in these tasks than their counterparts in the command-and-control bureaucracy. First, insurers have a strong profit motive to accurately price risk.²¹ Premiums that do not fully reflect policyholders’ risks will attract risky customers, tending to cause the insurer to pay out more than it takes in; premiums disproportionate to policyholders’ risks will drive potentially profitable customers away.²²

Second, as specialists in risk management, insurers develop and draw on deep expertise and proprietary knowledge as they assess the risks posed by their policyholders, craft incentives to mitigate those risks, and monitor policyholders to ensure that their premiums reflect their behavior.²³ Third, and crucially, these institutional advantages also render insurance requirements more practically and politically viable than command-and-control regulations. By opting for insurance requirements, a regulator can effectively subcontract the design and enforcement of finer-grained rules to the insurer.

IV. Sketching a Coastal Industry FAM

A. For Which Liabilities Should Financial Assurance Be Required?

FAMs ensure that funds will be available to pay potential liabilities. Initially, at least, I suggest that coastal industry FAMs should cover only existing liabilities. Specifically, coastal industries should provide financial assurance sufficient to fully remediate worst-case spills, releases, and other such environmental disasters. As discussed above, the costs of these disasters are not fully internalized to firms, and cli-

14. A similar redistributive mechanism is already at work in the residential adaptation context in the guise of NFIP, through which all taxpayers subsidize coastal residents’ living expenses by paying for the gap between NFIP’s premiums and claims paid. See, e.g., Mark Fogarty, *Industry Victory on Flood Insurance Will Be Taxpayers’ Loss*, NAT’L MORTGAGE NEWS (Apr. 15, 2014), <https://perma.cc/TNR8-9TC4>.

15. See Boyd, *supra* note 7, at 1 (FAMs are also known as financial requirements or bonding requirements).

16. *Id.* at 23.

17. *Id.* at 25.

18. *Id.* at 20–21, 26–27.

19. See, e.g., Omri Ben-Shahar & Kyle D. Logue, *Outsourcing Regulation: How Insurance Reduces Moral Hazard*, 111 MICH. L. REV. 197, 207 (2012) (“Differentiated insurance premiums provide explicit prices to people’s choices of care in much the same way as Pigouvian taxes.”); see also *id.* at 233 (“By converting the uncertain expected cost of liability into a certain cost of the insurance premium, insurance premiums enable insureds to make more informed choices regarding activity levels. Since most regulated parties do not have the information necessary to accurately convert expected ex post liability awards and fines into an exactly equivalent Pigouvian tax, and since the government does not provide such estimates to help people plan, insurers fill this void.”).

20. See David A. Dana & Hannah J. Wiseman, *A Market Approach to Regulating the Energy Revolution: Assurance Bonds, Insurance, and the Certain and Uncertain Risks of Hydraulic Fracturing*, 99 IOWA L. REV. 1523, 1527–28, 1563–65 (2014).

21. See Omri Ben-Shahar & Kyle D. Logue, *Outsourcing Regulation: How Insurance Reduces Moral Hazard*, 111 MICH. L. REV. 197, 207 (2012).

22. See *id.* at 204.

23. See *id.* at 205–06, 233.

mate change will make them much more likely. FAMs that address only existing liabilities will require less legal revision and impose fewer costs and uncertainties on subject businesses than FAMs that impose novel liabilities.

A FAM aimed at climate-related coastal environmental disasters should logically apply to facilities that are vulnerable to the coastal impacts of climate change, and that contain substances and operations capable of serious harm if disrupted. Existing regulations provide proxies for both of these characteristics:

- **Vulnerability to the coastal impacts of climate change:** Some coastal facilities are of particular concern given their exposure to flooding and storm surge. The Federal Emergency Management Agency's (FEMA) flood insurance maps provide estimates of flood risk at any location in the United States, and designate certain areas as especially vulnerable.
- **Presence of potentially harmful substances and operations:** The Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and its implementing regulations identify certain facilities as posing a particular risk of dangerous contamination, and require those facilities to make disclosures to state and local regulators.

Together, FEMA's flood maps and EPCRA's reporting standards suggest a rough rule of thumb for identifying facilities to subject to the FAM. This rule of thumb is imperfect; FEMA's flood maps, in particular, have been widely criticized as both under- and over-inclusive in certain areas.²⁴ Nonetheless, the combination of EPCRA and flood map data offers a coherent, reasonably robust, and easily implementable initial framework.²⁵

B. Which Assurance Mechanism(s) Should the FAM Use?

The FAM must also identify acceptable mechanisms of assurance. Some real-world FAMs provide laundry lists of acceptable mechanisms.²⁶ Others leave the decision to indi-

vidual regulators, rather than (or in addition to) making a choice in the law itself.²⁷ Still others emphasize or require a particular mechanism.²⁸

Two major concerns frame the choice among financial assurance mechanisms. The first is regulatory complexity. FAMs that allow self-insurance require regulators to confirm and monitor regulated parties' financial stability. Even the most sophisticated regulators have struggled with this task.²⁹ Implementation is simpler if the regulated party purchases financial assurance—the regulator needs only to verify that the party in fact did so, and that the terms of the assurance (e.g., the type and amount of liability covered) meet the FAM's requirements.³⁰

The second framing concern is the extent and immediacy of risk mitigation incentives. In theory, all financial assurance mechanisms ensure that those subject to FAMs bear the costs at issue. This theoretically should drive risk mitigation no matter which financial assurance mechanism is chosen. However, businesses are unlikely to take strong action if they do not face immediate, risk-responsive financial incentives.³¹

In the case of a coastal industry FAM, both of these factors favor a private insurance requirement. Resource-strained state and local governments may not be able to effectively manage informationally intensive assurance mechanisms such as self-insurance.³² Private insurance, and the private regulatory apparatus it entails, also provides the upfront risk mitigation incentives lacking in other FAMs.³³

V. Confronting Potential Objections to a Coastal Industry FAM

A. Financial Assurance Will Be Very Expensive or Even Unavailable at Any Price

The first and most obvious counterargument goes something like this: Insurance is expensive. Insurers will demand high premiums in order to have enough money on hand if a coastal disaster produces many expensive claims.³⁴ In

24. See, e.g., Christopher Joyce, *Outdated FEMA Flood Maps Don't Account for Climate Change*, NAT'L PUB. RADIO (Sept. 15, 2016, 4:37 AM), <https://perma.cc/82QK-8JFQ>; Andy Horowitz, Op-Ed, *New Orleans's New Flood Maps: An Outline for Disaster*, N.Y. TIMES (June 1, 2016), <https://perma.cc/J9DS-GQWY>; Al Shaw et al., *Federal Flood Maps Left New York Unprepared for Sandy—and FEMA Knew It*, PROPUBLICA (Dec. 6, 2013, 5:00 AM), <https://perma.cc/A6HF-NT3F>; Theodor Meyer, *Using Outdated Data, FEMA Is Wrongly Placing Homeowners in Flood Zones*, PROPUBLICA (July 18, 2013, 1:07 PM), <https://perma.cc/V4N7-RTYD>.

25. See, e.g., Ivan Maddox, *Why FEMA Flood Maps Don't Tell the Whole Risk Story*, INTERMAP: THE RISKS OF HAZARD (Dec. 3, 2014, 10:09 AM), <https://perma.cc/3ESP-XVTZ>. See, e.g., Joyce, *supra* note 24 (FEMA's ongoing map revision process may help fix some of the maps' errors); Al Shaw, *How Well Did FEMA's Maps Predict Sandy's Flooding?*, PROPUBLICA (Dec. 6, 2013), <https://perma.cc/4U2Z-Q8UW> ("areas with newer [FEMA] maps using newer technology predicted . . . flood extents far more accurately overall"). But see Horowitz, *supra* note 24.

26. The Oil Pollution Act is one example. See 33 U.S.C. § 2716(e) (2012); 30 C.F.R. § 138.80 (2014); see also Kenneth S. Abraham, *Catastrophic Oil Spills and the Problem of Insurance*, 64 VAND. L. REV. 1769, 1776 (2011) ("the principal means" of complying with OPA's FAMs "is through the purchase of liability insurance").

27. See, e.g., CLEVELAND, OHIO, CODE OF ORDINANCES § 354A.08(b)(1) (2016) (requiring a "performance bond or equivalent financial instrument . . . sufficient to guarantee full and faithful performance of the requirements of this chapter and . . . satisfactory to" certain city officials).

28. SMCRA, for example, emphasizes bonding. 30 U.S.C. § 1259 (2012).

29. See Boyd, *supra* note 7, at 61–66.

30. See *id.* at 21.

31. See *infra* note 51 and accompanying text; Dana & Wiseman, *supra* note 20, at 1581; cf. Thomas W. Merrill, *Insurance and Safety Incentives* 10 (2011) (working paper for the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling), <https://perma.cc/P7U4-D4ME>.

32. See Michael P. Vandenbergh, *The Private Life of Public Law*, 105 COLUM. L. REV. 2029, 2081 (2005); Tracy Gordon, *State and Local Budgets and the Great Recession*, RUSSELL SAGE FOUND. & STAN. CTR. POVERTY & INEQUALITY (Dec. 2012), <https://perma.cc/QU3P-NSTH>; Dana & Wiseman, *supra* note 20. But see *infra* Section V.D (discussing difficulties in defining the required amount of assurance, regardless of the assurance mechanism chosen).

33. See Dana & Wiseman, *supra* note 20, at 1581.

34. See, e.g., PAUL K. FREEDMAN & HOWARD KUNREUTHER, *MANAGING ENVIRONMENTAL RISK THROUGH INSURANCE* 40–48 (1997); Howard C. Kunreuther & Erwann O. Michel-Kerjan, *Climate Change, Insurability of Large-*

especially risky areas, they may refuse to provide insurance altogether, forcing businesses to close or relocate. In other areas, high premiums will increase the cost of doing business so much that companies will be at a significant disadvantage relative to those in unregulated areas. In turn, they will close their doors, or flee for other jurisdictions.

This argument has some merit. All else equal, industries in jurisdictions with FAMs will be at a competitive disadvantage relative to jurisdictions without them. For three reasons, however, this dynamic should not worry policy-makers too much.

1. Private Insurance Is Unlikely to Be Very Expensive or Unattainable

Historical and theoretical evidence both suggest that the costs of complying with coastal industry FAMs will be modest. Predictions of sky-high premiums, unavailable insurance, widespread insolvencies, and the like were heard ad nauseam when many modern FAMs were enacted, yet none of these consequences came to pass. Moreover, from a theoretical perspective, it is not clear that coastal climate risk specifically should be unusually difficult or expensive to insure. To simplify slightly, insurers set premiums in light of four basic considerations.³⁵ First, insurers will charge higher premiums for ambiguous risks, that is, risks with large variances in the likelihood of losses arising and/or in the magnitude of those losses.³⁶ Second, they will charge more if they cannot tell whether their customers are especially likely to make claims (adverse selection).³⁷ Third, they will charge more if customers are likely to act more dangerously once insured (moral hazard).³⁸ Fourth, they will charge more if risks are correlated, that is, if many customers are likely to make claims at the same time.³⁹

On the one hand, moral hazard and adverse selection probably would not cause insurance premiums to rise, because customers would not have an informational advantage over insurers. Rather, insurers should be equally or more able than the customers themselves to discern whether their customers are vulnerable to climate risk. This is because insurers can monitor customers and draw on superior proprietary information to evaluate risk exposure.⁴⁰ Similarly, by monitoring customers and varying

their premiums according to the risks uncovered, insurers should be able to ward off moral hazard.

On the other hand, ambiguity and correlation should tend to raise premiums, as the impacts of climate change are uncertain and can produce many losses all at once. Nonetheless, there is cause for optimism. Insurers have been able to provide affordable insurance even in markets with similarly high ambiguity and correlation, such as offshore drilling, where a robust and risk-responsive private insurance market exists.⁴¹ And by encouraging risk-mitigating behavior, insurers can narrow the range of potential losses, further reducing ambiguity.⁴²

2. A FAM's Costs Will Not Necessarily Drive Industries Away

Even if a coastal industry FAM raises costs, businesses subject to the FAM will not necessarily flee. After all, the coasts offer easy access to port facilities, fuel terminals, and other important infrastructure, as well as to major population centers.⁴³ Partially for this reason, many coastal areas have developed robust networks of upstream product producers, downstream input suppliers, and specialized contractors and service providers, allowing productivity-enhancing informational exchanges and fostering deep labor markets.⁴⁴ Energy producers and businesses in other coastally concentrated industries cannot easily forsake the locational amenities available along the coasts.

3. High Costs or Relocation, If They Occur, May Actually Be Socially Beneficial

Finally, insofar as the FAM does increase costs or drive industry from the coasts, this may be a good thing. To the extent that FAMs “increase” the cost of doing business, they do not create that cost, but rather shift it from society back to those regulated.⁴⁵ From a social welfare perspective, then, businesses whose operations are so socially risky that they cannot afford to mitigate or insure them *should not continue to exist*, and businesses that can only avoid crippling insurance costs by relocating *should* be forced to do so.⁴⁶

Scale Disasters, and the Emerging Liability Challenge, 155 U. PA. L. REV. 1795, 1821–22 (2007).

35. See, e.g., *id.*; Michael Faure & Véronique Bruggeman, *Catastrophic Risks and First-Party Insurance*, 15 CONN. INS. L.J. 1, 16, 33 (2008) (“Due to problems of ambiguity, adverse selection, moral hazard, and highly correlated losses, insurance companies will want to charge a risk premium that considerably exceeds the expected loss. This premium can, however, be so high that there would be very little demand for coverage at that rate.”); a fifth factor, which I will set aside here, is administrative costs. I see little reason to believe that the administrative costs of providing climate-related environmental insurance will be wildly different from those of providing other forms of individualized specialty insurance.

36. See FREEDMAN & KUNREUTHER, *supra* note 34, at 40–43.

37. See *id.* at 43–44.

38. See *id.* at 17–19.

39. See *id.* at 19–20.

40. See Kunreuther & Michel-Kerjan, *supra* note 34, at 1824.

41. See, e.g., Mark A. Cohen et al., *Deepwater Drilling: Law, Policy, and Economics of Firm Organization and Safety*, 64 VAND. L. REV. 1853, 1901 (2011); Dana & Wiseman, *supra* note 20, at 1573–74.

42. See, e.g., Celine Herweijer et al., *Adaptation to Climate Change: Threats and Opportunities for the Insurance Industry*, 34 GENEVA PAPERS 360, 366 (2009).

43. See, e.g., Needham et al., *supra* note 9, at 14; U.S. Energy Information Agency, *Flood Vulnerability Assessment Map*, U.S. DEP’T ENERGY, <https://perma.cc/CQJ4-64LB> (last visited Nov. 24, 2014) (mapping energy infrastructure located in flood hazard zones); Kate Spinner, *For Chemical Disaster, Just Add Storm Surge*, SARASOTA HERALD-TRIBUNE (Sept. 19, 2010, 12:01 AM), <https://perma.cc/KBS6-JS4W> (“A quarter of all the gas, 40 percent of jet fuel and 60 to 70 percent of military jet fuel is all refined in the hurricane surge zone in Texas.”).

44. See generally Glenn Ellison et al., *What Causes Industry Agglomeration? Evidence From Coagglomeration Patterns*, 100 AM. ECON. REV. 1195, 1196 (2010); David Schleicher, *The City as a Law and Economic Subject*, 2010 U. ILL. L. REV. 1507 (2010) 1509–10, 1514, 1517–28.

45. See, e.g., Boyd, *supra* note 7, at 29.

46. Cf. Dana & Wiseman, *supra* note 20, at 1582.

B. A FAM Is Politically Implausible

A coastal industry FAM might also face vigorous opposition from the sectors to be regulated and their employees. With no broad pro-FAM lobby to counter this opposition, the FAM would either fail or be diluted to the point of ineffectiveness.

Again, there is some merit to this argument. At the national level, it will likely take major disasters for legislators to consider a robust coastal industry FAM. At the state and local level, too, jurisdictions that have experienced major weather disasters, such as Florida and New York City, have poured effort into designing and implementing coastal adaptation strategies.⁴⁷

Yet, although they face political headwinds for the time being, coastal industry FAMs have at least three important political advantages. First, as I have shown, the costs of a coastal industry FAM will probably be modest. Second, even if coastal industry FAMs raise costs, many jurisdictions may be willing to enact them anyway. Because states and localities can implement them on their own, FAMs can emerge piecemeal even in the absence of a properly functioning Congress (or even state legislature) or a nationally galvanizing catastrophe.

Third, coastal industry FAMs will not directly affect most coastal residents, so they may provoke less political resistance than other adaptation initiatives have. The politics of the FAM, in turn, might more closely resemble those of conventional environmental regulations. These are not easy to enact, of course, but may be more attainable than regulations that threaten to directly increase costs for coastal homeowners.⁴⁸

C. Self-Insurance and Rate Regulation Will Prevent the FAM From Mitigating Risk

Even those who favor FAMs in theory might doubt whether their theoretical advantages will translate to the real world. In practice, it could be argued, coastal industry FAMs will be compromised in two ways. First, regulators can allow businesses to self-insure by demonstrating sound finances

and ample reserves. Self-insurance removes the third-party monitoring and upfront financial incentives that cause companies to reduce risks.⁴⁹ It is important to note, however, that FAMs that allow self-insurance should still promote the core goal of cost internalization to some extent. Moreover, self-insurance is not inevitably allowed in real-world FAMs. Many, especially at the state and local level, do not explicitly allow it, and self-insurance is certainly not the only form of insurance that major corporations are willing to obtain.⁵⁰ To promote upfront risk mitigation, jurisdictions implementing FAMs can and should choose not to allow self-insurance.⁵¹

Second, legislators and insurance regulators may prevent insurers from charging fully risk-sensitive premiums, reducing coastal businesses' incentives to adapt and possibly causing private insurers to leave the market altogether.⁵² But this has not happened with existing industry FAMs, in sharp contrast to residential FAMs. Premiums in

49. Dana & Wiseman, *supra* note 20, at 1580–82.

50. See, e.g., *Deepwater Horizon Disaster Not a Watershed Event for P&C Insurance Market*, TOWERS WATSON (Aug. 2010), <https://perma.cc/SN8G-UUV6> (describing private insurance held by major players in the Deepwater Horizon disaster); Abraham, *supra* note 26, at 1787.

51. See, e.g., Richard Dobbs et al., *Building the Healthy Corporation*, MCKINSEY Q., Aug. 2005, at 63, <https://perma.cc/YVL9-KELP> (discussing “short-sighted behavior” among corporate managers); Dana & Wiseman, *supra* note 20, at 1581; Crawford & Seidel, *supra* note 9, at 8, 21–22 ([C]orporate adaptation “frameworks typically draw from a historical picture of risk and often do not adequately consider the changing character—such as frequency and intensity—of extreme weather events . . . [c]ompanies’ investment in building resilience competes with other business objectives and resources, many of which are more immediate and tangible. Short-term costs and cash flows are often considered more important than benefits that may not be realized until much later.”); Max Messervy et al., *Insurer Climate Risk Disclosure Survey Report & Scorecard: 2014 Findings & Recommendations*, CERES 6 (2014), <https://perma.cc/7RJ5-Z999> (describing climate risk planning among the 350 largest American insurers and finding that “most of the companies responding to the survey reported a profound lack of preparedness in addressing climate-related risks and opportunities”); *Are UK Companies Prepared For the International Impacts of Climate Change?: FTSE 350 Climate Change Report 2013*, CARBON DISCLOSURE PROJECT (2013), <https://perma.cc/75WE-4TY7> (concluding that FTSE 350 “companies’ current focus on risks and opportunities needs broadening. While the majority of FTSE 350 companies identify risks (86%) and opportunities (82%) from climate change, the focus remains relatively narrow, looking primarily at direct, shorter-term risks. Only 32% of companies report risks (14% opportunities) which have timeframes of ten years or more and 13% of companies report that they have not identified any climate change related risks at all.”); Aleka Saville et al., *2015 Corporate Adaptation Survey*, NOTRE DAME GLOBAL ADAPTATION INDEX 6–7, 17 (May 2015), <https://perma.cc/L953-P86C>; On the Global 100, see *S&P Global 100 Methodology*, S&P DOW JONES INDICES 3 (September 2016), <https://perma.cc/G6V6-N2SR>. See also Ana Maria Cruz et al., *Identifying Hurricane-Induced Hazardous Material Release Scenarios in a Petroleum Refinery*, 2 NAT. HAZARDS REV. 203, 203 (“emergency management preparations to deal with natural disaster-induced hazmat releases, however, are very limited, if they exist at all” among Gulf Coast petroleum refineries). Cf. Sean B. Hecht, *Climate Change and the Transformation of Risk: Insurance Matters*, 55 UCLA L. REV. 1559, 1591–93 (2008) (reviewing behavioral psychology findings concerning underinvestment in insurance); Faure & Bruggeman, *supra* note 35, at 16, 21–26 (finding that “empirical evidence . . . suggests that there is generally no adequate interest in and thus no demand for voluntary [first-party] insurance protecting against natural catastrophes” and discussing various cognitive and informational explanations) (citations omitted).

52. See, e.g., Bradley G. Bodiford, *Florida’s Unnatural Disaster: Who Will Pay for the Next Hurricane?*, 21 U. FLA. J.L. & PUB. POL’Y 147, 158–160 (2010) (discussing the woes of Florida’s state-operated property insurer). See generally Richard A. Epstein, *Exit Rights and Insurance Regulation: From Federalism to Takings*, 7 GEO. MASON L. REV. 293, 303–08 (1999).

47. See Curtis Morgan, *Impact of Hurricane Andrew: Better Homes*, MIAMI HERALD (June 2, 2012), <https://perma.cc/3CE8-6EVY>; Dep’t of City Planning, *Flood Resilience Zoning Text Amendment*, CITY OF N.Y. (Oct. 9, 2013), <https://perma.cc/BA84-G5DG>. See generally John Schwartz, *Pragmatism on Climate Change Trumps Politics at Local Level Across U.S.*, N.Y. TIMES (Oct. 24, 2014), <https://perma.cc/N4BU-P934>.

48. If recent history is any indication, the American public broadly supports environmental regulations that apply directly to businesses, and implementing new regulations is possible despite vociferous business opposition. See, e.g., FREDERICK MAYER ET AL., AMERICANS THINK THE CLIMATE IS CHANGING AND SUPPORT SOME ACTIONS 2–3 (Duke Univ. Nicholas Inst. for Envtl. Pol’y Sol. 2013), <https://perma.cc/422Y-J4GT>; Zack Colman, *Most Americans Support Climate Regulations Even With Costs: Poll*, WASH. EXAMINER (Nov. 20, 2014, 10:25 AM), <https://perma.cc/ELU2-EFF5>; Juliet Eilperin, *Autos Must Average 54.5 MPG by 2025, New EPA Standards Say*, WASH. POST (Aug. 28, 2012), <https://perma.cc/9GEC-MNHR>; Amy Harder, *Obama Carbon Rule Backed by Most Americans—WSJ/NBC Poll*, WALL STREET J. (June 18, 2014), <https://perma.cc/K72V-CD45>. But see Coral Davenport, *EPA Funding Reductions Have Kneecapped Environmental Enforcement*, NAT’L J. (Mar. 3, 2013), <https://perma.cc/FN9T-8TY4>.

economic sectors subject to FAMs vary widely according to insurers' perceptions of risk, as do business insurance premiums in general.⁵³

D. Regulators Will Struggle to Determine How Much Assurance to Require

As noted above, FAM implementation might be fairly simple if purchased financial assurance is required. Nevertheless, regulators will face a tricky design question regardless of their chosen assurance mechanism: how much assurance to require. A FAM that attempts to align financial responsibility with the full extent of potential liability (as I have advocated) must estimate potential damages from a worst-case disaster and translate those damages into a minimum policy limit for insurance regimes, a minimum bond amount for surety bond regimes, a minimum self-insurance capacity for self-insurance regimes, and so on.

This is a real challenge, but it should not be overstated. Regulators can make the task of defining appropriate assurance levels easier on themselves by setting sector-wide required policy limits. This is the approach of most FAMs. In any event, in opting for FAMs, regulators take up the task of determining required assurance amounts, but they avoid many other informationally intensive tasks inherent in other regulatory approaches.⁵⁴

E. A FAM Is Unnecessary Because Coastal Businesses Are Already Insured

Coastal industry FAMs will obviously be superfluous if the businesses they target already have private insurance for the impacts the FAMs address. However, this is probably not the case. Data on the prevalence of insurance against the potential coastal impacts of climate change are scarce, and many vulnerable facilities are no doubt already insured to some extent.⁵⁵ However, as I have argued, there is strong evidence that coastal businesses are underpreparing generally for these impacts—even when they directly threaten core operations.⁵⁶

Moreover, current shortfalls in the broader environmental liability insurance market suggest that coastal businesses are unlikely to be consistently and adequately insured. To the contrary, industry publications suggest that the market is growing but underdeveloped and that regulatory man-

dates are needed to drive demand. This shortfall derives in part from businesses' reliance on self-insurance, which theoretically internalizes costs but may fail to drive investment in risk mitigation in practice.⁵⁷ Demand-suppressing institutional and psychological factors also appear to play a role.⁵⁸ Whatever the reason, although the broader market for environmental insurance does appear to have grown in recent years,⁵⁹ it is still sorely underdeveloped.⁶⁰ Given this, it seems unlikely that coastal businesses are already well insured against environmental liabilities to third parties resulting from climate change.

VI. Conclusion

I have argued that FAMs can help advance climate adaptation among coastal industries. Those industries appear to be underpreparing for climate change, risking devastation for the communities in which they are concentrated. By internalizing the potential costs of those disasters to industry through risk-attuned private regulation, FAMs, and especially insurance mandates, can help reduce the chance of disaster.

Spills and releases are a logical starting point for coastal adaptation FAMs, but these policies could also help tackle other problems. Climate change and its coastal impacts implicate many sources of liability under existing law, and as these impacts mount, policymakers may be inclined to create new liabilities as well.⁶¹ FAMs can help ensure that liable parties pay up, and can encourage investment in measures that reduce the risk of liabilities in the first place. As the waters rise and the storm clouds gather, FAMs can and should play a leading role in protecting coastal communities from the dangers of climate change.

57. See Dana & Wiseman, *supra* note 20, at 1581; Abraham, *supra* note 26, at 1787.

58. See *supra* note 51; Chad Hemenway, *Environmental Liability Market Still Has Plenty of Room for Growth*, NAT'L UNDERWRITER PROP. & CASUALTY, July 19, 2010, at 12.

59. See, e.g., Heather Turner, *Environmental Insurance Activity Is on the Rise*, INS. BUS. AM. (Mar. 30, 2016), <https://perma.cc/2HH2-NTSN>; Rosalie L. Donlon, *ACE: There Is a Global Need for Environmental and Pollution Protection Insurance*, PROPERTYCASUALTY360 (May 13, 2015), <https://perma.cc/6SC5-8TBZ>; Brian Anderson, *Environmental Trends and Market Prospects: Part 3*, INS. BUS. AM., <https://perma.cc/U57V-EKXW> (last visited Dec. 8, 2014).

60. See, e.g., David Dybdahl, *A Big Picture on Environmental Insurance*, INT'L RISK MGMT. INST. (July 2016), <https://perma.cc/5PFV-49QJ>; Hemenway, *supra* note 58; Dave Lenckus, *The Polluter Pays*, GLOBAL FIN. (Jan. 3, 2013), <https://perma.cc/26RL-6GPV>. See also Judy Greenwald, *Environmental Liability Insurance Market Stabilizes on Increased Capacity*, BUS. INS. (Feb. 2, 2014), <https://perma.cc/H7UH-5JA7> (noting that rates have decreased in recent years and insurers are actively competing with one another for business); Turner, *supra* note 59.

61. An analysis of the legal and policy merits of expanded liability is beyond the scope of this Article. However, the previous sections have indicated a few ways in which policymakers might choose to expand liability.

53. See, e.g., Julia Kollwe, *BP Disaster Raises Oil Industry's Insurance Costs*, THE GUARDIAN (June 3, 2010, 7:45 AM), <https://perma.cc/R5JY-LC5F>.

54. See Richard B. Stewart, *Controlling Environmental Risks Through Economic Incentives*, 13 COLUM. J. ENVT'L L. 153, 156 (1988); Dana & Wiseman, *supra* note 20, at 1548.

55. In fact, the Murphy Oil refinery was insured. John Henry, *Murphy Oil Says Gulf Spill Covered By Insurance*, ARK. BUS. (Dec. 5, 2005), <http://www.arkansasbusiness.com/article/49693/murphy-oil-says-gulf-spill-covered-by-insurance>.

56. See Crawford & Seidel, *supra* note 9, at 21.