

# Flood Insurance Redesigned: Regulatory Considerations for a Viable and Sustainable Private Market

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**IMPORTANCE** Explores the environment for growing private markets for U.S. flood insurance, and recommends state-level policy strategies to encourage these markets' viability and sustainability.

**OBJECTIVES** This study contributes to the literature on flood risk and insurance by (1) exploring the market challenges in the development of private flood insurance; (2) demonstrating the importance of local risk considerations and flexible program features for state-level, private strategies that provide a sustainable framework for insurers to consider; and (2) highlighting the alignment of recent model laws and several state programs with the recommended features.

**EVIDENCE** The federally backed National Flood Insurance Program (NFIP) has provided most of the protection to property owners against flood losses in the United States for nearly six decades. Comprehensive insurance against flooding would benefit a significant proportion of the U.S. population. Despite the risk, most property owners do not buy flood insurance, leaving the vast majority of U.S. properties uninsured against flood. Low flood insurance penetration is set against a backdrop of significant and increasing U.S. risk of flood. Federal legislators have been unwilling to provide long-term renewal of the NFIP since 2017, instead opting for short-term reauthorizations. The private insurance market has an opportunity to deploy its knowledge and capacity to close the flood protection gap and create more resilient communities. Factors that drive the opportunity include (re)insurer risk appetite, improving knowledge of flood risk and a favorable lender acceptance environment. The goals of the NFIP do not align with the goals of private insurers. While the NFIP is charged with insurance availability and affordability, private insurers are focused on availability at an adequate, risk-based price.

**FINDINGS** If a viable private flood risk market can be established, the NFIP's best future utility is as a market of last resort for residual (primarily highest-flood-risk) properties. Mitigation-inducing, price-to-risk matching (to the extent practicable) is key to a healthy private market, and government-sponsored insurance programs are best limited to otherwise uninsurable risks. If an appropriate policy objective is to build a viable and sustainable private flood insurance market, the states themselves must determine the eco-system that simultaneously best encourages private insurers to

enter the market and most reliably protects solvency and consumers. The importance of risk-based rates and premiums, as well as the importance of allowing insurers to update the pricing in light of the dynamic risk assessment and modeled losses are key to market health. The best state public policies will create an environment in which program and insurer flexibility are embedded in the design. We explore seven states - Alabama, Florida, New Jersey, North Carolina, Pennsylvania, South Carolina and Virginia - in an effort to understand the regulatory environments for private flood insurance as they unfold. Of these, Florida and North Carolina have implemented clear rules that new rating variables are allowed and that there exists a model approval process. Therefore, in these two states it is clear that there is a focus, not just on growing the private flood insurance market, but also on rate solvency, reasonability, and objectivity. Taking a closer look then at the Florida and North Carolina policy strategies is a useful exercise for other states since both are illustrative of what is meant by design flexibility.

**CONCLUSION AND RELEVANCE** This paper advocates for a private flood insurance marketplace that is supplemented by the NFIP (for residual-risk properties). Such a financing system would require sustainable growth in the existing private market for flood insurance and state strategies that accommodate private insurer needs for short-term experimentation and long-term profitability. Therefore, state-level public policies related to private flood insurance that are designed with program and insurer flexibility in mind may work best. But flexibility at the expense of regulatory goals would be folly, so a key to financial viability and loss-reduction is risk-based pricing. To serve the coverage needs of the millions of at-risk consumers with rates that are adequate and equitable requires best-practice flood loss modeling and actuarial work, both of which can be provided by the private insurance market. State policy elements that are important to ensure the long-term viability of private flood insurance programs include: (1) Promote rates that optimize program solvency and sustainability; (2) Determine the critical and reasonable disclosures; and (3) Ensure regulator access to rates.

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## **ABSTRACT**

Several factors have converged in recent years, bringing the need for admitted-market, private flood insurance options in the U.S. to the fore. Meanwhile, other factors have coincided that make modeling and pricing large segments of the U.S. flood risk exposures more accessible and more accurate than was historically possible. The National Flood Insurance Program (NFIP), despite recent rating reforms, faces daunting financial and market challenges. The U.S. flood risk has increased: The risk of severe flooding and the cost of such events continues to grow. Flood loss models that can support granular pricing are now commercially available, outperforming the Federal Emergency Management Agency's (FEMA's) flood maps historically used for rating and loss mitigation purposes. Several states have begun encouraging admitted insurance markets to provide flood insurance in addition to the NFIP and the excess and surplus lines coverages already available. This paper examines the private market opportunity and challenges, highlights state-level strategies, and demonstrates the importance of flexibility in program legislation and regulation—with respect to both program design and implementation. Our work contributes to the literature by: 1) exploring the market challenges in the development of private flood insurance; 2) demonstrating the importance of local risk considerations and flexible program features for state-level, private strategies that provide a sustainable framework for insurers to consider; and 3) highlighting the alignment of recent model laws and several state programs with the recommended features.

## 1. Introduction

A federally backed flood insurance policy has provided most of the protection to property owners against flood losses in the United States (U.S.) for nearly six decades. Comprehensive insurance against flooding would benefit a significant proportion of the U.S. population. Despite the risk, most property owners do not buy flood insurance, leaving the vast majority of U.S. properties uninsured against flood. Only 15% of surveyed U.S. homeowners report having a flood insurance policy despite the fact that 98% of U.S. counties have been impacted by floods (Insurance Information Institute [III], 2020). Further, it is estimated that the survey figures are upwardly biased by consumers that incorrectly assume their existing homeowners insurance covers flood damage. A 2020 Milliman report estimates only 4% of single-family homeowners have flood insurance of any kind, when including both the National Flood Insurance Program (NFIP) and the private flood insurance market (Evans et al., 2020).

This tiny flood insurance penetration is set against a backdrop of significant and increasing U.S. risk of flood. Climate and weather change, shifts in population density, changes in land use, and aging infrastructure all contribute to the risk. Therefore, the need for flood risk capital grows, and future demand for flood insurance can be expected to rise as lenders and property owners recognize the broadening and increasing exposure (Kousky et al., 2021).

Climate volatility is widely acknowledged and has been linked to the recent increase in storm severity. For example, analyzing historical precipitation and flood damage, Davenport et al. (2021) estimate that approximately 36% of the cost of flood damages during 1988-2017 is a result of historical changes in precipitation. An increase in the frequency and severity of high precipitation events has increased the likelihood of flooding. Climate change and sea level rise can cause severe flooding even in the absence of storms.<sup>1</sup>

The movement of people enhances the impact of flooding events in hurricane and flood-prone areas, as well as changes in land use. Land use changes can alter the ability of the land to accommodate heavy precipitation or can change the natural flow of rivers and streams; in turn, these changes increase the potential for flooding.<sup>2</sup> Development of buildings and infrastructure necessitated by changing demographics and land use has impacted flood risk significantly.<sup>3</sup> The changes in land use associated with urban development may increase flooding in multiple ways.<sup>4</sup> For example, a study of the Mississippi River found that the increase in flooding over the past 150

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1. Some flooding is related to "rising water"—which could be release of a dam's water, increase in sea level, or other 'fluvial' events that are not necessarily caused by just high precipitation.

2. Examples of land use changes include construction in floodplains, increased use of impermeable surfaces such as asphalt, the removal of wetlands and riverbank vegetation, deterioration of water-management infrastructure, and the building of dams, levees, or channels.

3. Using the Weather Research and Forecast model—a numerical model for simulating weather and climate at regional scales—and statistical models, the researchers quantified the separate contribution of urbanization to rainfall and flooding. They found the probability of extreme flood events is multiplied 21 times (2100%) because of urbanization.

4. The implications of urbanization for flooding are well established. See *Effects of Urban Development on Floods*. U.S. Geological Survey Fact Sheet 076-03. Retrieved from <https://pubs.usgs.gov/fs/fso7603/>. One example is that as permeable soil and vegetation are replaced with infrastructure such as roads and buildings, the natural capacity of the area to store rainfall is reduced which in turn increases the rate of water runoff into nearby streams and rivers, which increases the potential for flooding.

years cannot be explained by precipitation patterns alone and that river engineering and agricultural expansion are responsible for up to 75% of the increased flood risk (Union of Concerned Scientists, 2018). A direct example of land use effects on disaster outcomes is the response of the land to the rainfall in the Houston, Texas area resulting from Hurricane Harvey. Not only have researchers found that Harvey-related flooding was exacerbated by urbanization, but they estimate that the probability of 'extreme' flooding was 21 times what it would have been without the changes in land use.<sup>5</sup> As a result, properties outside of the traditional high-risk flood zones face significant flood risk. This geographic diversification of flood risk creates an important opportunity for insurers to enjoy increased flood insurance demand and diversification.

Increasingly, governmental budgetary pressures and the shift of resources to other, more immediate projects (such as environmental initiatives) have left critical infrastructure needs for mitigating flooding or its effects in a state of aging disrepair. Complicating the infrastructure problem, damage from flooding (and other natural disasters) further degrades infrastructure, making it weaker against future floods. This adverse cycle is measurable and significant (Neal, 2014).

The American Society of Civil Engineers' (ASCE's) 2021 *Infrastructure Report Card* (ASCE, 2021) depicted the condition and performance of infrastructure across and within 18 categories.<sup>6</sup> The 2021 report card gave the nation an overall grade of C-, pointing to the need for significant increases in infrastructure investment and modernization. Notably, three areas of infrastructure that are important to protecting against flooding—levees, dams, and stormwater—individually received grades of D, below the C- grade given to infrastructure overall. The U.S. Congress passed the Bipartisan Infrastructure Law (Infrastructure Investment and Jobs Act) in the first half of 2022, in part to address such concerns.<sup>7</sup> The legislation is the largest investment in the resilience of physical and natural systems in American history, yet staggering inflation rates have already decreased its real value, forcing states to cancel or delay projects (Snyder, 2022).

In the face of this increasing risk (and market opportunity), financial challenges that exist within the NFIP (FEMA, 2018a) lead to uncertainty regarding its long-term viability as well as its capacity to keep up with changes in the likelihood and impact of flood losses. Even if one did not directly consider the financial uncertainties associated

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5. Using the Weather Research and Forecasting model—a numerical model for simulating weather and climate at regional scales—and statistical models, the researchers quantified the separate contribution of urbanization to rainfall and flooding. They found the probability of extreme flood events, like Harvey, increased on average by about 21 times (i.e., by 2100%) during August 20-25, 2017, because of urbanization alone (Zhang, Villarini, Vecchi and Smith, 2018).

6. The report included scores for aviation, bridges, broadband, dams, drinking water, energy, hazardous waste, inland waterways, levees, ports, public parks, rail, roads, schools, solid waste, stormwater, transit, and wastewater. Today, our infrastructure needs are more diverse and fragmented than in the past, with most centered at a local rather than national level. Most U.S. infrastructure is owned and funded primarily at the state and local level, and these governments are being asked to deliver more and better services with constricted revenues. Exacerbating the challenge is the scarcity problem with federal funding. Although federal assistance at first seems a mitigator of these state and local outflows, most infrastructure projects do not receive federal funding. Yet even the possibility of federal funding to assist in projects incentivizes delays on the part of state and local officials (Gribbin, 2019).

7. This U.S. federal legislation for \$550 billion in infrastructure improvements includes over \$50 billion pledged to protect against droughts, heat, floods, and wildfires, in addition to a major investment in weatherization. See <https://www.whitehouse.gov/bipartisan-infrastructure-law/> for details of the legislation.

with the NFIP, increasing U.S. catastrophe risk overall creates pressure to find private market solutions.<sup>8</sup>

This paper emphasizes the potential for and desirable features of a private, admitted market for flood insurance and explores how such a market can make important contributions as a cost-sharing mechanism for property owners, with the potential to limit the need for NFIP coverage to only the most high-risk exposures. We describe how the federal “stage is set” to encourage a private, admitted market (in Section 2), and explore the environment for a private market and continued opportunities for growth (in Section 3). The work’s most meaningful contributions to the literature are that it: 1) examines the unique challenges faced by states and insurers in the development of a primary flood insurance market (in Section 3.3); 2) demonstrates the importance of local risk considerations and program features for state-level, private strategies that provide a sustainable framework for insurers to consider (in Section 4.1); and 3) highlights the alignment of recent model laws (in Section 4.2) and several state programs (in Section 4.3) with the recommended features. The importance of flexibility in program legislation and regulation is at the core of our recommendations, with the implications explored further in a concluding discussion (in Section 5).

## **2. NFIP and the Need for a Private Market Solution**

The public policy and socioeconomic implications of government involvement in the supply of insurance capital are not trivial, even if the problems of adverse selection and moral hazard are set aside. Public supply of insurance not only impacts the price of insurance and the economics for (re)insurers and policyholders but also the entire tax base since every tax-paying individual becomes an at-risk “investor” of the government-as-insurer (Boyer & Nyce, 2013). If conditions exist for a viable private market to take the lead role in providing insurance capacity, the cost of risk can be allocated more fairly and efficiently between the parties exposed to the risk and the private entities willing to shoulder the risk. In the case of U.S. flood risk and the long history of coverage by the NFIP, even government representatives at the Federal and State level are concerned about the far-reaching economic implications of continuing to be the “market of first resort,” and are seeking private market strategies.

The performance and status of the NFIP are undeniable factors in the need for widespread access to a private flood insurance market. The features and amounts of flood coverage available through the NFIP, as well as the policy rating system and overall program uncertainty, have direct implications for the program’s future cost and status, and for participation by property owners.<sup>9</sup> The history and present status of the NFIP are discussed in Appendix A for readers who desire a refresher on the challenges faced within the public insurance market for flooding. Maybe the most important takeaway from the information provided there is that federal legislators have

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8. As long ago as 2010, the expected cumulative exposure of the U.S. government to catastrophes by 2085 was estimated at approximately \$7 trillion (Cummins et al., 2010). And this was, of course, prior to the trillions of federal government costs incurred from the COVID-19 pandemic.

9. The prior literature on the NFIP, and most particularly work by Jaffee et al. (2011), Kousky (2018), Kousky et al. (2021), and Netusil et al. (2021) all point to the importance of the NFIP policy design, terms, and rate structure as problematic from both perspectives: cost and take-up rates.

been unwilling to provide long-term renewal of the NFIP since 2017, instead opting for short-term reauthorizations (with some lapse periods). Policymakers are aware of the need for reform to protect the program's future. Even with the intended changes, the program will offer inadequate coverage capacity for most property owners and cross-subsidization will remain an important feature for the highest-risk exposures. As a result, we assert that if a viable private flood risk market can be established, the NFIP's best future utility is as a market of last resort for residual (primarily highest-flood-risk) properties.

## 2.1. Self-Limiting Demand, Lack of Per-Exposure Capacity, and Low Take-Up Rates

Although NFIP coverage is available to anyone in a participating community,<sup>10</sup> purchase is generally voluntary, with the exception of those in Special Flood Hazard Areas (SFHAs). Mandatory purchase of flood insurance is required only of property owners within SFHAs as a condition for any mortgage made, guaranteed, or purchased by any federal agency, federally regulated lending institution, or government-sponsored enterprise (Horn & Webel, 2018).<sup>11</sup> The residential coverage provided is limited to a \$250,000 dwelling limit, which is below both the U.S. average and median replacement-cost values of residential structures. Therefore, only the relatively low-cost structures can be sufficiently insured.

It does not seem surprising, then, that while estimates of the NFIP's insurance penetration rate vary widely by location, take-up rates for NFIP coverage among homeowners are low. According to a 2019 survey from the National Association of Insurance Commissioners (NAIC Survey, 2019a), 41% of respondents either agreed or strongly agreed that flood insurance is a "good idea," while only 17% said they had ever purchased flood insurance. While the III estimates that only 3-4% of homeowners currently have flood insurance,<sup>12</sup> other estimates suggest that take-up rates vary from less than 10 up to 50% within the SFHAs, and from nearly 0 to no more than 20% outside the SFHAs (Evans et. al., 2020).<sup>13</sup>

## 2.2 Program Reforms<sup>14</sup>

The NFIP has recently developed both a new rating system and map updates via Risk Rating 2.0. Premiums calculated under Risk Rating 2.0 will reflect an individual

10. In order to be eligible to participate, communities must adopt specific land use and building code standards. See the Congressional Research Service *In Focus* Report, from December 8, 2021 at <https://sgp.fas.org/crs/homesecc/IF10988.pdf> and The Watermark, NFIP financial statements, at <https://www.fema.gov/flood-insurance/work-with-nfip/watermark-financial-statements> for details.

11. Property owners who do not obtain flood insurance when required are not eligible for certain types of disaster relief after a flood, and a few lenders require borrowers outside of SFHAs to purchase flood insurance to financially secure the property.

12. See the III's Facts About Flood Insurance, located on its website at [www.iii.org/article/facts-about-flood-insurance](http://www.iii.org/article/facts-about-flood-insurance) for the derivation of this statistic.

13. According to these estimates, national averages are 34% in the SFHAs, 2% outside of SFHAs, and 3.6% in total for single-family homes.

14. See [https://www.fema.gov/sites/default/files/documents/fema\\_flood-insurance-reform-proposal\\_5242022.pdf](https://www.fema.gov/sites/default/files/documents/fema_flood-insurance-reform-proposal_5242022.pdf) for the proposed reforms sent to the Honorable Kamala D. Harris as Senate President from the Department of Homeland Security's Assistant Secretary for Legislative Affairs, Alice Lugo. The document includes proposed legislative text in addition to descriptions of the reforms requested.

property's flood risk, and set risk-based rates. New policies written on or after October 1, 2021, are calculated using the new rating methodology. All existing policies renewing on or after April 1, 2022, are calculated using Risk Rating 2.0 methodology.<sup>15</sup> A brief comparison of Risk Rating 2.0 to the NFIP's historical rating structure is provided in Appendix B. Unfortunately, for property owners at the highest risk, the new rating system inevitably means that a federally provided insurance policy premium may become prohibitively expensive for homeowners in the lower-income strata. Without viable alternatives for coverage, these homeowners may be forced to relocate. Such a result goes against the traditional purposes of government insurance programs.

Following Risk Rating 2.0, FEMA, in May 2022, proposed to Congress a number of additional reforms intended to stabilize the NFIP. While some of these reforms would provide social benefit, other proposed reforms appear to be intended as NFIP-program preserving strategies. For example, proposed federal legislation to: 1) establish certain minimum flood-risk reporting requirements for sellers and lessors at or before residential transaction closings as a necessary condition for participation in the NFIP; and 2) strengthen the minimum standards for local flood plain management and address repetitive loss and severe repetitive loss properties<sup>16</sup> would have social-welfare improving effects. But the proposed strategies for NFIP premium affordability and program financial stability questionably are more about "propping up" the NFIP than they are about any social welfare benefit.

*Premium affordability.* FEMA has asked Congress to consider a targeted assistance program that would offer low- and moderate-income current and prospective NFIP policyholders a graduated risk premium discount (while still providing them with knowledge of the full-risk price). As previously mentioned, the change in rating structure has affordability implications for many property owners. Under existing legislation and authority, the NFIP can only improve affordability by offering discounts and cross-subsidies, primarily based on a building's age, flood risk map changes at a building's location, or by considering mitigation activities undertaken by the property owner or community. Such affordability strategies, while providing social benefit, should be considered with caution as they may be inconsistent with risk-premium incentives, can contribute to policyholders misunderstanding their actual flood risk, and lead to negative externalities (Kelly & Kleffner, 2003; Maroney et al., 2011; Medders et al., 2014; Browne & Medders, 2021).

*Financial.* FEMA has requested a financial framework that allows the NFIP to "balance affordability and fiscal soundness." Congress authorized FEMA to borrow from the U.S. Treasury up to \$30 billion to pay claims. The NFIP currently carries \$20.5 billion in debt to the U.S. Treasury and pays approximately \$300 million in interest expenses annually—using the current premiums to pay for past claims. As currently structured, the program may be unable to ever fully pay this debt. .

### **3. A Market for Private Flood Insurance**

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15. Details of Risk Rating 2.0 are available at <https://www.fema.gov/flood-insurance/risk-rating>.

16. About 2.5% of insured properties are considered unmitigated repetitive loss properties, having a high risk for future flooding. Multiple loss properties contribute to the NFIP's financial challenges and explain some of the public's negative perceptions of the program.



A wealth of economic literature regarding the costs and benefits of government interventions in insurance exists and overwhelmingly points to a limited purpose for social insurance programs.<sup>17</sup> Kwon and Skipper (2007) describe the need for social insurance in markets where a large-scale need for insurance (such as in the face of catastrophic risk) exists and there is widespread unavailability of private coverage. Historically, these conditions were present for flood insurance. If a sustainable private marketplace can be established to insure flood risk, the need for a government solution and the pressure on the NFIP can be substantially reduced.

A wealth of literature exists outlining both the demand and supply side of private insurance markets.<sup>18</sup> These markets experience a number of well-known difficulties, from seller-buyer informational problems to seller constraints on capacity. Markets that have high potential for catastrophic industry losses especially are subject to these problems. Thus, the relationships between demand-supply efficiencies, resulting market performance, and aggregate market capacity are important in the study of catastrophe-exposed markets, such as a prospective admitted flood insurance market would be.

We submit that the primary takeaways from the literature for the exploration of private flood insurance here are that: 1) mitigation-inducing, price-to-risk matching (to the extent practicable) is key to a healthy private market; and 2) government-sponsored insurance programs are best limited to otherwise uninsurable risks. Solvency constraints (such as heavy cross-subsidization of premiums and/or losses or suppressed pricing) limit the available capacity of the marketplace. Kelly and Kleffner (2003) and Klein and Kleindorfer (2003) develop a theoretical illustration of the negative externalities, and ultimately market failures, that can result from policy design and/or pricing that distorts the true cost-of-risk sharing within catastrophe-prone markets. Grace and Klein (2009) and Medders et al. (2014) provide further descriptive evidence of these adverse market impacts within catastrophe property markets.

### **3.1 The Private Flood Insurance Environment**

Some of the FEMA reforms—actual and proposed—have the potential to improve the NFIP's financial stability, but they simultaneously mimic private market features (e.g., Risk Rating 2.0). If there was no willing capacity in the private market for flood risk, these reforms might be useful. However, there does appear to be willing capital within the private market for the risk, which over time could make the NFIP's optimal purpose that of a collaborating residual market within a large and widespread U.S. flood risk financing system in which the private marketplace takes the lead. The private insurance market has an opportunity to deploy its knowledge and capacity to close the flood protection gap and create more resilient communities. Factors that drive

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17. Kwon and Skipper (2007) provide a comprehensive bibliography of this literature. Grace and Klein (2009) and Medders et al. (2014) provide thorough reviews of the literature as relates to catastrophe markets.

18. Both the demand- and supply-side literature include myriad efforts—theoretical and empirical—to understand the micro- and macroeconomics of insurance markets. Seminal work by Arrow (1971) describes basic models for insurance demand by individuals, and Kunreuther (1998) describes the special effects of catastrophic risk on these models. Stone (1973), followed by Grace et al. (1999) lay out the capacity issues faced by insurers when considering risk-taking in problematic markets. Medders et al. (2014) provide a comprehensive literature review of work that has built upon these earlier efforts.

the opportunity include (re)insurer risk appetite, improving knowledge of flood risk, and a favorable lender acceptance environment.

### 3.1.1 Risk Appetite

The (re)insurance industry's capacity (potential and willing) to absorb large, catastrophic losses is a concern not only for insurance providers, but also for regulators and policymakers (Cummins et al., 2010). Although many primary insurers are not equipped to retain the full risk of a catastrophic flood in a single year, reinsurance is available to protect against such contingencies. Globally, over the past decade, reinsurers have expressed robust interest in advancing the private flood market. Several have flood experience and expertise based on underwriting flooding in other parts of the world, and can help primary insurers define their target markets, model potential portfolios, develop flood products, create underwriting rules, and implement sophisticated rating plans that match price to risk (Watkins & Evans, 2019). Hiscox Re, Munich Re, and Swiss Re all offer turnkey products to insurers: Munich Re and Swiss Re can be found in a considerable number of flood insurance rate filings.<sup>19</sup>

Overall, the risk appetite among reinsurers for flood is broad and robust, backed by financial strength, an improved understanding of the flood risk, and the capability to aggregate risk portfolios more optimally than was possible in the past. Property insurance capacity overall is sensitive to catastrophic events, with its ability to write large lines necessarily bolstered by reinsurance market capital. The NFIP has helped to catalyze the market with its reinsurance program and capital market placements in recent years.<sup>20</sup> Flood insurance is a potentially large growth line for reinsurers since virtually all property owners in the U.S. face some risk of flood. When property market reinsurance is limited, as has been the case in 2022, flood reinsurance capacity is constrained similarly for both the private market and NFIP.

### 3.1.2 Flood Risk Knowledge and Models

Commercial catastrophe models for hurricanes have been available since the mid-1990s, gaining momentum for research and development after Hurricane Andrew devastated South Florida in 1992, driving insurers to contract their capacity and raise their prices (Medders et al., 2014). Since then, the use of the models by insurers has become standard. The state of Florida, in fact, requires insurers to use state-approved hurricane wind models for pricing residential property insurance in the state.<sup>21</sup> In North Carolina, two hurricane models are required by statute.

The quality of flood loss modeling in the U.S. has evolved relatively quickly. A generation ago, the insurance market was limited in its ability to assess the true flood risk for a location. Today, there are U.S. flood models that can deliver vastly improved risk information, in much finer detail, so an insurer can rate the risk on individual

19. For the Hiscox Re product, see <https://www.artemis.bm/news/hiscox-re-and-ils-launches-flood-product-with-alt-capital-backing/>

20. Information about the program is available at <https://www.fema.gov/flood-insurance/work-with-nfip/reinsurance>.

21. The Florida Commission on Hurricane Loss Projection Methodology (Florida Commission) is a state body of experts that reviews submitted models biannually for approval to be used in setting Florida prices. Information regarding Florida Commission standards and approved models can be found at <https://www.sbafla.com/methodology/CommissionDocumentsStandards.aspx>.

location, exposure, and unique characteristics. Contemporary flood loss models allow for a consistent, widespread measure of risk. Further, they provide risk management and pricing analytics that private insurers need to launch their own programs.

Numerous flood loss models continue to evolve to assist in risk pricing and aggregation for the eventuality of extensive private market involvement in flood insurance. In fact, the Florida Commission on Hurricane Loss Projection Methodology (Florida Commission), which must approve hurricane wind models for use in setting residential insurance rates in Florida, in recent years developed model review/approval standards for flood modeling—both coastal and inland.<sup>22</sup>

In theory, catastrophe models should work well for evaluating flood risk since the lack of past data is a huge barrier to traditional rating. Models are based on simulations created by analyzing the characteristics of past and potential events rather than fixating on strictly the analysis of past loss history. Models bring in numerous sources of data relevant to flood risk, simulating storm surges and significant precipitation events, relating the water flow to local topography and hydrology, and estimating damages based on the physical characteristics of properties.

A variety of companies have produced catastrophe models for floods and are marketing them to insurers, but providing enough data and examples of the accuracy of their models is a significant challenge. Their hesitancy to discuss model specifics could be due to a desire to keep product information proprietary. The flood events over the last few years are helping insurers, reinsurers, and modeling companies validate their models against real losses which will aid in convincing others of model accuracy. While superior flood loss models are beginning to evolve in the industry, many models are still under intense scrutiny because of their newness to the market.

- Each model has its own strengths and weaknesses, and certain features are superior if implemented correctly. For example, the following features are generally more desirable when assessing flood risk:
- Complete models that measure the hazard of flood risk, the vulnerability of a structure, and the financial terms of insurance policies and reinsurance contracts.
- Fully probabilistic models that generate thousands of years of simulated flooding and can aggregate them into an average annual loss (AAL) by location.
- Hydrological modeling across a full set of flood perils (pluvial, fluvial, and storm surge). All models actually do not cover the entire set of flood events for each peril. For example, flooding caused by nor'easter storms in New England, tidal flooding, or west coast storm surges is often ignored by modelers.
- Model inputs reflecting the range of structural characteristics relevant to flood risk, such as first-floor height, basement presence and type, and number of stories.

Again, each of the above characteristics is only superior if modelers have implemented them appropriately. Industry professionals strongly believe that flood is a definable peril and that the development of robust and accurate catastrophe flood models is inevitable (Evans et. al., 2020).

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22. Ibid. The Florida Commission completed its initial Flood Standards in 2017.

### 3.1.3 Lender Acceptance

Households with federally-insured mortgages in the SFHA are required to buy flood insurance, and close to half of the NFIP's policies are in the SFHA (Kousky, 2018; Kousky et al., 2018). To comply with this mandate, coverage must be purchased through the NFIP or private insurer coverage must be at least as broad as the coverage of the NFIP.<sup>23</sup> Historically, it was unclear whether private flood coverage satisfied the mandatory purchase requirement, and lender compliance concerns prevented consumers from purchasing private flood coverage. With fewer consumers able to purchase, insurers were discouraged from writing the segment of the market with the highest take-up rates, premiums, and awareness of flood risk (Watkins & Evans, 2019). A federal rule impacting this issue became effective on July 1, 2019, implementing provisions of the Biggert-Waters Flood Insurance Reform Act of 2012 (BW-12). The rule requires lenders to accept private flood insurance when issuing loans for real property within designated high-risk flood areas.

This rule provides federally regulated lending institutions with guidance concerning private flood insurance. Under the new rule, banks are able to accept private flood insurance to satisfy mandatory purchase requirements as long as the coverage meets certain requirements, including the important requirement that the private coverage be at least as generous as provided by the NFIP.<sup>24</sup> It is important to ensure the "continuous coverage" under NFIP requirements and helps ensure mortgage company acceptance. Lenders may, at their discretion, allow private flood insurance in lieu of any NFIP flood insurance coverage that may otherwise be required, and are expected to follow the "FEMA6" to determine the viability of the private coverage as a substitute for NFIP coverage: 1) Underwritten and sold by a licensed, admitted carrier or approved surplus lines carrier; 2) 45-day notice of policy cancellation by the carrier; 3) Coverage at least as broad as that provided by the NFIP policy; 4) Mortgage interest clause similar to that found in the NFIP policy; 5) One-year limit to file suit after a claim is denied; and 6) Policyholder cancellation provisions as restrictive as those of the NFIP.

### 3.1.4 Coverage Gap Opportunity

Based on NFIP program statistics alone, flood insurance penetration in the U.S. is low, while the potential demand is high. Willing flood insurance demand is difficult to infer from the available data since only high-risk properties with a loan from a federally backed or regulated lender are required to purchase flood insurance, and consumer information about flood risk and insurance is low (Netusil et al., 2021). Several studies have attempted to find the greatest correlates to flood insurance demand. Unsurprisingly, they generally find take-up rates are higher in areas where the hazard is greater (or risk perceptions greater) and that take-up rates increase with higher levels of education and income, as well as higher home values.<sup>25</sup>

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23. This mandatory purchase requirement is not enforced by FEMA but rather by lenders, and lenders can be fined up to \$2,000 for each instance of noncompliance (Horn & Webel, 2018).

24. Details available at <https://www.fdic.gov/regulations/compliance/manual/5/v-6.1.pdf>.

25. Netusil et al., (2021) provide a thorough discussion of the prior literature in this area.

As previously discussed, NFIP policy limits are relatively low, notably so for non-residential properties or properties in high-cost areas.<sup>26</sup> Private market property insurance can offer limits over and above the maximum limits highlighted here. In addition to limited coverage, the NFIP policy includes coverage restrictions that are not common in private insurance markets, such as no coverage for living expenses or business interruption impacts after an event, or for appurtenant structures, aside from some coverage for detached garages, as well as actual cash value loss settlement and separate deductibles for building and contents. While it is impossible to yet know the full obtainable market potential of a flood insurance market, there is potential private insurance capital as well as congressional and state political will to encourage the market. Given the supply-side interest is met with the importance of adequate homeowners insurance (and in many cases mortgage insurance) coverage to lenders, and the existing ability of lenders to effectively mandate these coverages for most homeowners via required insurance clauses, obtainable market demand appears adequate to make a viable market.

### **3.2 Private Market Activity and Flood Insurance Availability**

Although private (re)insurers have taken on minimal flood risk since initially withdrawing from the market, their primary involvement in the flood market has been through the NFIP, by administering and/or reinsuring policies. Additionally, a growing number of companies offer private flood insurance.

#### **3.2.1 Administration of NFIP Policies**

To date, the main way in which the private market is directly involved with flood insurance is through the administration of NFIP policies. While FEMA provides management to the NFIP and is ultimately the risk bearer, the day-to-day operations of the NFIP are handled by private companies. There are two types of arrangements that the NFIP has with private insurers, and in both, the NFIP retains the financial risk of paying the claims and the policy terms and premiums are the same. The first is the Direct Servicing Agent (DSA) in which the private insurer acts as a private contractor selling NFIP policies on behalf of FEMA to individuals seeking to purchase coverage directly from the NFIP (Horn & Webel, 2018). The second arrangement is the Write Your Own (WYO) Program. Through this program, companies are paid to write and service the standard NFIP flood insurance policies in their own name. The WYO Program has three main goals: to increase the NFIP policy base and geographic distribution, improve service to NFIP policyholders, and provide the insurance industry with direct operating experience with flood insurance (FEMA, 2019c). About 12% of the NFIP policy portfolio is managed through the DSA program with the remaining 88% administered through the 50 companies participating in the WYO Program<sup>27</sup> (Horn & Webel, 2018).

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26. Single-family homes are limited to \$250,000 building coverage and \$100,000 contents coverage. Other residential buildings are limited to \$100,000 building coverage and \$500,000 contents coverage.

27. A list of companies participating in the WYO Program is available at <https://nfipservices.floodsmart.gov/wyo-program-list>.

### 3.2.2 Access to Catastrophe Capital for the NFIP

Another way in which the private market already interacts with flood insurance is via reinsurance. The 2014 Homeowner Flood Insurance Affordability Act (HFIAA) enabled the private market to begin bearing a portion of the NFIP flood risk by giving FEMA the authority to secure reinsurance for the NFIP from private reinsurers as well as the capital market (Horn & Webel, 2018). There were a few motives for implementing this change, the most notable being that it reduces the chance that FEMA will need to borrow from the U.S. Treasury to pay claims. Additionally, it allows FEMA to price policies more efficiently because FEMA can factor what it is paying in reinsurance premiums into its own pricing model. The main benefit of reinsurance is that it creates stability and reduces the volatility of losses over time, especially when potentially extreme events are involved. For the past six years, FEMA has purchased reinsurance to cover losses from individual flood events, as opposed to aggregate losses.

In addition to reinsurance, insurance-linked securities (ILS) have provided capital to the NFIP. FEMA secured \$450 million in catastrophe bonds in early 2022, in front of \$300 million in catastrophe bonds maturing in March. Given that FEMA includes catastrophe bonds as an element of its overall reinsurance program, the early 2022 catastrophe bond issues increased the size of FEMA's flood reinsurance program for the NFIP to nearly \$2.5 billion after that maturity. With the traditional reinsurance tower coverage barely over \$1 billion, the catastrophe bond market dominates the traditional reinsurance market as the larger source of reinsurance capacity.

### 3.2.3 Private, Non-NFIP Flood Insurance Activity

The 2012 congressional reauthorization of the NFIP included provisions aimed at encouraging private flood insurance, including the encouragement of a private, admitted market. Private capital has increasingly entered the market for flood risk in recent years, indicating an increase in private capacity. Most private flood coverage has been and at least for now continues to be written by surplus lines carriers,<sup>28</sup> although a number of admitted carriers have begun to offer it as well. While private flood insurance now makes up only 3%-4% of the total U.S. flood insurance market, the segment is growing steadily.

The overall growth in U.S. flood insurance premiums and the commensurate profitability over 2016-2021 were substantial. The NAIC reported almost \$1 billion in private market flood net written premiums for 2021, up from the \$357 million written in 2016, representing an overall increase of over 79% during the six-year period.<sup>29</sup> While commercial lines still represent the majority of the private business written, with approximately 65% of the market, the residential premium share is growing (Bradt & Kousky, 2020). Based on anecdotal evidence from several states on rate filings, the

28. Private company policies have typically provided commercial coverage or residential coverage beyond the NFIP coverage limits. Additionally, the private market has heretofore tended to focus on high-value properties, which have higher premiums, therefore justifying the start-up costs of flood underwriting (Horn & Webel, 2018).

29. Premiums are from NAIC Annual Statements sourced through S&P and the III's Facts About Flood Insurance, located on its website at [www.iii.org/article/facts-about-flood-insurance](http://www.iii.org/article/facts-about-flood-insurance). These figures do not include FM Global flood insurance premiums for 2019 and forward. The insurer (the largest writer of private flood insurance) reclassified private flood insurance into allied lines starting that year, making it impossible to separate the flood insurance premium. If including FM Global, the NAIC reports estimated numbers indicating that privately offered (non-NFIP) flood insurance likely more than doubled from 2016-2019.

2022–2023 period is expected to show a marked increase in the residential premium share. In North Carolina, one private program was filed and approved in 2022, and in Florida, 2023 has already seen an increase in the number of private insurers filing to write flood business.<sup>30</sup>

### 3.3 Unique Features and Challenges of Flood Risk

Flood risk involves several features and challenges that call for regulatory flexibility in building forms and rates. Insurers seeking to provide flood insurance in the admitted market must obtain approval from the state regulator. The regulators evaluate the form language while considering the goal to be at least as broad as NFIP. The rating model and financial viability of the product are evaluated to ensure solvency. State regulators are required to comply with their specific state insurance laws while addressing the concerns of property owners, realtors, and lenders. There are special problems in attempting to insure flood that must be acknowledged. First, the flood hazard has unique features that must be assessed properly. Second, insurers are beset by practical barriers to developing flood insurance products and programs (e.g., providing proof of concept, obtaining the appropriate expertise, modeling costs, and filing requirements). The resultant uncertainty in expected returns creates business challenges.

#### 3.3.1 Level of Granularity Required

Although public flood insurance has been available in the U.S. since the 1970s, the need for privatization did not draw much public attention until the past decade, when the federal insurance program started to present a larger and larger amount of financial deficit. Therefore, the original intent of the majority of “older” flood risk models was to assist regional officials in land-use planning, mitigation project assessment, and emergency response. Flood risk is generally categorized as low-likelihood-high-magnitude and with spatial correlation across losses. Thus, highly detailed information is necessary to price flood risk accurately, and investment in this information may be a barrier to new entrants in the market, particularly for private companies in small markets (White, 2011).

The granularity issue poses insurance problems. First, some models are not adequately granular to price the risk accurately. Many flood risk models, in an effort to be more granular, are area-specific, and therefore not universally useful to an insurer’s risk portfolio—actual or desired. On the one hand, risk analysts should select the best available model, yet, on the other hand, the application of flood risk models that vary by geographical region raises potential inconsistency in the aggregate management

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<sup>30</sup>. These statements are made based on conversations with officials at the Florida Office of Insurance Regulation (OIR), the North Carolina Department of Insurance, and the North Carolina Rate Bureau. Moreover, recent reports either imply or directly indicate growth expectations in the private flood insurance market. For instance, Florida is the first state to mandate flood insurance coverage for some homeowners. The state recently passed legislation that requires policyholders of its residual insurer, Citizens Property Insurance Corporation, to be insured for flood. The reduction of subsidies within the NFIP implies that at least in Florida, insurers may find attractive exposures that will have flood insurance demand going forward even if they did not in prior years. See <https://wusfnews.wusf.usf.edu/politics-issues/2022-12-15/10-key-issues-addressed-florida-insurance-overhaul>. A Jan. 2023 MarketWatch report estimates growth in the private market segment over the next five years as well. See <https://www.marketwatch.com/press-release/flood-insurance-market-size-outlook-with-prominent-players-challenges-technological-trends-and-forecast-2028-2023-01-11>

of risk. Furthermore, modeling the dependence of flood risks across different spatial and temporal dimensions is important for, at the very least, the sake of good modeling and to reap its benefits by realizing the diversification effect.

### **3.3.2 Limited Historical Loss Availability and Reliance on Catastrophe Models**

The private market needs an extensive amount of data regarding both past flooding events and resulting claims in order to develop useful flood loss models as well as for use in other steps of the rate-making process. Since flood insurance has not been offered by private companies for so long, they are facing a severe lack of this necessary data. NFIP data on flood losses and claims was largely unavailable to the private market until 2019 (Watkins & Evans, 2019). Improved access to past NFIP data allows insurers to better estimate future losses and price their policies, which ultimately will determine whether they are willing to enter the market and which properties they might be willing to insure.

Even with the recent release of NFIP data, detailed exposure data—critical to loss estimation and insurance pricing—can be difficult to obtain. Construction, number of stories, basement (and use), and first-floor height all contribute to flood risk, as do measures taken to mitigate the flooding itself and the damage to the property. Historically, flood certifications have been required by FEMA. With the advance of mapping, technology now exists so that variables like first-floor height can be mathematically obtained without a flood elevation certificate.

### **3.3.3 Inherent Variability and Risk of Flood**

Flood risk is complex, but so are hurricane and earthquake risks, for which rating is already largely based on loss estimates from catastrophe models.<sup>31</sup> The inherent variability in flood risk primarily lies with topography, property elevation, existence of flood defenses, and information on what is happening below the ground floor. (Is there a basement? What is it used for? Are expensive items stored there?). Another point of variability over time is the climate-land use-urbanization nexus. Even among scientists who agree in large part on the nature and effects of climate change, a great deal of uncertainty remains about the scale and timing of potential climatic changes. These parameters are dependent on assumptions inherent in predicting future climate drivers, particularly the economic development scenario chosen (Solomon & Qin, 2007). This uncertainty in itself presents a challenge for those in the business of insuring flood risks in the future. Changing climate brings extra challenges because in downscaling global climate models to appropriate spatial scales, the forecasts become inherently less precise (Intergovernmental Panel on Climate Change, 2012). These issues have led to the view in some markets that flood risk is so problematic as to insure that the market alone cannot provide universal cover (Making Flood Insurable, 2010).

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31. According to Robert Muir-Wood, chief research officer for Risk Management Solutions (RMS), flood risk is more complex to model than are hurricane and earthquake risk. See his summarized comments made during the 2019 reinsurance Rendez-Vous de Septembre (RVS) at <https://www.insurancejournal.com/news/international/2019/01/24/515647.htm>.



### **3.4 Differing Goals and Objectives Between Private Markets and the NFIP**

The NFIP program, unlike private insurance, has a long history of intentional cross subsidies and suppressed top-end premiums. If subsidies stay within the NFIP program (as opposed to being shifted to taxpayers more widely), then low-risk NFIP policyholders must necessarily pay artificially higher premiums to create affordable premiums for the high-risk NFIP policyholders.

It is important to note that the goals of the NFIP do not align with the goals of private insurers. While the NFIP is charged with making flood coverage available to those who need it at an affordable price, private insurers are focused on making flood coverage available at an adequate (although not excessive) risk-based price. Because of this difference in purpose, the risk rating that FEMA gives a property may not align with the risk rating that the private market would assign to the same property.<sup>32</sup>

## **4. Private Flood Insurance Design for the Admitted Market**

We now turn our attention to the practical elements of policymaking for private market design. If an appropriate policy objective is to build a viable and sustainable private flood insurance market, the states themselves must determine the ecosystem that simultaneously best encourages private insurers to enter the market and most reliably protects solvency and consumers. We reiterate here the importance of risk-based rates and premiums, as well as the importance of allowing insurers to update the pricing in light of the dynamic risk assessment and modeled losses.<sup>33</sup> Given the unique features and challenges of flood risk as well as the differing goals of private insurers from those of the NFIP (discussed in Sections 3.3 and 3.4), our overarching recommendation is for state public policies to create an environment in which flexibility—for the program as well as for insurers—is embedded in the design. This section focuses on the practical means by which program flexibility can coexist with regulatory goals.

### **4.1 Flexibility as a Key to Market Viability and Sustainability**

In the design of private flood insurance market legislation and regulation, states serve as the architects for the actual insurance programs insurers can construct. It is thus imperative that insurance regulators and policymakers be mindful of their respective states' unique flood risks and needs as they develop strategies for a private flood marketplace. To date, only a few states actively promote the development of a private flood insurance market, yet no state outright forbids such a market to develop.

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32. The justification for subsidized premiums aligns closely with the goals of the NFIP. In some communities, lowering premiums for existing structures made it easier to join the NFIP, thereby increasing the number of communities with sound floodplain management and reducing the nation's flood risk exposure. Reasonable premiums also increase the likelihood that a property owner purchases insurance and at least partially funds their own recovery from flood damage, which is preferable to often more limited disaster relief coming solely from taxpayer funding. Extremely high premiums for flood insurance could also cause the abandonment of economically viable buildings, which does not support the goals of the NFIP.

33. Jaffee et al. (2010) advocate for long-term (multi-year) NFIP flood insurance policies linked to the properties rather than to the property owners. Their work emphasizes that its primary goals are to increase NFIP take-up rates and reduce policy lapses rather than to grow a private insurance market. Moreover, it discusses the possible necessity of adjustable premium contracts that would allow for NFIP price increases during the contract term. Where they refer to the private market, they concede that the long-term insurance concept may raise many economic and practical challenges that would need to be resolved either in future research or by the markets themselves.

In the vast majority of states, no laws explicitly apply to private flood coverage, so new flood insurance programs are evaluated against rules that were designed for residential property insurance. Applied to flood, these state laws and rules may be so onerous and misaligned that they unintentionally discourage private insurers from entering the market. For instance, California does not allow the cost of reinsurance to be built into most property insurance rates. The laws and/or regulatory rules in some states prohibit insurers from or are highly frictional for insurers attempting to increase rates due solely to claims occurring from catastrophes.<sup>34</sup> In many states, regulators express a willingness to work with carriers to create a private flood market, yet most provide no explicit information about which of the standard rules are suspended or how long this suspension will last. It may not make sense for large insurers to invest in a private flood program if the rules are known for only a handful of states. Therefore, despite much policy collaboration and regulatory cooperation, legal and regulatory uncertainty creates legitimate hesitation for potential market entrants.

Other states have taken a flexible approach in response to insurer concerns. The Alabama department of insurance (ALDOI), for instance, commissioned Milliman, Inc. in 2020 to conduct a survey of insurers, reinsurers, managing general agents, and other industry stakeholders about their concerns and perspectives around writing private flood insurance in Alabama (Watkins & Evans, 2020).<sup>35</sup> There were four notable areas of response upon which Milliman developed recommendations for the ALDOI. One fairly consistent response from survey participants was the desire for flexibility in forms, rates, and exposure management. The second and third areas of strong respondents suggested that the state requires flood risk disclosures be made to consumers and that the state collaborates with agents, lenders, insurance industry organizations, floodplain managers, and other government agencies to raise consumer awareness about flood risk and insurance. The final area of response was a call for the ALDOI to promote mitigation and responsible building to reduce the underlying flood risk.

In order to minimize the uncertainty that insurers face, and thereby optimize the promotion of private flood insurance, we advocate for state flood insurance programs that incorporate flexibility and insurer choice in their planning. Regulating the market while maintaining flexibility is possible, especially if the regulator allows for insurer and modeler confidentiality and clearly defines what filing a rate for flood means as well as standardizes and communicates filing requirements.<sup>36</sup> Even though the state may have a commonly-understood definition of a rate filing for other lines of business, it may be necessary to clearly define a flood insurance rate filing separately, as it may be different than for other lines.

Overall, flexibility (within reason) is of paramount importance to market growth. We suggest both areas in which flexibility is critical and areas in which flexibility is helpful, even if not critical.

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34. Findings from a recent working paper by Oh et al. (2022) indicate that California, Hawaii, Minnesota, North Carolina, Texas, and Wyoming are particularly high-friction jurisdictions from a rating standpoint in the wake of catastrophe losses.

35. See the survey report at <https://aldoi.gov/PDF/Misc/DOIFloodInsuranceSurveyReport.pdf>

36. Regulators may desire periodic data from insurers writing flood insurance business, including competitive comparisons, exposure, and expected loss summaries. To best monitor the competitiveness of the market and ensure fairness across competitors, a thoughtful means to standardize the data is important.

#### 4.1.1 Areas where Flexibility is Critical

*Limit the level of detail required in filing.* A requirement to share full details in the rate filing can be problematic for at least two reasons. First, given the granularity of flood insurance modeling, including an entire rate table in a rate filing may not be possible as it has been in traditional lines of insurance. Second, even if it is available, it may expose substantial intellectual property and may not be able to be filed because it is proprietary.

*Allow reinsurance, capital, and/or risk costs to enter pricing.* In an effort to promote the affordability of private flood insurance, states may be tempted to restrict insurers from fully reflecting flood model results, reinsurance costs, and cost of capital in rates and prices. Risk and premium loading provisions that allow insurers to pass on all real costs are preferable since private insurers cannot justify market entry without reasonable expectations of profitability.<sup>37</sup> Careful design and implementation of targeted assistance programs may improve affordability without eroding mitigation incentives (Michel-Kerjan et al., 2012; Browne & Medders, 2021).

*Provide for flexibility and/or allowances for models.* Model advances in flood loss estimation are happening quickly as technological advances make improved granularity and specificity possible. Furthermore, best practices in flood modeling are still evolving. The best approach today may not be best practice in five years. Requirements that models be fully approved by a state before being used in rate filings may limit model innovation, agility, and an insurer's ability to use cutting-edge underwriting, pricing, and aggregation.

*Allow insurers to minimize exposure to severe repetitive loss properties.* Notoriously, the NFIP has suffered from being required effectively to continue to insure properties that have had previous flood losses, even some that have experienced flood losses repeatedly. Removing or significantly relaxing the restrictions on surcharges for catastrophic or "Act of God" claims allows companies to avoid, or at least minimize, their exposure to severe repetitive loss properties.

#### 4.1.2 Areas where Flexibility is Warranted, Even if not Critical

*Allow new rating variables.* The NFIP's rating did not historically account for much of what varies between and among flood insurance properties and policies that are correlated with flood losses. Property characteristics, such as first-floor height and number of stories, have been shown to have significant statistical relationship to losses. Policy-specific characteristics, such as percent insured to value (ITV) and deductible provisions also are connected to losses. While the property's location and overall coverage value may be critically important rating variables, optimal rating benefits from additional variables.

*Approve models and/or model vendors.* Today, Florida is the only state that vets flood loss models to determine whether they meet minimum flood model standards for rating and filing purposes within the state. It is expensive to start up and operate a reviewing body for models, but the Florida Commission does provide an example

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37. In addition to the regulatory goals that insurance rates be adequate, not excessive, and not unfairly discriminatory, insurer goals include loadings for expenses, profitability, and contingencies (The Institutes, 2020).

of one for which the value has been established.<sup>38</sup> A key to fairness in dealing with flood loss model vendors, especially if vetting their models for acceptability, is to credibly and reliably promote trust with them that detailed model results (and other proprietary information) will not be disclosed. The Florida Commission, for instance, makes provision for closed meetings to discuss a modeler's intellectual property and competitive intelligence, after which all shared information is immediately returned to the modeler.<sup>39</sup> Additionally, insurers seek improved certainty around the possibility of offering flood insurance, especially as pertains to residential flood insurance. For reasons previously discussed, the process ideally does not require them to be publicly filed.

*Focus on rate solvency, reasonability, and objectivity.* The key to regulating rates with desired flexibility built in hinges on limiting rigorous regulation to solvency issues, and not subjecting carriers to rigorous defense of rating components (similar to other property lines of business). There is substantial uncertainty in estimating flood risk, and regulators do well to recognize that two companies can come to equally valid conclusions for pricing flood that lead to very different results.

## 4.2 Guidance and Model Laws for States to Consider

### 4.2.1 NAIC Guidance

The NAIC has not developed a model law for flood insurance. In late 2019, the organization did document information regarding concrete ways for a department of insurance (DOI) to encourage the growth of private residential flood insurance (NAIC, 2019b). The NAIC's Property and Casualty Insurance (C) Committee has enhanced the collection of private flood data to include: 1) collecting information that separates residential private flood insurance premiums from commercial private flood insurance premiums; and 2) breaking the information down by stand-alone policies and endorsements to homeowners insurance policies, by both first dollar and excess. Additionally, the supplement provides flood claims and policy data (NAIC, 2019b).

Lastly, the document expresses the NAIC's view that while there are several barriers to the residential private flood insurance market, the most significant barrier for private insurers may be uncertainty about the state regulatory environment. In response to this uncertainty, the NAIC suggests that states might want to consider permitting insurers to file private flood insurance products without a prior approval requirement, allowing them to submit rates on an informational basis,<sup>40</sup> consistent with our recommendations for flexibility in state regulation.

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38. States should consider how to enable efficient reviews. A 2022 issue paper released by the American Academy of Actuaries (Academy) outlining lessons learned from recent U.S. experience with wildfires makes the point, "An impartial regional- or even national-level review of catastrophe models may be the most efficient way to increase confidence in wildfire models." This statement similarly applies to flooding.

See [https://www.actuary.org/sites/default/files/2022-02/Wildfire.2022\\_.pdf](https://www.actuary.org/sites/default/files/2022-02/Wildfire.2022_.pdf), page 24 for this discussion.

39. The detailed protocol for handling proprietary information that is shared with Florida Commission members and/or the related professional team is detailed in the Florida Commission Flood Standards Report of Activities, November 2021, found at [https://fchlpm.sbafla.com/media/bdmfov4y/2021\\_floodroa.pdf](https://fchlpm.sbafla.com/media/bdmfov4y/2021_floodroa.pdf)

40. Other suggestions include: 1) approving private flood insurance products; 2) removing diligent search requirements; 3) listing private flood insurance products on a DOI website; 4) collecting residential private flood insurance data; 5) implementing specific continuing education (CE) requirements for producers; and 6) increasing the weighting of flood insurance questions on producer licensing exams.

## 4.2.2 National Conference of Insurance Legislators Model Act

The National Conference of Insurance Legislators (NCOIL) developed a draft of the Private Primary Residential Flood Insurance Model Act in 2020.<sup>41</sup> The goal of creating the model was to provide a tool for state legislators and help facilitate a diverse and robust private flood insurance market. The model includes a recommendation that states utilize a “use and file” or “file and use” for private flood insurance coverage. Insurers must attest that the rates are based on actuarial data, methodologies, standards, and guidelines relating to flood that are not excessive, inadequate, or unfairly discriminatory. It also recommends that states not impose greater filing requirements for private flood insurance form filings than the state requires for other property lines of insurance.<sup>42</sup> These recommendations are consistent with our assertions that flexibility in rates and forms is critical to the development of a viable private flood insurance marketplace.

## 4.3 State Flood Insurance Policies in Light of the Need for Flexibility

Several states have approved flood insurance rates and forms. The Insurance Services Office (ISO– Verisk) has filed a multi-state program in most states. In light of state proposals to encourage private market underwriting of flood risk as well as improved analytics for pricing the risk more accurately, the ISO developed both personal and commercial flood programs. The Personal Flood Policy FD 00 01 11 18 form was filed and approved for November 2018 (Barlow, 2021). Most states have adopted the form.

Adopting standardized forms is a helpful, but insufficient, element to making provision for a private market. Alabama<sup>43</sup>, Florida, New Jersey<sup>44</sup>, North Carolina,

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41. NCOIL Adopts Private Primary Residential Flood Insurance Model Act Press Release dated Sept. 24, 2020. Contact: Tom Considine, NCOIL CEO. The purpose of the Model is “to provide protection of lives and property from the peril of flood,” and is “designed to encourage a robust private primary residential flood insurance market to provide consumer choices and alternatives to the existing NFIP.”

42. The Model also includes consumer information regarding NFIP options before placing the consumer application with private flood insurance. So far in 2022, legislators in Delaware and Illinois enacted laws based on the NCOIL Model Act. For the Delaware legislation, see <https://legis.delaware.gov/json/BillDetail/GenerateHtmlDocument?legislationId=109438&legislationTypeld=1&docTypeld=2&legislationName=SB282>.

For the Illinois legislation, see <https://ilga.gov/legislation/publicacts/fulltext.asp?name=102-0720&GA=102&SessionId=110&DocTypeld=HB&DocNum=2739&GAID=16&SpecSess=&Session=>

43. In late 2021, the ALDOI relaxed requirements for insurers filing flood insurance rates (except for those covering vehicles). The exemption includes rates for stand-alone flood insurance policies and endorsements for other property policies, such as homeowners, dwelling, and commercial property. The ALDOI also will not attempt to enforce regulations that had previously required insurers to provide advanced notice of coverage restrictions or nonrenewal of policies. See <https://www.insurancejournal.com/news/southeast/2021/11/29/643557.htm>.

44. The New Jersey surplus lines flood insurance market took off following Superstorm Sandy in 2012. Since that time, the private flood market has expanded and continues to accelerate. The growth is encouraged by the state’s insurance regulators. “There is a very, very strong insurance department in New Jersey supporting private flood,” said Steffey, the ShoreOne CEO. “It’s not true in every state, but it’s certainly true in New Jersey.” Property Insurance Report, May 23, 2022 Focus: New Jersey.

Pennsylvania<sup>45</sup>, South Carolina<sup>46</sup>, and Virginia<sup>47</sup> are among the earliest states to promote admitted-market residual flood insurance (and in some cases to significantly deregulate flood rates) and have provided sufficient information about their programs to be included in this discussion. Furthermore, each of these states allows private flood insurance to insure residential structures for amounts far above the NFIP coverage limit (into the millions of dollars), based on replacement cost value. Private insurers may also offer coverage for additional living expenses.

The program features differ between these states with respect to their clarity and flexibility for use by interested insurers. Florida and North Carolina provide the clearest roadmap for insurers with flexibility in the design. The policies of the other five states are noteworthy as well and appear to be aligned with insurer flexibility, even if not as clearly mapped as those of Florida and North Carolina.

### 4.3.1 Overall State Comparisons

Table 1 compares the seven states' current policies with regard to the areas in which flexibility is critical and warranted. "YES" indicates the state's policies are consistent with flexibility in the stated area of concern. So far, all seven states require a limited level of detail in filing rates and forms, allow all risk costs to enter the insurance pricing, and allow insurers flexibility as to whether to use one or multiple models in the derivation of rates. Although not clarified for all, none of these seven require insurers to expose their book of business to severe repetitive loss properties.

**Table 1: State Flood Insurance Regulatory Comparisons**

	Alabama	Florida	New Jersey	North Carolina	Pennsylvania	South Carolina	Virginia
Flexibility is Critical							
Limited level of detail required in filing?	YES	YES	YES	YES <sup>48</sup>	YES	YES <sup>49</sup>	YES

45. The Pennsylvania DOI has focused on consumer education, collaboration with the Department of Banking, and partnerships with FEMA and the Pennsylvania Emergency Management Agency to promote its growth. These efforts continue with the current leadership as displayed in a July 1, 2022 press release from the Pennsylvania DOI. The press release includes encouragement from Insurance Commissioner Michael Humphreys, informing consumers "flood insurance is available through both the National Flood Insurance Program (NFIP) and the rapidly growing private market, regardless of whether you live in a designated flood zone."

46. The South Carolina Private Flood Insurance Act (S.882) became effective Nov. 28, 2020. See <https://doi.sc.gov/CivicAlerts.aspx?AID=283&ARC=363>

47. The Virginia Bureau of Insurance has encouraged the development of a standard market private flood market through Administrative Order No. 12077 in March 2019. The Order suspends rate information used in writing private flood from the Code of Virginia File and Use filing requirements 38.2-1906, though still includes that they shall not be excessive, inadequate, or unfairly discriminatory. The Order provides an exemption to the typical regulatory oversight in the Virginia standard market and is intended to encourage growth in the standard flood insurance market. Filings are not necessary for private flood insurance written by an admitted insurer that is not written or reinsured by the NFIP. The types of private flood insurance impacted include: 1) stand-alone first dollar coverage, 2) coverage provided by an endorsement or included as covered cause of loss; and 3) excess coverage. Forms are still subject to approval by the Bureau on a file and use basis.

48. Filing is done at the North Carolina Rate Bureau (NCRB) level, unlike in other states, and is already approved for carriers to use.

49. The Act streamlines the regulatory oversight of forms and rates through a Use and File approval model. Rates are available for public review. Based on an interview with Ray Farmer, then Director of South Carolina DOI, on Oct. 12, 2021.

All risk costs allowed in pricing?	YES	YES	YES	YES	YES	YES	YES
Model flexibility allowed?	YES	YES	YES	YES	YES <sup>50</sup>	YES	YES
Exposure to repetitive loss properties minimized? <sup>51</sup>	YES*	YES	YES*	YES	YES*	YES*	YES*
Flexibility is Warranted							
New rating variables allowed?	NA	YES	NA	YES	NA	NA	NA
Model approval required?	NO	YES	NO	YES	NO	NO	NO
Rate solvency, reasonability, and objectivity focused?	NA	YES	NA	YES <sup>52</sup>	YES	NA	NA

Only in Florida and North Carolina are the rules clear that new rating variables are allowed and that there exists a model approval process. Therefore, in these two states it is clear that there is a focus, not just on growing the private flood insurance market, but also on rate solvency, reasonability, and objectivity. Taking a closer look, then, at the Florida and North Carolina policy strategies is a useful exercise for other states since both are illustrative of what is meant by design flexibility. Notwithstanding Florida's political risk, its flood insurance strategy appears to allow insurers ample freedom to select a business strategy and risk portfolio that meet business goals. North Carolina's program, although uniquely the product of a rate bureau, likewise allows insurer flexibility (with its most limiting factor being the requirement of a standalone insurance policy) and is transferable to other states. It is an interesting one to follow as it attempts to create a balance between the need for insurers to develop products with marketable coverage and profitable rates and the need for regulators to protect solvency and consumers.

50. Insurers have the flexibility to file any rate exhibits they use to derive the price to include catastrophe models, linear models, or other evidence to justify the rates. Conversation with David Buono, Pennsylvania Deputy Insurance Commissioner in the Office of Market Regulation on July 12, 2022, and follow up email correspondence on July 15, 2022.

51. An asterisk indicates that these responses are based solely on the information provided as outlined here. Authors were not able to find specific information in any other documents or sources. For Alabama, intentions stated in response to the ADOI-Milliman survey findings. Survey report at <https://aldoi.gov/PDF/Misc/DOI/FloodInsuranceSurveyReport.pdf>. For New Jersey, information implied within the Property Insurance Report, May 23, 2022 – focus on New Jersey in discussions of property losses resulting from Hurricane Sandy. For Pennsylvania, information based on conversation with David Buono, Pennsylvania Deputy Insurance Commissioner in the Office of Market Regulation on July 12, 2022 and follow up email correspondence on July 15, 2022. For South Carolina, information is based on interviews with Ray Farmer, then Director of South Carolina Department of Insurance, October 12, 2021, and Michael Wise, Acting Director of SCDOI, July 1, 2022. For Virginia, information is based on quote from Virginia Insurance Commissioner Scott White's press release on Nov. 30, 2022, at <https://scc.virginia.gov/newsreleases/release/SCC-Notes-Flooding-Not-Limited-to-Hurricane-Season>

52. Ibid. The regulator determines that rates filed for private flood insurance are adequate, fair, and not excessive.

### 4.3.2 Florida

The State of Florida passed a specific private flood law with regulator backing and input in 2014, allowing rates to be developed directly from catastrophe models, with certain consumer safeguards, until a sunset date (currently Oct. 1, 2025).<sup>53</sup> Also in 2014, the Florida Legislature expanded the role of the Florida Commission to develop standards and review flood loss models used in the development of personal lines residential flood loss and the calculation of flood probable maximum loss levels.<sup>54</sup>

As of this writing, the most recent development in the Florida private market design is a flood insurance mandate passed by the Florida Legislature. Under this legislation, any Florida residence with homeowners insurance provided by Citizens Property Insurance Corporation must also carry flood insurance that meets or exceeds NFIP coverage.<sup>55</sup> This mandate is the first statute in the nation that requires flood insurance to be purchased for properties outside of a FEMA-designated high-risk flood zone.

In Florida, insurers have flexibility in rates and forms. Insurers seeking to write private flood insurance in Florida outside of the NFIP can write primary or excess flood insurance. For insurers licensed in Florida, private flood insurance coverage can be written as a stand-alone flood policy or as an endorsement of a residential policy.

Section 627.715, Florida Statutes<sup>56</sup>, establishes guidelines for filings made to Florida's Office of Insurance Regulation (OIR) by an insurer interested in offering private flood insurance within the state. Five types of flood coverage may be written, as defined in section 627.715, Florida Statutes, including:

- Standard flood insurance
- Preferred flood insurance
- Customized flood insurance
- Flexible flood insurance
- Supplemental flood insurance<sup>57</sup>

The Standard and Preferred types of flood coverage are required to be at least as broad as the NFIP flood coverage, and the Customized flood insurance must be broader than the Standard insurance. Insurers may request the OIR to certify that a policy, contract, or endorsement provides flood insurance coverage that equals or exceeds the NFIP coverage, which may be important to satisfy mortgage requirements.

Preferred flood insurance policies issued by the private market must include the same coverage as provided under standard flood insurance, and must:

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53. Senate Bill 542 Flood Insurance approved by Governor Rick Scott on June 13, 2014 <https://www.flsenate.gov/Session/Bill/2014/542/?Tab=BillHistory>

54. The Florida Commission began developing standards for and reviewing hurricane loss models in 1995. See <https://fchlpm.sbafla.com/about-the-fchlpm/> for the Florida Commission's annual *Report of Activities*, which includes at a minimum the model standards, modeler submissions, the models reviewed, and the results of the reviews.

55. The requirement will be phased in over several years, but all Citizens-insured residences will be required to have flood insurance by 2027, *supra* note 29.

56. Commercial non-residential property rates, on the other hand, are informational only, and forms can be filed (optionally) by insurers pursuant to section 627.4102, Florida Statutes.

57. Details provided about these coverage types are taken from the Florida Department of Financial Services, Flood Insurance Overview, available at <https://www.myfloridacfo.com/division/consumers/understanding-insurance/flood-insurance-overview>



- Include, within the definition of flood, losses from water intrusion originating from outside the structure that are not otherwise covered under the definition of flood.
- Include coverage for additional living expenses.
- Require that any loss under personal property or contents coverage that is repaired or replaced be adjusted based upon replacement cost settlement, up to the policy limits.

Flexible flood insurance policies issued by private insurers must cover losses meeting the NFIP flood definition and may also include coverage for losses from water intrusion originating from outside the structure which is not otherwise covered by the definition of flood. Flexible flood insurance must include one or more of the following provisions:

- An agreement between the insurer and the insured that the flood coverage is in a specified amount, such as coverage that is limited to the total outstanding mortgage applicable to the covered property.
- A requirement for a deductible in an amount authorized under s. 627.701, including a deductible in an amount authorized for hurricanes.
- A requirement that flood loss to a dwelling is adjusted based upon replacement cost settlement or adjusted on the basis of the actual cash value of the property.
- A restriction limiting flood coverage to the principal building defined in the policy.
- A provision including or excluding coverage for additional living expense.
- A provision excluding coverage for personal property or contents as to the peril of flood.

### 4.3.3 North Carolina<sup>58</sup>

North Carolina utilizes a unique system for rating residential property insurance through the North Carolina Rate Bureau (NCRB).<sup>59</sup> Today, North Carolina is the only state remaining that uses a rating bureau to establish full rates in residential property insurance. Licensed insurers writing residential property insurance are required to participate, thus the rate approval process in North Carolina is unique to that found in other states. The NCRB proposes and promulgates (with the approval of the commissioner) standard insurance policy forms and base rates, which are filed on behalf of all licensed North Carolina residential property insurers.

In early 2020, the North Carolina DOI approved a private flood insurance program for use by the member companies of the NCRB (NCRB, 2019).<sup>60</sup> The NCRB program provides a unique structure for flood insurance that sets all private insurers on the same foundation for developing their own respective programs. NCRB's responsibility for promulgating residential property (including flood) insurance rates for insurers

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58. Information on the North Carolina Flood Insurance Program is largely sourced from Marlett et al., 2020. The report provides in-depth explanation and evaluation of the program's development and features.

59. The enabling legislation was N.C.G.S. §58-36 (1977). Karl et al. (2020) provide detailed discussion of the NCRB, its purposes, and operations. The NCRB is a nonprofit, nongovernment, unincorporated entity that provides services and programs for the insurance industry in North Carolina, coordinating the prior approval process for residential property rates and other "essential lines of insurance coverage." By state law, all insurers writing residential property insurance in North Carolina must subscribe to the NCRB.

60. The number of NCRB member insurers for property is currently in excess of 600.

in the state provides a framework from which individual insurers can deviate. The program provides coverage at least as generous as that afforded by the NFIP. In 2022, the North Carolina Legislature passed a bill that allows carriers to file optional enhanced endorsements related to the flood insurance policy, which allows individual private insurers flexibility in developing flood products in North Carolina, and further encourages the development of admitted, private market products (Statute 58-36-43).

The North Carolina program is based on a stand-alone flood insurance policy and is a product that can be sold by insurers who are NCRB members. The use of a stand-alone product helps to ensure the existence of “continuous coverage” under NFIP requirements and helps ensure mortgage company acceptance. Additionally, any flood insurance coverage litigation would be in state court (as opposed to NFIP coverage litigation, which primarily occurs in federal court). The stand-alone policy ensures that the premium dollars charged to a homeowner for flood coverage are entirely segregated from premium dollars charged for insurance against other perils. Moreover, a stand-alone policy allows the NFIP to still be used as a market of last resort for flood, preventing flood from being covered in the State’s Beach/FAIR plan markets.<sup>61</sup>

The NCRB policy form is based on an ISO form template. Since most residential and commercial property insurance policies are developed using ISO forms, the choice of ISO means the policy can look familiar to insurance agents and consumers, much like a standard homeowners policy. Carriers opting to use the North Carolina forms can potentially expand flood insurance offerings to other states without large changes in coverages, terms, and conditions if the ISO program is utilized. Furthermore, because the ISO forms have been used widely by the industry for many years, they are court tested and include language that reflects what has been learned from court precedent.

The insurance pricing for the NCRB program is done at the property level, based on latitude and longitude, rather than at the zip code or zone level. In addition, the individualized rating program incorporates the first-floor height of the insured structure, such that a high degree of exposure granularity is ensured. Additionally, the program allows property owners to fully insure their homes to value. Notwithstanding the wide variation in pricing that results, more than 95% of a market basket of North Carolina properties subjected to both the NCRB rating plan and the NFIP rating plan in 2019 received a lower rate from the NCRB plan (Marlett et al., 2020).<sup>62</sup> This is early evidence that a private market need not necessarily lead to higher premiums than those available under the NFIP, excepting the most high-risk properties.

The NCRB program allows for some insurer flexibility. The program allows coverage limits based on the insurable value of the property, unlike the restrictive NFIP \$250,000 coverage limit. It also incorporates the extent to which coverage limits equal the property’s insurable value (Insurance to Value, or ITV) as a rating factor, unlike the typical property insurance contract that adjusts for the ITV choice within a coinsurance clause that impacts loss settlement. Furthermore, the program allows for a variety of deductible amounts that can be selected as a dollar amount or as a

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61. Also, because the policy is designed to stand alone, homeowners can easily compare premiums (with some mental adjustments for coverage value differences) to determine whether they prefer to be insured within the NFIP program.

62. In development of the North Carolina program, the NCRB and Milliman conducted a comparative study of premiums under the two programs for a simulated basket of homes insured with \$250,000 flood coverage limits.

percentage of coverage limits, unlike either the NFIP or typical homeowners policies, which allow for a limited number of deductible options.

## 5. Considerations and Implications for Future Public Policy Regarding Flood Insurance

This paper advocates for a private flood insurance marketplace that is supplemented by the NFIP (for residual-risk properties). Such a financing system would require sustainable growth in the existing private market for flood insurance and state strategies that accommodate private insurer needs for short-term experimentation and long-term profitability. Therefore, state-level public policies related to private flood insurance that are designed with program and insurer flexibility in mind may work best. Nevertheless, flexibility embedded at the expense of meeting regulatory goals would be folly. A key to any risk-financing system's financial viability and loss reduction is risk-based pricing. The prior literature, as discussed in earlier sections, is clear that price-to-risk matching is an important element within the system—including both the private and public segments. Any subsidies in a market for residential flood insurance are best limited to residual risks (where the unsubsidized price is prohibitively expensive) that are primary residences (as a means to avoid resident displacement), based on financial need (e.g., an income-based sliding scale), and made transparent to the property owner (so the true cost of risk and amount of subsidy are clear). In the development of a viable marketplace, three elements of state-level policies are important to ensure the long-term viability of private programs:

- Promote rates that optimize program solvency and sustainability
- Determine the critical and reasonable disclosures
- Ensure regulator access to rates

*Rates that optimize program solvency and sustainability.* Developing an environment where insurers can successfully and fairly write flood insurance business and sustain a reasonable level of profitability on a long-term basis is a critical objective in private market design. Long-established actuarial principles generally determine the setting of insurance premiums for the private market. Insurance premiums are required to yield revenues that will pay expected future claims (losses) and insurance program expenses (costs), and theoretically, premiums for an individual policy are based on the long-term expected claims plus fees for each individual policy. Also, theoretically, no cross-subsidy exists, where one group of policyholders pays artificially higher premiums so that other policyholders will pay artificially lower premiums. Last, premiums are no higher than necessary to ensure that these principles are met.

*Determine the critical and reasonable disclosures.* Provisions for agent, lender, and consumer disclosures are important for program promotion, and are equally important for consumer awareness and loss mitigation purposes. Important disclosures may include flood risk, lender acceptance, limitations of coverages, loss of any NFIP subsidies if applicable, among others.

*Ensure regulator access to rates.* Provided they are not publicly available, insurer rates and rating plans may be almost, if not entirely, opaque to consumers. It is

imperative that regulators be able to access insurers' rating plans and meaningfully understand how they are developed, so regulator access to the rates is important. Confidential access for regulators can be achieved by simply including in the rules a provision for confidentiality. Require from flood insurance writers the attestation that rates do not change without filing and that they are available for access by regulators.

Flood risk is widespread and dynamic: The geography of every U.S. state holds significant exposure. According to FEMA (2020), 99% of U.S. counties were impacted by flooding during 1996-2019. Meanwhile, FEMA records indicate that over 425,000 people have dropped their NFIP coverage since the implementation of Risk Rating 2.0. Many consumers clearly do not see an appealing value proposition when considering NFIP insurance for their properties. We assert that the private insurance market has a substantial opportunity to build a viable, admitted market for flood insurance. What is needed for private market viability centers on flexibility—to serve the coverage needs of consumers at rates that are adequate and equitable based on best-practice flood loss modeling and actuarial work. We have outlined in this paper ways in which state legislators and regulators can aid in creating and preserving the flexibility needed to attract admitted insurers to the private market.

## Appendix A

### NFIP's History and Present Status

During 2012-14, legislation passed that significantly impacted the NFIP. The Biggert-Waters Flood Insurance Reform Act of 2012 was passed to address the fiscal insolvency of the NFIP by funding the national mapping program and allowing certain rate increases to transition the program from subsidized to full actuarial rates reflective of true risk (FEMA, 2018a). In 2014, the Consolidated Appropriations Act prohibited the implementation of certain parts of Biggert-Waters, effectively stopping certain rate increases, while new law was developed to address concerns related to raising rates (FEMA, 2018a). As a result, the Homeowner Flood Insurance Affordability Act of 2014 repealed certain parts of Biggert-Waters, restored grandfathering (allowing low rates remain even if risk is found to be higher), put limits on rate increases, and updated the approach to ensure fiscal soundness by applying a surcharge to all policyholders (\$25 for a primary residence and \$250 for all others) (FEMA, 2018a).

The NFIP is currently managed by FEMA and is the primary provider of flood insurance coverage in the U.S. The program provides approximately \$1.3 trillion in coverage for just under 5 million residential policies. As of March 31, 2022, the program faced over \$45 billion in Probable Maximum Losses annually, with approximately \$17.8 billion in claims-paying capacity and \$20.5 billion outstanding debt to the U.S. Treasury. (See FEMA's *The Watermark 2022*, 2nd Quarter, NFIP's financial statements, at [https://www.fema.gov/sites/default/files/documents/fema\\_fy22-q2-watermark.pdf](https://www.fema.gov/sites/default/files/documents/fema_fy22-q2-watermark.pdf) for details.)

The NFIP operates so that in years of multiple catastrophic disasters it is able to borrow from the Treasury to cover the gap between claims paid and premiums collected. However, over time, the NFIP's debts have increased sharply, and with projected total claims of \$9.7 billion for the 2017 hurricane season, congress had to cancel \$16 billion of NFIP debt in order for the program to pay its claims, thus making the cancelled debt a nontransparent liability for general taxpayers, and as such a subsidy (Horn & Webel, 2018). As of March 31, 2022, the NFIP had \$9.9 billion of remaining borrowing authority, as well as possible reinsurance payments of up to \$2.34 billion. (See the Congressional Research Service *In Focus* Report from December 8, 2021, at <https://sgp.fas.org/crs/homesec/IF10988.pdf>.)

Congress must periodically renew the NFIP's status, which can be disruptive to NFIP operations, and undermine stakeholder confidence in the program. For instance, on March 11, 2022, President Biden signed congressional legislation that extended the NFIP's authorization to Sept. 30, 2022. (See <https://www.congress.gov/bill/117th-congress/senate-bill/2724>.) On Dec. 29, 2022, the president signed legislation that extended the NFIP's authorization to Sept. 30, 2023. (See <https://www.fema.gov/flood-insurance/rules-legislation/congressional-reauthorization>.) Since the NFIP's last multi-year reauthorization expired on Sept. 30, 2017, the NFIP has experienced 23 short-term extensions, including four brief lapses. According to the legislative proposal pages of FEMA's flood insurance website (last updated March 15, 2023), "The frequent short-term extensions are disruptive and cause existing and potential policyholders to lose confidence in the NFIP as a reliable insurance program available to protect their

homes and contents from the risk of flooding.” (See <https://www.fema.gov/flood-insurance/rules-legislation/congressional-reauthorization/legislative-proposals>.) In May 2022, FEMA proposed to congress a 10-year reauthorization with program reforms.

## **Appendix B**

### **Risk Rating 2.0 versus Historical NFIP Rating**

[Note: We keep our discussion of the NFIP Risk Rating 2.0 here brief because: 1) our purpose is not a primer on Risk Rating 2.0, which is readily, publicly available online through FEMA; and 2) to the extent that Risk Rating 2.0 improves the NFIP program's competitiveness with a private marketplace, this competitiveness is discussed in the main body of the paper.]

Historically, NFIP insurance rates have been predominantly based on relatively static measurements, focused on a property's elevation within a Flood Insurance Rate Map (FIRM) zone. The NFIP rates in different ways dependent upon whether a FIRM has been issued for the community (FEMA, 2015). All buildings constructed after a FIRM are charged full-risk, actuarially fair premiums; if the construction is in compliance with the floodplain management ordinances, the premium should be reasonable and affordable (Hayes & Neal, 2012).

This enhances the NFIP goal of discouraging building in high-risk flood areas because the full-risk premiums do not subsidize insureds. Additionally, all buildings found to be outside of SFHAs are charged full-risk premiums. In these areas, since the risk is generally low, the premiums are low as well (Hayes & Neal, 2012). Buildings in SFHAs that were constructed before the development of the FIRM are charged discounted, or subsidized, premiums, since their full-risk premiums could be extremely high in some instances (Hayes & Neal, 2012). It is notable that FEMA is not provided funds to offset the subsidized and discounted premiums. Subsidized and discounted premiums have contributed to FEMA's need to borrow from the U.S. Treasury to pay NFIP claims (Horn & Webel, 2018).

This historical approach does not incorporate as many flooding variables as Risk Rating 2.0. These include flood frequency, multiple flood types—river overflow, storm surge, tsunami, great lakes flooding, coastal erosion and heavy rainfall—and distance to a water source along with property characteristics such as elevation and the cost to rebuild. FEMA utilizes flood hazard information by incorporating private sector data sets, catastrophe models, and evolving actuarial science to set rates that are fairer than in the past and ensure rate adjustments are equitable.

Historically, policyholders with lower-valued homes have paid disproportionately high premiums while policyholders with higher-valued homes paid disproportionately low premiums, relative to the property loss exposure represented. Because Risk Rating 2.0 considers rebuilding costs, FEMA can equitably distribute premiums across policyholders based on home value and a property's individual flood risk.

## References

- Arrow, K. (1971). *Essays in the theory of risk bearing*. Markham Publishing Company, Chicago.
- Adriano, L. (2018, November 2). Are FEMA maps missing the mark? *Insurance Business America*. <https://www.insurancebusinessmag.com/us/news/catastrophe/are-fema-maps-missing-the-mark-115356.aspx>
- American Society of Civil Engineers. (2021, February). *2021 Infrastructure Report Card*. <https://www.infrastructurereportcard.org/>
- Barlow, C. (2018). *Personal flood insurance coverage guide* (1st ed.). The National Underwriter Company.
- Boyer, M., & Nyce, C. (2013). An industrial organization theory of risk sharing. *North American Actuarial Journal*, 17(4), 283-296.
- Bradt, J., & Kousky, C. (2020, January 14). *Flood insurance in the U.S.: Lessons from FEMA's recent data release (part I)*. University of Pennsylvania Wharton College, Risk Management and Decision Processes Center. <https://riskcenter.wharton.upenn.edu/lab-notes/lessonsfromfemadatapart1/>
- Browne, M., & Medders, L. (2021). Toward true price-to-risk matching: Importance of risk-based pricing and transparent subsidies in a sustainable insurance market for inland flood. *Proceedings of the 8th Annual Appalachian Business in Research Symposium*, ARBS: Eastern Kentucky University.
- Clark, K. (2002). The use of computer modeling in estimating and managing future catastrophe losses. *The Geneva Papers on Risk and Insurance - Issues and Practice*, 27(2), 181-195.
- Cummins D., Suher M., & Zanjani G. (2010). *Measuring and managing federal financial risk*. Lucas, D. (Ed.). National Bureau of Economic Research, Univ. of Chicago Pr., 61-96.
- Dapena, K. (2018, September 29). The rising costs of hurricanes. *The Wall Street Journal*. <https://www.wsj.com/articles/the-rising-costs-of-hurricanes-1538222400>
- Davenport, F., Burke, M., & Diffenbaugh, N. (2021). Contribution of historical precipitation change to U.S. flood damages. *Proceedings of the National Academy of Sciences, USA*, 1-7.
- Evans, D., Webb, C., Braunstein, E., Glowacki, J., Netter, A., Katz, B., & Lohmann, D. (2020, May). Residential flood risk in the United States: Quantifying flood losses, mortgage risk and sea level rise. *Society of Actuaries and Milliman*. <https://www.soa.org/globalassets/assets/files/resources/research-report/2020/soa-flood-report.pdf>
- Federal Emergency Management Agency (FEMA) (2015). *National Flood Insurance Program Specific Rating Guidelines*.
- FEMA (2017, June). *Fact Sheet: Community Rating System* (Publication). [www.fema.gov/community-rating-system](http://www.fema.gov/community-rating-system)
- FEMA (2018a). *Flood insurance reform - The law*. [www.fema.gov/flood-insurance-reform-law](http://www.fema.gov/flood-insurance-reform-law)
- FEMA (2018b, December 11). *Community Rating System*. [www.fema.gov/community-rating-system](http://www.fema.gov/community-rating-system)
- FEMA (2020, July 24). *Historical flood risk and costs*. <https://www.fema.gov/data-visualization/historical-flood-risk-and-costs>



- Grace, M., Klein, R., & Kleindorfer, P. (1999). *The supply of catastrophe insurance under regulatory constraint*. (Working Paper). Wharton Managing Catastrophic Risks Project.
- Grace, M., Klein, R. (2009). The perfect storm: Hurricanes, insurance and regulation. *Risk Management and Insurance Review*, 12(1), 81-124.
- Gribbin, D. (2019, February 28). *Why is federal infrastructure policy so difficult?* The Brookings Institution. <https://www.brookings.edu/blog/the-avenue/2019/02/28/why-is-federal-infrastructure-policy-so-difficult/>
- Hayes, T., & Neal, D. (2012). *National Flood Insurance Program: Actuarial Rate Review* (Rep.). FEMA.
- Horn, D. (2019, November). *National Flood Insurance Program: The current rating structure and risk rating 2.0* (CRS Report No. RA5999). Congressional Research Service. <https://crsreports.congress.gov/product/pdf/R/R45999>
- Horn, D., & Webel, B. (2018, July 31). *Private Flood Insurance and the National Flood Insurance Program* (CRS Report No. R45242). Congressional Research Service. <https://fas.org/sgp/crs/homesec/R45242.pdf>
- Insurance Information Institute (III). (2020, October 6). *Spotlight on: Flood Insurance*. [www.iii.org/article/spotlight-on-flood-insurance](http://www.iii.org/article/spotlight-on-flood-insurance)
- Intergovernmental Panel on Climate Change (IPCC). (2012). *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change Cambridge University Press, Cambridge UK, and New York.
- Jaffee, D., Kunreuther, H., & Michel-Kerjan, E. (2010). Long-term property insurance. *Journal of Insurance Regulation*, 29(2), 167-187.
- Karl, J., Marlett, D., Neale, F., & Anderson-Parson, J. (2020). Consent to rate laws: A case study of the North Carolina homeowners insurance marketplace. *Journal of Insurance Regulation*, 39(3).
- Kelly, M., & Kleffner, A. (2003). Optimal loss mitigation and contract design. *The Journal of Risk and Insurance*, 70(1), 53-72.
- Klein, R., & Kleindorfer, P. R. (2003) Regulation and markets for catastrophe insurance. Sertel, R. and Koray S. (Eds.). *Advances in Economic Design*, Springer-Verlag, Berlin.
- Kousky, C. (2018). Financing flood losses: A discussion of the National Flood Insurance Program. *Risk Management and Insurance Review*, 21(1), 11-32.
- Kousky, C., Kunreuther, H., Lingle, B., & Shabman, L. (2018, July 24). *The Emerging Private Residential Flood Insurance Market in the United States* (Publication). <https://riskcenter.wharton.upenn.edu/slider/the-emerging-private-residential-flood-insurance-market-in-the-united-states/>
- Kousky, C., Kunreuther, H., Xian, S., & Lin, N. (2021). Adapting our flood risk policies to changing conditions. *Risk Analysis*, 41(10), 1739-1743.
- Kunreuther, H. (1998). The role of insurance in dealing with catastrophic risks from natural disasters, Klein, R.W. (Ed.). *Alternative Approaches to Insurance Regulation*, National Association of Insurance Commissioners.
- Kwon, W., & Skipper, H. (2007). *Risk Management and Insurance: Perspectives in a Global Economy*, Wiley-Blackwell, Malden, MA.
- Lattimore, C. & Medders, L. (2019, June 19). *Water is Coming: Planning for the Future of North Carolina Flood Risk*. Appalachian State University Risk Initiative for Student Engagement (AppR.I.S.E).

- Making Flood Insurable for Canadian Homeowners.* (2010). Swiss Re/Institute for Catastrophic Loss Reduction.
- Marlett, D., Medders, L., & Lattimore, C. (2020, September 4). *An Evaluation of the North Carolina Rate Bureau's Residential Flood Insurance Program*, a report submitted to NCREaltors®.
- Maroney, P., Medders, L., & Nyce, C. (2012). Managing windstorm exposure: Lessons learned from Florida. *Journal of Insurance Regulation*, 31, 3-26.
- Medders, L., Nyce, C., & Karl, J. (2014). Market implications of public policy interventions: The case of Florida's property insurance market. *Risk Management and Insurance Review*, 17(2), 183-214.
- Michel-Kerjan, E., & Kunreuther, H. (2011). Redesigning flood insurance. *Science*, 333(6041), 408-409.
- Michel-Kerjan, E., Lemoyne de Forges, S., & Kunreuther, H. (2012). Policy tenure under the U.S. National Flood Insurance Program (NFIP). *Risk Analysis*, 32(4), 644-658.
- NAIC (2019a, June 3). *NAIC Survey Reveals Love for Flood Insurance Far Outstrips Purchase*. <https://www.prnewswire.com/news-releases/naic-survey-reveals-love-for-flood-insurance-far-outstrips-purchase-300861046.html>
- NAIC (2019b, November). *Considerations for State Insurance Regulators in Building the Private Flood Insurance Market*.
- NAIC (2020, September). *U.S. Property & Casualty and Title Insurance Industries - 2020 First Half Results*.
- Neal, G. (2014, May). *The Physical and Economic Impacts of Urban Flooding on Critical Infrastructure and Surrounding Communities: A Decision Support Framework*. [Master's thesis, University of Tennessee - Chattanooga.]
- Netusil, N., Kousky, C., Neupane, S., Daniel, W., & Kunreuther, H. (2021). The willingness to pay for flood insurance. *Land Economics*, 98(4).
- Newburger, E. (2020, May 21). *More Dams will collapse as aging infrastructure can't keep up with climate change*. CNBC. <https://www.cnbc.com/2020/05/21/more-dams-will-collapse-as-aging-infrastructure-cant-keep-up-with-climate-change.html>
- North Carolina Rate Bureau. (2019, September 19). *North Carolina Residential Flood Proposal to the North Carolina Department of Insurance*.
- Oh, S., Sen, I. & Tenekedjieva, A. (last revised 2022, December 22). Pricing of climate risk insurance: Regulation and cross-subsidies. Available at SSRN: <https://ssrn.com/abstract=3762235> or <http://dx.doi.org/10.2139/ssrn.3762235>
- Scism, L., & Campo-Flores, A. (2022, December 15). Florida lawmakers approve property insurance overhaul, sending bill to DeSantis. *Wall Street Journal*. <https://www.wsj.com/articles/florida-lawmakers-approve-property-insurance-overhaul-sending-bill-to-desantis-11671048780>
- Solomon, S. & Qin, D. (2007). *Climate change 2007: The physical science basis. Contribution of working group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, UK and New York, New York.
- Snyder, T. (2022, June 17). *Biden's incredible shrinking infrastructure plan*. Politico. <https://www.politico.com/news/2022/06/17/democrats-shrinking-infrastructure-plan-00039588>
- Stone, J. (1973). A theory of capacity and the insurance of catastrophe risk (part II). *Journal of Risk and Insurance*, 40(3), 339-355.

- The Institutes (2020). Exploring Reinsurance. Myhr, A. (Ed.), *Connecting the Business of Insurance Operations* (1st ed.), 8.1-8.29). The Institutes, Malvern, Pennsylvania.
- Union of Concerned Scientists. (2018). *Climate Change, Extreme Precipitation, and Flooding: The Latest Science* (Publication).
- Watkins, N. & Evans, D. (2019, September 27). U.S. private flood insurance: The journey to build a new market. *Insurance Journal*. <https://www.insurancejournal.com/news/national/2019/09/27/541314.htm>
- Watkins, N. & Evans, D. (2020, August). *Private flood insurance survey*, Milliman Client Report commissioned by the State of Alabama.
- White, E. (2011). *Flood insurance - lessons from the private markets*. Roundtable on Flood Risk Management, GFDRR/The World Bank, Washington.
- Willis Re. (2020, September). *Reinsurance Market Report - Half Year 2020*. Willis Towers Watson.
- Zhang, W., Villarini, G., Vecchi, G., & Smith, J. (2018). Urbanization exacerbated the rainfall and flooding caused by hurricane Harvey in Houston. *Nature*, 563(7731),384-388.