INSURANCE & LIABILITY

Solving Congress's Samaritan's Dilemma

The National Flood Insurance Program may be the best realistic policy option.

BY PETER VAN DOREN

Who should pay for the damages caused by natural disaster? The American ethos has long called on personal responsibility and private charity, rather than broad public aid, to secure people's welfare. Though public emergency services play a vital role during and immediately after a catastrophe, this ethos looks to private insurance and aid from disaster-oriented organizations such as the Red Cross to be the main modes of recovery from a flood or storm, as well as prior care in siting and constructing buildings to blunt the effects of wind and rain.

Despite this, the U.S. government has often come to the financial assistance of Americans harmed by mass calamity. Even in the Founders' era, in 1803, Congress enacted a form of disaster relief by suspending for several years the bond payments owed by Portsmouth, N.H. merchants after a fire struck the seaport. (In keeping with the young nation's values, President Thomas Jefferson also anonymously donated $100—the equivalent of $2,400 today—for humanitarian aid to the city's residents.)

The impulse for government-provided disaster assistance is understandable. But public aid crowds out private relief and dampens incentives for private insurance and damage prevention. On the international level, economists Paul Raschky and Manijeh Schwindt of Australia's Monash University tested for this effect using data from 5,089 natural disasters in 81 developing countries over the period 1979–2012. They found that "past foreign aid flows crowd out the recipients' incentives to provide protective measures that decrease the likelihood and the societal impact of a disaster."

Policymakers thus face what Nobel economics laureate James M. Buchanan called the Samaritan's dilemma: the choice to either render aid after a catastrophe or else, seemingly heartlessly, withhold aid to incentivize people in calamity-prone areas to purchase disaster insurance, take preemptive private and local public measures to reduce losses, and build robust private charity systems for when catastrophe strikes. To achieve the latter, elected policymakers must effectively "precommit" to not render financial aid, warding against the temptation to be "time inconsistent" and backtrack when the public sees heart-rending images of disaster victims.

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THE NATIONAL FLOOD INSURANCE PROGRAM

Congress created the National Flood Insurance Program (NFIP) in 1968 to escape the Samaritan's dilemma in a politically palat-

able way. In prior decades, lawmakers had routinely handed out ad hoc aid to flood and storm victims. The NFIP was intended to reduce such aid and protect federal taxpayers while providing prospective flood victims a way to financially protect against loss.

The NFIP is a government program, but lawmakers wanted it to charge most insureds roughly "actuarially fair" premiums. Though buildings constructed prior to the legislation would qualify for discounted rates (and thus receive public subsidy), owners of subsequently built structures who purchased coverage would de facto "prepay" the cost of restoring their properties following catastrophe. The program also requires that, for buildings in high-risk areas to qualify for coverage, those areas must be zoned to limit construction and their building codes must include provisions to make new structures better able to withstand floodwaters, e.g., by requiring their main levels to be elevated above typical floodwaters.

Except for the "grandfathered" preexisting structures, lawmakers intended for the NFIP to be largely subsidy-free, protecting

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taxpayers. According to University of Florida law professor Christine A. Klein, Congress expected that the number of grandfathered structures would approach zero after 25 years. And indeed, the percentage of subsidized policies has decreased over time, but now—after more than a half-century of the NFIP—they have not disappeared. And in the past decade, Congress has partly retreated from the commitment to end the subsidies.

So, what should be done about flood disaster policy going forward? Though private flood insurance has entered the market in the last few years, there are questions whether it will persist over the long term. And elected policymakers are unlikely to ignore the plight of large groups of people whose homes are struck by floodwaters. Yet, a return to the ad hoc aid of the mid-20th century is undesirable. So, though flawed, the NFIP likely is the best policy response that is politically attainable. That said, the program can be improved, and the most important step Congress can take is to return to the original intention that it charge unsubsidized, actuarially fair rates for covered structures.

PRE-NFIP FEDERAL DISASTER POLICY

Between 1803 and 1947, Congress enacted at least 128 specific legislative acts offering ad hoc relief after various disasters. But some catastrophes were followed by no federal response. For example, in 1887 President Grover Cleveland vetoed relief for Texas farmers struck by that year's devastating drought.

Until the 1960s, federal disaster policy mostly focused on engineering solutions rather than relief. For instance, in 1879 Congress created the Mississippi River Commission to coordinate *private* levee projects to avoid the problem of one area "solving" its flooding problems by building levees to divert the waters to other areas. But Midwest businessmen lobbied for a sustained federal financial commitment to manage Mississippi floods. Congress authorized a round of flood control spending as part of the Mississippi River Commission's work in 1917 and again six years later, but local funding was still required to cover one-third of the works' costs.

The Great Mississippi Flood of 1927, which inundated some 16.5 million acres and killed several hundred people, resulted in permanent federal responsibility for controlling flooding along the river under the Flood Control Act of 1928. That responsibility expanded to the entire country in the Flood Control Act of 1936. This aid was overwhelmingly directed to building flood control projects.

This began to change with the Disaster Relief Act of 1950 (now known as the Stafford Act), which assumed federal responsibility for the repair and restoration of local public infrastructure after disasters. Overall, federal responsibility for disaster recovery spending began to grow. From 1955 through the early 1970s, federal disaster relief expenditures increased from 6.2% of total damages after Hurricane Diane in 1955 to 48.3% after Tropical Storm Agnes in 1972.

Where was private flood insurance? / In many calamities, private insurance provides relief following a loss: auto insurance covers those harmed in a car crash, and homeowner's insurance covers losses in a housefire or burglary, for instance.

At various times in American history, private insurers have offered flood coverage. But the magnitude of losses from major floods frequently pushed those insurers into bankruptcy. Until very recently no reputable insurer had offered flood insurance since the 1927 Great Mississippi Flood. As Wharton School economist Howard Kunreuther et al. explain in a 2019 paper:

> In 1897, an insurance company offered flood insurance to property along the Mississippi and Missouri Rivers motivated by the extensive flooding of these two rivers in 1895 and 1896. Two floods in 1899 not only caused the insurer to become insolvent since losses were greater than the insurer's premiums and net worth, but the second flood washed the office away. No insurer offered flood coverage again until the 1920s, when thirty fire insurance companies offered coverage and were praised by insurance magazines for placing flood insurance on a sound basis. Yet, following the great Mississippi flood of 1927 and flooding the following year, one insurance magazine wrote: "Losses piled up to a staggering total.... By the end of 1928, every responsible company had discontinued coverage."

Can private flood insurance be economically viable? Much scholarly discussion on this question has been vague rather than definitive: "The experience of private capital with flood insurance has been decidedly unhappy," wrote William Hoyt and Walter Langbein in their 1955 book *Floods*. "From the late 1920s until today, flood insurance has not been considered profitable," noted the Congressional Research Service (CRS) in a 2005 report. Kunreuther et al. quote a commenter in a May 1952 industry publication offering this blunt assessment:

> Because of the virtual certainty of the loss, its catastrophic nature, and the impossibility of making this line of insurance self-supporting due to the refusal of the public to purchase insurance at rates which would have to be charged to pay annual losses, companies could not prudently engage in this field of underwriting.

GOVERNMENT INSURANCE

With no private flood insurance available to property owners, Congress in the mid-20th century took on an increasing role in providing disaster relief. But lawmakers realized that they were placing a growing burden on taxpayers.

In 1965, Congress appropriated relief funds for that year's flood losses on the upper Mississippi as well as Hurricane Betsy and other storms that devastated the South in 1963 and 1964. The legislation included a provision directing the Department of Housing and Urban Development to study whether a federal flood insurance program would be a desirable alternative to ad hoc disaster relief. The resulting 1966 report recommended such a program, adding that any federal premium subsidies should be limited to existing structures in high-risk areas, while new construction should be charged actuarially fair rates.

Congress enacted the National Flood Insurance Act in 1968, incorporating most of the HUD study's recommendations. Though structures erected prior to full implementation of the program qualified for subsidized premiums, all other covered structures ideally were to pay full actuarial rates. Flood-prone areas that are eligible for NFIP coverage are designated on Flood Insurance Rate Maps (FIRMs) that were drawn and are periodically updated under the legislation. According to a 2015 National Research Council (NRC) report, "The expectation was that, over time, the properties receiving pre-FIRM subsidized premiums would eventually be lost to floods and storms and pre-FIRM subsidized premiums would disappear through attrition."

But details of the 1968 legislation mean that even "unsubsidized" NFIP premiums do not fully cover the costs of catastrophes striking those properties. For instance, the NRC report explains, "The legislation stipulated that the US Treasury would be prepared to serve as the reinsurer and would pay claims attributed to catastrophic-loss events." A reinsurer is, in essence, an insurer for the insurer, so federal taxpayers ultimately backstop the NFIP in the event of severe losses. As a result, even post-FIRM buildings receive some degree of subsidy.

Land-use controls / Actuarially fair rates were only one way the NFIP was supposed to reduce taxpayer exposure to losses. The statute also includes the aforementioned zoning requirements to limit construction in flood-prone areas and building code requirements intended to make structures built in those areas less vulnerable to flood damage.

Under the 1968 law, federal flood insurance is available only in communities that agree to land-use controls that limit construction in a high-risk area—a so-called "100-year floodplain." Known officially as a Special Flood Hazard Area (SFHA), these zones are defined as having an annual flooding probability of 1% (which actually yields a cumulative probability of flooding over 100 years of 63.4%). Structures in communities that have not adopted these zoning controls cannot receive mortgages sponsored by or sold to any federal agency, including Fannie Mae, Freddie Mac, the Federal Housing Administration, and the Veterans Administration. Explains Klein:

> Such regulation would constrict the development of land which is exposed to flood damage and minimize damage caused by flood losses. Second, regulation would guide the development of proposed future construction, where practicable, away from locations which are threatened by flood hazards.

Though Congress intended for construction to retreat from the floodplains, NFIP rules have always allowed new construction in the zones *provided that* the structure's first floor is elevated above the high-water level predicted to occur with 1% annual probability, the so-called Base Flood Elevation (BFE). The 1968 statute also requires elevation for pre-FIRM properties that subsequently are "substantially damaged or substantially improved, which triggers a requirement to rebuild to current construction and building code standards," according to the 2005 CRS report. From the beginning of the program, federal regulation has defined "substantially damaged and substantially improved" as repairs or alterations that equal or exceed 50% of the market value of the structure before damage or renovation occurred. So, despite the initial intent of the 1968 legislation to abandon structures and

development in floodplains, the rules quickly allowed rebuilding—with elevation and engineering improvements.

Making NFIP subsidies disappear? / The inclusion of these land-use and building-code provisions *in addition to* true actuarial pricing has been justified historically as lawmakers attempting to curtail "moral hazard," the propensity to take on additional risk when one is shielded from the full cost of that risk. But this justification does not make sense for two reasons.

First, if homeowners pay higher premiums that adequately cover the risk presented by their vulnerable, non-flood-proofed homes, there is no moral hazard, strictly speaking. The higher premiums incentivize structure owners to elevate their buildings if the cost of doing so plus the present value of the lower premiums associated with elevation is less than the present value of the premiums for un-elevated structures. Also, regardless of whether a structure owner elevates, if the premiums for pre-FIRM structures were not subsidized, the government and taxpayers should be indifferent to paying claims for repetitive losses.

Second, moral hazard is an increase in the incidence of damages (by those who are insured) relative to the incidence used by insurance companies to calculate the rates because of *unobserved behavior* on the part of insureds. But it is easy to observe whether a structure's first floor and important utilities have been elevated above the BFE when assigning it to an actuarially fair rate class. Thus, though "moral hazard" is offered as a market-failure rationale for employing land-use and building-code controls in addition to actuarial prices, the term apparently is being used in a casual rather than rigorous fashion.

The more likely reason for these requirements is to further protect lawmakers from the Samaritan's dilemma. Members of Congress and the executive branch appreciate the political forces associated with disaster relief. Given constituents' desire for government-provided aid, the land-use and building-code requirements can be seen as a commitment device to eliminate, over time, the subsidies for the grandfathered pre-FIRM structures. Eventually, all pre-FIRM structures would be abandoned or rebuilt in such a way that they would not be subject to flooding losses.

And overall, this bit of political engineering appears to have been successful. The percentage of NFIP-covered structures receiving pre-FIRM subsidies fell dramatically over the first five decades of the program. Some 75% of covered properties received the subsidy in 1978, but only about 28% did in 2004 and only 13% in September 2018.

It should be noted that the elevation requirement does not appear to be rigorously enforced. A 2020 *New York Times* investigation revealed there are 112,480 NFIP-covered structures nationwide with first floors below BFE paying premiums that are not reflective of that risk. The owners of these properties filed 29,639 flood insurance claims between 2009 and 2018, resulting in payouts of more than $1 billion, an average of $34,940 per claim.

The NFIP also contains cross subsidies between different groups of insureds. One example of this has to do with the type of flooding to which a property is vulnerable. Within the 100-year floodplain, land is divided into two categories: one for coastal areas subject to tidal flooding ("V" zones) and thus that are especially high-risk and should pay higher rates, and the other for non-tidal flooding ("A" zones). A property that is initially mapped in zone A and is built to the proper building code and standards, and then later is remapped to higher-risk zone V, is entitled to continue paying zone-A premiums if the property has maintained continuous NFIP coverage. That subsidy is financed by other NFIP participants, who pay premiums above actuarially fair levels.

Another cross subsidy involves the remapping of BFE levels. If an updated FIRM indicates that an elevated property now faces a higher risk of flooding—say, a property that was initially mapped as being 4 feet above BFE but is reappraised as being just 1 foot above BFE—the property owner can continue to pay the previous, lower-risk premium. As of September 2018, about 9% of NFIP policies received cross subsidies from one of those two forms of grandfathering.

Step forward, step back / In 2012, lawmakers took a big step toward curtailing NFIP subsidies by enacting the Biggert–Waters Flood Reform Act. Under the legislation, premiums for non-primary residences, severe repetitive loss properties, and business properties (about 5% of policies) were to increase 25% per year until they reflected the Federal Emergency Management Agency's best estimate of their flood risk. Pre-FIRM single-family homes had to have elevation certificates indicating BFE levels to ensure proper pricing because rates vary with the elevation of the structure above BFE. Grandfathering of structures from zone and elevation reclassification was to be phased out through premium increases of 20% per year until the actuarial fair prices were reached. Finally, the sale of any grandfathered properties would subject the new owner to actuarially fair rates for coverage.

But after Hurricane Sandy hit politically important New Jersey and New York later in 2012 and FEMA subsequently released new flood maps indicating increased risk, thousands of homeowners were faced with large premium increases. Congress retreated from the Biggert–Waters reforms when it enacted the 2014 Homeowners Flood Insurance Affordability Act (HFIAA). The NFIP's original grandfathering provisions were reinstated. The assessing of actuarial fair rates upon sale of a property was repealed. And most properties newly mapped into a 100-year floodplain after April 1, 2015, receive subsidized premiums for one year, though they then increase 15% per year until they are actuarially fair. As of September 2018, about 4% of NFIP policies receive this last form of subsidy.

How much do the NFIP subsidies reduce premiums? In 2011, FEMA estimated that policyholders with discounted premiums were paying roughly 40%–45% of the full-risk price. Later in the decade, matters had improved somewhat, but FEMA estimated "that the receipts available to pay claims represent 60% of expected claims on the discounted policies," according to a 2017 Congressional Budget Office report.

THE PROBLEMS FACED BY PRIVATE FLOOD INSURANCE

Private insurance is a contract between risk-averse individuals and insurers in which the insurer assesses a risk-based premium of its insureds and then covers the cost of their losses in a catastrophe.

Insurers calculate their premiums using *population-level* data on the incidence of damages. Roughly speaking, if individuals with the same probability of damages randomly purchase insurance, insurers can charge each of them the average damage cost and in return protect them from high losses. Insured individuals whose actual damages are below the average will, in essence, "pay for" the damages incurred by those above the average.

Insurance "works" only if potential insureds have no knowledge about their likely future damages relative to the average. Insureds would be willing to pay for such coverage, even if the premium is the average amount of loss, because they would prefer the certainty of that payment over the risk of a much higher loss from disaster.

However, floods have characteristics that require insurance companies to charge more than the average damages. Those higher premiums limit consumer demand for private, unsubsidized insurance. As explained in a 2012 article by the Wharton School's Carolyn Kousky and Resources for the Future's Roger Cooke, three characteristics subject flood insurers to risk of insolvency even if they get their actuarial work right *and* they assemble a large pool of equally risky insureds: dependence among events, fat-tailed frequency distributions, and tail dependence.

Dependence / Flood risk tends to be spatially correlated, meaning that when a disaster hits a region, many structures are affected simultaneously. Insurers can dampen this risk by increasing the spatial distance between policies. Ideally, insurers could space out their policies far enough that the correlation is zero. In that case, the actuarially fair price for coverage would be the sample average loss of a spatially diverse set of policies because the probability of damages from any policy would be random (independent) within the population of insurance policies.

But such diversification is hard to achieve because flooding risk is largely confined to specific geographic areas. If there is even a small positive correlation among policies, it significantly increases the risk of loss faced by the insurer. Claims tend to occur in "clumps" drawn from the population of policies. To ward against insurer insolvency from clumped claims, premiums would have to be much greater than the average loss, depending on how large the correlation is among claims.

Kousky and Cooke use annual flood claim data from flood-prone Broward County, FL to demonstrate this risk and its effect on flood insurance pricing. If an insurer had 100 policies with Broward County characteristics (which are roughly distributed log-normal) and claims were independent, the insurer would have to charge 1.51 times the average claim to stay solvent with 99% probability. Demonstrating the benefits of more predictable results from holding a larger portfolio of policies, if the insurer had 200 policies, it would only have to charge 1.34 times the average.

However, at the county level, *there is dependence* in flood claims in the United States. Claims exhibit a correlation of 0.04, a small, positive correlation. Introducing that level of dependence into Kousky and Cooke's simulation requires premiums 2.17 times the average loss for the insurer to remain solvent with 99% probability if it holds 100 policies and 2.10 times the average loss if it holds 200 policies.

Such high premiums do not necessarily make flood insurance an impossibility, but it would require many risk-averse property owners who are willing to pay these expensive premiums.

Fat tails / If events are normally distributed, the probability of an extreme result becomes less likely quickly; hence, the thin edges of a normal distribution "bell curve." But if events are "fat-tailed," meaning the edges are thicker, then extreme results are more likely. According to Kousky and Cooke, "Many natural catastrophes, from earthquakes to wildfires, have been shown to be fat-tailed."

They incorporated fat tails into their simulation—specifically, "a fat-tailed Pareto distribution with mean 1 and a tail index of 2, indicative of infinite variance—a very fat tail." The required premiums to ensure 99% insurer solvency had to be 1.77 times average losses for 100 county policies and 1.49 for 200 policies if claims were independent. The authors then also assumed dependence using the 0.04 correlation found in U.S. county-level data and found that premiums needed to be 2.45 times average losses for 100 policies and 2.31 times average losses for 200 policies to ensure 99% probability of insurer solvency.

Tail dependence / Tail dependence means that "clumps" of claims are more likely to occur simultaneously (rather than randomly) on the right, high-cost side of the frequency distribution of claims. According to Kousky and Cooke:

> Tail dependence refers to the probability that one variable exceeds a certain percentile, given that another has also exceeded that percentile. More simply, it means bad things are more likely to happen together. This has been observed for lines of insurance covering over 700 storm events in France. Different types of damages can also be tail dependent, such as wind and water damage, or earthquake and fire damage.

Kousky and Cooke incorporated tail dependence in their simulation. They found that premiums would need to be 3.7 times higher than the average claim, regardless of whether the insurer holds 100 or 200 policies in the county, to ensure 99% insurer solvency for log-normal Broward County claims data.

The real problems came when Kousky and Cooke incorporated all three of these characteristics (dependence, a fat-tailed Pareto distribution with mean 1 and a tail index of 2, and tail dependence) into their simulation. They found that to ensure 99% probability of insurer solvency, premiums had to be 4.43 times average losses for 100 policies and *8.69 times average losses*

for 200 policies. That is, the larger an insurer's portfolio of covered properties, the *higher* it had to set its individual premiums to ward against insolvency.

The implication of this analysis is not that private insurance is impossible, but that the premiums required for 99% probability of insurer solvency are far above the amount of the average claim, even if the insurer has correctly ascertained the risk posed by its insureds. If claims are dependent rather than independent, then the reduction in premiums arising from portfolio diversification is reduced. And fat-tail dependence, if it exists in the form Kousky and Cooke assume, places severe constraints on private and even public insurance. The more policies that are written, the *greater* the required premiums must be relative to the average claim if the insurer is to have enough assets to stay solvent with 99% probability. Few property owners are likely to purchase such costly coverage.

HOW CAN PRIVATE FLOOD INSURANCE EXIST?

Despite Kousky and Cooke's theoretical work, private flood insurance does exist in practice. The 2012 Biggert–Waters Act directed FEMA to allow private insurance coverage that was equivalent to NFIP coverage to qualify as complying with the requirement that homes have flood insurance if they are in flood zones and have federally sponsored mortgages. The agency took seven years, until July 2019, to write the regulations implementing the statute. Under pressure from Congress, FEMA also removed language from contracts with the private insurers that wrote federal NFIP policies that prohibited them from offering other flood-insurance products.

Arbitraging NFIP's cross subsidies / One reason that private insurers are interested in offering flood insurance is the cross subsidies within the federal program. Originally, the subsidies for pre-FIRM structures were to come from taxpayers explicitly through appropriations, but that system was abandoned and replaced with cross subsidies from new insured structures to old—that is, post-FIRM structure owners paid a de facto "tax" as part of their premiums to subsidize coverage of pre-FIRM structures. And, as described earlier, some newer structures that undergo A-to-V zone or BFE-level transitions are also cross subsidized at the expense of other NFIP insureds.

Private insurance allows those who would be overcharged in the federal program to escape from paying this "tax." A 2019 CRS report modeling exercise that examined premiums for single-family homes in Louisiana, Florida, and Texas suggested that 77% of single-family homes in Florida, 69% in Louisiana, and 92% in Texas would pay less with a private policy than with the NFIP. However, 14% in Florida, 21% in Louisiana, and 5% in Texas would pay over twice as much.

Cross subsidies work only if entry is restricted, forcing people to pay the "tax." The most famous U.S. example of this is telephone cross subsidies from long distance to local service back in the days of the AT&T monopoly. Long-distance rates were set far above cost to keep local calling prices below cost. The entry of MCI into long-distance service allowed callers to escape this tax, ultimately yielding the breakup of AT&T and the end of the cross subsidy. The decision by Congress to expose federal flood insurance to private alternatives likewise reveals and eventually should eliminate NFIP cross subsidies.

FEMA has responded to private flood insurance with proposed revisions to its premium schedule to price the risk of its individual policies more accurately. Currently, NFIP rates are not finely tuned, meaning they only roughly reflect the risk posed by a particular property. They vary only by zone (A or V) within the SFHA and with structure elevation above the BFE.

As the CRS explains in a 2021 report:

> For example, two properties that are rated as the same NFIP risk (e.g., both are one-story, single-family dwellings with no basement, in the same flood zone, and elevated the same number of feet above the BFE), are charged the same rate per $100 of insurance, although they may be located in different states with differing flood histories or rest on different topography, such as a shallow floodplain as opposed to a steep river valley. In addition, two properties in the same flood zone are charged the same rate, regardless of their location within the zone.

In contrast, "NFIP premiums calculated under [proposed risk assessment formula] Risk Rating 2.0 will reflect an individual property's flood risk" using historical flood data as well as commercial catastrophe models.

The political system has resisted FEMA's attempts to rationalize the rate structure. The new rates were supposed to take effect in October 2020, but the Trump administration delayed them to 2021 (after the 2020 presidential election). With Donald Trump no longer president, Senate Majority Leader Chuck Schumer (D–NY) is now the chief impediment for the new rates because of their implications for his constituents on Long Island, where some rates could increase by 500% over time. This is allowing private insurers to "cherry pick" NFIP insureds, offering lower rates to those property owners who are cross subsidizing the riskier properties. Over time, this competition will eliminate the cross subsidizing of some NFIP insureds, resulting in higher prices for Schumer's constituents on Long Island and other properties. Given the politics of disaster relief, this will likely result in explicit subsidies from taxpayers to the owners of flood-damaged waterfront properties, probably in the form of bailouts following large disasters—in essence, a return to pre-1968 policy.

So, some proportion of private retail flood insurance in the United States is the result of cross subsidies within the current FEMA system. Once those subsidies are eliminated by private competition, FEMA policies allegedly will consist only of explicitly subsidized policies, which will be of no interest to private insurers, and the more-or-less actuarily fair policies that private insurers presumably could take over.

But cross subsidies do not explain the existence of private flood *reinsurance*, the private insurance that insurers purchase for themselves to ward against large losses. Private flood reinsurance not only exists, but FEMA itself purchases it. Since 2017, the agency has purchased reinsurance for claims that total between $4 billion and $10 billion per year, with taxpayers then acting as the reinsurers for even higher losses.

The existence of private flood reinsurance suggests that those insurers are not concerned about Kousky and Cooke's worst-case scenario of a fat-tailed Pareto distribution with tail dependence for flooding. If those insurers are wrong, then the cross-country and over-time diversification they are pursuing through reinsurance will ultimately have much the same result as the fire insurers' attempt to cover flooding along the Mississippi in the 1920s.

CONCLUSION

Federal flood insurance arose as a policy device with two purposes: to reduce the use of post-disaster congressional appropriations for disaster relief and to impose the cost of rebuilding on the owners through premiums. This has been partially successful. The percentage of pre-FIRM structures receiving subsidized coverage has fallen from 75% in 1978 to 13% in 2018.

But some degree of taxpayer subsidy remains and has grown recently. After Hurricane Sandy and subsequent FEMA flood map updating, Congress protected owners from rate increases by grandfathering structures so that they pay below-actuarially-fair rates in relation to the specifics of their flood zones and the degree they are elevated above the floodplain. Moreover, enforcement of the elevation requirement is spotty at best.

The appearance in recent years of private flood insurance may seem to be a hopeful sign that federal flood policy is moving toward something more consistent with the nation's ethos. However, these insurers' entry appears to be the product of cross subsidies within the federal program, not an overall move to replace government protection with private coverage. Once the overcharged properties have largely moved out of the NFIP to private coverage, the remaining policies will likely be explicitly subsidized—either with direct aid following a disaster or with government subsidies to purchase private insurance. It is unclear how that would be better than the current system.

The existence of private flood reinsurance suggests that claims about the impossibility of private provision are incorrect. But even if that's true, there is still the question of whether property owners who currently receive cross subsidies for their waterfront properties are willing to pay actuarially fair rates, and what happens if they do not and then are struck by floodwaters.

The NFIP raises other important policy questions. Is the 50% "substantially damaged and substantially improved" trigger the right threshold to require property owners to elevate their buildings above BFE? What should be done about the poor enforcement of the BFE requirement?

There is also the question of what—if anything—to do about structures that predate federal flood insurance, do not have mortgages, and do not purchase federal flood insurance. Ideally, these structures should present no policy problems at all: their owners are neither asking for nor receiving subsidy and are bearing the cost of their risk-taking; moreover, the emergence of a private flood insurance market may provide them products that they do find attractive. If neither they nor policymakers are time-inconsistent on this arrangement, these property owners should be allowed to continue to choose and bear flood risks. But even they receive indirect subsidy through federal grants to repair local infrastructure following disasters.

In short, the NFIP was an important decision by Congress to move away from providing ad hoc disaster aid to flood victims at taxpayer expense. But lawmakers' commitment to a subsidy-free system has been imperfect from the beginning, and they have backslid further from that in recent years. The NFIP needs to reembrace the goal of insureds paying actuarially fair premiums. Hopefully, the recent appearance of private flood insurers will help with this and not merely cherry-pick cross subsidies in the current system. More hopefully, these private insurers will not suffer the financial wipeout that felled their predecessors a century ago. *R*

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