Improving the financial resilience of public entities and individuals for natural disasters

A resource guide for state and local government

Noreen Clancy, Lloyd Dixon, Jessica Welburn Paige, Sam Morales, Brian Wong, Andrew M. Parker, Katherine Grace Carman
About This Report

Individuals and state and local governments (hereafter referred to as public entities) incur losses associated with natural disasters. For individuals, there are costs associated with evacuating, possible periods of unemployment, and costs associated with physical damage caused by the event, many of which are uninsured losses. Similarly, public entities incur damage to public buildings and public utilities and tax base losses associated with reduced economic activity. Although an entire community experiences a natural disaster, low-income communities and communities of color are disproportionately vulnerable to the risks of natural hazards and encounter the most difficulty in recovering from disasters.

The U.S. federal government provides funds for disaster response and recovery for both individuals and public entities. However, federal assistance is limited, and financial gaps remain. This report does not make policy recommendations but rather is a resource meant to document programs and products that some communities have adopted to help improve individual and community financial resilience. Many of these products are available from the private sector, and others are programs developed by public entities or nongovernmental organizations. Improving the financial resilience of public entities and individuals after a natural disaster strengthens and speeds up a community’s ability to rebound.

This research was sponsored by the Under Secretary of Homeland Security for Science and Technology under contract number HSHQDC-16-D-00007 and conducted in the Infrastructure, Immigration, and Security Operations Program of the RAND Homeland Security Research Division (HSRD), which operates the Homeland Security Operational Analysis Center (HSOAC).

About the Homeland Security Operational Analysis Center

The Homeland Security Act of 2002 (Public Law 107-296, § 305, as codified at 6 U.S.C. § 185) authorizes the Secretary of Homeland Security, acting through the Under Secretary for Science and Technology, to establish one or more federally funded research and development centers (FFRDCs) to provide independent analysis of homeland security issues. The RAND Corporation operates HSOAC as an FFRDC for the U.S. Department of Homeland Security (DHS) under contract HSHQDC-16-D-00007.

The HSOAC FFRDC provides the government with independent and objective analyses and advice in core areas important to the department in support of policy development, decisionmaking, alternative approaches, and new ideas on issues of significance. The HSOAC FFRDC also works with and supports other federal, state, local, tribal, and public- and private-sector organizations that make up the homeland security enterprise. The HSOAC FFRDC’s research is undertaken by mutual consent with DHS and is organized as a set of discrete tasks. This report presents the results of research and analysis conducted under task order 70RSAT21FR0000148, Community and Individual Disaster Assistance.

The results presented in this report do not necessarily reflect official DHS opinion or policy.

For more information on HSRD, see www.rand.org/hsrd.

For more information on this publication, see www.rand.org/t/RRA1770-3.

Acknowledgments

The authors appreciate the support of David Alexander, senior science advisor for resilience within the Science and Technology Directorate of DHS. We are also grateful for the insights provided by Katie Sabo, managing director of public sector partnerships, Aon Insurance Brokers. We are thankful to our colleague Carolyn Kousky of the Environmental Defense Fund for early contributions to this study. This report benefited by the astute comments provided by our peer reviewers: Lisa Abraham, economist, RAND Corporation, and Cassandra Davis, assistant professor, University of North Carolina at Chapel Hill.
Private-sector insurers, public entities, or NGOs can improve financial resilience of individuals and communities.
Summary

Individuals and public entities incur losses associated with natural disasters. The federal government provides funds for disaster response and recovery for both individuals and public entities. However, federal assistance is limited, and financial gaps remain. This report is meant to be a resource, cataloging programs and products that have been used or proposed by private-sector insurers, public entities, or non-governmental organizations (NGOs) to improve financial resilience of individuals and communities. The flexibility of these funds mean they have the potential to be specifically used to bridge the gaps low-wealth communities and communities of color experience following natural disasters. This report does not make policy recommendations but rather is an attempt to document programs and products that other communities might look to emulate in an attempt to bolster their own financial resilience.

1 This report does not detail the labor market aspects of natural disasters.
Key findings include

Natural disasters in the United States have grown more costly and more frequent and are having a significant financial impact on U.S. households. Although an entire community experiences a natural disaster, persistent racial and economic inequality can mean that low-income communities and communities of color are disproportionately vulnerable to the risks of natural hazards and encounter the most difficulty in recovering from disasters.

Three key factors contribute to economic vulnerability for vulnerable groups in the United States: housing costs, limited ability to cover unexpected expenses, and location and mobility challenges.

Although private insurance and federal assistance benefits provide help after a disaster, households still face gaps in coverage, and local governments also experience significant financial burdens after a disaster.

The private sector offers parametric insurance products to public entities to fill budget gaps created by disasters. Parametric insurance products are a nontraditional insurance product that provide specified payouts based on a “trigger” event, such as winds over a certain speed. Several public entities have purchased these products.

The private sector has also developed several parametric insurance products for individuals. Maximum payouts vary across the programs and range from several thousand to $30,000.

Several state governments have created catastrophe savings accounts, which are tax-advantaged savings accounts that can be used to provide quick cash and cover out-of-pocket expenses after a disaster.

Community-based insurance models have been proposed that spell out various roles a local government or special-purpose district might play in arranging coverage for individual properties in the community.

Charities and NGOs have developed innovative approaches for distributing assistance, including blockchain mechanisms for direct cash payments and forecast-based financing. Blockchain solutions do not require a recipient to have a bank account, and forecast-based financing enables access to humanitarian funding for early action to prepare for disasters based on in-depth forecast information and risk analysis.
# Contents

About This Report .................................................................................................................................. iii

Summary ................................................................................................................................................ v

Introduction ............................................................................................................................................. 1

Part I: Financial Impact of Disasters on Individuals and State and Local Government ................. 7
   Some Groups Are More Vulnerable to the Impact of Disasters .......................................................... 7
   Disaster Response Efforts Help Individuals and Households but Leave Gaps ..................................... 10
   Disasters Fiscally Burden Local Governments ....................................................................................... 11

Part II: Innovative Products and Programs Aimed at Improving Financial Resilience ............... 15
   Products Offered by the Private Sector ................................................................................................. 15
   Public-Sector Programs .......................................................................................................................... 26
   Charity- and Non–Governmental Organizations–Supported Efforts .................................................... 29

Abbreviations .......................................................................................................................................... 32

References .............................................................................................................................................. 33

---

## Tables

Table 1. Public Sector Insurance for Natural Disasters .......................................................................... 17
Table 2. Insurance Rates and Premium for Coverage Amount Offered by New Paradigm Underwriters to the City of Miami Beach .......................................................................................... 19
Table 3. Events Determining Miami Beach's Parametric Policy ............................................................... 19
Table 4. Relative Payouts and Corresponding Wind Speed Intervals for Miami Beach's Parametric Policy ........................................................................................................................................ 20
Table 5. Hurricane Intensity and Corresponding Payouts for Miami Beach's Parametric Policy ......... 20
Table 6. Recovery Rates and Wildfire Index Values for Los Angeles Department of Water and Power Wildfire Parametric Catastrophe Bond .............................................................................. 21
Table 7. Private-Sector Products Targeted at Individuals in the United States .................................. 23
Table 8. Contribution Limits for Catastrophe Savings Accounts .......................................................... 27
Introduction

In recent years, natural disasters in the United States have grown more costly and more frequent, and they are disrupting the lives of and having a financial impact on more people every year. The increase in the frequency and severity of natural disasters is due in part to climate change and to the growing number of people and assets in areas exposed to natural hazards (Hayhoe et al., 2018). Communities in the western and southwestern United States are increasingly burdened by wildfires and drought. Coastal towns across the eastern and Gulf coasts are experiencing more-frequent storm surges and high winds. Communities in southeastern states are experiencing an increase in tornadoes and riverine flooding, while those in the Midwest and East are subject to frequent riverine flooding, daily nuisance flooding, and winter storms. Authors of an analysis of Federal Emergency Management Agency (FEMA) data found that in 2021, 40 percent of Americans lived in a county affected by extreme weather (Kaplan and Tran, 2022).

Besides the personal hardship caused by these disasters, the financial impact is significant, in that the United States is experiencing a record number of natural disasters that result in more than a billion dollars in damage each. For example, from 1980 to 2021, the United States experienced an annual average of 7.7 natural disasters that caused more than a billion dollars in damage, with an average cost of $52.4 billion per event (Consumer Price Index [CPI] adjusted). However, from 2017 to 2021, the United States experienced 17.8 billion-dollar disasters on average per year, with an average cost of $152.9 billion per event (CPI adjusted) (National Oceanic and Atmospheric Administration [NOAA], 2022). Examples of such disasters include recent events, such as Hurricane Ian in 2022, which displaced thousands of residents and resulted in 109 deaths (Florida Department of Law Enforcement, 2022), leading to an estimated $31 billion to $53 billion in insured losses and $10 billion to $17 billion in uninsured losses (CoreLogic, 2022).

Natural disasters can have other financial consequences. The possibility of a disaster often requires households to spend money preparing for a storm or other disastrous event, such as by stocking up on supplies, hardening property to withstand a storm, or preparing for an evacuation (e.g., filling the car with gas or paying for hotel rooms). In one study, authors estimated that the average household costs associated with evacuation during Hurricane Harvey were $1,200 (Bierling et al., 2020). Natural disasters can also result in income
Although an entire community experiences a natural disaster, the effects and costs are not distributed evenly. Low-income communities and communities of color are disproportionately susceptible to the risks of natural hazards and encounter the most difficulty in recovering from disasters.
or job loss (whether temporary or permanent), which hits at the very time cash is needed to cover disaster-related expenses.

Although an entire community experiences a natural disaster, the effects and costs are not distributed evenly. Low-income communities and communities of color are disproportionately more susceptible to the risks of natural hazards and encounter the most difficulty in recovering from disasters (Klein, 2007; McKernan et al., 2016; Nelson et al., 2022; Ratnadiwakara and Venugopal, 2020; Smiley et al., 2022).

There are several products and programs that can help households manage the financial consequences of a disaster. Chief among these is private insurance, which can provide a household with a reliable infusion of funds after a disaster to cover the cost of repairs and related costs, such as temporary housing, without needing to dip into savings or take on debt. Insurance also typically provides greater and more-timely assistance than federal disaster aid (Kousky et al., 2018; Kousky, 2019).

However, standard homeowners insurance policies exclude damage from certain types of natural disasters, primarily floods and earthquakes. Private insurers have historically excluded these perils because they are difficult to model and, when they do occur, the losses are often geographically concentrated and catastrophic (Brown and Franzel, 2009). People with insurance also often have other disaster-related expenses, such as deductibles that need to be paid before the insurance will reimburse costs. Furthermore, insurance typically will not compensate all losses incurred. In addition, low-income individuals and households are less likely to be property owners and to have insurance. About half of renters carry renters insurance (Insurance Information Institute, 2020) but only a fraction of renters have coverage for flooding, leaving many personal losses uninsured.

Other sources of financial support include the federal government, nonprofits, and individual savings. However, emergency financial assistance from FEMA could be limited based on eligibility requirements; federal assistance for property-related damage often takes many months or even years to reach those who have experienced the disaster, and the assistance often arrives after decisions about what and how to repair have already been made (Cackley, 2022). Financial assistance might also be available from charities but is unlikely to cover the full cost of a disaster. Financial professionals recommend that individuals have three to six months’ worth of living expenses in emergency cash reserves, such as in a savings account or money market account. Research suggests that a low-income household with even one month of savings can avoid significant financial hardship after it experiences a financial shock (Sabat and Gallagher, 2019). Authors of a recent report from the Consumer Financial Protection Bureau estimated that “24 percent of consumers have no savings set aside for emergencies, while 39 percent have less than a month of income
What can be done, then, to help U.S. households, especially low-income households, absorb the financial impact of a disaster and build financial resilience to mitigate the impact of future disasters?

Part I of this report examines the fiscal burden posed by disasters, especially on certain disadvantaged groups.

What can be done, then, to help U.S. households, especially low-income households, absorb the financial impact of a disaster and build financial resilience to mitigate the impact of future disasters? To help answer this research question, Part I of this report examines the fiscal burden posed by disasters, especially on certain disadvantaged groups. We then identify gaps in federal efforts to address these burdens, before turning to the burden a disaster can place on state and local government. In Part II of this report, we address the second research question: Are there examples of innovative products and programs that have been used in the United States or abroad to help individuals and government manage the financial consequences of a disaster? We hope this resource guide will help state and local governments identify approaches that work best for them in helping their communities more quickly rebound from disasters.
Method

To gather the information on the financial burden that natural disasters impose on both state and local governments and individuals, especially for low-income or other disadvantaged groups, we conducted a literature review of (1) academic journals and (2) other reports produced outside traditional academic and commercial publishing, such as the not-for-profit and for-profit sectors and government reports. We identified these documents via such academic databases as Academic Search Complete, Scopus, and Web of Science. Keywords included “natural disaster,” “financial assistance,” “financial preparation.” In total, our search yielded 386 results. We reviewed results in two phases. First, we conducted a title and abstract review of each source to determine whether it was relevant to our central research questions. Second, we reviewed the full texts of the subset of sources determined to be most relevant for our research. For this phase, we reviewed sources that focused specifically on natural disasters and financial preparedness in the United States.

To identify innovative products and programs that various entities have used to improve financial resilience to natural disasters, we conducted an environmental scan. We began with a list of familiar products. We searched the academic literature, news sources, and insurance industry information and conducted a general web-based search for insurance-linked security products, such as parametric insurance and catastrophe bonds, focused on state and local government and individuals. We also interviewed a major insurance broker who focuses on insurance products for state and local government and provided additional specific examples. There are limitations to what we were able to uncover regarding the level of specificity for each product mentioned. There is no central database that captures all of these individual products and programs, so what we were able to find represents primarily an educated convenience sample. For example, insurance contracts are private agreements, and the specifics of coverage limits and premiums are rarely made public. We were able to find a couple of examples of costs and coverage limits for public entities from public documents, which we present below, but, for the most part, this level of information is considered proprietary and is rarely made public. As a result, there are limits to the breadth and specificity we were able to identify for each product.
Three key factors that contribute to economic vulnerability for vulnerable groups in the United States are
1. housing costs
2. limited ability to cover unexpected expenses
3. location and mobility.
Part I: Financial Impact of Disasters on Individuals and State and Local Government

Some Groups Are More Vulnerable to the Impact of Disasters

The effects and costs of natural disasters are not distributed evenly. We identified three key factors that contribute to economic vulnerability for vulnerable groups in the United States: housing costs, limited ability to cover unexpected expenses, and location and mobility. These factors can operate differently depending on the context, but all have an impact on victims’ ability to respond to a natural disaster.

Housing Costs

One of the most significant barriers faced by many Americans is access to affordable housing (Airgood-Obrycki, Hermann, and Wedeen, 2022). In 2020, 30 percent of households were defined as moderately cost-burdened, meaning that they spent more than 30 percent of their annual income on housing, and 14 percent of households were severely cost-burdened, meaning that they spent 50 percent or more of their annual income on housing. Renters are more likely to be cost-burdened—46 percent were found to be moderately burdened and 24 percent were severely burdened. Households making less than $30,000 per year, African American, Latino American, and Asian American households are also disproportionately cost-burdened (Airgood-Obrycki et al., 2022). Cost-burdened individuals are more likely to be vulnerable to financial shocks because such a large portion of their monthly income is used to pay for housing.

Limited Ability to Cover Unexpected Expenses

In addition, a substantial number of Americans lack a financial safety net to protect them in times of difficulty. Low- and moderate-income families struggle to meet basic expenses, such as utilities, after an economic disruption (McKernan et al., 2016). Using data from the 2020 Survey of Household Economics and Decision Making, the Federal Reserve found that 64 percent of U.S. adults did not have $400 to cover unexpected expenses. It also found that African American and Latino American households were less likely than White households
to be able to cover unexpected expenses. Although the survey was conducted during the coronavirus disease 2019 (COVID-19) pandemic, results were similar to those from 2018 and 2019, before the pandemic hit (Board of Governors of the Federal Reserve System, 2021).

These financial challenges mean that many households might not have the financial resources to deal with a natural disaster, putting them at risk for both short- and long-term financial challenges. Cunningham-Erves et al. (2022) drew upon qualitative interviews to explore obstacles that African Americans faced during the COVID-19 pandemic. They found that many interview respondents were not prepared for the financial hardships created by the pandemic, particularly if they faced unexpected unemployment. Ratcliffe and her colleagues (Ratcliffe, Congdon, Stanczyk, et al., 2019; Ratcliffe, Congdon, Teles, et al., 2020) and Kousky, Palim, and Pan (2020) provide empirical evidence that a natural disaster can negatively affect families’ financial situations even several years after the disaster has passed. The financial outcome for residents who have experienced a natural disaster looks different from that for similar groups in unaffected communities. Those who have experienced a natural disaster fall behind on their financial responsibilities, leading to mortgage delinquencies, increases in debt collection, and declining credit scores, affecting access to credit. Studies have also found that those who are more financially fragile before a disaster experience worse financial outcomes after a disaster, exacerbating existing inequalities (Ratcliffe, Congdon, Stanczyk, et al., 2019; Ratcliffe, Congdon, Teles, et al., 2020).

The cumulative effects of medium-sized disasters appear to result in larger negative declines in credit scores than larger disasters. The negative effects are likely more pronounced due to the more-frequent occurrence of small and medium-sized storms, which also lack the infusion of massive federal assistance dollars and the temporary relief programs from financial institutions, lenders, and others that often follow major disasters (Ratcliffe, Congdon, Stanczyk, et al., 2019; Ratcliffe, Congdon, Teles, et al., 2020).

**Location and Mobility**

Research has also shown that historical and contemporary dimensions of racial and economic inequality can limit residential opportunities for members of disadvantaged groups. As a result, members of these groups are more likely to reside in neighborhoods that are particularly vulnerable to the effects of natural disasters, such as hurricanes and flooding (Klein, 2007; Maldonado, 2014; Nelson et al., 2022; Rivera, Jenkins, and Randolph, 2022). For example, Rivera, Jenkins, and Randolph (2022) examined the impact of Hurricane Dolly (2008) on residents of the Rio Grande Valley, finding that Mexican American descendants of migrant farm workers were disproportionately negatively impacted because their fami-
lies were forced to reside in *colonias*—rural communities often located in unincorporated areas—on immigrating to the United States. These areas were particularly vulnerable to the consequences of natural disasters because they lacked the public resources needed to engage in adequate predisaster management. Residents were also disproportionately economically disadvantaged, creating additional barriers to disaster preparation. As a result of the combination of historical residential segregation and limited access to financial resources, residents in the Rio Grande Valley experienced significant property damage from Hurricane Dolly.

In addition, due to affordability issues, groups with limited resources might be more likely to move into areas that are disaster-prone. Ratnadiwakara and Venugopal (2020) shows that (1) people moving into neighborhoods after severe flooding (rather than before) might be more economically vulnerable, and (2) more-limited financial resources might make this group particularly vulnerable to the impact of future natural disasters. The researchers used nationwide data from the FEMA Disaster Declarations Summary, the Home Mortgage Disclosure Act, and Zillow to examine how flooding affected mortgage lending between 1996 and 2017. They found that significant flooding in a neighborhood caused home prices to drop an average of $6,000. After a flood, buyers seeking mortgages in these neighborhoods earned an average of $8,000 per year less than those neighborhood residents seeking to refinance mortgages. The researchers also found that buyers who purchased their homes after severe flooding were 8.5 times more likely to be 150 or more days behind on mortgage payments than those who purchased their homes before severe flooding.

Limited financial resources can also make it difficult for members of vulnerable groups to move away from disaster-prone areas, even when they realize the risk of remaining in their homes.¹ For example, Nelson et al. (2022) explored the experiences of residents of a low-lying, rural community in Louisiana that was highly susceptible to the effects of hurricanes and flooding. The residents were disproportionately low income and resided in homes that were at risk for severe damage or complete destruction in the event of a significant natural disaster. Some communities at risk were not interested in relocating. However, in other in-

---

¹ There may be nonfinancial reasons a household chooses to reside in a disaster-prone area (such as social place attachment) that is not explored in this report. For more on that topic, see Davis et al., 2022.
stances, many residents lacked the financial resources to relocate. In another case, flooding and coastal erosion in Newtok, Alaska, have made it an increasingly challenging place to live because of the significant risk of property damage or destruction. Still, many residents of the community—which was majority Alaska Native and has disproportionately high poverty rates—lacked the resources to relocate despite known risks (Ristroph, 2021).

Disaster Response Efforts Help Individuals and Households but Leave Gaps

After a natural disaster occurs, certain federal assistance benefits are activated when a presidential disaster declaration (PDD) has been made. FEMA provides Individual Assistance to households (to both homeowners and nonhomeowners) that have experienced damage, though the assistance is limited and not meant to make households whole. FEMA also provides assistance to state and local governments and some nonprofits through its Public Assistance program and mitigation grant programs (such as the Hazard Mitigation Grant Program). The federal government, working with the state, can provide Disaster Unemployment Assistance. The U.S. Department of Agriculture works with states to provide Disaster Supplemental Nutrition Assistance Program (D-SNAP). The U.S. Small Business Administration (SBA) and state entities provide low-interest disaster loans or bridge loans for small businesses.

These and other programs available to public entities, individuals, and households require a PDD, and most natural disasters do not qualify for such a declaration. Each program also has its own eligibility requirements, which might exclude certain populations. For example, moderate-income households do not likely qualify for Supplemental Nutrition Assistance Program (SNAP) benefits.

Sometimes the requirements of various programs can leave some households without assistance. For example, households that experience vehicle damage during a severe storm are required to first seek assistance from insurance or from the SBA in the form of a low-interest disaster loan. Many financially burdened households would struggle to take on additional debt, even with low interest rates. Households that do not receive assistance from insurance
or the SBA might be eligible for assistance through FEMA’s Other Needs Assistance program. However, Hornsby (2013) found that FEMA requires proof of an applicant’s auto accident liability insurance to qualify for assistance and that this requirement disproportionately affected low-income households that struggle to afford insurance (Hornsby, 2013).

There are gaps in the current disaster response and recovery network, and the needs of many individuals following a disaster go unmet. Households might not meet eligibility requirements for certain programs, and most natural disasters fall short of receiving a PDD and the influx of federal investments that follows. Households that are financially vulnerable can fall further down the economic ladder as a result of the economic shock resulting from a natural disaster (McKernan et al., 2016; Ratcliffe, Congdon, Teles, et al., 2020).

**Disasters Fiscally Burden Local Governments**

Disasters can also create significant fiscal strain for local governments (Boustan et al., 2020; Chen, 2020; Crow et al., 2018; Jerch, Kahn, and Lin, 2020; Miao, Hou, and Abrigo, 2018). Finucane et al. (forthcoming) interviewed emergency management officials in Dallas, Texas; Yavapai County, Arizona; Pinellas County, Florida; and a state emergency management official in Arkansas. Officials in Texas, Florida, and Arkansas cited limited local financial resources as a significant barrier to assisting residents after a major disaster.

Jerch, Kahn, and Lin (2020) examined the financial impact on municipalities hit by hurricanes between 1972 and 2017 in 21 coastal states that border the Atlantic Ocean or Gulf of Mexico. They used data from the Census of Governments, the National Historical Geographic Information System, and the Atlantic Hurricane Database to compare local government financials before and after a municipality was hit by a hurricane, finding that local revenue fell in the ten years after a hurricane. This is in part due to a shrinking tax base because of a decline in residents after the storm. The reduced tax base can also lead to a reduction of public services, such as water, sewer, and trash. The most significant decline typically occurs between years 6 and 10, the period after most intergovernmental cash transfers related to the disaster have subsided. In these years, municipalities experience a 2-percent decline in revenue.

In addition, Jerch, Kahn, and Lin (2020) found that local government debt falls by an average of 19.2 percent in the ten years after a hurricane. As the tax base declines, the cost of borrowing increases, so taking on more debt becomes even more expensive. The authors argued that this was because of downgrades in municipal bonds, which led to a 17-percent increase in default risk. Municipal debt is used to make infrastructure investments in such things as public services, so a decline in municipal debt could reflect a decline in municipal
investment. The researchers found that the financial impact of a hurricane is more significant for municipalities with higher numbers of racial minorities, low-income households, and less educated residents. For example, municipalities with a 1-standard-deviation increase in the percentage of racial minority population had twice as much revenue loss and eight times higher risk of debt default than municipalities with average racial composition.

Boustan et al. (2020) also found that natural disasters can have a negative impact on local economies. They examined the county-level impact of federally declared natural disasters that occurred between 1920 and 2010. They found that resident outmigration rates at the county level increased by an average of 1.5 percent in the decade following a natural disaster. In addition, housing and rent costs at the county level decreased by an average of between 2.5 and 5 percent in the decade following a natural disaster. Thus, their findings further demonstrate that natural disasters can have a significant effect on local population and revenue in counties across the United States.

McKernan et al. (2016) argued that improving the financial well-being of residents is a critical part of improving the financial well-being of the cities in which they live. Thus, providing local residents with better tools for dealing with the financial impact of disasters might reduce the negative effects that disasters can have on local governments.
Providing local residents with better tools for dealing with the financial impact of disasters might reduce the negative effects that disasters can have on local governments.
Part II: Innovative Products and Programs Aimed at Improving Financial Resilience

Some state and local governments have created programs aimed at addressing the financial gaps that households experience following disasters. Private insurers have also created products, targeting primarily state and local governments, with the goal of assisting governments through the economic hardship of natural disasters. Some of these products could be used by public entities to assist individual residents.

In this section, we identify options for helping households build financial resilience. We also identify products offered to public entities to help with their own finances. Many of these products offer flexibility and timeliness in how the funds are used, which would allow public entities to assist individuals in financial need. Products in this section might not directly target vulnerable populations but may give useful background information about how these are utilized in individual, commercial, local, national, and multinational contexts. We also catalog examples of many of the nonfederal innovative programs and products that are being offered in the United States and in the rest of the world.

Products Offered by the Private Sector

Parametric Insurance

Parametric insurance is one of the more common examples of an innovative product purchased by local governments, small businesses, homeowners, or renters to fill financial gaps left by natural disasters. Whereas traditional indemnity insurance policies compensate policyholders for a part of realized losses, parametric insurance policies provide compensation based on the observed magnitude or the relative location of an event, known as a trigger. These triggers are typically predetermined parameters based on observable data, such as wind speed, distance to a named storm’s eye, flood level, or earthquake magnitude. Triggers can take different forms. For example, parametric policies in their simplest form provide compensation based on whether the trigger is satisfied, which are known as single-trigger policies. Some, called double-trigger, might require a second trigger, in which the policyholder needs to document actual losses that resulted from the event. Parametric insurance is a way to provide quicker and more-flexible funds to victims of disasters, which
can increase financial resilience and broaden insurance coverage among populations vulnerable to natural disasters.

Successful real-world parametric products share four common characteristics. First, parametric insurance schemes tend to have clear and comprehensible trigger thresholds. Second, external data providers and collection agencies produce key information related to trigger thresholds. At times, insurance providers might provide their own data collection software or technology. Third, parametric schemes can require easily identifiable proof-of-loss documentation, as opposed to having claims adjusters arrive on the premises under traditional insurance programs, which involves negotiation about what is covered and what is not. Last, a relatively quick payout is crucial to cover immediate costs following a disaster. Delivery mechanisms vary from direct deposit transfers to individuals to access to liquidity for public-sector agencies or governments.

Low-wealth communities might be attracted to parametric policies because they are likely less expensive than traditional indemnity insurance because of the narrowly defined risk. The downside to a parametric policy is basis risk. Basis risk might occur when the realized losses of an event differ from the amount that parametric insurance might cover or when the insured incurs losses without the trigger being met (Sengupta and Kousky, 2020). The lack of coverage from basis risk might undermine trust in these policies from populations that are unable to cover additional out-of-pocket expenses related to disasters (Sibiko, Veettil, and Qaim, 2018). Some policies might also require a second trigger, in which the policyholder must document actual losses from an event and for which the insurer might audit claims through traditional claims adjusters, potentially delaying payouts following a disaster event. Public regulators can also mandate these double-trigger requirements to classify parametric policies as insurance products rather than financial derivatives.

**Public Sector Insurance for Natural Disasters**

A parametric insurance policy purchased by a public entity and meant to cover the net fiscal loss left by individual private insurance and federal disaster aid is used as a fiscal risk management tool meant to reduce the effects natural disasters can have on public bud-
gets (Table 1). The quick influx of cash can help communities rebound more quickly. These products are backed by traditional insurance and capital markets and come in the form of insurance, reinsurance, or catastrophe bonds. As discussed earlier, the payout is triggered by a predetermined event (such as wind speeds over 120 miles per hour, an earthquake of a certain magnitude, or temperatures of certain degrees for a designated time period). Once the trigger is met, payouts are made within 10 to 90 days from the event (Rosenberg and Sabo, undated), and some products boast paying out within hours (Ellfeldt, 2023). The government entity that purchased the product has only a few limitations on how funds can be spent, with the primary limitation being that any funds received may not be duplicated through a payout from federal public disaster assistance.

<table>
<thead>
<tr>
<th>Insurance Provider</th>
<th>Disaster Event Covered</th>
<th>Trigger</th>
<th>Public Entity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swiss Reinsurance Earthquake Insurance</td>
<td>Earthquake</td>
<td>Earthquake magnitude</td>
<td>State of Utah</td>
</tr>
<tr>
<td>New Paradigm Underwriters</td>
<td>Hurricane</td>
<td>Wind speed and proximity from storm’s eye</td>
<td>City of Miami Beach</td>
</tr>
<tr>
<td>Metro Re Catastrophe Bond</td>
<td>Named storm or earthquake</td>
<td>Storm surge</td>
<td>New York Metropolitan Transportation Authority</td>
</tr>
<tr>
<td>Power Protective Re Catastrophe Bond</td>
<td>Wildfires</td>
<td>Wildfires within a boundary of a covered area</td>
<td>Los Angeles Department of Water and Power (LADWP)</td>
</tr>
<tr>
<td>Lloyd’s of London</td>
<td>Wildfires</td>
<td>Not Applicable</td>
<td>State of Oregon</td>
</tr>
<tr>
<td>Swiss Reinsurance Hurricane Insurance</td>
<td>Hurricane</td>
<td>Wind speed</td>
<td>State of Louisiana</td>
</tr>
</tbody>
</table>
The flexibility provided by these funds would allow government entities to use them to fill some of the financial gaps that are often left by the current disaster response system, identified earlier in this report. These funds could be used specifically to bridge the gaps low-wealth communities and communities of color experience. We do not know the extent to which these products are actually meeting those needs, though we do recognize the potential to use these products for that purpose. As is noted in the examples that follow, purchasing these products is a relatively recent phenomenon and is not yet widespread. To our knowledge, there have not been assessments of whether these products are reducing or widening the gap between high-wealth communities and low-wealth communities or communities of color, but that is an area worthy of future research.

**Examples of Private-Sector Products Purchased by Public Entities in the United States**

**Utah.** In 2017, the State of Utah purchased a parametric earthquake insurance policy from Swiss Reinsurance. The parametric product allocated funds less than four weeks after the event to cover immediate expenses. Swiss Reinsurance utilized a third-party data provider, the U.S. Geological Survey (USGS), to calculate ground shake intensity for insured areas, which then led to payouts based on the intensity of the event (Swiss Re Corporate Solutions, undated).

**The City of Miami Beach.** The City of Miami Beach purchased a parametric policy for hurricanes that covers losses excluded from traditional property policies, with no distinction between wind and flood losses based on wind speeds and hurricane intensity. This program is offered by New Paradigm Underwriters, which aims to provide “affordable first dollar catastrophe cover[age] for items that are difficult to impossible to insure traditionally” (New Paradigm Underwriters, undated). Table 2 shows the respective insurers’ rates,
premiums, and insurance limits offered by New Paradigm Underwriters to the City of Miami Beach.

TABLE 2

<table>
<thead>
<tr>
<th>Limit</th>
<th>Rate</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>$20 million</td>
<td>5.15%</td>
<td>$1,030,434</td>
</tr>
<tr>
<td>$25 million</td>
<td>5.15%</td>
<td>$1,288,033</td>
</tr>
<tr>
<td>$30 million</td>
<td>5.15%</td>
<td>$1,545,631</td>
</tr>
<tr>
<td>$35 million</td>
<td>5.15%</td>
<td>$1,803,237</td>
</tr>
</tbody>
</table>

SOURCE: Reproduces premium indications from New Paradigm Underwriters presented in a letter to the commission for the City of Miami Beach (Financial Services, 2018).

NOTE: Indications include applicable taxes and fees.

The structure of the parametric policy is based on the following two potential events outlined in Table 3: the highest of either the wind speed trigger or the cat-in-a-circle qualifying event (where the catastrophe occurs inside a predefined area—in this case, a circle). Although payouts are not additive within the same storm event or named storm, payouts can be added over subsequent named storms.

TABLE 3

<table>
<thead>
<tr>
<th>Triggering Event</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind speed qualifying event</td>
<td>Coverage is triggered if the 60-second sustained wind speed meets or exceeds mile-per-hour thresholds</td>
</tr>
<tr>
<td>Cat-in-a-circle qualifying event</td>
<td>Coverage is triggered if an event track point falls on or within the boundaries of the 10-mile covered radius, as reported by the National Hurricane Center’s Public Advisory Reports</td>
</tr>
</tbody>
</table>

SOURCE: Reproduces premium indications from New Paradigm Underwriters presented in a letter to the commission for the City of Miami Beach (Financial Services, 2018).

NOTE: Table is from Premium Indication from New Paradigm Underwriters presented in a letter to commission for the city of Miami Beach.
Wind speeds are captured by hurricane-resistant anemometers as part of the policy provided by New Paradigm Underwriters, and these anemometers are owned and operated by a third-party company, Weatherflow. Table 4 shows the relative payout with the corresponding wind speed interval, measured in miles per hour.

### Table 4
Relative Payouts and Corresponding Wind Speed Intervals for Miami Beach’s Parametric Policy

<table>
<thead>
<tr>
<th>Wind Speed (miles per hour)</th>
<th>Wind Speed Payout (percentage of maximum payout)</th>
</tr>
</thead>
<tbody>
<tr>
<td>96–100</td>
<td>1–3</td>
</tr>
<tr>
<td>100–107</td>
<td>3–10</td>
</tr>
<tr>
<td>107–123</td>
<td>10–40</td>
</tr>
<tr>
<td>123–129</td>
<td>40–100</td>
</tr>
</tbody>
</table>

**SOURCE:** Reproduces premium indications from New Paradigm Underwriters presented in a letter to the commission for the City of Miami Beach (Financial Services, 2018).

Coverage for the cat-in-a-circle trigger corresponds to the named storm's intensity, as reported by the National Hurricane Center’s Public Advisory Reports, as long as the two anemometers’ locations are within a 10-mile radius of the storm. Corresponding payouts to hurricane intensity are displayed in Table 5.

### Table 5
Hurricane Intensity and Corresponding Payouts for Miami Beach’s Parametric Policy

<table>
<thead>
<tr>
<th>Hurricane Intensity</th>
<th>Cat-in-a-Circle Payout (percentage of maximum payout)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1</td>
<td>0</td>
</tr>
<tr>
<td>Category 2</td>
<td>0</td>
</tr>
<tr>
<td>Category 3</td>
<td>25</td>
</tr>
<tr>
<td>Category 4</td>
<td>60</td>
</tr>
<tr>
<td>Category 5</td>
<td>100</td>
</tr>
</tbody>
</table>

**SOURCE:** Reproduces premium indications from New Paradigm Underwriters presented in a letter to the commission for the City of Miami Beach (Financial Services, 2018).
Another example of a local government utilizing parametric insurance is when Miami-Dade County school board held a parametric policy from Swiss Re that provided $10 million if wind speeds exceeded 87.5 miles per hour (Flavelle and Chiglinsky, 2019). However, the county’s experience led to a case of basis risk, when Hurricane Irma caused $19 million in damage to the school district but led to no compensation because the storm did not reach the wind speed trigger (Flavelle and Chiglinsky, 2019). In fiscal year 2019, the school board did not renew the parametric policy for storms because premiums increased significantly (Morales, 2019).

**New York.** Following Hurricane Sandy in 2012, the New York Metropolitan Transportation Authority (MTA) issued a parametric catastrophe bond, which transferred potential losses to capital market investors, who received a yield in return. For perils of storm surges from named storms or earthquakes, a trigger event would allow up to 100 percent of the principal to be transferred to the MTA (Artemis, undated; Braun and Kousky, 2021).

**California.** The LADWP began a wildfire parametric catastrophe bond in 2020. The trigger for this bond was based on the total cost of reconstruction within a specified wildfire perimeter. It was touted as the first wildfire parametric catastrophe bond and the first catastrophe bond globally to benefit a municipal utility (Rosenberg and Sabo, undated). The parametric structure was based, first, on the location of the wildfire, which had to be within a boundary of a covered area, similar to a cat-in-a-circle parameter. Reconstruction cost values were estimated for residential properties in this area, and this cost was augmented by a 1.43-times multiplying payout factor to account for wildfire damage beyond residential properties (such as commercial property, smoke damage, and variation in reconstruction costs). The resulting value, referred to as the wildfire index value, corresponds to an LADWP recovery rate, which was multiplied by the original principal amount of the bond. Recovery rates and wildfire index values are shown in Table 6.

<table>
<thead>
<tr>
<th>Wildfire Index</th>
<th>LADWP Recovery Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>75–127.4</td>
<td>35–69%</td>
</tr>
<tr>
<td>127–174.9</td>
<td>70–99%</td>
</tr>
<tr>
<td>&gt;175</td>
<td>100%</td>
</tr>
</tbody>
</table>

**SOURCE:** Presentation to the California Senate Insurance Committee (Rosenberg and Sabo, undated).
Oregon. Insurance company Lloyd’s of London provides Oregon with the only statewide catastrophic wildfire insurance coverage of its kind, purchased in 1973 to support firefighting costs. Premiums are split between the state and private timberland owners. As wildfires in the region become increasingly frequent and destructive, Lloyd’s has been increasing deductibles for the ongoing indemnity policy, with Oregon filing claims valued at twice the cost of premiums. Although this is the only statewide wildfire insurance policy in the United States, increases in wildfire costs along with rising premiums might lead to an affordability issue for the state.

Louisiana. Swiss Re, which provides Utah with parametric insurance following an earthquake, also provides the State of Louisiana with $1.25 million once a storm with winds of 80 miles per hour for at least one minute makes landfall in Louisiana.

Examples of Private-Sector Products Targeted at Individuals in the United States

Table 7 outlines private-sector products that are targeted at individuals in the United States.
### Table 7

**Private-Sector Products Targeted at Individuals in the United States**

<table>
<thead>
<tr>
<th>Insurance</th>
<th>Disaster Event Covered</th>
<th>Parametric Trigger</th>
<th>Payout Maximum</th>
<th>Customer Base</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FirstTrack</strong></td>
<td>Hurricane</td>
<td>Wind speed and storm eye proximity</td>
<td>$25,000</td>
<td>Renters and homeowners in Hawaii</td>
</tr>
<tr>
<td><strong>StormPeace</strong></td>
<td>Hurricane</td>
<td>Storm eye proximity and hurricane category</td>
<td>$10,000</td>
<td>Individual property owners and renters in Florida</td>
</tr>
<tr>
<td><strong>Jumpstart</strong></td>
<td>Earthquake</td>
<td>Earthquake magnitude</td>
<td>$10,000 for individuals, $20,000 for small businesses</td>
<td>Renters, homeowners, businesses and nonprofits in California</td>
</tr>
<tr>
<td><strong>Recoop</strong></td>
<td>Multiperil (hurricane, wildfire, tornado, earthquake, gas explosion, winter storm, dust storm)</td>
<td>Varies depending on the disaster event (payout is from magnitude of loss rather than magnitude of event)</td>
<td>$25,000</td>
<td>Homeowners and renters in 39 states and Washington, D.C.</td>
</tr>
<tr>
<td><strong>Flood Flash</strong></td>
<td>Flooding</td>
<td>Flood levels</td>
<td>Varies</td>
<td>Commercial landlords/tenants and residential landlords</td>
</tr>
<tr>
<td><strong>Raincoat</strong></td>
<td>Hurricane, earthquake, and flooding</td>
<td>Proprietary advanced weather modeling to pay instantly based on modeled losses</td>
<td>Not applicable</td>
<td>Individuals and small businesses in Puerto Rico</td>
</tr>
<tr>
<td><strong>United Surety and Indemnity Company (USIC)</strong></td>
<td>Hurricane and earthquake</td>
<td>Storm eye proximity, wind speed, earthquake magnitude</td>
<td>$4,000</td>
<td>Property owners</td>
</tr>
</tbody>
</table>

**FirstTrack.** Hawaii First Insurance Company offers FirstTrack, another parametric insurance program that covers immediate relief after a hurricane. The policy covers the six major Hawaiian Islands and offers different coverage levels depending on the category of wind speed determined by the National Hurricane Center and three radius proximity cat-

---

23
egories. The maximum payout is $25,000, and payouts are followed by an automated email that allows insured people to accept claim payments following a trigger event (First Insurance Company of Hawaii, undated).

**StormPeace.** In Florida, Hurricane insurance provider Assured Risk Cover offers a program called StormPeace, a parametric insurance program for individual property owners and renters. The product provides claim payments based on the distance of the insured person’s property from the hurricane’s eye and the category of the hurricane when closest to the property. Payments are made within 72 hours of an initial claim (StormPeace, undated).

**Jumpstart.** Jumpstart Earthquake Insurance provides an earthquake insurance program in California that guarantees a predefined lump sum payment via automated direct deposit in a matter of days, triggered by USGS earthquake data. Jumpstart offers a $10,000 immediate payout for individuals and $20,000 for small businesses (Jumpstart, undated).

**Recoop.** Recoop Disaster Insurance offers a multiperil disaster insurance policy, which provides quick lump sum payments of $25,000 following a hurricane, wildfire, tornado, earthquake, gas explosion, winter storm, or dust storm. Recoop’s product has been referred to as “parametric-like,” in that a set payout is sent following a specific trigger event, though the payout is based on the magnitude of losses rather than the magnitude of the disaster event (Recoop, undated). It is likely that the multiperil structure of the product aims to diminish the variability of losses based on event strength (Wiley, 2022).

**FloodFlash.** Founders of United Kingdom commercial flood insurance start-up FloodFlash introduced a product in the United States similar to what is offered in the United Kingdom aimed at commercial landlords and tenants, and residential landlords (Hall, 2021). FloodFlash installs a flood sensor on the property that measures the depth of water. The purchaser chooses the specific water depth that will serve as the trigger. The company’s website allows the purchaser adjust the trigger and see the corresponding premium amount. Because the sensor is electronic, once the flood depth is reached, the firm pays the agreed-upon coverage amount. The firm claims that it pays out within hours of the flood sensor reaching the trigger depth (FloodFlash, undated).

**Raincoat.** Another example of a company using innovative proprietary technology in parametric insurance is Puerto Rican start-up Raincoat. Raincoat is attempting to provide parametric insurance at scale. It was created after Hurricane Maria, when many businesses and individuals submitted insurance claims and, after a long process, many claims were denied. Raincoat sells automated insurance directly to consumers and businesses by applying advanced weather modeling to pay instantly based on modeled losses. The firm claims to issue payouts within days of the triggering event (Raincoat, undated).

**USIC.** USIC offers hurricane and earthquake parametric microinsurance for both home-
owners and renters in Puerto Rico, using distance from a property to the eye of a hurricane and intensity of an earthquake at the property’s location. USIC offers individual hurricane and earthquake insurance but also offers a “bundle package” product. USIC claims that its parametric microinsurance products include no applied deductibles, universal residential property eligibility regardless of location or type of construction, and unconditional quick cash transfers. Although the maximum payment for hurricane insurance is $4,000, and the maximum payment for earthquake insurance is $30,000, the maximum payment for the bundle package is $4,000, which applies to each peril type when parametric triggers are met (USIC, undated).

**International Examples**

**Peru.** GlobalAgRisk, with support from DAI, the U.S. Agency for International Development, and COPEME (El Consorcio de Organizaciones Privadas de Promoción al Desarrollo de la Micro y Pequeña Empresa), designed a parametric insurance product driven by Pacific Ocean surface temperature data from NOAA, which is highly predictive of an El Niño event months in advance. This scheme allows for advance payments to support mitigation strategies for the agricultural sector in northern Peru and provides access to credit for small-scale farmers (GlobalAgRisk, 2013). This example of forecast-based financing allows workers and communities in exposed industries to take informed approaches to disaster planning.

**Caribbean Catastrophe Risk Insurance Facility.** This consortium offers multiperil short-term liquidity for disaster-stricken countries 14 days after an event. A 7.2 magnitude earthquake hit Haiti in August 2021, which led to a payout of $39,953,272 to provide government liquidity for supplemental resources to assist with longer-term recovery and redevelopment. Named storms, such as Tropical Cyclones Dorian (2019), Laura (2020), Eta (2020), Iota (2020), and Elsa (2021), have all led to payouts for one or more islands in the consortium (Caribbean Catastrophe Risk Insurance Facility, 2021).

**Jamaica.** In July 2021, the World Bank purchased a catastrophe bond that provided Jamaica’s government with financial assistance for named storms through December 2023, with financial protection of up to $185 million (World Bank, 2021). Payouts to Jamaica are based on location and severity triggers for named storms, with payouts expected to arrive in a matter of weeks. The catastrophe bond is seen as the first of its kind in utilizing a cat-in-the-grid parametric design, in which an extreme weather event (catastrophe) triggers the policy if the said event passes within a distance of a specified area (grid).
Public-Sector Programs

Examples of public-supported programs to build financial resilience include catastrophe financial education, community-based insurance programs, catastrophe savings accounts (CSAs), and other charity or nongovernmental efforts, including direct cash payments and forecast-based financing.

Financial Education

Some states and local governments have developed financial education related to natural disasters. Although we have not conducted a systematic review of available resources, all of the programs we found were limited to informational websites. Many of these sites recommend that one have an emergency fund, purchase insurance, and have access to key financial and identification documents. Many point to the FEMA Emergency Financial First Aid Kit. These informational websites help primarily those who are already looking to prepare financially for disasters, rather than bring awareness to new people because the programs are typically limited to websites. If other events, such as webinars or in-person courses, are taking place, we were not able to find evidence of them.

Community-Based Insurance for Natural Disasters

Community-based catastrophe insurance (CBCI) is a disaster insurance program arranged by a local government or special-purpose district covering individual properties in a community (Bernhardt et al., 2021). CBCI can be structured in a variety of ways, with varying levels of community responsibility. At one end of the spectrum, the community might arrange an insurance policy for homeowners and other community members but leave it to individuals to contract directly with an insurer. At the other end of the spectrum, a community might set up a captive insurer that offers coverage to community members. In the middle are models in which a community arranges a group policy for its members similar to an employee group health plan or models in the community buy a parametric policy that pays out to individual community members (Bernhardt et al., 2021). Potential benefits of a CBCI are that they might increase a community’s financial resilience, accelerate recovery of the insured, and incentivize community-level risk reduction. Although CBCI models have been formulated and applications to flood insurance examined by the National Academies of Sciences, Engineering, and Medicine, we are not aware that any have been implemented (National Academies of Sciences, Engineering, and Medicine, 2015).
Catastrophe Savings Accounts

Several states have introduced CSAs, which can be used to offset or replace the cost of insurance for disasters. CSAs are tax-advantaged accounts offered at the state level, similar to 529 college savings accounts. Contributions up to the allowed limit and interest earned are tax-deductible at the state level, and disaster-qualified withdrawals are not included in taxable income. CSAs complement traditional insurance products by providing quick cash to cover out-of-pocket expenses, such as deductibles. The American Property Casualty Insurance Association, representing home, auto, and business insurers, supports CSAs and encourages states to further expand the policy (Leefeldt and Danise, 2022).

Families with no savings who experience income disruptions are more likely to utilize income maintenance programs, such as social security or welfare (McKernan et al., 2016). Such programs provide a benefit that is comparable to having savings of $2,000 to $4,999. Some research shows that a low-income family with this amount of savings is less likely to experience financial hardship than a middle-income family with no savings (McKernan et al., 2016).

Alabama, Mississippi, and South Carolina all offer CSAs to their residents. The CSAs can be used only for primary residences, are limited to one account per household, can only be interest-bearing accounts named “catastrophe savings accounts,” and are to be used only for disaster purposes. Descriptions and a table of deduction limits of these three states’ CSAs follow (Table 8).

<table>
<thead>
<tr>
<th>Deductible Amount</th>
<th>Alabama</th>
<th>Mississippi</th>
<th>South Carolina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than or equal to</td>
<td>Up to $2,000</td>
<td>Up to $2,000</td>
<td>Up to $2,000</td>
</tr>
<tr>
<td>$1,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than $1,000</td>
<td>Lesser of $15,000 or twice the amount of the deductible</td>
<td>Lesser of $15,000 or twice the amount of the deductible</td>
<td>Lesser of $15,000 or twice the amount of the deductible</td>
</tr>
<tr>
<td>Self-insured</td>
<td>Lesser of $250,000 or the value of the residence</td>
<td>Lesser of $350,000 or the value of the residence</td>
<td>Lesser of $250,000 or the value of the residence</td>
</tr>
</tbody>
</table>

TABLE 8

Contribution Limits for Catastrophe Savings Accounts
Alabama. Alabama has three tiers of CSA deductions for its taxpayers based on insurance deductibles. Taxpayers are allowed to open one savings account as a CSA, which must be used only for disaster purposes. Contributions are deductible in the tax year they are made and can be made over multiple years until the limits are met (Alabama Department of Revenue, 2022). The taxpayer can contribute up to $2,000 if a deductible is less than or equal to $1,000. The taxpayer can contribute the lesser of $15,000 or twice the amount of the deductible if the deductible is more than $1,000. A self-insured taxpayer can contribute the lesser of $250,000 or the value of the taxpayer’s legal residence (Alabama Department of Revenue, undated). For example, if a homeowner in Alabama had a homeowners insurance policy with a deductible of $900, they could contribute up to $2,000 to a CSA. If there is a natural disaster and the governor declares an emergency, then the homeowner can use the CSA funds to pay for the deductible and other immediate expenses. The average CSA balance is more than $2,500 in Alabama (Leefeldt and Danise, 2022). This is an order of magnitude higher than the recommended savings thresholds of $250 to $749, the amount that most families would need to have on hand in order not to be evicted, miss a house payment, or require public benefits when income disruptions occur. CSAs in Alabama cannot be replenished. After the CSA is used to pay for recovery, a participant cannot once again deduct contributions to the CSA.

Mississippi. In Mississippi, taxpayers are allowed to open one savings account as a CSA, which must be used only for disaster purposes, and contributions can be made over years until the limits are met. The account is also tiered by deductions. As in Alabama, a taxpayer can deduct up to $2,000 if the deductible is less than or equal to $1,000. A taxpayer can deduct the lesser of $15,000 or twice the amount of the deductible if the deductible is more than $1,000. A self-insured taxpayer can contribute the lesser of $350,000 or the value of the taxpayer’s legal residence, which is more than Alabama’s policy for self-insured homeowners (Mississippi Insurance Department, undated).

South Carolina. South Carolina also allows CSAs. They are also tiered by deductions. A taxpayer can deduct up to $2,000 if a deductible is less than or equal to $1,000. A taxpayer can deduct the lesser of $15,000 or twice the amount of the deductible if a deductible is more than $1,000. A self-insured taxpayer contribute the lesser of $250,000 or the value of the taxpayer’s legal residence (South Carolina Department of Insurance, undated).

Direct Cash Payments

Direct cash payments for disasters differ from traditional aid in that they provide cash payments, rather than goods or services, to beneficiaries. Such payments have both direct and indirect effects on households by reducing monetary poverty while potentially improv-
ing school attendance, nutrition, savings, employment, and female empowerment (Bastagli, Hagen-Zanker, and Sturge, 2016). These programs can be implemented through both government and community-based organizations and can use a variety of payment methods, such as traditional banking solutions and digital platforms.

Direct cash payments have been used by various nations, states, localities, and community-based organizations. The City of St. Louis used direct cash payments in response to COVID-19 and used means testing to determine eligibility based on an income threshold and loss of income from the pandemic. It used an online-only banking solution to provide funds to households (City of St. Louis, undated). The State of Washington also used means testing to determine eligibility for its natural disaster direct cash assistance program via income tiers, hours worked, and number of children in the household (Washington State Department of Social and Health Services, 2021). Similarly, Wisconsin partnered with the American Red Cross to provide client assistance cards, which were prepaid credit cards for disaster victims (Wisconsin Department of Revenue, undated).

Charity- and Nongovernmental Organization-Supported Efforts

There are also some charity- or nongovernmental organization (NGO)-supported programs that address disaster relief. These include direct cash payments (from traditional debit cards to blockchain solutions) and forecast-based financing pioneered by the Red Cross.

Direct Cash Payments

Outside the U.S. context, the International Monetary Fund provides guidance on setting up a direct cash transfer program for informal sectors of the economy during emergencies (Una et al., undated). The World Food Programme, the food assistance branch of the United Nations, offers emergency food relief for those recovering from conflict, disasters, and the impact of climate change. The program has its own payment solution for vulnerable communities (World Food Programme, undated-b), which provides direct cash payments to beneficiary accounts or mobile wallets. It has mapped payment infrastructures for more than 62 countries and has implemented the solution in Zambia and Haiti. In Zambia, the
program reached approximately 18,000 refugees, allowing them to choose their own goods at local markets (Smeulders and Mboshya, 2021).

Blockchain solutions, a type of distributed ledger technology that consists of a growing list of records that are securely linked together, also provide cash and other resources to disaster victims. Blockchain solutions do not require recipients to have bank accounts, but they do require access to technology (such as a smartphones). As of 2021, 97 percent of Americans had cell phones and 85 percent had smartphones (Pew Research Center, 2021; Silver, 2019). For those earning less than $30,000 annual salary, 24 percent did not have cell phones. For those earning between $30,000 and $99,000 annual salary, 13 percent did not have cell phones (Pew Research Center, 2021). There are start-ups in the United States focused on developing ledgers for coordination across agencies (Joseph and Kunkel, 2020; Wolfson, 2022). The World Food Programme has its own technology incubator using blockchain technology in Bangladesh and Jordan, delivering $325 million in assistance and saving $2.5 million in bank fees (World Food Programme, undated-a).

**Forecast-Based Financing**

Forecast-based financing enables access to humanitarian funding for early action based on in-depth forecast information and risk analysis. Triggers are established based on threshold values for weather and climate risks. Vulnerability and impact assessments are also developed such as three-day-ahead typhoon (Forecast-Based Financing, Philippine Red Cross et al., 2020) forecasts or three-day and seven-day heat forecasts (Forecast-Based Financing, Vietnam Red Cross et al., 2020). Once triggers are met, predefined measures in forecast-based financing’s early-action plans are deployed to minimize the impact of extreme weather events (International Federation of Red Cross and Red Crescent Societies [IFCR], undated).

Early action resources include cash distributions in Bangladesh ahead of potential floods (IFCR and German Red Cross, 2019); deployment of livestock evacuation, cash for work programs, and distribution of shelter strengthening kits in the Philippines ahead of a typhoon (Forecast-Based Financing, Philippine Red Cross et al., 2020); and community cooling centers, transportation to cooling centers, and shading retrofits in informal settlements in Vietnam before a heat wave (Forecast-Based Financing, Vietnam Red Cross et al., 2020).

The examples of forecast-based financing we observed were limited to Red Cross and Red Crescent organizations and the World Food Programme (World Food Programme Climate and Disaster Risk Reduction Programmes Unit, 2019). The approach can be replicated across other organizations. With planning, resources are ready to respond immediately to an emergency.
Discussion

Low-income communities and communities of color are disproportionately more susceptible to the risks of natural hazards and encounter the most difficulty in recovering from disasters. Households that are financially vulnerable can fall further down the economic ladder from the economic shock resulting from a natural disaster.

Disasters can also create significant fiscal strain for local governments, with local revenue falling after a natural disaster. Limited local financial resources are cited as a significant barrier to assisting residents after a major disaster.

Federal disaster response and recovery funding does help state and local governments and individuals rebound from natural disasters. However, that funding stream might take years to reach the communities and individuals affected and is insufficient to cover all losses. In the case of small- and medium-sized storms, federal recovery dollars might never get triggered. This leaves a financial resilience gap on the part of individuals and state and local governments.

Increasingly, state and local governments are seeking supplemental measures to assist with restoring their communities. This resource identifies some innovative products offered by the private sector that pay out more quickly than federal resources and are often more flexible in how the funds can be used. These products are available to public entities and can be used to restore public services and public budgets, which ultimately is to the advantage of individual residents. The flexibility provided by these funds indicates that there is the potential to use these funds specifically to bridge the gaps low-wealth communities and communities of color experience, which are more at risk financially following disasters. To our knowledge, there have not been assessments of whether these products are reducing or widening the gap between high-wealth communities and low-wealth communities or communities of color, but that is an area worthy of future research. Other products are available directly to individuals, and state and local governments can encourage, promote, or even facilitate adoption by residents. All of the products and programs discussed here would help communities rebound from natural disasters more quickly. We hope this resource guide provides insight for state and local governments exploring more tools for improving community resilience.
## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>COVID-19</td>
<td>coronavirus disease 2019</td>
</tr>
<tr>
<td>CPI</td>
<td>Consumer Price Index</td>
</tr>
<tr>
<td>CSA</td>
<td>catastrophe savings account</td>
</tr>
<tr>
<td>FEMA</td>
<td>Federal Emergency Management Agency</td>
</tr>
<tr>
<td>LADWP</td>
<td>Los Angeles Department of Water and Power</td>
</tr>
<tr>
<td>NGO</td>
<td>nongovernmental organization</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>PDD</td>
<td>presidential disaster declaration</td>
</tr>
<tr>
<td>SBA</td>
<td>U.S. Small Business Administration</td>
</tr>
<tr>
<td>USGS</td>
<td>United States Geological Survey</td>
</tr>
<tr>
<td>USIC</td>
<td>United Surety and Indemnity Company</td>
</tr>
</tbody>
</table>
References


CoreLogic, “CoreLogic Analysis Shows Final Estimated Insured and Uninsured Damages for Hurricane Ian to Be Between $41 Billion and $70 Billion,” press release, October 6, 2022.


First Insurance Company of Hawaii, “FirstTrack FAQs,” webpage, undated.


IFCR and German Red Cross—See International Federation of Red Cross and Red Crescent Societies and German Red Cross.


International Federation of Red Cross and Red Crescent Societies, “About Forecast-Based Financing,” webpage, undated. As of November 30, 2022: https://www.forecast-based-financing.org/about/

International Federation of Red Cross and Red Crescent Societies and German Red Cross, *Forecast-Based Financing: A New Era for the Humanitarian System*, 2019.


New Paradigm Underwriters, “About,” webpage, undated. As of November 30, 2022:
https://www.npuins.com/read-me

Pew Research Center, “Mobile Fact Sheet,” webpage, April 7, 2021. As of November 30, 2022:
https://www.pewresearch.org/internet/fact-sheet/mobile/

Raincoat, homepage, undated. As of March 15, 2023:
www.getraincoat.com


Recoop, “How It Works,” webpage, undated. As of November 30, 2022:
https://www.recoopinsurance.com/how-it-works


USIC—See United Surety and Indemnity Company.


Wisconsin Department of Revenue, “Disaster Relief Payments,” webpage, undated. As of November 30, 2022: https://www.revenue.wi.gov/Pages/FAQS/ise-disaster.aspx


World Food Programme, “Building Blocks,” webpage, undated-a. As of November 30, 2022: https://innovation.wfp.org/project/building-blocks

World Food Programme, “plugPAY,” webpage, undated-b. As of November 30, 2022: https://innovation.wfp.org/project/plugpay

World Food Programme Climate and Disaster Risk Reduction Programmes Unit, “Forecast-Based Financing (FbF): Anticipatory Actions for Food Security,” World Food Programme, April 2019.
Individuals and state and local governments (hereafter referred to as public entities) incur losses associated with natural disasters. For individuals, there are costs associated with evacuating, possible periods of unemployment, and costs associated with physical damages caused by the event, many of which are uninsured losses. Similarly, public entities incur damage to public buildings and public utilities and tax base losses associated with reduced economic activity. Although an entire community experiences a natural disaster, low-income and communities of color are disproportionately vulnerable to the risks of natural hazards and encounter the most difficulty in recovering from disasters.

The U.S. federal government provides funds for disaster response and recovery for both individuals and public entities. However, federal assistance is limited, and financial gaps remain. This report does not make policy recommendations, but rather is a resource meant to document programs and products that some communities have adopted to help improve individual and community financial resilience. Many of these products are available from the private sector, and others are programs developed by public entities or non-governmental organizations. Improving the financial resilience of public entities and individuals after a natural disaster strengthens and speeds up a communities’ ability to recover.