Private Markets and Public Assistance for Natural Disaster Supplies

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There is a large literature on the economic effects of natural disasters, but relatively limited work on disaster preparedness.¹ In this paper we assess the importance of well-functioning markets for critical goods in the context of U.S. natural disasters in recent decades. We show that disaster risk in the U.S. is both common and widespread, that its consequences threaten the immediate availability of electricity, water, and food, and that a substantial share of U.S. house-holds do not have the supplies necessary to cope already in their homes.

Given the urgent need for consumers to procure supplies such as batteries, flashlights, food, and water under adverse conditions, assistance from the federal government plays a critical role. We show in this paper, however, that the private retail market for disaster supplies is much larger than the provisions provided by U.S. federal agencies for all but a small set of the most extreme disasters. This underscores the need for research to provide guidance on effective policy to promote the efficient and equitable operation of such markets even in the unusual circumstances created by natural disasters.

This work contributes to a small existing literature on disaster preparedness. Notably, Beatty,

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¹e.g., Botzen, Deschenes and Sanders (2019) review a broad range of evidence on the economic impact of disasters.

Shimshack and Volpe (2019) quantify preparedness for hurricanes in the US. They show that supply purchases fall considerably closer to hurricane landfall than recommended by government advice. Our work also highlights the importance of studies on pricing, supply, and demand in private markets for disaster supplies, such as Cavallo, Cavallo and Rigobon (2014); Gagnon and López-Salido (2019); Beatty, Lade and Shimshack (2021), and work-in-progress by Dinerstein, Lucas, Nath and Rayl (2025).

I. U.S. Exposure to Natural Disasters

Americans face widespread and frequent exposure to natural disasters. The Federal Emergency Management Agency (FEMA) tracks the dates and causes of federal disaster declarations, which they define as an instance of one or more states receiving approval for federal disaster assistance. Figure 1 shows the total count of disasters across U.S. counties in the decade from 2014-2023, excluding events directly caused by humans (such as terrorist attacks).

On average, nearly one in three Americans lives in a county with a disaster declaration each year, with 89% of Americans meeting this criterion of exposure at least once during the 10-year sample. Of the 106 million Americans who face at least one disaster declaration each year, 46 million are subject to at least one repeat shock.

Severe storms comprise the majority of U.S. natural disasters. Each year, an average of 38 million Americans live in a county experiencing a disaster-level hurricane and 40 million more face a non-hurricane severe storm with some combination of rain, wind, snow, or ice. Flood-ing and wildfires affect an additional 19 million and 24 million people each, respectively. Overall, storms, wildfires, and floods constitute over 97% of U.S. natural disasters, with other events such as tornadoes, earthquakes, and landslides affecting relatively few Americans.

The incidence of natural disaster risk is some-



FIGURE 1. COUNTY-LEVEL FEDERAL DISASTER DECLARATIONS FROM 2014-2023

Note: Map shows total county-level federal disaster declarations for hurricanes, storms, floods, wildfires, tornadoes, earthquakes, and volcanoes from 2014-2023. Data comes from FEMA.

what skewed towards low-income and minority populations. Non-white Americans are 9% more likely than average to be exposed to a disaster declaration, and 23% more likely to face more than one disaster in the same year. Similarly, Americans living below the poverty line are 2% more likely than average to experience a disaster declaration, and 10% more likely to face multiple disasters in a year. As Figure 1 shows, these patterns are driven largely by disproportionate exposure in southern states such as Louisiana and Mississippi, and may involve some endogeneity in a state's decision to apply for federal aid.

Natural disasters bring a number of consequences for the health and well-being of affected populations. In the immediate occurrence and aftermath of disasters, some risks can only be mitigated through evacuation orders. When wildfires or flood waters engulf people's homes, no amount of preparation is sufficient for anyone left inside to remain safe.

Data from the U.S. Census Bureau's Pulse Survey suggests that about 3.4 million Americans evacuated their homes due to a natural disaster in 2023, which amounts to about 2.5% of all Americans experiencing a disaster in that year. Over half of those that evacuated left home for more than a week, and over a quarter did not return home within six months, suggesting that evacuations were in especially severe cases.

II. Disaster Needs and Existing Preparedness

For the vast majority of Americans who remain in place during natural disasters, FEMA provides a variety of resources and information to help people stay safe. Among these is a list of suggestions for a basic emergency supply kit, which recommends a three-day supply of nonperishable food and water (one gallon per person per day), batteries, flashlights, and health supplies such as a first aid kit, among other items.

FEMA's recommendations for disaster preparation index heavily on the consequences of potential power outages. Batteries and flashlights provide a reliable source of locally powered light, non-perishable food can survive the absence of refrigeration, and water stocks can substitute for breakdowns in water distribution systems that rely on electricity.

To document the extent to which such emergency supplies might be necessary, we use data from the Environment for Analysis of Geo-Located Energy Information (EAGLE-ITM) (Brelsford et al., 2024) to estimate the effects of natural disasters on power outages in the U.S. from 2014-2022. The data, which is compiled by researchers at Oak Ridge National Laboratory, documents the number of utility customers experiencing an outage at 15 minute intervals at the county-level.

Figure 2 shows event study estimates, with

FIGURE 2. EVENT STUDY ESTIMATES OF POWER OUTAGES DURING NATURAL DISASTERS



Note: Figure shows the effects of federally declared natural disasters on power outages in a regression with county and day fixed effects. Data for power outages is from the EAGLE-ITM database compiled by Oak Ridge National Laboratory. Dates and locations of federal disaster declarations are from FEMA.

day and county fixed effects, of the effects of disaster declarations on customer-hours of power outage. The estimates show that power outages begin right when disasters are declared, peak one week later, and do not disappear entirely until more than two weeks after the disaster. The average disaster causes 40,000 customer-hours of outages per day a week after impact, though note that each "customer" in the data refers to an electric utility grid connection and thus may represent an entire apartment building or commercial establishment rather than an individual or single family dwelling.

Overall, 36% of all power outage customer hours in the United States occur during disasters (within 21 days after a declaration). These losses are also heavily concentrated in a few events, with just 10 disasters accounting for 47% of all outage hours since 2014. Relatedly, 52% of all lost customer hours occurred in just three states - Texas, Louisiana, and Florida.

We are not aware of systematic measures of food and water availability following disasters, though circumstantial evidence suggests risks consistent with the FEMA preparedness recommendations. News reports following Hurricane Helene in 2024 confirm the possibility of gaps in water access, for example.

In addition, since 1973, concerns about food access have driven the federal government to provide a disaster addendum to the Supplemental Nutrition Assistance Program (D-SNAP), expanding eligibility to those who suffer losses during disasters but do not otherwise meet the income thresholds to qualify. The D-SNAP benefits target those for whom affordability concerns, rather than supply chain disruptions, threaten access to nutrition. Relatedly, 35% of disaster evacuees in the Census Pulse survey report "some" or "a lot" of difficulty with food shortages even a month after a disaster, likely reflecting lingering financial impacts.

Given that disasters can result in the loss of power, water, refrigeration capacity, and access to transportation, preparing in advance can be a key component of preserving well-being. Americans recognize that disaster risk is prevalent, with 75% expressing concern in a 2018 YouGov poll about a disaster affecting their communities within the next five years. Despite this, 51% of respondents self-report feeling unprepared to handle a disaster event in a separate survey conducted by FEMA.

More specifically, 27% of Americans in the FEMA survey report being unable to live for more than three days in their home without power, and 41% say the same for water. In the YouGov survey, 39% of Americans report having a non-perishable food stock available, 28% have a stockpile of water, and 27% have a flashlight. Given that Figure 2 shows that power outages last for over two weeks on average, these answers imply that the majority of households would require restocking supplies during the disaster period. Only 26% of Americans in the FEMA survey report feeling prepared to withstand a power outage of two weeks or longer.

Americans who feel the least prepared for dis-

asters in advance are also those with the fewest resources available to cope when they occur. Among households in the FEMA survey with an annual income above \$150,000, 59% feel well-prepared for surviving a disaster, compared with just over a third of those with incomes below \$50,000. Overall, 28% of Americans report having no money available to manage an emergency, a number that rises to 48% for those who feel they cannot withstand three days without power and water.

Taken together, the survey evidence suggests that while many Americans have taken steps to prepare themselves for natural disaster exposure, a substantial share of households have both a strong need to procure critical supplies during crisis events and a low ability to pay for them.

III. Private Markets and Public Provisions

We document private sales and public provisions of natural disaster supplies using NielsenIQ scanner data and Freedom of Information Act (FOIA) requests from FEMA and the United States Department of Agriculture (USDA). The NielsenIQ data contains weekly prices and quantities for over 60,000 U.S. retailers from 2006-2018 for a wide variety of products, including food, water, flashlights, and batteries. The FOIA requests provide total annual expenditures by USDA from 2000-2023 on nutritional assistance during disasters, and disaster-level expenditures on the direct provision of seven categories of supplies, including food and water, by FEMA from 2005-2024.

The data shows that private retailers exhibit large increases in the sales of key disaster supplies during disasters. In the week of a disaster declaration, the quantities of flashlights, batteries, and matches sold are 207%, 55%, and 48% higher than non-disaster weeks, respectively. This is consistent with consumers experiencing both the threat and the realization of power outages, and taking steps to acquire supplies they did not own beforehand. Similarly, bottled water sales are 24% higher in disaster weeks than non-disaster weeks. The disaster week increase in sales for food is more modest, however, ranging from 3-7% for eggs, bread, rice, pasta, canned beans, and canned fruit.

While disasters are a critical event for consumers, the data suggests that they may be less important for suppliers. Despite high demand in disaster periods, the relative infrequency of disasters means that over 94% of sales occur outside of disaster periods for the median store for 17 of the 18 product categories in the data. Only for a small share of products and stores do disaster sales comprise a substantial share of their business. For example, disaster periods represent over 25% of flashlight sales for 10% of the retailers in the sample. Overall, however, the data suggests that retailers may not find it worthwhile to take special steps to ensure the reliability of disaster period supplies.

The data provided by USDA and FEMA also show a substantial direct public provision of disaster supplies. On average, the two agencies spent \$51 million per year from 2005-2024 on food for disaster aid recipients, with FEMA accounting for nearly 90% of these expenditures. Note that these numbers exclude financial assistance from programs such as D-SNAP, and count only expenditures on publicly provided goods. In addition to food, FEMA also spent \$12 million per year on providing water during this period, and \$69 million on other goods such as medical supplies and emergency equipment.

When comparing the public and private sources of disaster supplies, Figure 3 shows that the latter is relatively large for most disasters. Overall, in the overlapping years of the samples from 2006 to 2018, FEMA provided 9% as much water to recipients as NielsenIQ retailers sold in the three weeks immediately following disasters. While restricting sales to the disaster week raises the relative proportion to over 25%, the private sales in the sample also understate the true population total because not all retailers are covered in the NielsenIQ data. For food, FEMA provisions amount to 32% of NielsenIQ sales in the three week disaster window, despite only 10 categories of food being covered in our selection of NielsenIQ data.² On the other hand, comparing relative expenditures may understate the proportion of public provision if bulk federal procurement brings lower unit prices.

For a small handful of disasters, public provisions are much greater. For example, during Hurricane Harvey in 2017, FEMA provided seven times more water and 29 times more food

²We include bread, eggs, pasta, rice, canned soup, canned beans, canned fruit, peas, lentils, and corn.

FIGURE 3. PUBLIC AND PRIVATE SPENDING ON NATURAL DISASTER SUPPLIES



Note: Data shows the relative magnitude of private sales and public provision of water (left panel) and food (right panel) during natural disasters, by quintile of private sales. Private market data is from NielsenIQ and covers a subset of U.S. retailers for the three weeks following disaster declarations. Public provision data is from FEMA, acquired through a Freedom of Information Act request.

to affected regions than the private sales measured in NielsenIQ. Such instances, however, are rare. In total, there have been 14 disasters from 2006 to 2018 in which public provisions of food and water exceeded our measure of private sales, representing fewer than 1% of disasters during this period.

IV. Conclusion

Overall, the data shows that the vast majority of Americans face at least some risk from natural disasters, that relatively few people evacuate to avoid them, and that most people do not have the supplies necessary to cope already in their homes in advance. In addition, those who do not generally keep disaster supplies available are especially likely to be low-income and/or lack liquidity for even small immediate purchases.

While federal assistance from FEMA and USDA provides direct public provision of disaster supplies, we show that the magnitude of private sales of these goods is far larger for the great majority of disaster events. This suggests an important need for more research to understand how policy can enable such markets to function efficiently and equitably during these unusual but critical periods.

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