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Severe Weather Events and Local Economic and Banking Conditions

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Severe Weather Events and Local Economic and Banking Conditions

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Abstract

This paper summarizes a limited study conducted by the Federal Deposit Insurance Corporation (FDIC) in 2021 to analyze the net effect that six of the most severe weather events over the past two decades had on local economic conditions, community bank performance, and the structure of the local banking landscape. The study analyzes economic and banking performance before and after each event, including the relative performance of low- and moderate-income (LMI) areas and community banks headquartered in the local area. The study concludes that the severe weather events affected local communities and banks differently. Studied areas with more vibrant economies ahead of a weather event generally recovered within a two-year period, while areas with struggling economies ahead of a weather event had more difficulty recovering. Government assistance, insurance proceeds, and other aid were instrumental in reducing the financial consequences of the severe weather events on community banks. No banks headquartered in any of the event areas failed during the study period. This paper concludes with suggestions for further research.

*The views expressed are those of the authors and do not necessarily reflect the official positions of the Federal Deposit Insurance Corporation or the United States.

In 2021 the FDIC performed a study and related research to assess the net effects of specific, severe weather events on local economic conditions, community bank performance, and the structure of the local banking landscape.[1] The study analyzes six of the most severe weather events in U.S history: three of the costliest hurricanes in history (Katrina, Harvey, and Irma); the strongest drought in 50 years, which significantly affected several Midwest states; and the two costliest wildfires in history (Camp and Tubbs). The study assesses quarterly economic and banking performance for the two years following each weather event and compares them to results for the two years before each event. The study also compares the relative economic performance of low- and moderate-income (LMI) areas and community banks headquartered in these areas before and after each weather event, when possible.[2]

The study has several limitations. First, its scope is limited. In any given year, numerous severe weather events in the United States cause damages in excess of $1 billion. This study focuses on six such events over the past two decades. Although small in number, the events were extraordinarily damaging and costly. Second, the study is historical; if weather events worsen in the coming years as many climate experts predict, the ability to draw conclusions from past weather events may become less reliable. Third, the study focuses only on discrete severe weather events, which represent a subset of physical risks associated with climate change, and the study does not assess potential transition risks.

Physical risks generally refer to the financial losses resulting from harm to people and property arising from acute, climate-related events, such as hurricanes, wildfires, floods, and heatwaves, and chronic shifts in climate, including higher average temperatures, changes in precipitation patterns, sea level rise, and ocean acidification. Transition risks refer to stresses to certain financial institutions or sectors arising from the shifts in policy, consumer and business sentiment, or technologies associated with the process of adjusting toward a low-carbon economy. This discussion of climate-related financial risks focuses only on a subset of physical risks to communities and banks arising from certain historical weather-related events. Because transition risks are longer-term, prospective risks, they are beyond the scope of this retrospective review.

Hurricanes

Climate-change literature frequently focuses on hurricanes because of their destructive power. In this analysis, we study the effects of three of the top five costliest hurricanes in U.S. history—Katrina, Harvey, and Irma—that struck hurricane-prone areas along the Gulf Coast.[3]

I. Katrina (August 2005)

Katrina made landfall on August 29, 2005, in Louisiana and Mississippi as a Category 3 hurricane after achieving Category 5 status in the Gulf of Mexico.[4] Katrina was notable for its storm surge, which reached as high as 28 feet. Floodwalls and levees were breached in New Orleans, causing 80 percent of the city to be flooded by as much as 20 feet of water within a

[1] This study was originally conducted in mid-2021. The event window of the analysis included two years after the event, so the most recent economic and banking data used are from 2020. The authors revisited the analysis and the data in May 2022 and determined that the paper's conclusions are still valid. Community banks are used in this paper because, by definition, they have a limited geographic scope and would be more likely to be affected by a local disaster than banks with a wider scope. The criteria for defining "community banks" was originally developed in the *2012 FDIC Community Banking Study*: https://www.fdic.gov/resources/community-banking/report/2012/2012-cbi-study-full.pdf.

[2] The Community Reinvestment Act defines "low- and moderate-income (LMI) area" as an assessment area in which, relative to the metropolitan statistical, division, or statewide nonmetropolitan areas, the median family income is below 80 percent. For a deeper description of this term, see Ben Horowitz, "Defining 'Low- and Moderate-Income' and 'Assessment Area'," Federal Reserve Bank of Minneapolis, March 8, 2018, https://www.minneapolisfed.org/article/2018/defining-low--and-moderate-income-and-assessment-areas#:~:text=LMI%20census%20tracts%20are%20identifiable,nonmetropolitan%20area%20median%20family%20income. The two wildfires examined in this study did not affect any LMI counties as defined in this paper. See Appendix 1 for the study's methodology and definitions, including the definition of an "LMI county." Appendix 2 provides details on the areas associated with each weather-related event.

[3] Since mid-2021, Hurricane Ida surpassed Irma as the fifth most costly hurricane. For details on how event areas were selected for this study, see Appendix 1.

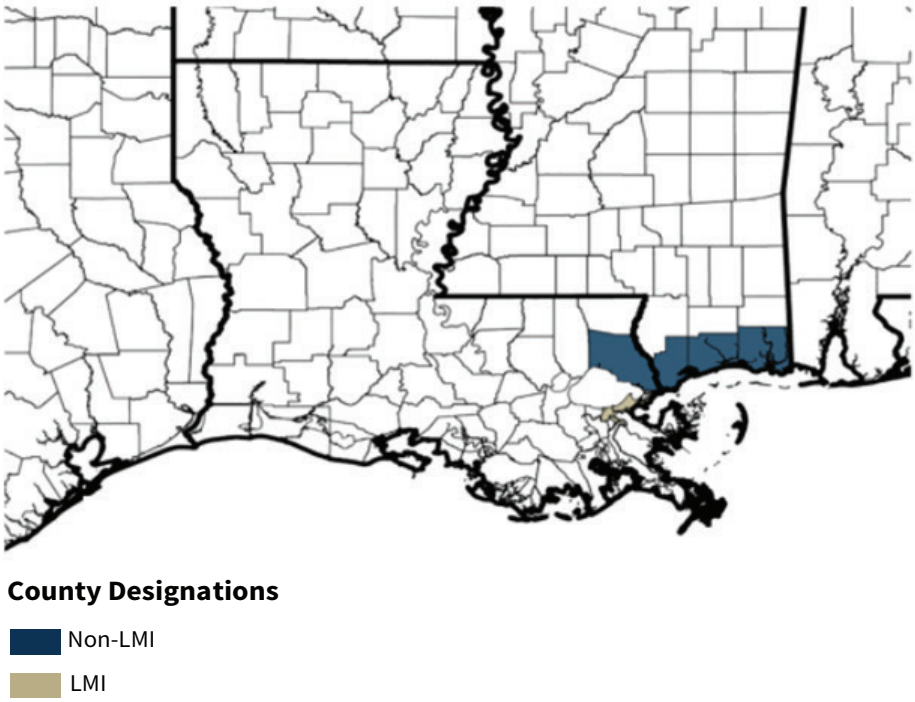
[4] Unless otherwise noted, all data in this paragraph are from Richard D. Knabb, Jamie R. Rhome, and Daniel P. Brown, "Tropical Cyclone Report, Hurricane Katrina, 23-30 August 2005," December 20, 2005, National Oceanic and Atmospheric Administration (NOAA) National Hurricane Center.

day of the hurricane's landfall. Some areas remained flooded for six weeks. The flood destroyed entire neighborhoods in New Orleans and severely damaged coastline communities in Mississippi. Katrina resulted in the loss of approximately 1,800 lives. More than one million homes were damaged or destroyed and three million residents registered for Federal Emergency Management Agency (FEMA) assistance.[5] At the time, Katrina was the third-deadliest hurricane to make landfall in the United States since 1900. At an inflation-adjusted $176 billion, Katrina is the most costly hurricane in U.S. history.[6]

Although Katrina affected five states in all, our analysis focuses on the five counties in Louisiana and Mississippi where the hurricane made landfall. Map 1 shows the five counties that comprise the event area in this analysis: one LMI county (Orleans Parish in the New Orleans, Louisiana, metro area) and four non-LMI counties (one in Louisiana and three in Mississippi).

Map 1

Hurricane Katrina Severely Affected Several Counties in Louisiana and Mississippi



Sources: FEMA and FFIEC.

Note: LMI is a low- and moderate-income county. LMI counties are designated based on the populations of LMI census tracts within the county.

Orleans Parish in Louisiana was suffering from a weak economy before the hurricane. In the four quarters that preceded Katrina, employment in the county declined 11 percent (or nearly 28,000 jobs). In contrast, employment in the non-LMI counties was relatively flat over those four quarters. Job losses in Orleans Parish were widespread, with six of eleven sectors losing at least 11 percent of their job base in the four quarters that preceded Katrina.[7]

[5] U.S. Department of Housing and Urban Development, "A Look Back at Hurricane Katrina," September 21, 2021, https://www.huduser.gov/portal/pdredge/pdr-edge-frm-asst-sec-092121.html.

[6] NOAA National Centers for Environmental Information, "Costliest U.S. Tropical Cyclones," https://ncdc.noaa.gov/billions/dcmi.pdf. All hurricane cost data are based on 2021 Consumer Price Index adjusted cost.

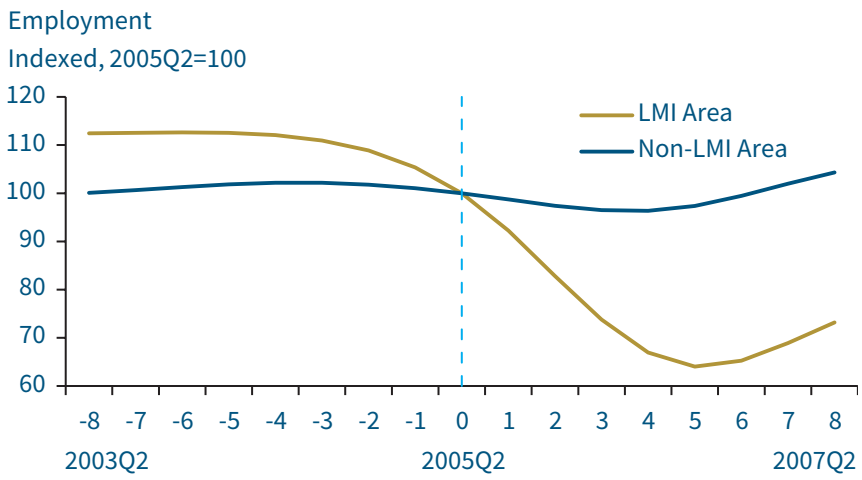
[7] The two sectors that lost the most jobs were education and health services (8,190 jobs) and leisure and hospitality (5,695 jobs).

Before the hurricane, the economy in the New Orleans metro area was lagging well behind national trends, and job opportunities were limited for many residents.[8] At approximately $35,000, estimated median household income in the New Orleans metro area was well below the average of approximately $45,000 for the nation. Low-paying jobs in sectors such as leisure and hospitality were prevalent, and the metro had a much smaller share of higher-paying manufacturing jobs than the nation.[9]

The combination of its weak economy, the high number of low-paying jobs, and the severity and duration of flooding distinguish Orleans Parish from the four non-LMI counties. Employment in Orleans Parish plunged 36 percent five quarters after the hurricane and had recovered only modestly eight quarters after the hurricane (Chart 1). In contrast, the four non-LMI counties lost just 3.6 percent of their jobs four quarters after the hurricane, and eight quarters after the hurricane these counties had added 4.3 percent to their pre-event employment level. Population also plummeted during this period. Eight quarters after Katrina, population in Orleans Parish was 45.6 percent below its pre-event level. In the non-LMI counties, population was down just 2.9 percent by the same point. The damage to Orleans Parish lasted well beyond the study period; as of first quarter 2021, total employment and population in the county still had not returned to pre-Katrina levels.[10]

Chart 1

LMI Areas Lost One Third of Jobs After Katrina



Source: Bureau of Labor Statistics.

Note: Dotted line represents the quarter end before the weather event took place. LMI is a low- and moderate-income county. Data are quarterly.

Katrina adversely affected community banks in the event area, especially the LMI area of Orleans Parish. One quarter after the event, the 12 community banks headquartered in Orleans Parish reported a spike in past-due and nonaccrual (PDNA) loan ratios from 1.8 percent to 10.1 percent (Chart 2). In contrast, the average PDNA loan ratio among the ten community banks in non-LMI counties rose from 1.7 percent to 4.2 percent in the quarter after the event. The increase in PDNA loan ratios among

[8] Michael L. Dolfman, Solidelle Fortier Wasser, and Bruce Bergman, "The Effects of Hurricane Katrina on the New Orleans Economy," *Monthly Labor Review*, June 2007, p. 3, https://www.bls.gov/opub/mlr/2007/06/art1full.pdf.

[9] Based on Bureau of Labor Statistics data, Moody's Analytics creates "Wage Tier" employment categories. According to Moody's, the number of high-wage earners in the New Orleans metro area peaked in 1982. Almost 30 percent of those jobs were gone by the time Katrina made landfall, and almost half were gone a decade after the hurricane.

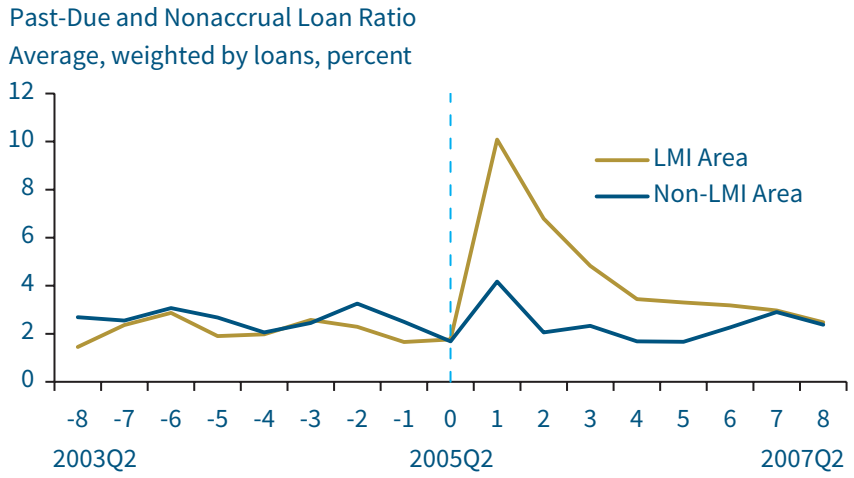
[10] As of first quarter 2021, employment in Orleans Parish was 18.5 percent below the pre-Katrina level and population was 27.8 percent below the pre-Katrina level.

Orleans Parish banks was widespread, with all but two banks reporting higher PDNA ratios in third quarter 2005 compared with second quarter 2005. Commercial real estate portfolios largely drove the increases.

Through a combination of charge-offs and improving loan quality, banks in Orleans Parish reported declining PDNA ratios from fourth quarter 2005 through the end of the study period in second quarter 2007. Orleans Parish banks reported PDNA ratios of 3.4 percent in second quarter 2006, a year after the event, down nearly two-thirds from the peak. By first quarter 2007, seven quarters after the event, the PDNA ratios of Orleans Parish banks and banks in non-LMI counties converged once again.

Chart 2

LMI Area Community Banks Reported High Levels of Delinquent Loans Immediately After Katrina



Source: FDIC.

Note: Dotted line represents the quarter end before the weather event took place. LMI is a low- and moderate-income county. Data are annualized quarterly.

Orleans Parish bank earnings and loan growth metrics also diverged substantially from banks in non-LMI counties. The median return on assets (ROA) ratio at Orleans Parish banks fell from 0.94 percent in second quarter 2005 to negative 0.78 percent in fourth quarter 2005. Banks in non-LMI counties reported a smaller decline in median ROAs in the two quarters following the event. Orleans Parish bank ROAs recovered in first quarter 2006 to reach the level of banks in non-LMI counties. In terms of total loans, on an indexed basis (with second quarter 2005, the quarter prior to Katrina, set to 100), Orleans Parish banks lost loan volume beginning three quarters after the event and recovered to an indexed level of 110.4 by the end of the study period in second quarter 2007. In contrast, loan volumes at banks in non-LMI counties rose consistently after the event, reaching 139.8 on an indexed basis by second quarter 2007.

Branch offices in LMI and non-LMI areas diverged after the hurricane. Branch offices in Orleans Parish declined 7 percent between June 30, 2005 and June 30, 2007, while branches in non-LMI counties in the event area increased 18 percent over the same period. No banks failed in the parish or the non-LMI counties during the study period.

Our study does not examine the extent to which federal assistance, insurance proceeds, and other forms of financial assistance contributed to the decline in PDNA ratios or the increase in median ROA ratios for banks in the areas affected by Katrina.

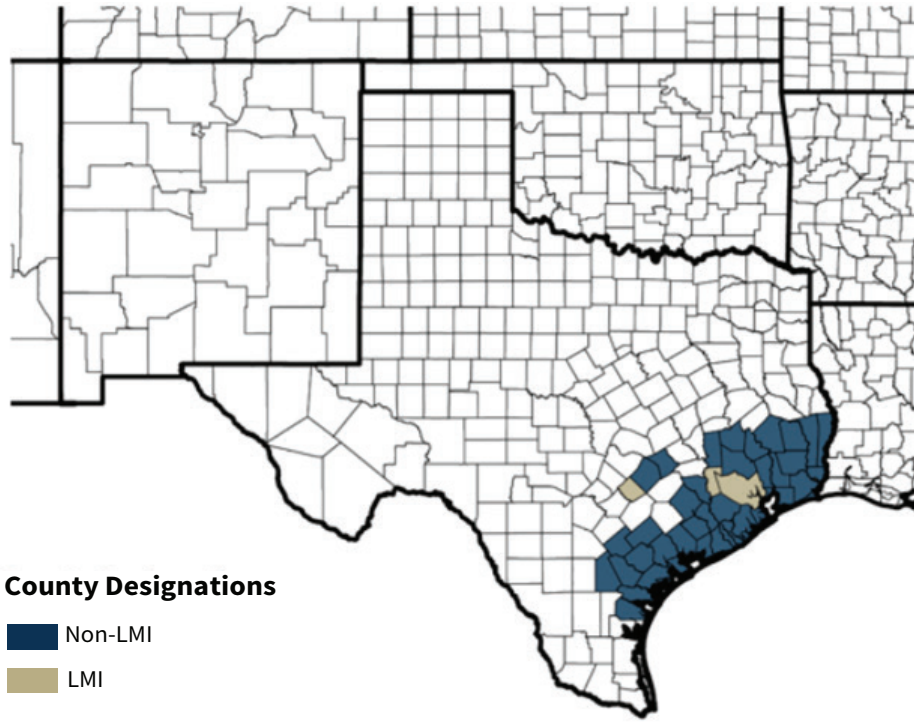
II. Harvey (August 2017)

Harvey made landfall on August 25, 2017, as a Category 4 hurricane near Rockport, Texas.[11] Harvey was the most significant tropical cyclone rainfall event in U.S. history, both in scope and peak rainfall amounts. The highest storm total rainfall report from Harvey was more than 60 inches. The storm quickly weakened to a tropical storm but remained over land—primarily the Houston metro area—for two days, dropping large amounts of rain on the metro area. The meteorological impacts from Harvey lasted a record 117 hours. At least 68 lives were lost from the direct impact of Harvey and as many as 35 lives were lost due to indirect results of the storm. Almost 220,000 structures were damaged or destroyed by Harvey, and more than 895,000 residents registered for FEMA assistance.[12] Harvey was the second-costliest hurricane in U.S. history at an inflation-adjusted $136 billion.[13]

Harvey's event area encompassed 37 counties, all in Texas, of which 3 were LMI counties (Map 2). Harris County dominates the LMI counties. Harris County is part of the Houston metro area and has a population of more than four million, making it the largest county by population in Texas.

Map 2

Hurricane Harvey Hit the Houston Metro Area and Much of the Texas Coastline



Sources: FEMA and FFIEC.

Note: LMI is a low- and moderate-income county. LMI counties are designated based on the populations of LMI census tracts within the county.

[11] Unless otherwise noted, all data in this paragraph are from NOAA's National Hurricane Center, "Tropical Cyclone Report, Hurricane Harvey," May 9, 2018.

[12] The Governor's Commission to Rebuild Texas, "Eye of the Storm," November 2018, https://www.rebuildtexas.today/wp-content/uploads/sites/52/2018/12/12-11-18-EYE-OF-THE-STORM-digital.pdf.

[13] NOAA National Centers for Environmental Information, "Costliest U.S. Tropical Cyclones." All hurricane cost data are based on 2021 Consumer Price Index adjusted cost.

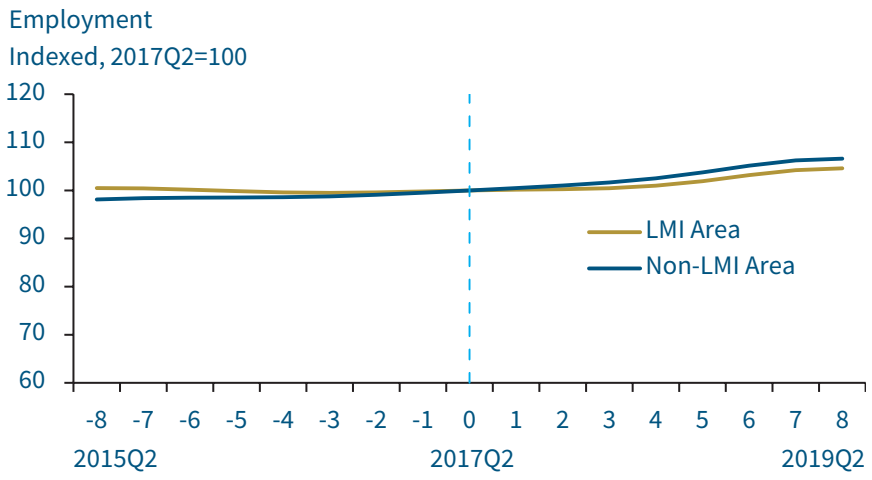
Because Harris County and Orleans Parish are significant areas in terms of population, it is sensible to compare the LMI areas in the Katrina and Harvey events. Unlike Orleans Parish, which was performing poorly well ahead of Katrina, Harvey's LMI counties were improving before the hurricane. The Houston metro area was recovering well from the oil price crash of 2014–16, and Harris County showed modest job gains in the year preceding the event.

Harvey's impact on its LMI counties was far less substantial than Katrina's. Job growth in Harvey's LMI counties lagged that of non-LMI counties in the first year following the hurricane, but the pace of job growth in LMI counties improved significantly in the second year following Harvey (Chart 3). Harvey's LMI counties added jobs at a 0.4 percent rate in the four quarters before Harvey; that rate increased to 1.0 percent in the four quarters following the event and 3.6 percent in the next four quarters. That trend contrasts sharply with the large job losses in Orleans Parish following Katrina. The output of Harvey's LMI counties showed the same trend—modest growth for a year followed by more robust growth— again, in contrast to the experience of Orleans Parish.

Non-LMI counties in the Harvey event area experienced solid job growth before Harvey that accelerated immediately following the event. In the four quarters before Harvey, non-LMI counties experienced job gains of 1.4 percent. In the four quarters following Harvey, employment in these counties grew 2.5 percent and then another 4.0 percent in the next four quarters.

Chart 3

Employment in LMI Counties Lagged Non-LMI County Growth for a Year After Harvey but Then Strengthened



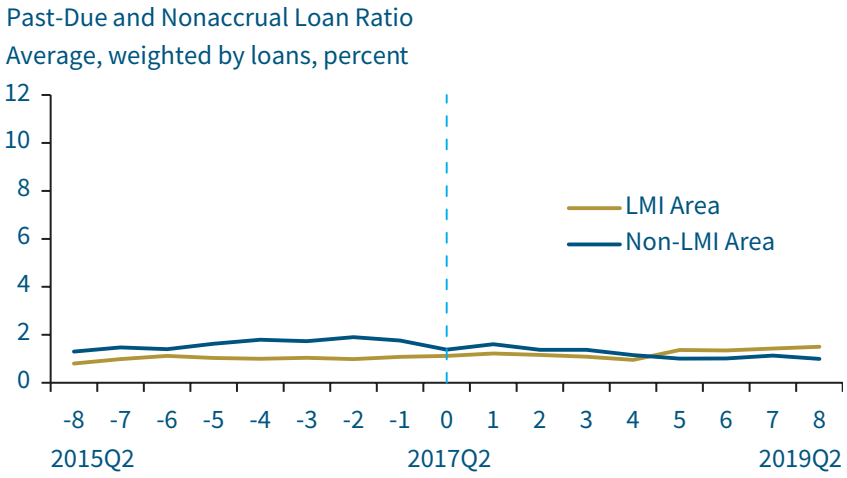
Source: Bureau of Labor Statistics.

Note: Dotted line represents the quarter end before the weather event took place. LMI is a low- and moderate-income county. Data are quarterly.

Community banks in Harvey's event area also fared much better than those in Katrina's event area. Neither banks in LMI counties nor those in non-LMI counties reported a surge in PDNA loan ratios after Harvey (Chart 4). Loan delinquencies in LMI counties were lower than in non-LMI areas before Harvey but increased modestly a year after the event. Other financial ratios were relatively unaffected by Harvey. For instance, the ROA at banks in LMI areas increased in the first year after the hurricane but remained low. At banks in non-LMI counties, the median ROA was largely flat for two years following the event. However, our study does not examine the extent to which federal assistance insurance proceeds and other forms of financial assistance contributed to the vitality of banks in the areas affected by Harvey.

Chart 4

Community Banks Did Not Report a Significant Increase in Delinquent Loans After Harvey



Source: FDIC.

Note: Dotted line represents the quarter end before the weather event took place. LMI is a low- and moderate-income county. Data are annualized quarterly.

III. Irma (September 2017)

Irma made landfall in the Florida Keys on September 10, 2017, as a Category 4 hurricane after making landfall in Cuba as a Category 5 storm.[14] Irma tracked from the Florida Keys through the center of Florida before dissipating in Alabama. With maximum winds of 185 miles per hour, Irma became the strongest storm on record in the Atlantic Ocean outside of the Caribbean and Gulf of Mexico. In the United States, at least 10 lives were lost from the direct impact of Irma and 82 lives were lost due to indirect results of the storm. While structural damage was widespread throughout the state of Florida, approximately 25 percent of homes in the Florida Keys were destroyed and another 65 percent of homes suffered significant damage.[15] At an inflation-adjusted $55 billion, Irma was the fifth-costliest hurricane in U.S. history.[16]

Irma's event area encompassed 49 counties in Florida, of which 11 were LMI counties (Map 3).

Despite the large amount of damage that Irma caused across Florida, the hurricane had little effect on the state's economy. For example, both LMI and non-LMI counties in the event area had similarly strong job markets before the hurricane, and the strong trends continued in the two years following the event (Chart 5). The same trends can be seen in gross domestic product (GDP) and unemployment rates, which continued to improve in both LMI and non-LMI counties after Irma. Total population continued to rise after the event but at a slower pace in LMI counties.

Bank performance also seemed relatively unchanged by the hurricane. PDNA ratios at banks headquartered in LMI and non-LMI counties were similar before the event, and banks in LMI counties reported lower ratios during the two years following the hurricane (Chart 6). Median ROA ratios for the two sets of banks were similar for much of the study period.

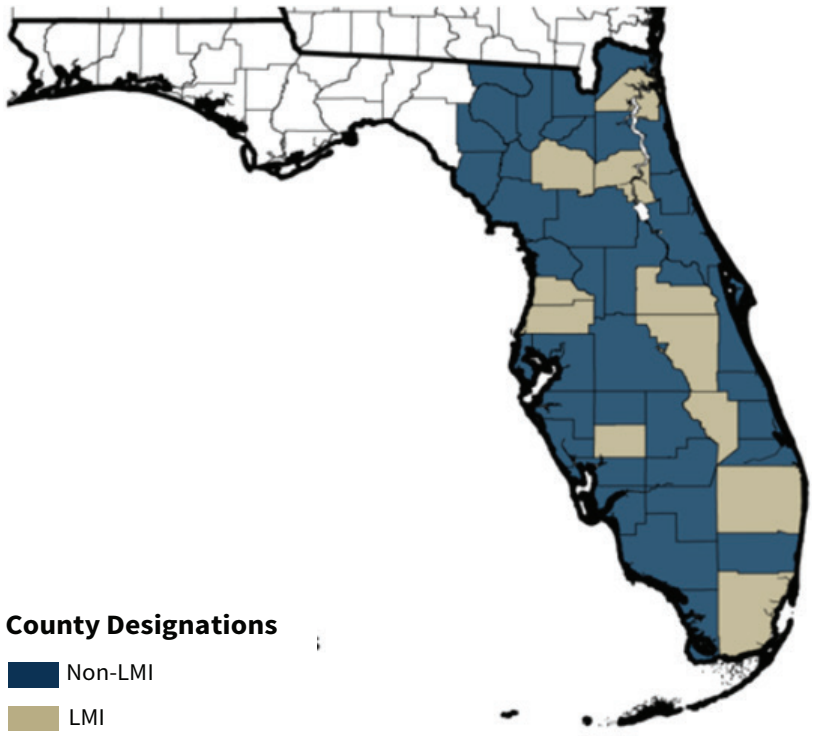
[14] Unless otherwise noted, all data in this paragraph are from NOAA's National Hurricane Center, "Tropical Cyclone Report, Hurricane Irma," June 30, 2018.

[15] FEMA, "Hurricane Irma in Florida," December 2018, https://www.fema.gov/sites/default/files/2020-07/mat-report_hurricane-irma_florida.pdf.

[16] NOAA National Centers for Environmental Information, "Costliest U.S. Tropical Cyclones." All hurricane cost data are based on 2021 Consumer Price Index adjusted cost.

Map 3

Hurricane Irma Affected Most of Florida

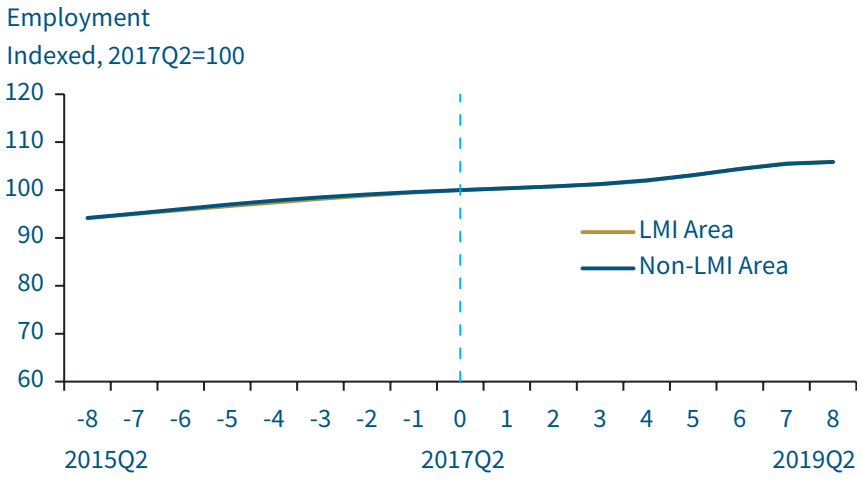


Sources: FEMA and FFIEC.

Note: LMI is a low- and moderate-income county. LMI counties are designated based on the populations of LMI census tracts within the county.

Chart 5

Irma Did Not Substantially Affect Employment Levels in LMI or Non-LMI Counties



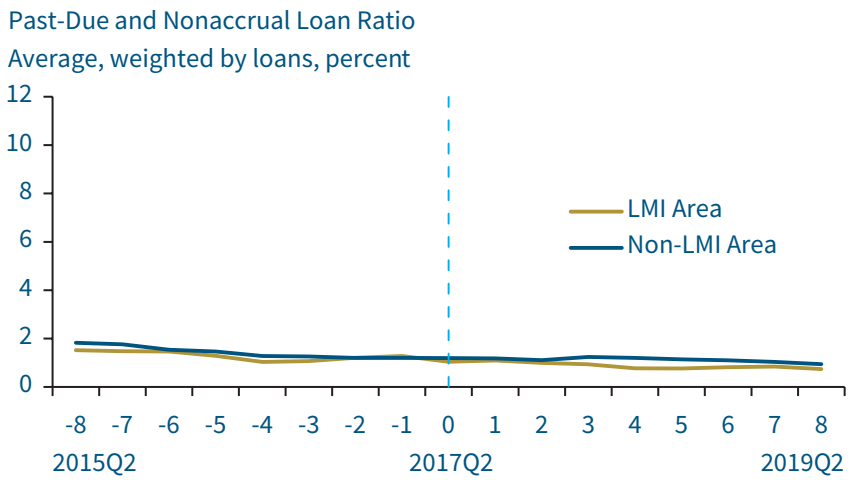
Source: Bureau of Labor Statistics.

Note: Dotted line represents the quarter end before the weather event took place. LMI is a low- and moderate-income county. Data are quarterly.

However, our study does not examine the extent to which federal assistance, insurance proceeds, and other forms of financial assistance contributed to the vitality of banks in the areas affected by Irma.

Chart 6

Community Bank Loan Portfolios in LMI and Non-LMI Counties Continued to Improve After Irma



Source: FDIC.

Note: Dotted line represents the quarter end before the weather event took place. LMI is a low- and moderate-income county. Data are annualized quarterly.

Midwest Drought

The 2012–2013 Midwest drought formed when several regional droughts combined into a nationwide drought.[17] At its peak in September 2012, the drought encompassed two-thirds of the continental United States, making it the worst drought in more than 50 years.[18] In the Central Great Plains, precipitation shortfalls during the summer of 2012 were the worst on record dating to 1895.[19]

Drought has outsized effects on agricultural producers, and agricultural losses from this drought event were significant. This analysis focused on states in the Midwest, where banks have substantial exposures to agriculture. To be included in the event area, counties had to be in a "severe" drought or worse condition for much of 2012 and 2013.[20] The event area encompassed 84 counties, of which 12 were LMI counties (Map 4).

Economic conditions in the event area's 12 LMI counties were weakening before the start of the drought, and the weakness persisted throughout the drought. At year-end 2011, total employment in the LMI counties was 26,200, down from 26,500 at year-end 2010. Total employment fell even further to 25,900 by the time the drought concluded at year-end 2013. In contrast, employment levels in the event area's 72 non-LMI counties continued to increase through the drought

[17] Richard R. Heim Jr., "A Comparison of the Early Twenty-First Century Drought in the United States to the 1930s and 1950s Drought Episodes," *Bulletin of the American Meteorological Society* 98, no. 12 (2017), https://journals.ametsoc.org/view/journals/bams/98/12/bams-d-16-0080.1.xml.

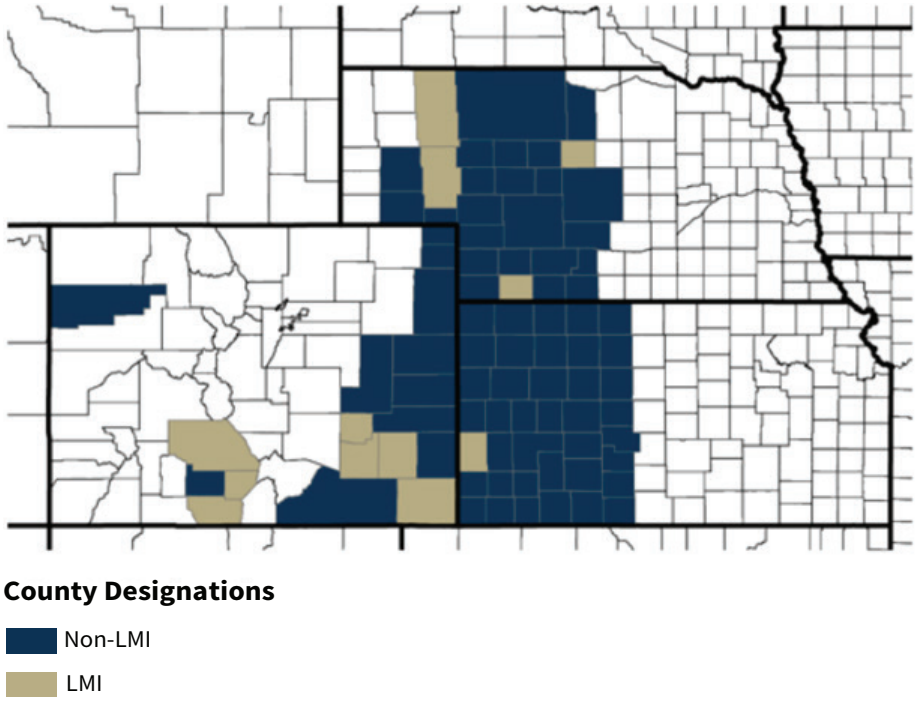
[18] Heim (2017).

[19] M. Hoerling, J. Eischeid, A. Kumar, R. Leung, A. Mariotti, K. Mo, S. Schubert, and R. Seager, "Causes and Predictability of the 2012 Great Plains Drought," *Bulletin of the American Meteorological Society* 95, no. 2 (2014).

[20] See Appendix 1 for more details on the selection criteria.

Map 4

The 2012–2013 Drought Affected Many Rural Counties in Nebraska, Kansas, and Colorado



Sources: U.S. Drought Monitor and FFIEC.

Note: LMI is a low- and moderate-income county. LMI counties are designated based on the populations of LMI census tracts within the county.

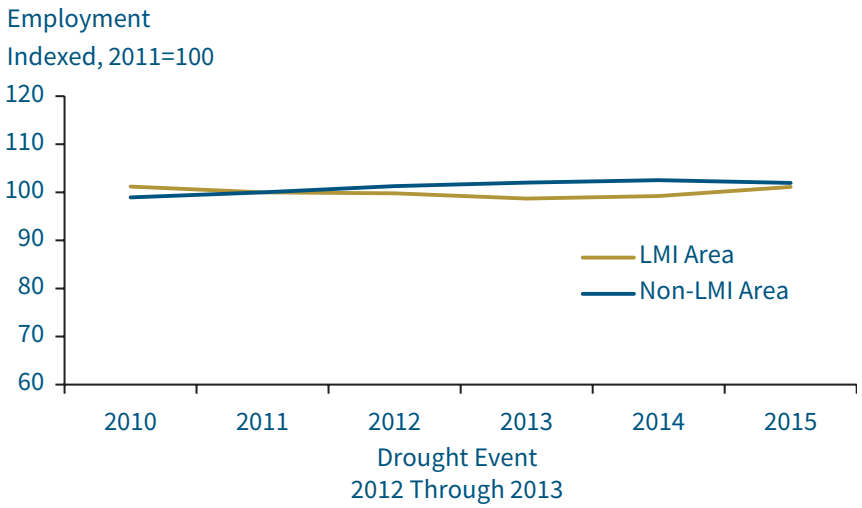
event (Chart 7). Two years following the drought, however, employment levels in LMI counties had improved substantially, nearly converging with employment levels in non-LMI counties. Trends in GDP and unemployment rates in LMI and non-LMI areas followed a pattern similar to employment, with LMI areas lagging non-LMI areas during the drought but improving substantially after the event.

Population growth in LMI counties lagged relative to non-LMI counties before and during the drought event. Total population in LMI counties declined annually from 78,600 at year-end 2010 to 76,500 at year-end 2013, at which point population stabilized. Meanwhile, total population among non-LMI counties declined far more slowly throughout the study period.

The drought had little adverse effect on community banks headquartered in the event area. PDNA ratios in both LMI and non-LMI counties were lower after the drought (2014) than before the drought (2011). Banks in LMI counties reported a slight decline in their PDNA ratio during the drought, while banks in non-LMI counties continued to report a trend of declining PDNA ratios that existed before the event (Chart 8). Government assistance likely played a key role in maintaining farmers' financial health during the drought.

Chart 7

LMI Areas Recovered Quickly After the Drought Ended

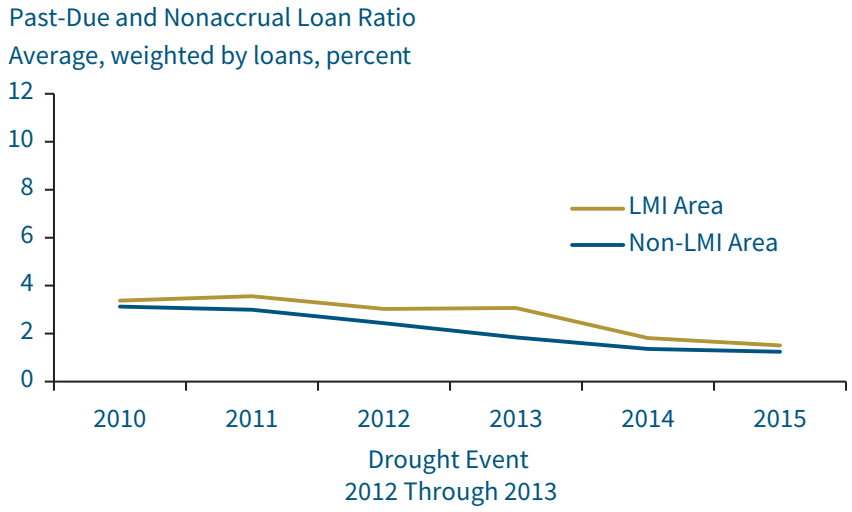


Source: Bureau of Labor Statistics.

Note: LMI is a low- and moderate-income county. Data are annual.

Chart 8

Community Bank Loan Portfolios Continued to Improve After the Drought



Source: FDIC.

Note: LMI is a low- and moderate-income county. Data are annual.

Wildfires

The Camp and Tubbs wildfires, both of which affected northern California, are the two costliest wildfires in the nation in terms of estimated insured losses.[21] California has the largest number of properties at risk of wildfire.[22] With minimal precipitation during summer, vegetation and grass typically become very dry. Also, strong wind gusts that normally occur in northern California in the fall can accelerate or even trigger fires by causing falling debris. Finally, California's large population and increased development near wildlands contribute to the rising prevalence and cost of wildfires in the state.[23] In 2020, California accounted for 40 percent of the burned acreage in the nation, a disproportionately large share relative to its 4 percent share of the nation's land area.[24]

I. Camp Wildfire (November 2018)

The Camp Wildfire occurred in Butte County, California, 170 miles northeast of San Francisco. The wildfire started in the northern part of the county and quickly spread south, causing significant damage in the town of Paradise. The Camp Wildfire lasted 17 days before it was fully contained. It ranks as the nation's costliest wildfire with estimated insured losses of an inflation-adjusted $10.8 billion.[25] The wildfire burned more than 153,000 acres, destroyed 18,800 structures, and resulted in 85 fatalities.[26]

An investigation by California's Department of Forestry and Fire Protection (Cal Fire) concluded that the Camp Wildfire was caused by a broken electrical transmission line. While the wildfire was triggered by the faulty power line, the lack of rainfall, strong winds, and low humidity accelerated the spread of the fire.[27] Low precipitation contributed to dead shrubs around the bottom of trees that created a path for the wildfire to climb from the ground to the treetops, which intensified the fire. The area typically has five inches of rain by early autumn, but it had less than one-half inch of rain in the same period before the Camp Wildfire.[28]

The Camp Wildfire affected Butte County. Since Butte County is not an LMI county, the analysis compared the county's employment levels and banking conditions with those in two adjacent counties, Sutter and Yuba, which were not affected by the wildfire (Map 5).[29]

[21] Note that the wildfires are discussed in their order of severity, not chronologically.

[22] Insurance Information Institute, https://www.iii.org/fact-statistic/facts-statistics-wildfires#Wildland%20fires.

[23] For human-caused wildfires, see National Park Service, "Wildfire Causes and Evaluations," https://www.nps.gov/articles/wildfire-causes-and-evaluation.htm. For dry California winds aiding wildfire spread, see Brandon McClung and Clifford F. Mass, "The Strong, Dry Winds of Central and Northern California: Climatology and Synoptic Evolution," October 1, 2020, Weather and Forecasting 35, no. 5 (October 2020), https://journals.ametsoc.org/view/journals/wefo/35/5/wafD190221.xml. For California's seasonal climate, see Tom Di Liberto, "Hot, Dry Summer and Slow Start to Wet Season Primed California for November 2018 Fires," November 15, 2018, NOAA, https://www.climate.gov/news-features/event-tracker/hot-dry-summer-and-slow-start-wet-season-primed-california-november. For movement to wildland and costs of wildfires, see American Academy of Actuaries Extreme Events and Property Lines Committee, "Wildfire – An Issue Paper: Lessons Learned from the 2017 to 2021 Events," January 2022, https://www.actuary.org/sites/default/files/2022-02/Wildfire.2022_.pdf.

[24] Nearly 18 percent of the nation's wildfires and 40 percent of burned acreage in 2020 were in California. See National Interagency Fire Center, "National Report of Wildland Fires and Acres Burned by State," https://www.predictiveservices.nifc.gov/intelligence/2020_statssumm/fires_acres20.pdf. For state area measurements, see the U.S. Census Bureau, "State Area Measurements and Internal Point Coordinates," https://www.census.gov/geographies/reference-files/2010/geo/state-area.html.

[25] Insurance Information Institute, "Facts + Statistics: Wildfires," https://www.iii.org/fact-statistic/facts-statistics-wildfires#Wildland%20fires. Estimated insurance losses are adjusted to 2021 dollars.

[26] Cal Fire, https://www.fire.ca.gov/incidents/2018/11/8/camp-fire/.

[27] Cal Fire, "CAL FIRE Investigators Determine Cause of the Camp Fire," press release, May 15, 2019, https://www.fire.ca.gov/media/5121/campfire_cause.pdf. For weather conditions leading to fire, see National Weather Service, "Service Assessment: November 2018 Camp Fire," January 2020, https://www.weather.gov/media/publications/assessments/sa1162SignedReport.pdf.

[28] NOAA National Centers for Environmental Information, https://www.ncdc.noaa.gov/cdo-web/.

[29] We found no LMI counties in the Camp Wildfire event area or the Tubbs Wildfire event area using the same methodology for determining LMI counties that was used for the analysis of hurricanes and drought. In lieu of LMI counties, the wildfire analysis evaluated economic and banking conditions in neighboring counties. See Appendix 1 for further details.

Map 5

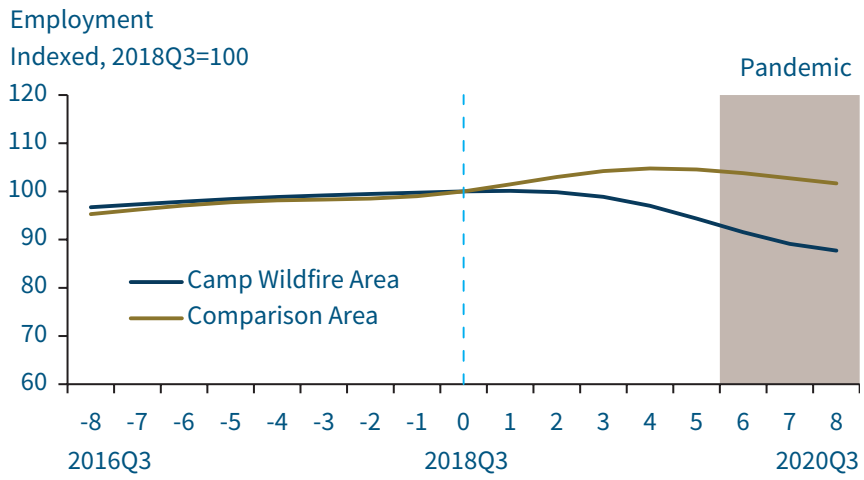
The Camp Wildfire Occurred in Butte County, in Northern California

Source: National Interagency Fire Center.

Before the wildfire, economic activity in Butte County and the comparison counties followed a similar path of steady employment growth (Chart 9).[30] In the two years before the event, employment increased 3.4 percent in Butte County, slightly below the growth rate for the comparison counties. Immediately following the wildfire, employment in Butte County was stable, as cleanup efforts and construction activity to repair structural damage to the area's infrastructure supported the county's employment level. But after initial rebuilding activity, Butte County's employment declined steadily.[31] Two years after the wildfire, employment in Butte County was 12.3 percent below its level before the wildfire. In contrast, employment in the comparison counties was up two years after the wildfire. Employment was up 4.8 percent in the year following the event in the comparison counties before declining at the start of the pandemic in 2020.

Chart 9

Employment in Butte County Weakened After the Initial Rebuilding Activity



Source: Bureau of Labor Statistics.

Note: Dotted line represents the quarter end before the wildfire event took place. Data are quarterly.

[30] Bureau of Economic Analysis/Moody's Data Buffet. As of third quarter 2018, Butte County's economic base, defined as the combination of GDP and employment base, was almost double that of comparison counties. Butte County's GDP was $11.6 billion and its employment base was 83,000. The GDP of comparison counties was $6.6 billion and their employment base was 44,000. The population for Butte County was 230,000, nearly 25 percent larger before the wildfire than the comparison counties' combined population of 175,000.

[31] Economic and Planning Systems, Inc. and Industrial Economics, Inc., "Final Report: Camp Fire Regional Economic Impact Analysis," January 2021, https://3coreedc.org/wp-content/uploads/2021/03/Camp-Fire-Regional-Economic-Impact-Analysis-January-2021.pdf.

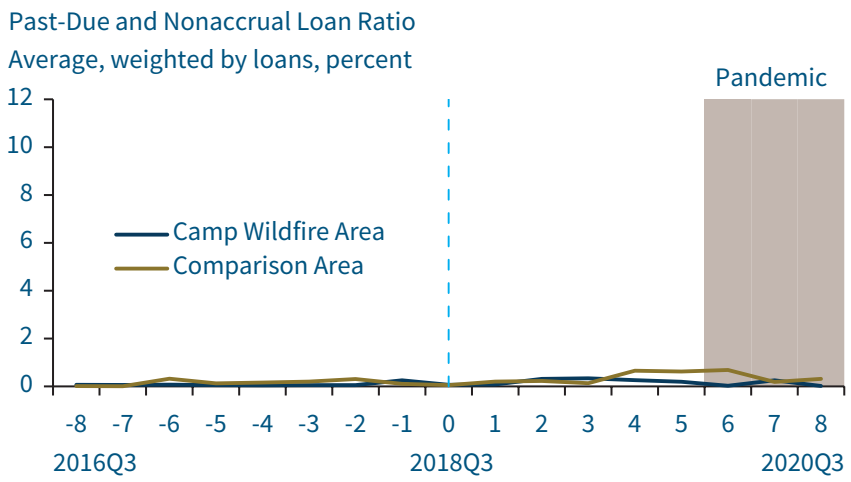
Trends in economic activity and population between Butte County and the comparison counties before and after the Camp Wildfire mirror employment trends, marked by deterioration in Butte County. In the two years before the wildfire, Butte County's GDP rose 5.4 percent before contracting 4.5 percent during the two years after the Camp Wildfire. By comparison, economic activity in the comparison counties continued to grow after the wildfire but at a slower rate than before the event.[32] Similarly, population declined in Butte County following the wildfire but increased slightly in the comparison counties.[33]

The effect of the Camp Wildfire on the town of Paradise was more severe. More than 85 percent of the town's homes were destroyed and only a small fraction of homes have been rebuilt.[34] Most of the town's residents left and have not returned. The population in Paradise is less than 25 percent of its pre-fire level, down from almost 27,000 residents to about 6,000 residents.[35] While some of the town's residents received insurance and other aid after the fire, many had difficulty renewing homeowners insurance and moved elsewhere. Some people who left Paradise relocated within Butte County, thus cushioning the effect of the Camp Wildfire on the county's population and employment base.[36]

Despite the damage from the Camp Wildfire, the two community banks headquartered in Butte County did not experience significant asset quality deterioration. Instead, these institutions performed similarly to the two community banks headquartered in the comparison counties (Chart 10).[37] The PDNA rate for one community bank in Butte County peaked at 0.8 percent in second quarter 2019, less than one year after the event. The PDNA rate at the other community bank in Butte

Chart 10

Asset Quality Ratios Among Community Banks Headquartered in Butte County and the Comparison Counties Remained Low Following the Camp Wildfire



Source: FDIC.

Note: Dotted line represents the quarter end before the wildfire event took place. Data are annualized quarterly.

[32] Bureau of Economic Analysis/Moody's Data Buffet. GDP increased 6.8 percent in the comparison counties during the two years before the Camp Wildfire and slowed to 3.1 percent growth during two years after the wildfire.

[33] Bureau of Economic Analysis/Moody's Data Buffet. Two years after the wildfire, population in Butte County was 7.9 percent less than before the wildfire, while population in the comparison counties had increased by 1.9 percent.

[34] California Department of Finance, data as of January 1, 2021, https://www.dof.ca.gov/Forecasting/Demographics/Estimates/e-5/.

[35] California Department of Finance, data as of January 1, 2021.

[36] Peter Hansen, "Mapping a Displaced Population," November 7, 2019, *Chico State Today,* https://today.csuchico.edu/mapping-a-displaced-population/.

[37] FDIC, Consolidated Reports of Condition and Income. This analysis includes two community banks with combined total assets of $476 million that were headquartered in Butte County as of third quarter 2018. Another bank was also headquartered in Butte County but is a noncommunity bank and was not included in this analysis. Two community banks were headquartered in the comparison counties as of third quarter 2018, with combined total assets of $481 million.

County remained well below 0.2 percent for the two years following the wildfire. Charge-off rates were very low or zero for the community banks headquartered in Butte County and the comparison counties through the entire study period. There was no discernable disruption to ROA for the community banks in Butte County or the comparison counties.[38]

With the influx of insurance proceeds and aid to local residents and businesses, deposits held in bank branches in Butte County increased strongly after the Camp Wildfire. After rising 5.2 percent in the year before the wildfire, deposits increased 36.8 percent in the year after the wildfire. Deposits held in branches in the comparison counties increased 2.3 percent in the year after the wildfire.[39]

II. Tubbs Wildfire (October 2017)

The Tubbs Wildfire occurred about a year before the Camp Wildfire and was the nation's costliest fire at that time. The Tubbs Wildfire started near Calistoga in the northern part of Napa County. Fueled by strong southerly winds, the fire quickly spread south to Sonoma County during the night.

An investigation by Cal Fire determined that the Tubbs Wildfire was caused by a private electrical system next to a residence.[40] Other studies suggest that strong winds either directly damaged power lines or caused trees or debris to fall on electrical systems, triggering the sparks that started the wildfire. The speed of the wildfire during the night, propelled by warm, strong winds typical to the area in the fall, contributed to fatalities and the spread of the wildfire into populated areas.[41] Further, the summer of 2017 was at the time California's warmest summer on record, resulting in dry vegetation that fueled the wildfire.[42]

The city of Santa Rosa, in Sonoma County, incurred the most economic damage. Upon containment nearly three weeks after its start, the Tubbs Wildfire caused more than $9 billion in estimated insured losses, damaged nearly 5,600 structures, burned nearly 37,000 acres, and resulted in 22 fatalities.[43]

The number of acres burned by the Tubbs Wildfire was one-quarter the acres destroyed in the Camp Wildfire, yet the estimated dollar cost was close to that of the Camp Wildfire. Property values and density of structures and homes destroyed in the Tubbs Wildfire were higher than the Camp Wildfire.[44]

Like the Camp Wildfire, no LMI counties were affected by the Tubbs Wildfire, so the analysis used two adjacent comparison counties: Contra Costa and Solano (Map 6).[45]

Employment in the event counties of Napa and Sonoma increased steadily after the Tubbs Wildfire and followed a similar path as the comparison counties (Chart 11). Combined, employment increased 1.9 percent in the year following the wildfire in Napa and Sonoma counties compared with 1.3 percent in the comparison counties. An increase in construction

[38] The ROA for the two Butte County community banks following the wildfire was steady and similar to the comparison group, and no bank reported an ROA lower than 1.36 percent following the wildfire.

[39] FDIC, Summary of Deposits. The sum of the deposits includes all branches in Butte County and in the comparison counties for the periods between June 30, 2017 and June 30, 2018, and between June 30, 2018 and June 30, 2019.

[40] Cal Fire, "CAL FIRE Investigators Determine the Cause of the Tubbs Fire," press release, January 24, 2019, https://www.fire.ca.gov/media/5124/tubbscause1v.pdf.

[41] Clifford F. Mass and David Ovens, "The Northern California Wildfires of 8–9 October 2017: The Role of a Major Downslope Wind Event," *Bulletin of the American Meteorological Society* 100, no. 2 (February 1, 2019): 235-256, https://journals.ametsoc.org/view/journals/bams/100/2/bams-d-18-0037.1.xml.

[42] Debra Kahn and Anne C. Mulkern, "Scientists See Climate Change in California's Wildfires," *Scientific American*, October 12, 2017, https://www.scientificamerican.com/article/scientists-see-climate-change-in-californias-wildfires/; and NOAA National Centers for Environmental Information, https://www.ncdc.noaa.gov/sotc/national/201708.

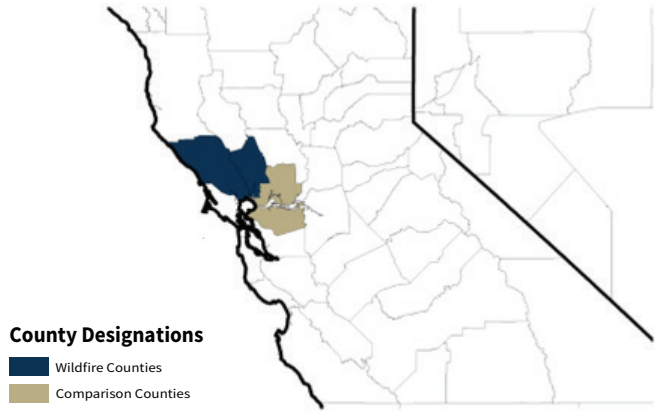
[43] Cal Fire, https://www.fire.ca.gov/incidents/2017/10/8/tubbs-fire-central-lnu-complex/; and Insurance Information Institute, "Facts + Statistics: Wildfires," https://www.iii.org/fact-statistic/facts-statistics-wildfires.

[44] Insurance Information Institute, "Facts + Statistics: Wildfires;" and U.S. Forest Service, "Most California Fires Occur in Area of Wildland-Urban Interface with Less Fuel and More People," press release, September 24, 2019, https://www.nrs.fs.fed.us/news/release/wui-interface-intermix.

[45] Bureau of Economic Analysis/Moody's Data Buffet. The counties in the comparison area had combined population and employment levels that were twice the size of Napa and Sonoma counties. As of third quarter 2017, employment in the comparison counties was 513,300 jobs and population was 1.6 million people, compared with 278,500 jobs and a population of 641,500 people in Napa and Sonoma counties.

Map 6

The Tubbs Wildfire Caused Damage in Napa and Sonoma Counties



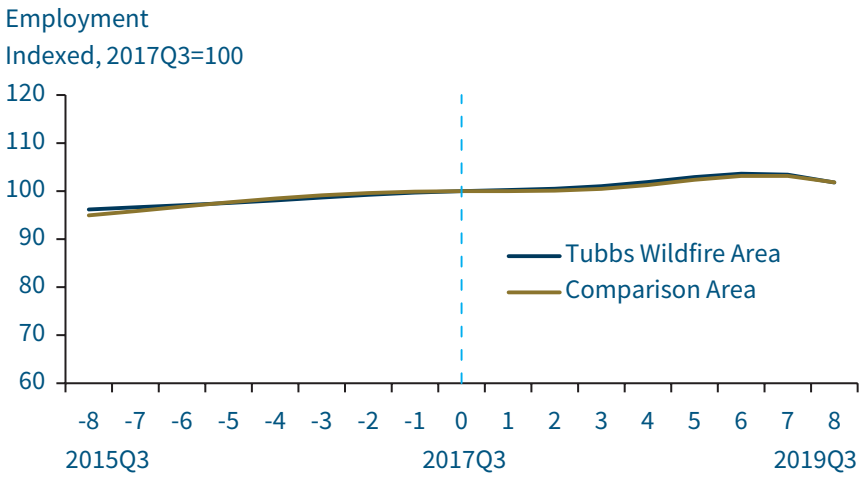
Source: National Interagency Fire Center.

jobs temporarily boosted employment in the affected counties as the area rebuilt.[46] Economic activity in Napa and Sonoma and the comparison counties continued to grow following the wildfire. However, population declined slightly in Napa and Sonoma in the two years after the event while increasing modestly in the comparison counties.[47]

While economic conditions in Butte County weakened following the Camp Wildfire, the Napa and Sonoma employment levels were not meaningfully affected by the Tubbs Wildfire. Several factors explain the difference in economic performance in the counties affected by the two wildfires. The Tubbs Wildfire area had a larger employment, population, and economic base than the Camp Wildfire area. Combined, the employment, population, and economic base in Napa and Sonoma counties pre-wildfire was nearly three times that of Butte County.[48] Napa and Sonoma also had a greater share of higher-wage jobs than

Chart 11

Employment in Areas Affected by the Tubbs Wildfire Was Unchanged Relative to Comparison Counties



Source: Bureau of Labor Statistics.

Note: Dotted line represents the quarter end before the wildfire event took place. Data are quarterly.

[46] Bureau of Labor Statistics. In the year after the Tubbs Wildfire, construction jobs in the event counties increased 18.9 percent. The share of construction jobs in the event counties increased from 6.4 percent in third quarter 2017 to 7.3 percent in third quarter 2018.

[47] Bureau of Economic Analysis/Moody's Data Buffet. In the two years after the event, as of third quarter 2019, the combined GDP for Napa and Sonoma counties grew 2.6 percent. In the same period, GDP in the comparison counties increased 5.7 percent. From third quarter 2017 through third quarter 2019, the population for Napa and Sonoma counties fell 1.4 percent, while population in the comparison counties increased 0.8 percent.

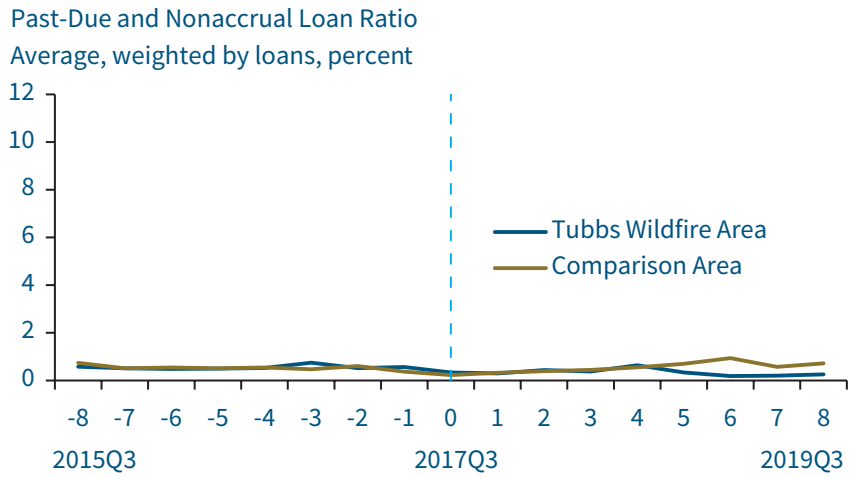
[48] Bureau of Economic Analysis/Moody's Data Buffet. As of third quarter 2017, the population of Napa and Sonoma counties was 641,500. Butte County's population at the time of its event, third quarter 2018, was 230,400. The combined GDP for Napa and Sonoma counties was $40 billion in third quarter 2017 compared with $11.6 billion for Butte County in third quarter 2018. As of third quarter 2017, Napa and Sonoma counties combined had 278,500 jobs; as of third quarter 2018, Butte County had 82,700 jobs.

the Camp Wildfire area, including professional services jobs.[49] Napa and Sonoma counties were also more affluent than Butte County. As of 2017, household income in Napa and Sonoma was 1.6 times higher than Butte County, and the median home price was more than twice as high.[50] The larger economic landscape helped insulate the economies of Napa and Sonoma from long-term repercussions, as many residents elected to rebuild their homes after the fire instead of leaving the area.

Similar to banks in the Camp Wildfire area, community banks headquartered in the Tubbs Wildfire area did not report asset quality weakness following the wildfire (Chart 12).[51] PDNA ratios remained low for the four community banks headquartered in Napa and Sonoma counties before and after the wildfire event, and the ratios were similar to the four community banks headquartered in the comparison counties. The net charge-off rate among community banks headquartered in the event area and comparison counties also remained low following the wildfire.

Chart 12

Asset Quality Ratios Among Community Banks in Napa, Sonoma, and the Comparison Counties Remained Favorable After the Tubbs Wildfire



Source: FDIC.

Note: Dotted line represents the quarter end before the wildfire event took place. Data are annualized quarterly.

Deposits held in branches in Sonoma County, which incurred the most dollar and structural damage from the Tubbs Wildfire, increased 12.6 percent in the year after the event as insurance proceeds and other aid flowed into the community. This deposit growth rate exceeded the 7.0 percent growth rate in the year preceding the wildfire.[52] Deposits also rose in branches in the comparison counties following the wildfire but at a rate lower than deposits held in branches in Sonoma County.

[49] Bureau of Economic Analysis/Haver Analytics. As of 2019, the share of professional, scientific, and technical services jobs in Butte County was 4.6 percent, compared with 7.5 percent in Sonoma County.

[50] Bureau of the Census and Redfin/Haver Analytics. In 2017, the median household income was $49,000 in Butte County, $79,000 in Sonoma County, and $84,000 in Napa County. As of third quarter 2017, the median home price in the Chico metro area, contiguous with Butte County, was $293,000. The median home price in the Santa Rosa metro area, contiguous with Sonoma County, was $583,000.

[51] FDIC, Consolidated Reports of Condition and Income. As of third quarter 2017, one community bank was headquartered in Napa County and three community banks were headquartered in Sonoma County. Assets of the four banks totaled $3.5 billion. Four community banks were headquartered in the comparison counties with total assets of nearly $3.6 billion. Two noncommunity banks were headquartered in the affected counties and three noncommunity banks were headquartered in the comparison counties.

[52] FDIC, Summary of Deposits. The sum of the deposits includes all branches in Sonoma County and in the comparison counties for the periods between June 30, 2016 and June 30, 2017, and between June 30, 2017 and June 30, 2018. Deposits held in branches in Napa County rose 6.0 percent in the year after the wildfire similar to the deposit growth rate in the year preceding the wildfire.

Government and Insurance Support Provides Insulation

Government assistance, federal disaster loan payments, insurance proceeds, and other sources of financial and economic support, risk mitigation strategies, and forbearance programs to borrowers in affected communities have helped insulate community banks from the negative effects of individual severe weather events.[53]

Hurricanes: Federal support for communities, companies, and individuals affected by hurricanes tends to be substantial. A June 2016 Congressional Budget Office report stated that federal spending as a percentage of economic data for hurricanes from August 2005 to the present averaged 60 percent of the total economic damage.[54] The same report said that total government spending for Katrina was nearly 75 percent of total economic damage.[55]

Drought: Federal assistance likely mitigated much of the adverse economic effects of the drought across the 2012–2013 event area. In 2012, drought disaster assistance and drought-related crop insurance indemnity payments totaled approximately 6 percent of total U.S. crop cash receipts, the second-highest level in records back to 1970.[56] Government-subsidized crop insurance policies paid out $720.6 million to drought-event counties in 2012 and $913.3 million to drought-event counties in 2013.[57] In addition, direct government payments to farmers in drought-event counties totaled $503.9 million in 2012 and $692.8 million in 2013.[58]

Wildfires: Insurance companies paid $18.7 billion to victims of the two wildfires in this study, while FEMA paid out at least $102 million in direct assistance to victims and $744 million to state and local governments. In addition, a major utility company was found liable for starting several fires and has set aside a fund of $13.5 billion to resolve claims by individual victims related to these fires, including the two in this study. Our study does not examine the extent to which this financial assistance contributed to the resiliency of banks in the areas affected by these two wildfires.

Conclusions

The study's results suggest that severe weather events can be economically damaging to a local area, particularly if the affected area's economy is struggling before the event or has a smaller, less diverse economic base. Conversely, underlying economic strength before a negative weather event appears to contribute to the strength and speed of the recovery after the event. Specifically:

- Differences in the economic performance of LMI counties and non-LMI counties were evident following Hurricane Katrina.
- Hurricanes Harvey and Irma affected their LMI counties less than Hurricane Katrina, in part because of modest-to-strong economic growth before the hurricanes.
- LMI areas fared worse economically than non-LMI areas during the two-year Midwest drought, but the trends were in line with those preceding the event. The differences dissolved within a year after the drought ended.
- The Camp Wildfire area had a less vibrant economy before the fire, and the fire affected the event area more than the Tubbs Wildfire affected its area.

[53] Our research into this area is not comprehensive. See our suggestions for further research into assistance that helps to insulate communities and banks from the effects of severe weather events.

[54] Congressional Budget Office, "Potential Increases in Hurricane Damage in the United States: Implications for the Federal Budget," June 2016, p. 24, Table 4, https://www.cbo.gov/sites/default/files/114th-congress-2015-2016/reports/51518-hurricane-damage.pdf.

[55] Ibid, p. 17, Table 3.

[56] Steven Wallander, Elizabeth Marshall, and Marcel Aillery, "Farmers Employ Strategies to Reduce Risk of Drought Damages," Amber Waves, June 5, 2017, https://www.ers.usda.gov/amber-waves/2017/june/farmers-employ-strategies-to-reduce-risk-of-drought-damages/.

[57] USDA Risk Management Agency, Cause of Loss Historical Data Files, https://www.rma.usda.gov/SummaryOfBusiness/CauseOfLoss. Other federal government actions to assist farmers during extreme weather events include permitting emergency grazing of Conservation Reserve Program land, increased eligibility for low-cost emergency loans from the Farm Service Agency, and deferment of Farm Services Agency loan payments. See USDA Disaster Assistance Programs At a Glance, https://www.farmers.gov/sites/default/files/2021-09/fsa-disasterassistance-at-a-glance-sept.-2021.pdf.

[58] USDA/Moody's Data Buffet.

Except for Katrina, the events studied had only a modest effect on community bank performance and asset quality. This modest effect was likely due to the amount of government aid, insurance proceeds, and other sources of financial and nonfinancial assistance that helped insulate community banks in the affected areas from deterioration in financial performance measures, including profitability and asset quality. Three branch offices in the LMI area affected by Katrina closed in the two years following the hurricane; the other event areas did not experience this effect. No banks headquartered in the event areas failed during our study period.

Suggested Future Research

This analysis studied the effects of significant severe weather events on community banks and LMI communities. Climate-change models predict increased frequency and severity of similar events. Consequently, the authors suggest future research in the areas below to illuminate the areas in the financial system that may absorb or transmit climate-related risks, the actions that banks or other financial agents take to mitigate or exacerbate risk, other sources of climate-related financial risk beyond the scope of this analysis, and bank responses to repeated climate events that may better reflect climate change predictions.

- The role of insurance in climate-related financial risks at banks – Given that insurance firms (or other private-sector companies) absorb weather-related losses, future research might evaluate how climate change could affect the insurance industry. For example, research could explore the potential for rapidly increasing premiums, the decreasing insurability of its clients, or the potential fragility of firms' ability to pay claims when faced with more costly disasters.[59] Future research might also examine how such changes may ultimately transmit to the banking sector.
- The role of government programs and climate-related financial risks at banks – Direct government aid, loan programs, and government insurance programs influence the extent to which banks realize losses associated with severe weather events. Future research may help quantify the extent to which government programs shield banks from climate-related financial risk or affect risk-taking incentives by banks and borrowers.
- Bank responses to climate-related financial risks – Bank actions can mitigate or exacerbate their exposures to climate-related financial risks. Underwriting requirements, resale of loans on secondary markets, and other bank decisions can affect the climate-related financial risk exposures to banks, the transmission or insulation of those risks to elsewhere in the financial sector, and credit availability to LMI communities. Future research may help to quantify the extent to which bank actions affect risk outcomes.
- Transition risk – This study focuses on certain physical risks resulting from severe weather events, but transition risks are another source of climate-related financial risks. The authors suggest that climate-related transition risks be explored further. Future research could determine how transition risks could be transmitted to communities and banks and which communities are most vulnerable to transition risk.
- Cumulative risk – Though climate change is characterized by increases in the frequency and severity of weather-related events, this study focuses on areas harmed by individual severe weather events. The FDIC has not studied the effect of sequential severe weather events or the cumulative impact that climate-related financial risks could have on bank performance, asset quality, and the ongoing effectiveness of risk mitigation strategies. One potential area to study is the communities on the Louisiana coast that incurred damage from three major hurricanes—Laura, Ida, and Nicholas—between August 2020 and September 2021.

[59] For example, the insurance claims associated with Hurricane Andrew in 1992 resulted in the subsequent failure of seven U.S. property and casualty insurers. See Lynne McChristian, "Hurricane Andrew and Insurance: The Enduring Impact of an Historic Storm," Insurance Information Institute, August 2012, p. 4, https://www.iii.org/sites/default/files/paper_HurricaneAndrew_final.pdf.

Appendix 1 – Methodology

Event-area selection criteria: Specific criteria for each type of weather event studied determined the definition of the affected area.

- **Hurricanes:** We selected three of the top-five costliest hurricanes in U.S. history (as of June 2021) in inflation-adjusted dollars.
    - ◊ For Harvey and Irma, we used the Federal Emergency Management Agency's (FEMA) Large Incident Claims Database to determine damage at the census-tract level. To ensure that we did not include areas with nominal damage, we eliminated the bottom one-third of the tracts in the database by the amount of damage. To aggregate the census-tract level data to the county level, we included any county that had one or more census tracts with the required level of damage.
    - ◊ We used a different methodology for Katrina because FEMA's Large Incident Claims Database begins in 2010, after Katrina occurred. Therefore, we used FEMA's Disaster Declarations Database, which identified census tracts in which at least 80 percent of homes sustained damage. As with Irma and Harvey, if a county had one or more census tracts that met the criteria, it was included in the event area.
- **Drought**: We chose the 2012–2013 drought because of its severity and length. Because drought has outsized impacts on agriculture, and because agriculturally exposed banks tend to be in the center of the country, we specifically studied states in the Midwest and the Great Plains. The National Oceanic and Atmospheric Administration (NOAA) produces a weekly U.S. Drought Monitor map that displays areas by their drought status: D1 (Moderate Drought), D2 (Severe Drought), D3 (Extreme Drought), and D4 (Exceptional Drought). To be included in the drought event area, a county could not be located in a metropolitan area and had to be in a Severe Drought or worse condition for both: 75 percent of the total weeks in the 2012 and 2013 summer growing seasons, and 75 percent of the 104 total weeks in 2012 and 2013.[60]
- **Wildfires**: We selected the Camp and Tubbs wildfires because they were the most destructive in U.S. history in terms of both structures burned and insured losses. Data on structures damaged or destroyed are from the California Department of Forestry and Fire Protection (Cal Fire), and data on insured losses are from Aon via the Insurance Information Institute.
    - ◊ For selection into the "comparison area" for each fire, a county had to be adjacent to the wildfire area, had to not have been affected by the wildfire, and had to have similar population and banking activity to the affected counties.

Banks: We studied community banks, as defined by the FDIC's Community Bank Study, headquartered in counties in each event area, and community banks headquartered outside of the event area but which had at least half of their offices and deposits in the area.[61]

County-level analysis versus census-tract level: Our initial goal was to perform this analysis at the census-tract level. However, we determined that the economic data available at the census tract level were either unavailable or unreliable on a quarterly basis. Much of the event data were available and reliable at the census-tract level, so we aggregated census-tract data to the county level to perform the economic analysis. All results in this study are at the county level.

County LMI designations: Census tract income designations are from the Federal Financial Institutions Examination Council (FFIEC) Census Flat File based on the year of the event. For example, we based income designations for Hurricane Katrina on the 2005 FFIEC Income Data. We aggregated census tract populations to the county level. We summed the number of people living in LMI designated census tracts and expressed the total as a percentage of the county's total population. We designated a county as an LMI county if it exceeded its respective state's mean share of LMI population by at least one standard deviation.

[60] Because our focus was on the agricultural impacts of drought, it was reasonable to exclude the two counties in metropolitan areas that otherwise met these criteria.

[61] Only one community bank met the criteria for being included in this study because it had branches in the event areas, not its headquarters.

Study periods: The study periods for hurricanes and wildfires cover the eight quarters before the event and the eight quarters following the event. We define "time zero," the time of the event, as the calendar quarter that immediately preceded the event. For example, third quarter data would be defined as time zero for an event that occurred in October, November, or December. Given its longer duration, we studied the drought event over a six-year period from 2010 through 2015, examined at year-ends. Year-ends 2010 and 2011 represent the two years before the event, year-ends 2012 and 2013 capture the event period, and year-ends 2014 and 2015 span the two-year period following the drought event.

Appendix 2

Event Areas Details

Event	Number of Counties			Number of Banks		
	Event Area	LMI	Non-LMI or Comparison Area	Event Area	LMI Counties	Non-LMI or Comparison Area
Hurricane Harvey	37	3	34	77	22	55
Hurricane Irma	49	11	38	101	40	61
Hurricane Katrina	5	1	4	22	12	10
Midwest Drought	84	12	72	122	17	105
Camp Wildfire	3	1	2	4	2	2
Tubbs Wildfire	4	2	2	8	4	4

Source: FDIC.

Note: LMI is a low- and moderate-income county. Wildfire events did not contain LMI areas. Instead, adjacent non-LMI counties were selected as comparison counties. Number of banks is based on number of banks headquartered in designated area at the quarter end immediately preceding the quarter in which the event began.