A TALE OF TWO COUNTIES
IN THE WAKE OF THE 2017 HURRICANE SEASON

Economic Recovery & Resilience Project
January 2020 Update
SUMMARY

This report is the fourth update on the economic aftermath of the 2017 hurricane season. This update focuses on the impacts of Hurricanes Harvey and Irma on their respective directly hit areas along the Gulf of Mexico coast, as well as the performance of these economies in the following two years. The historical narrative of the local labor markets and industries is supplemented by a summary of business surveys conducted by the local chambers of commerce in 2018 and 2019.

This study is part of the Economic Recovery and Resilience project funded in part by the U.S. Economic Development Administration (EDA). As a complement to our earlier updates, this data-driven report describes the 2017 storms’ economic consequences and how Aransas County in Texas and Monroe County in Florida performed during their early recovery phase. The objective is to provide public officials, policymakers and constituents with an unparalleled inside look at community recovery from economic shocks inflicted by the historic events.

Read the online version of this report at stedc.atavist.com.

HIGHLIGHTS

- Both Aransas and Monroe Counties appear to be on track to full recovery.
- During the short-term recovery period, the industrial mixes of the local economies shifted. Employment in different sectors will likely continue to evolve until the two counties reach full recovery.
- The more rapid recovery progress in Aransas County is attributable to an absence of logistical disadvantages that might have impeded rebuilding activity and workforce inflows to its counterpart of Monroe County; relatively more federal relief aid; and a more effective local social network.
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- Santos McBain Management & Planning
- Small Business Administration
1. INTRODUCTION

The 2017 hurricane season broke records for natural disaster damages in the United States. For the first time, the U.S. experienced not one, but three hurricanes in the same year. Two hit the mainland. Category 4 Hurricanes Harvey and Irma were only two weeks apart. About another week later, Maria—a Category 5 hurricane—swept through Puerto Rico.

Harvey was the first Category 4 hurricane to make landfall in Texas since Carla of 1961. It made landfall near Rockport in a South Texas region known as the Coastal Bend. Irma made U.S. landfall in the Florida Keys and then continued to head north along southwestern Florida with Category 3 intensity. While these two tropical storms caused widespread devastation across U.S. regions around the Gulf of Mexico, the rural areas where the storms made landfall sustained disproportionately more destruction.

Against this background, we conduct an event study that begins with a historical narrative of the impact of the two hurricanes on two counties in their paths: Aransas County in the state of Texas and Monroe County in the state of Florida. We also look at how these two small, rural Gulf Coast communities have recovered in the wake of the historic disaster events. According to conventional wisdom, it takes at least several years to fully recover from a hurricane’s devastation (McCarthy, 2017). Yet by the second anniversary, developments in these two counties seemed to be against all odds. Given our objective to advance knowledge in community resilience, we explore how their economies have evolved and what has been driving or inhibiting their recovery.

The rest of this report is organized as follows. The next section reviews key aspects of the hurricanes and the two hardest-hit communities. The third section looks at the impacts of the storms and the economic performance of the two counties during the first two years of the event. The fourth section documents some findings from local surveys of business impacts and needs. The fifth section provides an overall synopsis with some historical comparisons, following by a conclusion. The Data Appendix lists major data sources.
2. BACKGROUND

2.1 The Hurricanes

According to the National Weather Service of National Oceanic and Atmospheric Administration (NOAA), Hurricane Harvey began as a tropical wave in the African coast in early August of 2017 (Blake and Zelinsky, 2018). The disturbance formed into a tropical storm east of the Lesser Antilles on August 17. Several days later, Harvey weakened to a tropical wave due to dry air and unfavorable winds in the Eastern Caribbean.

After crossing Mexico’s Yucatan Peninsula, its remnants moved back into the Gulf of Mexico and rapidly grew into a Category 4 hurricane as it made landfall on San Jose Island in Texas on the night of August 25. After stalling over South Texas for another day, Harvey’s center of circulation moved slowly eastward back into the Gulf of Mexico before making another landfall near Cameron, Louisiana, on August 30.

As Harvey was approaching the Texas coastline, Irma originated from a tropical wave in the west coast of Africa on August 27. The storm swept through parts of the Caribbean as a Category 5 hurricane. On September 10, Irma made landfall as a Category 4 hurricane in the Florida Keys. The eye passed Cudjoe Key in the Lower Keys and then moved northward along western Florida with Category 3 intensity.

2.2 Meteorological Factors

Harvey was unique in that it rapidly developed from a tropical depression into a Category 4 hurricane in 56 hours. This rapid development made it unpredictable for most weather forecasters until two days before landfall (Murphy, 2018). Although Harvey’s wind intensity weakened rapidly over land to a tropical storm within 12 hours after landfall, it stalled over southeastern Texas for another week and produced record rainfall totals of more than 60 inches near the Houston metro area.

Irma also set historic records. It was the strongest hurricane ever observed in the Atlantic Ocean. Irma was also one of only five hurricanes that reached maximum sustained wind speeds of 185 miles per hour or greater, and those winds prevailed for 37 hours—the longest on record (Cangialosi, Latto and Berg, 2018).

In the areas where the two hurricanes made landfall, the meteorological impacts were similar (Table 1). Harvey delivered wind gusts as strong as 134 miles per hour and storm surge as high as 12 feet. Aransas County, Texas, sustained an
average of 106 mile-per-hour sustained wind speed and storm surge averaged at 3.04 feet. The average amount of rainfall was 15 inches. Irma generated 132 mile-per-hour sustained winds, with an average wind speed of 110 miles per hour across Monroe County, Florida. Storm surge was as high as 8 feet in some locations in the Keys, with an average level of 3.05 feet.

### 2.3 Casualty and Physical Damage

In response to Harvey’s imminent landfall, officials of the City of Rockport and its neighboring town of Fulton in Aransas County ordered mandatory evacuation. An estimated 560,000 people in the Coastal Bend evacuated. In total, some 3.8 million Texas residents evacuated, the vast majority of whom were from Houston in anticipation of flooding (FEMA, 2019). Within the next two weeks of Harvey’s strike in Texas, some 6.5 million of Florida residents evacuated from Irma (FEMA, 2018). In the Keys, all residents and visitors were subject to mandatory evacuation orders. About 75% of residents across those islands in Florida evacuated before Irma’s landfall.

Harvey is the deadliest hurricane to hit Texas since 1919. It claimed a total of 68 direct deaths in the United States, all in Texas, and another 35 indirect deaths (Blake and Zelinsky, 2018). Direct deaths include those persons who drowned in storm surge, floods, lightning and wind-related events, such as collapsing structures. Indirect deaths occur from such factors as heart attacks, house fires, electrocutions and so on. All but three direct deaths were from flooding. No direct death occurred in Aransas County where Harvey made initial U.S. landfall. In Florida, Irma caused 47 direct deaths, and an additional 82 indirect deaths. In the Florida Keys, three people drowned during Irma’s passage.

According to NOAA, Harvey caused $125 billion in economic damage (Blake and Zelinsky, 2018). This was the second costliest natural disaster in U.S. history, trailing only Hurricane Katrina of 2005. While the economic costs of Katrina came mostly from storm surge in New Orleans, Harvey’s impacts were largely from flooding near the Houston area. The estimate for Irma’s economic toll is $50 billion, but this would have soared to $300 billion if it directly hit the Miami metro area—Florida’s most populous metro area—the way Harvey hit Houston (Cangialosi, Latto and Berg, 2018).
### Table 1: Summary Statistics

<table>
<thead>
<tr>
<th>Community Profile (2016):</th>
<th>Aransas County</th>
<th>Monroe County</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total area (sq. miles)</td>
<td>528</td>
<td>3,738</td>
</tr>
<tr>
<td>Land (sq. miles)</td>
<td>252</td>
<td>983</td>
</tr>
<tr>
<td>Housing Units</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Detached Units</td>
<td>10,145</td>
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</tr>
<tr>
<td>- Attached, Multi-Family Units</td>
<td>1,979</td>
<td>14,225</td>
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<tr>
<td>- Mobile Homes</td>
<td>3,288</td>
<td>7,508</td>
</tr>
<tr>
<td>- RVs, Boats, Vans</td>
<td>202</td>
<td>137</td>
</tr>
<tr>
<td>No. of Businesses</td>
<td>2,712</td>
<td>14,413</td>
</tr>
<tr>
<td>Population</td>
<td>25,572</td>
<td>77,013</td>
</tr>
<tr>
<td>Median Age</td>
<td>49</td>
<td>46.7</td>
</tr>
<tr>
<td>Labor Force Participation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Age 55+</td>
<td>15%</td>
<td>41%</td>
</tr>
<tr>
<td>- Age 65+</td>
<td>7%</td>
<td>21%</td>
</tr>
<tr>
<td>Median Household Income</td>
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<td>$63,000</td>
</tr>
<tr>
<td>Median Home Price</td>
<td>$180,200</td>
<td>$70,900</td>
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<tr>
<td>Hurricane Impacts:</td>
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<td></td>
</tr>
<tr>
<td>Maximum Wind Speed (mph)</td>
<td>134</td>
<td>130</td>
</tr>
<tr>
<td>Rainfall Amount (in.)</td>
<td>15</td>
<td>11.7</td>
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<tr>
<td>Average Storm Surge (ft.)</td>
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<td>3.05</td>
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<tr>
<td>Direct Deaths</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Homes Damage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Affected</td>
<td>19%</td>
<td>65%</td>
</tr>
<tr>
<td>- Minor</td>
<td>33%</td>
<td>13%</td>
</tr>
<tr>
<td>- Major</td>
<td>25%</td>
<td>8%</td>
</tr>
<tr>
<td>- Destroyed</td>
<td>11%</td>
<td>4%</td>
</tr>
<tr>
<td>Average Damage/Home (FEMA)</td>
<td>$2,467</td>
<td>$2,448</td>
</tr>
<tr>
<td>Debris (cubic yards)</td>
<td>2.8 million</td>
<td>2.2 million</td>
</tr>
</tbody>
</table>

In Florida, Irma brought a severe impact to its recreational and commercial fishing industries. An estimate of 1,800 boats and commercial vessels were destroyed in the Keys alone. Based on information collected on damages to fishing operations and related businesses, NOAA estimates that total damages to fishing vessels and businesses exceeded $95 million with $98 million in lost revenue (NOAA, 2018). Commercial fishing vessels accounted for about half of the damages and revenue losses.

The nature and extent of physical damage were comparable between the two counties of landfall. According to the Federal Emergency Management Agency’s databases, Harvey caused 2.8 million cubic yards of debris in Aransas County while Irma caused 2.2 million cubic yards across the Keys in addition to massive marine debris in canals. Unlike flooding in the Houston area, Rockport and its neighboring coastal communities sustained mostly wind damage. An estimate of 88% of homes in Aransas County were affected, of which 25% sustained major damage and 11% destroyed. In Monroe County, Irma damaged an estimate of slightly less than 90% of structures. Physical damage was most severe in the Middle and Lower Keys. The shares of homes with major damage (8%) and destroyed (4%), however, are relatively smaller in comparison with Aransas County.

Drawing on FEMA’s damage assessments of housing units in the Individual Assistance program, the average damage per home was $2,467 in Aransas County and $2,448 in Monroe County. The housing units approved for Individual Assistance amounted to 45% of all homes in Aransas County and relatively smaller at 31% in Monroe County. Irma could have caused physical damage comparable to Harvey. Yet Florida learned from Hurricane Andrew in 1992 and later Hurricane Charley in 2004. The state revamped building codes to make houses to withstand a 180-mile-per-hour wind load and elevation above expected levels of flooding. The Institute of Business and Home Safety (IBHS) has evaluated each U.S. coastal state’s residential building code programs. Florida has maintained the top ranking, with the most recent score of 95 in 2018. Today, 80 percent of the homes in Irma’s path were built to better withstand hurricane-force storms. By contrast, Texas has been among the bottom states for a resilient home building code, slightly above such Gulf Coast states as Alabama and Mississippi (IBHS, 2018).

The different degrees of overall property losses between the two counties can also be realized by changes in property values following the 2017 hurricane season. According to the Aransas County Appraisal District, residential and commercial properties lost an average of 16% in appraised values between the beginning of 2017 and 2018. For Monroe County, the total appraised value in fact rose 5%. However, because of the linear geographical layout of the Florida Keys, damage
was uneven (Silk, 2019). The loss of housing stock would potentially post long-term impacts beyond the immediate response and recovery phases.

2.4 Community Profiles

Aransas County is part of the Corpus Christi metro area. The county covers a total area of 528 square miles, of which 252 square miles is land (Figure 1). With a population of slightly more than 25,000, Aransas is the fourth smallest county in Texas by population. By contrast, Monroe is the largest county in Florida by total area, covering 3,738 square miles. Yet nearly three-quarters (73.7%) of this county is water, and 87% of the land area is on the Florida mainland that is an uninhabitable region of Everglades National Park and Big Cypress National Preserve. Other than the area in the mainland, the county consists of the entire Florida Keys island chain south of the Florida peninsula (Figure 2).

The Florida Keys are made up of more than 1,700 of low-lying tropical islands stretching about 120 miles off the southern tip of Florida’s most populous Miami-Dade County. The largest islands, from Key Largo closest to mainland Florida to the U.S. southernmost point of Key West, are connected by a 113-mile long Overseas Highway with 42 bridges as part of U.S. Route 1. Although the Keys make up only 13% of Monroe County’s landmass, they together account for more than 99% of the county population. Key West accounts for nearly one-third of residents and more than half (56%) of businesses in the county. The linear nature of the Keys with only one evacuation route makes effective evacuation a challenge.
Figure 1: Aransas County Map

Figure 2: Monroe County Map
2.5 Population Trends

Monroe County’s population grew to a peak of 82,182 one year after Category 5 Hurricane Andrew hit Key Largo and other parts of South Florida in 1992 (Figure 3). The downward population trend accelerated following Category 2 Hurricane Wilma hit the Florida Keys in 2005. The county population grew again beginning in 2009 until Irma’s strike. Within one year after Irma, a net of 2,024 people migrated out of Monroe County, contributing to a 2.1% population loss.

Unlike South Florida, the South Texas region has long been spared from the brunt of tropical storms. After the 1919 hurricane that hit both Florida and Texas, Hurricane Celia of 1970 was the most devastating storm before Harvey made landfall near Corpus Christi. Since Celia, Aransas County’s population expanded steadily at 2.3% annually on average through 2017. In the year after Harvey, a net of 1,533 people moved out of the county. Its 6.5% population loss was the largest percentage change among all U.S. counties in 2018.

2.6 Demographics

Despite strikingly different historical trends of population growth, the demographic patterns of the two counties are similar in various dimensions. According to the latest Census (2017), the median age of either county is exceptionally high: 49 years for Aransas and 47 years for Monroe, compared with 38 years for the U.S. total population.

Both Gulf Coast communities are popular destinations for retirees and visitors. Yet the labor force participation rates differ drastically between the two counties: 48% for Aransas versus 68% for Monroe. Monroe County’s labor force participation rate is even higher the 63% national average. Its relatively high labor force participation rate is attributable to employment among older residents. More than one in five (21%) residents aged 65 years or older are employed, compared with 7% in Aransas County.
Figure 3: County Population

Source: U.S. Census Bureau.
The age demographics changed drastically in the wake of the 2017 hurricane events. While the total population in either disaster county declined in 2018, the numbers of residents 65 years old or older in Aransas and Monroe Counties increased by 616 and 1,254, respectively. In other words, outmigration occurred mostly to those of younger age cohorts and their family members.

Monroe County’s relatively higher labor force participation rate is associated with a 41% higher median household income than that of Aransas County ($63,000 vs. $44,600). Despite a relatively higher median household income level, Monroe County’s median home price at $70,900 in 2017 was remarkably low (vs. $180,200 for Aransas County) due in part to a relatively large share of housing in multi-family units or apartments (27% in Monroe vs. 13% in Aransas). On the other hand, more than one in five housing units (21%) in Aransas County are mobile homes, compared with 6.5% nationwide. Mobile homes are particularly vulnerable to wind damage.

Hispanics or Latinos make up the largest minority population in either county: 27% in Aransas and 20% in Monroe. While people of Mexican origin make up 80% of this population in Aransas County, those of Cuban origin form the majority of this group in Monroe County.

### 2.7 Economic Profiles

The two Gulf Coast counties are more than 1,000 miles apart, but their overall economic landscapes are strikingly similar. Both economies rely heavily on tourism, which directly employs more than half (54%) of the workforce in Monroe County and about one-third (32%) of the workforce in Aransas County. The Florida Keys are a major U.S. and international tourist destination. Some 56% of businesses of the Florida Keys are in Key West. Its outer reefs form the world’s third largest barrier reef system that generates extensive recreational water activities. In Aransas County, the city of Rockport accounts for slightly less than half (48%) of all businesses. Rockport boasts its clean beaches, and it is one of the top small travel destinations in the United States (Rodriguez, 2019).

Figures 4 and 5 show the distributions of employment and business revenues based on the Economic Modeling Specialist Inc. (EMSI) database. Broken down by the NAICS two-digit sectors, the largest sectors in both counties are accommodation and food services, followed by retail trade. In either county, concentration of jobs in the accommodation and food services sector is at least twice as high as that nationwide. In addition to hotels and motels, scores of short-term vacation rentals operate through online booking platforms, such as Airbnb.
Other visitor-related businesses are in the arts and recreation and other services sectors, including fishing guides and travel agents.

Beyond dependence on tourism-related activities, different industries are driving these two economies. As for many Florida coastal communities, commercial and recreational fisheries and the seafood industry together play a sizable role in the Monroe County economy. This industry in Monroe County generated about $80 million annually in sales in 2016. According to the Florida Keys Commercial Fishermen’s Association, Irma caused a total revenue loss of $39 million in the local lobster industry in 2018 as a result of losing 27% of the 350,000 lobster traps and a 60% output loss in the area (Monroe County, 2019b).

The commercial fishing industry plays a much smaller role in the economy of Aransas County. The number of shrimp boats—the main commercial fishing vessels in the South Texas region—has declined steadily in the past 30 years (Cargo, 2019). Rather, the construction industry accounted for 10% of the all business revenues in the county in 2017—more than the 8% share of the accommodation and food services sector. As for the state of Texas, the county is exposed to oil and gas production, which represented 7% of local business revenues and 5% of local jobs.
Figure 4: Distribution of Employment by Sector, 2017Q2

Source: Economic Modeling Specialist Inc.
Figure 5: Distribution of Revenue by Sector, 2017Q2

Source: Economic Modeling Specialist Inc.
3. ECONOMIC IMPACTS AND RECOVERY

Beyond direct economic losses in the context of damage to physical properties and infrastructure, a hurricane typically wreaks havoc on the economy of its directly hit area. In the counties where Harvey and Irma made landfall, most businesses were closed for weeks and regional infrastructure, including water and electric power, was interrupted for at least one week. This section describes changes of the economies in Aransas and Monroe Counties in the wake of the hurricanes.

3.1 Business Conditions

A timely indicator of the local business conditions is the total volume of sales or revenues. The Texas and Florida States provide monthly sales figures in their sales tax collection reports for individual counties. Figure 6 plots for each of two counties year-over-year percentage changes in reported sales between August 2017 and July 2019. The baseline for comparison, or the pre-hurricane period, is defined as the month within one year leading to the month of the landfall, which is August 2017 for Harvey and September 2017 for Irma.

In Aransas County, the total volume of business sales has grown substantially in the wake of Harvey. During the first eight months through May 2018, monthly sales activity gained 13% on average over the baseline. The monthly gains reduced to an average of 5% for the rest of the observation period through July 2019. Although the number of establishments reporting sales tax collection was still down by mid-2019, some surviving businesses thrived as a result of the emergency response and the subsequent rebuilding activities. In Monroe County, interruptions to local businesses appeared to prevail for more than eight months. Beginning in July 2018, the monthly sales volume picked up steadily, gaining an average of 9% over the pre-Irma levels.
Figure 6: County Sales Activity Relative to Pre-Hurricane Levels

Source: Texas Comptroller of Public Accounts, and Florida Department of Revenue.
Figure 7: County Sales by Industry Relative to Pre-Hurricane Levels

Source: Texas Comptroller of Public Accounts, Florida Department of Revenue, and author’s calculations.
A hurricane’s local economic impacts varies across different industries. Some types of business establishments are more vulnerable to storm damage than others. As opposed to many service-oriented businesses, retail stores are prone to damage to inventory stocks and lodging establishments are particularly vulnerable to structural damage (Zhang, Lindell and Prater, 2009). Before the community fully recovers, businesses that rely on local customers, notably retail stores, restaurants and some business services, are less likely to thrive (Chang and Falit-Baiamonte, 2002; Tierney, 1997; Webb et al., 2002). Labor intensive businesses are also likely to face operational disruptions due to losses of employees who have been displaced or left the disaster area (Tierney, 1997; Xiao and Van Zandt, 2012). On the contrary, businesses in construction and engineering services are likely to face a boom due to rebuilding activities (Belasen and Polachek, 2008, 2009; Chang, 2010; Corey and Deitch, 2011; Brown et al., 2015).

The experiences of the two disaster counties so far reinforce the above general observations. Figure 7 contains two color-coded charts, each of which illustrates a county’s percentage changes in quarterly sales by economic sector in comparison with the corresponding quarters during the year leading to the hurricane event. As for the monthly sales figures, the quarter data draw from the Texas and Florida states’ online databases. Apparently, the construction and wholesale trade sectors have been driving much of the post-hurricane boom in overall sales growth. Wholesale trade includes sales of emergency supplies, hardware and equipment, and construction materials. The real estate industry has recovered steadily over time, as repairs for homes and business establishments were complete.

The performance of the accommodation and food services sector over time varied between the two counties. Its sales volume has recovered more rapidly in Monroe County than in Aransas County. As Section 2 above points out, this sector is a mainstay of both counties. Yet hotels and motels are particularly vulnerable to structural damage (Zhang, Lindell and Prater, 2009), exacerbating temporary housing shortages that typically occur in the wake of a hurricane.

Given the importance of the lodging industry, we take a closer look at its post-hurricane performance using monthly sales data. The data are derived from the states’ monthly Hotel Occupation Tax (HOT) reports. Figure 8 shows monthly changes in local lodging revenues relative to the pre-hurricane levels defined as above. In Aransas County, the total amount of hotel revenues declined by as much as 90% in November 2017. One year following Harvey, half of hotels and other lodging facilities in Aransas County remained closed. Meanwhile, industry-wide revenue losses had reduced to about 25% as a result of higher occupancy rates.
among reopened hotels. By the end of the second year, lodging revenues returned to pre-Harvey levels, although about 25% of hotel and motel rooms were still offline (Lee, 2020).

In the Florida Keys, the overall impact on the lodging industry seemed relatively modest. The amount of hotel revenues returned to the pre-Irma levels by year end 2018. According to the Florida Keys Tourism Council, 75% of hotel rooms throughout the Keys were back online by the end of the 2017. Irma’s damage was uneven across the 125-mile-long island chain. While the Lower Keys took the brunt of Irma, only about 10% of hotel rooms in Key West were closed by then. Within the Lower Keys, a vast majority of hotels east of Key West were closed. The room closure rate rose to about 50% in Marathon of the Middle Keys, and about 70% in Islamorada of the Upper Keys (Silk, 2017). Nonetheless, the Keys restored over 90% of its lodging inventory by the end of the first year after Irma (Miami Herald, 2018).

Figure 8: Hotel Revenues Relative to Pre-Hurricane Levels

Source: Rockport-Fulton Chamber of Commerce, and Florida Department of Revenue.
3.2 Labor Markets

Changes in unemployment capture the overall economic tolls of a hurricane. As evident in Figure 9, the two disaster counties' unemployment rates nearly doubled in September 2017. For Aransas County, its above 9% unemployment rate was the highest in its recorded history. In line with the Florida state trend, Monroe County has experienced a remarkably lower unemployment rate, implying a tighter labor market. The surge in the wake of Irma reversed the county’s steady downtrend following the end of the nationwide Great Recession of 2008-2009. Lee (2019) provides empirical support for the statistical significance of the respective hurricanes to these counties’ unemployment dynamics.

Post-hurricane recovery is evident in both counties as the monthly unemployment rates inched down successively until they returned to the pre-hurricane levels by late 2018. After the first anniversary, unemployment in Monroe County stabilized while Aransas County’s unemployment continued to inch down over time along with its state trend.

Typically, unemployment declines when the employment level grows. This inverse relationship in the labor market, however, does not hold when some residents move out of a disaster area. The two disaster counties lost a sizable proportion of their population in 2018 due to outmigration (1,530 in Aransas and 2,475 in Monroe), according to the 2018 Census. Outmigration reduced the size of the local labor force. For this reason, improvements in unemployment do not necessarily reflect corresponding increases in employment.

Figure 10 plots the seasonally adjusted employment and labor force levels of the two counties. The employment data (solid lines) are expressed relative to the pre-hurricane levels in August 2017, which equal 100. The labor force sizes (dotted lines) are calculated from the employment and unemployment data, so that the gaps between the employment and labor force levels in any month represent the unemployment rate.
Figure 9: County Unemployment Rates, Seasonally Adjusted

Figure 10: Employment and Labor Force, Seasonally Adjusted

For Monroe County, both the employment and labor force levels moved mostly in lockstep from one month to the next. The county lost about 7% of its workforce in September and October. As realized in the unemployment chart (Figure 9), its labor market regained most job losses by year end 2018. Since then, however, the sizes of both employment and labor force dwindled down somewhat.

At first glance, the employment pattern of Aransas County mirrors that of its Florida counterpart. However, other than a relatively modest initial decline, the number of jobs returned to the pre-Harvey level by year end 2017 rather than another year later as for Monroe County. This was attributable to an expanded local labor force coming primarily from the rest of the Corpus Christi metro area. The labor force of the other two counties within the metro area, Nueces and San Patricio, shrank within the first year of Harvey.

Two years following the hurricane events, Monroe County’s unemployment rate was only about half of its Texas counterpart’s, but it likely faced more severe labor shortages than before Irma due to a smaller local workforce supply. Continued labor shortages would hinder the area’s long-term recovery.

### 3.4 Federal Relief and Rebuilding Efforts

According to CNN, the federal government has, on average, provided relief aid to cover about 62% of property damage from hurricane events since Katrina in 2005. In response to Katrina, federal relief efforts amounted to 72% of the $160 billion (2019 dollars) estimated economic damage (Struyk, 2017).

Following the disaster events in 2017, including Hurricanes Harvey, Irma and Maria and the California wildfires, Congress approved two supplemental funding bills in September and October to appropriate a total of $34.5 billion in disaster relief funds, along with $16 billion in debt forgiveness for the National Flood Insurance Program (NFIP). In early 2018, Congress passed a two-year budget that included another $90 billion for disaster recovery. The total federal spending in response to the 2017 disasters exceeding $130 billion is a U.S. record.

FEMA is the primary federal agency for funding assistance in response to disasters. In the wake of Harvey, FEMA designated 41 counties in southern and southeastern parts of Texas as a disaster region (DR-4332) eligible for Individual Assistance. The federally declared disaster region for Irma (DR-4337) consists of 49 counties of the Florida peninsula. By August 2018—about one year after the hurricanes—the agency had doled out $13.8 billion to Texas and $3.7 billion to Florida. The funds were in the form of Individual Assistance (IA) to residents and homeowners, Small Business Administration (SBA) disaster loans, and NFIP claim payments to flood
policyholders. For local governments, FEMA had obligated $1.2 billion to Texas and $365 million to Florida in Public Assistance (PA) programs to rebuild infrastructure.

By early 2019, Texas had received over $14.7 billion in Harvey-related federal and state grants. The State has channeled nearly $10 billion from the federal government in the form of the Community Development Block Grant-Disaster Recovery (CBDG-DR) program specifically for housing and infrastructure repairs. The CBDG-DR program focuses on meeting housing, infrastructure and economic development needs that remain after other disaster relief has been exhausted, including federal assistance and private insurance. In response to Irma, Congress appropriated $616 million in CDRG-DR funding to the State of Florida for relief and recovery efforts. The State has implemented a program called Rebuild Florida for making decisions on funding allocations (Monroe County, 2019a).

Some infrastructure-related projects have also been funded through the Economic Development Administration (EDA) of the U.S. Department of Commerce. By mid-2019, the EDA had distributed $587 million to areas affected by the federally declared natural disasters in 2017. Private philanthropic organizations, such as the Red Cross, have also provided resources for emergency response and disaster relief, but those funds were by far much smaller than government sources. That said, the Rebuild Texas Fund, which is affiliated with the Susan and Michael Dell Foundation, has awarded a total of more than $100 million to Harvey-impacted communities in Texas.

To what extent has federal aid accelerated economic recovery in the wake of the 2017 hurricanes? For each of the two disaster counties, Figure 11 plots the monthly cumulative amounts of funds distributed by the major federal agencies, namely FEMA, SBA and EDA. The amounts of FEMA grants for individuals and local public entities and SBA disaster loans are derived from FEMA monthly updates for individual counties in the Harvey and Irma federally declared disaster regions. The EDA data are derived from its Disaster Supplemental program for the 2017 natural disasters.

Within the first year of the hurricane strikes, the total amounts of federal aid were quite close between the two counties, although the population size of Monroe County was about three times that of Aransas County. Beginning mid-2018, the cumulative amounts of relief aid allocated to Aransas County exceeded those allocated to Monroe County. Proportionally more residents applied for Individual Assistance in Aransas County than in Monroe County (29% vs. 22%). The total number of FEMA grants for Public Assistance projects was also larger for Aransas County (74 vs. 45), contributing to a larger cumulative total amount of PA funding ($39 million vs. $35 million) by the end of 2018. Lee (2019b) finds a strong causal
relationship between federal aid and employment growth across hurricane-impacted counties in Texas and Florida.

Figure 11: Cumulative Total Federal Funds (million dollars)

3.5 Resilience

A growing body of literature is devoted to understanding community resilience to natural disasters like hurricanes. Disaster resilience generally refers to how ready a community is to respond to disasters and how well it will subsequently recover. Cutter (2016) provides an overview of this broad concept and outline a framework to measure resilience explicitly. One popular set of measures is the Baseline Resilience Indicators for Communities (BRIC). Funded by FEMA, the BRIC project was developed by the Hazards and Vulnerability Research Institute at University of South Carolina (Cutter, Ash and Emrich, 2014).

With a total of 49 individual indicators, the BRIC index provides a comprehensive view of the socioeconomic aspects of a local community that might affect its resilience to natural disasters (Cutter, Ash and Emrich, 2014). Last updated in 2015, BRIC is made up of six broad categories of disaster resilience for each U.S. county: social (10 variables), economic (8 variables), community capital (7 variables), institutional (10 variables), infrastructural (9 variables), and environmental hazards (5 variables).

Variables in the social capacity category includes educational attainment, non-native English speakers, access to vehicles and physicians, and health insurance. Communities with higher levels of educational attainment, more English speakers, fewer retirees, higher rates of health insurance coverage, and more access to physical and mental health resources receive higher social resilience scores. The indicators of economic resilience reflect local economic vitality, diversity, and income equality. Higher economic resilience scores are given to communities with more owner-occupied housing units, more large businesses, and smaller income gaps. The infrastructural category consists of measures of community response and recovery capacity, such as rental housing units and healthcare facilities.

The indicators of community capital resilience reflect how inclined and prepared residents are to assist their fellow residents. Counties with higher percentages of voters, more civic organizations, and more Red Cross volunteers, receive higher scores in community capital. The institutional group includes measures of hazard mitigation planning and capacity to reduce risk. A county receives a higher score if more of its population or housing units are covered by a recent hazard mitigation plan or flood insurance policies. The environmental category includes metrics for vulnerability to environmental hazards, such as the proportion of land in wetlands and pervious surfaces.

To understand the extent of baseline resilience of the two disaster counties, Table 2 lists the scores of the first five BRIC indicators. Accordingly, the two counties seem equally resilient. Their respective composite indexes at 2.69 (Aransas) and
2.73 (Monroe) are remarkably close to each other, especially given the disparity of readings across all U.S. counties. Keep in mind that the scores are standardized and thus they are not directly comparable in the sense that a higher score by 10 percentage point, for example, does not necessarily imply a 10% greater resilience.

The scores for all five individual indicators of resilience are also quite similar. The readings for infrastructure are relatively low, reflecting resource constraints common to rural communities. Noticeable disparities occur in social capacity and community capital. A relatively lower social capacity value for Aransas County (0.59 vs. 0.63) is attributable to its lower overall educational attainment level, among other things. On the contrary, the county’s higher community capital value (0.33 vs. 0.27) accords with Lee’s (2020) assertion about the effectiveness of the area’s social networks facilitated particularly by the Rockport-Fulton Chamber of Commerce. Local social networks might have contributed to the relatively more robust economic recovery in Aransas County than in Monroe County. This also reinforces Cutter, Ash and Emrich’s (2016) finding of the relative significance of community capital for determining disaster resilience of rural communities, as economic capital is for urban communities.

Table 2: Baseline Resilience Indicators for Communities, 2015

<table>
<thead>
<tr>
<th></th>
<th>Aransas County</th>
<th>Monroe County</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td>0.59</td>
<td>0.63</td>
</tr>
<tr>
<td>Economic</td>
<td>0.39</td>
<td>0.39</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>0.26</td>
<td>0.28</td>
</tr>
<tr>
<td>Community Capital</td>
<td>0.33</td>
<td>0.27</td>
</tr>
<tr>
<td>Institutional</td>
<td>0.46</td>
<td>0.40</td>
</tr>
<tr>
<td>Overall Resilience Score</td>
<td>2.69</td>
<td>2.73</td>
</tr>
</tbody>
</table>

Source: Hazards & Vulnerability Research Institute, University of South Carolina.
4. BUSINESS RECOVERY SURVEYS

Surveys are popular tools for understanding challenges faced by the business community (Stevenson et al., 2018). This section documents key results of post-hurricane surveys conducted by the chambers of commerce in the two disaster counties. These surveys provide insights into the immediate impacts on businesses, as well as their performance and challenges during the short-run recovery phase. Table 3 lists statistical results for survey topics that are common between the two counties.

In Aransas County, the Rockport-Fulton Chamber of Commerce has conducted two surveys of local business impacts and needs (Lee, 2019a, 2020). The first survey concluded in February 2018 with a total of 108 responses. A subsequent survey generated 145 returns and it was completed in March 2019. Later in May 2019, Monroe County conducted a similar business survey in partnership with five Chambers of Commerce: Key Largo, Islamorada, Marathon, the Lower Keys Chamber in Big Pine Key, and Key West. This survey generated a total of 85 responses that broadly represent businesses and industries across the major areas of the island chain (Monroe County, 2019b).

The two county’s surveys were conducted independently, but the questionnaires are similar in that they are designed to assess the physical damage and economic impact to individual businesses, how affected businesses finance the economic losses, and what type of support they still need to recover fully. The businesses represented in the three surveys are reflective of the overall economic mix of the counties with a relatively high concentration of tourism-related businesses.

4.1 Damages and Losses

The extent of physical damage was reportedly similar between businesses in Aransas and Monroe Counties. According to the surveys, 48% of businesses in Aransas County sustained structural damage to their facilities, and 31% of them faced damage to contents, including supplies and equipment. Similarly, 46% of respondents in the Aransas County reported structural damage and 41% of them reported contents damage.

The impact on business operations is commonly monitored through the durations of temporary closure. The survey data indicate that about half of businesses took more than 30 days to reopen their doors in the wake of the hurricane events (54% of businesses in Aransas County and 48% in Monroe County). The proportion of businesses that were closed permanently was 3% for Aransas County and 7% for Monroe County.
Table 3: Business Survey Results

<table>
<thead>
<tr>
<th></th>
<th>Aransas County (February 2018; March 2019)</th>
<th>Monroe County (May 2019)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural damage</td>
<td>48%</td>
<td>46%</td>
</tr>
<tr>
<td>Contents damage</td>
<td>31%</td>
<td>41%</td>
</tr>
<tr>
<td>Out of business for 30 days+</td>
<td>54%</td>
<td>48%</td>
</tr>
<tr>
<td>Permanently closed</td>
<td>3%</td>
<td>7%</td>
</tr>
<tr>
<td>Post-Hurricane Staffing:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- About the same # employees</td>
<td>41%</td>
<td>58%</td>
</tr>
<tr>
<td>- More employees</td>
<td>24%</td>
<td>9%</td>
</tr>
<tr>
<td>- Fewer employees</td>
<td>35%</td>
<td>33%</td>
</tr>
<tr>
<td>Post-Hurricane Revenue:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- About the same</td>
<td>22%</td>
<td>14%</td>
</tr>
<tr>
<td>- More revenue</td>
<td>20%</td>
<td>8%</td>
</tr>
<tr>
<td>- Less Revenue</td>
<td>58%</td>
<td>78%</td>
</tr>
<tr>
<td>Business Insurance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Flood insurance</td>
<td>5%</td>
<td>31%</td>
</tr>
<tr>
<td>- Property insurance</td>
<td>15%</td>
<td>52%</td>
</tr>
<tr>
<td>- Business insurance</td>
<td></td>
<td>15%</td>
</tr>
<tr>
<td>- Windstorm insurance</td>
<td>33%</td>
<td>10%</td>
</tr>
<tr>
<td>- Uninsured or underinsured</td>
<td>34%</td>
<td>54%</td>
</tr>
<tr>
<td>- Have insurance</td>
<td>66%</td>
<td></td>
</tr>
<tr>
<td>- SBA loans</td>
<td>13%</td>
<td>29%</td>
</tr>
<tr>
<td>- Donations/philanthropic support</td>
<td>26%</td>
<td>21%</td>
</tr>
<tr>
<td>Top Challenges:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Customer base</td>
<td>57%</td>
<td>54%</td>
</tr>
<tr>
<td>- Lack financial resources</td>
<td>15%</td>
<td>39%</td>
</tr>
<tr>
<td>- Property damage</td>
<td>26%</td>
<td>34%</td>
</tr>
<tr>
<td>- Insufficient staff</td>
<td>20%</td>
<td>37%</td>
</tr>
</tbody>
</table>

Source: Rockport-Fulton Chamber of Commerce, Monroe County, and author’s calculations.
Among those surviving businesses, performance varied widely. The majority of respondents reported a lower business revenue since the 2017 hurricane season. By the time of the survey, 58% of respondents in Aransas County indicated less revenue, while 20% of respondents reported more revenue. In Monroe County, proportionally more businesses (78%) experienced a loss in revenue, and only 9% of them reported more revenue.

One major challenge facing local businesses was a temporary displacement or permanent loss of their staff. By the time of the surveys in 2019, about one third of businesses in either county operated with fewer employees than before the storms. Still some businesses in fact hired more (24% in Aransas County and 9% in Monroe County). As documented in Section 3 above, businesses in construction, wholesale and some service-related industries experienced a boom at least through mid-2019 due to rebuilding activities.

### 4.2 Recovery Finance

How did businesses finance their recovery and operations in the wake of the hurricanes? According to the surveys, 66% of businesses in Aransas County had insurance. For Monroe County, 54% of respondents reported that their businesses were uninsured or underinsured, leaving less than half of businesses (46%) to have received sufficient insurance payouts to cover their losses. Correspondingly, the proportion of businesses receiving SBA disaster loans was more than twice in Monroe County (29%) than in Aransas County (13%).

In Aransas County, one third of respondents (33%) received insurance payouts for windstorm damage. Since Harvey was largely a wind event, only 5% of them reported receipt of flood insurance payouts. By contrast, 31% of businesses in Monroe County reported that they had received flood insurance payments and 10% windstorm insurance payments. In addition to insurance payments, slightly more than one in five impacted businesses in either county reported receipt of private donations and grants from philanthropic organizations.

### 4.3 Business Challenges

When asked about the major challenges facing businesses, more than half of respondents cited issues related to the existing market size or customer base (57% in Aransas County and 54% in Monroe County). This finding aligns with the survey data on business revenue. Property damage and staffing needs are other common challenges. The need for financial resources for repairs or operations appears to
be more of a concern for businesses in Monroe County (39%) than in Aransas County (15%). It is noteworthy that the Monroe County survey allows for multiple responses. In the Aransas County survey, however, the corresponding survey question allows for only one response, and the statistical results as reported in Table 3 are adjusted by the follow-up, open questions for “other challenges.”

In the presence of damaged homes, housing for workers is logically more of a challenge for businesses in the Florida Keys than for businesses in Aransas County. In response to rebuilding activities in Aransas County, increasingly more workers migrated or commuted from other parts of the Corpus Christi metro area (recall Section 3 above). However, especially in Key West, workers are less likely to commute from mainland Florida due to the great distance. This logistic disadvantage in workforce mobility might have impeded rebuilding and recovery activities across the Florida Keys.
5. DISCUSSION

Despite that Harvey is regarded more than twice as “costly” as Irma, the extent of direct damage was comparable between Aransas and Monroe Counties. Their economies are also quite similar, particularly in their exposure to tourism. Both communities have also shown characteristics consistent with some stylized facts of a post-disaster area. In particular, unemployment surged immediately after a hurricane’s strike, followed by a gradual decline as employment was on the rise once again (Belasen and Polachek, 2008; 2009). How fast the local labor market condition would improve depended on the rebuilding efforts and business recovery underway in the disaster area.

Within the first two years, economic recovery appeared to be more robust in Aransas County than in Monroe County. Several factors might have contributed to the observed deviations. First, labor market tightness differed between the two counties. Aransas County and its surrounding areas have historically experienced relatively more labor market slack with unemployment rates higher than the national average. In Monroe County, on the contrary, tight labor market conditions had existed even before Irma, making it difficult to find additional workers needed for rebuilding activities since 2017. In addition, the linear geographical layout of the Florida Keys represents a constraint for meeting any additional workforce needs. This challenge also highlights the role of geographical or spatial considerations in post-hurricane recovery. In particular, Xiao and Nilawar (2013), and Balasen and Polachek (2008) observe a so-called “donut hole” effect, which refers to a sudden decline in employment within a disaster area but employment growth in its neighboring areas. Inside the disaster area, spatial spillover effects in recovery also occur among residents and businesses (LeSage, 2011; Xiao and Van Zandt, 2012; Lee, 2020).

The second factor for driving recovery is federal aid. Lee (2019b) finds causal effects of federal disaster aid on local employment growth. Along with other federally declared disaster counties in Texas, Aransas County might have benefitted from proportionally more federal funds that have helped accelerate the recovery pace. Rebuilding efforts have boosted business activity in construction and some services, reinforcing local economic growth.

The third contributing factor is social capital. Social capital is widely considered to be instrumental for disaster resilience especially among rural communities (Cutter, Ash and Emrich, 2016). Social networks like the Rockport-Fulton Chamber of Commerce might have contributed to a relatively fast pace of local business reopening rate following Harvey. This chamber has served as a collective voice for local businesses on economic development issues and facilitated communication.
with the federal and state government agencies, notably FEMA and Texas General Land Office. In 2018 and 2019, it joined other chambers of the South Texas region in lobbying the Texas state legislature against Texas Windstorm Insurance Association’s proposals for raising insurance premiums (Lee, 2020). In Monroe County, however, five chambers serve local businesses across the Florida Keys. This might have made it less effective as a conduit for post-disaster assistance from the government and other external sources, or to serve as a collective voice for their members on economic development issues.

It is too early to tell whether these two hurricane-ravaged communities are poised to bounce forward beyond their pre-hurricane conditions. Still the overall pace of recovery in these counties so far is admirable. Consider the aftermath of Hurricane Katrina—widely regarded the most destructive natural disaster in U.S. history. The hardest-hit areas, including the City of New Orleans and its metro area, did not fully recover even 10 years later. The city’s sales tax revenue did not return to the pre-Katrina level until 2011. Like Aransas and Monroe Counties, New Orleans’ unemployment rate dropped from a peak of nearly 16% to around 4% in 2007. Still more than one decade later, that area’s population and employment levels remained at least 13% below the pre-Katrina levels.

Business return is a precursor of community recovery. Shortly after Harvey hit Aransas County, the Rockport-Fulton Chamber of Commerce began to monitor the operating status of local businesses regularly. One year following Harvey’s strike, 84% of businesses in Aransas County resumed operations (Lee, 2019a). By comparison, 75% of establishments in downtown New Orleans reopened their doors at the end of the first year following Katrina (LeSage et al., 2011). Lam et al. (2009) and Schrank et al. (2013) report an even slower reopening rate for the broader New Orleans metro area.
6. CONCLUSION

Motivated by the historical significance of the 2017 hurricane season, we have first provided a narrative of the two Gulf Coast communities in the paths of Hurricanes Harvey and Irma. Aransas County in the state of Texas and Monroe County in the state of Florida were equally devastated by a hurricane landfall. The overall makeups of their economies are also similar, with tourism playing a key role. These common features constitute a unique opportunity for us to unravel factors that have affected the dynamics and resilience of these two economies on the road to full recovery.

Despite the depth of devastation, key economic indicators unequivocally support that the overall sizes of the economies in both disaster areas were restored within one year. However, as a stylized fact of a post-hurricane economy, the sectoral makeup has shifted: Industries in support of rebuilding activities expanded during the recovery phase, while businesses that rely on the clientele within the area, notably restaurants and professional services, did not fare as well until the community as a whole bounces back. Still businesses particularly prone to structural damage, such as hotels and motels, depended on how soon their facilities became operational. The sooner these establishments open their doors, the sooner other hospitality-related businesses and the rest of the local economy will thrive again. In other words, the industrial mixes will continue to evolve until the two counties reach a new steady state or full recovery.

We have supplemented observations in the local labor markets and industries with results from surveys of local businesses. The survey data provided insight into the timing of business reopening as well as the challenges that local businesses experienced. Compared with the outcomes of similar hurricane events in history, the overall progress of business performance was remarkable. In addition to federal aid, logistical constraints of Monroe County, particularly in the presence of housing shortages and a tight labor market, might have resulted in its slower recovery relative to the Texas counterpart.
REFERENCES


### DATA APPENDIX

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<tr>
<th>Agency</th>
<th>Data Description</th>
<th>Source</th>
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<tr>
<td>U.S. Census Bureau</td>
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<td>Texas Comptroller of Pubic Accounts</td>
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<td><a href="https://mycpa.cpa.state.tx.us/allocation/HistSales">https://mycpa.cpa.state.tx.us/allocation/HistSales</a></td>
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<td>Florida Department of Revenue, Office of Tax Research</td>
<td>Florida monthly sales and sales tax revenues by county and by industry</td>
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<td>National Oceanic and Atmospheric Administration</td>
<td>Meteorological data and physical damage estimates</td>
<td>National Hurricane Center Tropical Cyclone Reports</td>
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<tr>
<td>Economic Development Administration</td>
<td>Federal grants for community-level disaster mitigation and resilience</td>
<td><a href="https://www.eda.gov/disaster-recovery/supplemental/">https://www.eda.gov/disaster-recovery/supplemental/</a></td>
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