AN ANALYSIS OF THE ECONOMIC AND INSTITUTIONAL FACTORS AFFECTING RECOVERY BY LOCAL GOVERNMENTS FROM HURRICANES

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This dissertation examines the impact of major hurricanes on changes in GDP for counties in four states – Alabama, Florida, Louisiana, and Texas. The analysis examines the effectiveness of intergovernmental financing for major hurricanes between 2000 and 2014. It also examines whether institutional proximity of the disaster management function to the Governor's Office and the career status of the director affect the speed of recovery from the disaster. The analysis also assesses the impact that a counties's prior experience at dealing with disasters has on the speed of recovery.

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CHAPTER 1

INTRODUCTION

This dissertation examines how major disasters affect state and local economies, and how state institutional and intergovernmental arrangements for disaster response affect the speed of recovery. The study is important because it contributes to better understanding how federal, state, and local assistance following a major disaster enables gross domestic product (GDP) to return to pre-disaster levels. This research helps practitioners and policymakers to better know how to target disaster aid for the greatest impact on economic recovery. Furthermore, we as scholars lack an understanding of how institutional and intergovernmental configurations among the states affect economic recovery following a major disaster. This dissertation examines these important issues and draws implications for public administration theory and practice.

Disasters represent extreme but unpredictable events for the public manager. These conditions provide a timely setting to examine key questions of importance to public administration scholars. This dissertation studies the response of four states – Alabama, Florida, Louisiana, and Texas – to one of nature's most extreme disasters, hurricanes. Typhoons, hurricanes, and cyclones refer to the same weather event, but the terms are used to distinguish the location of the disturbance (National Oceanic and Atmospheric Administration, http://oceanservice.noaa.gov/facts/cyclone.html) Hurricane season is from June 1st to November 30th. These disasters occur in the Atlantic, northeastern Pacific, and Gulf of Mexico; typhoons occur in the northwestern Pacific; cyclones occur in the south Pacific and Indian Oceans.

The precursor to any of these three weather events is the tropical cyclone. Tropical cyclones are central low-pressure zones with wind speeds of at least 34 knots (NOAA, 2014).

This name refers to a general term for a storm with an organized system of thunderstorms that require warm ocean temperatures of at least 82 degrees Fahrenheit to form (NOAA, 2014). A tropical depression, on the other hand, is a type of tropical cyclone with sustained winds of 38 mph or less. Tropical storms are also a type of tropical cyclone with maximum sustained winds of at least 39 mph. A tropical storm with wind speeds beyond 74 mph is called a hurricane.

In the United States from 1980 to 2011, hurricane-induced damages were approximately $418 billion dollars (Smith & Katz, 2013) making this the costliest type of disaster followed by droughts/heat waves ($210.1 billion) and severe local storms ($94.6). During the last thirty years of the 20th century, hurricanes have taken the lives of 587 U.S. residents (NOAA, 2014). The number of lives lost has more than doubled over the last 14 years. According to the National Weather Service (NWS), from 2000 to 2014 1,168 lives were lost due to hurricane/tropical cyclones. In 2005, for example, Hurricane Katrina accounted for 1,168 fatalities, which is approximately 87 percent of this total.

Disasters are also costly. From 2000 to 2014, the financial damage caused by hurricanes reached an estimated $395 billion (NOAA, 2014). This includes, but is not limited to, implementing safeguards to reduce damage to property and loss of lives, debris removal, repairing or restoring infrastructure and repairing or rebuilding public facilities and private property.

The state of Alabama has experienced 23 hurricanes from 1851 to 2014. From 2000 to 2014, the state has five major declared disasters (FEMA.gov, 2015). While there were no hurricane-related fatalities in Alabama, Hurricane Ivan was deemed the worst disaster given its magnitude, length of time, and record flood levels (NOAA, 2014. Hurricane Ivan made landfall

in the state as a category 3 hurricane with maximum sustained winds of 132 mph and lasted nearly 6 days causing $25 billion (in 2014 US dollars) in damage (NOAA, 2014).

The state of Florida has experienced 114 hurricanes from 1851 to 2014. From 2000 to 2014, the state of Florida has nine major declared disasters (FEMA.gov, 2015). Hurricane Charley, for example, was the strongest hurricane since Hurricane Andrew struck in 1992, making landfall as a category 4 hurricane. This disaster resulted in $13 billion in damages across the state and ten deaths.

Louisiana has experienced 54 hurricanes from 1851 to 2014. From 2000 to 2014, the state of Louisiana has seven major declared disasters. The year of 2005 ranks as the season with the most named storms at 28 (NOAA, 2015). For the state of Louisiana Hurricane Katrina is the costliest and deadliest storm the nation has experienced. The total cost now exceeds $125 billion.

Lastly, Texas has experienced 63 hurricanes from 1851 to 2014. From 2000 to 2014 the state of Texas had six major declared hurricanes. In 2008, Hurricane Ike took the lives of 112 people and flooded over 100,000 homes and businesses. Ike was responsible for $29.5 billion in damages in the Galveston and Houston area making this the second costliest disaster in U.S. history (Wilder, 2013).

These four states are the most frequently affected by major storms. They were selected because of their frequent encounters with major hurricanes and the varying organizational approaches used by the states in managing disasters. From Table 1.1, it is apparent that Alabama and Louisiana had comparable populations (according to the 2010 U.S. Census) of 4,779,736 and 4,533,372, respectively, while Florida and Texas have larger populations of 18,801,310 and 25,145,561, respectively.

The most interesting category in this table is the per capita change in gross domestic product (GDP). Alabama and Texas had the fewest major declared disasters and had the higher changes in per capita GDP (16.4 and 25.5, respectively) than Florida and Louisiana (5.6 and 11.4, respectively). This dissertation examines the role of federal and state disaster aid in explaining these differences as well as the role of institutional arrangements and intergovernmental relations in explaining how quickly a state can return to a pre-disaster level of economic growth.

Hurricanes have the ability to impair economic activity for an extended period of time. The economic disruption from evacuation, relocation, and dislocation of people and the closing of businesses and government functions impact state and local economies. The more quickly a state can recover from such a disruption, the more quickly economic activity can return to normalcy. For scholars in public administration, better understanding the institutional and intergovernmental factors that facilitate recovery from a disaster provides the basis for improving how state and local governments cope with disruptive and costly disasters.

Productivity is the staple to a nation and state's real gross domestic product (real GDP) and a state's real gross domestic product (GDP). Real GDP is dependent upon the input of labor, which is measured in hours of work, and multiplied by labor productivity, which is measured as real output per hour of work (Schreyer & Pilat, 2001). The hours worked depends on the size of the employed labor force, and labor productivity depends on the health, training, resources, and education provided to workers. With the temporary or permanent closing of businesses, and the temporary or permanent dislocation of people caused by a major hurricane, real GDP slows or even declines as a result of the weather disruption. A hurricane, as with any disaster, causes temporary market failure – the inability of producers to meet the needs of consumers. Governments fulfill a well-documented role of reestablishing a competitive market whenever

there is market failure. The more quickly a community can return to economic normalcy, the more quickly its marketplace can resume normal activity.

While most observers would agree that disasters are exogenous shocks that have adverse impacts on population and infrastructure, little research has examined the effect disasters have on states' economic recovery in the short and long run. The literature examining economic growth following disasters generally focuses on recovery by the private sector, specifically exploring the importance of business recovery using indicators such as business size, age, type, and existing financial conditions (Rose & Lim, 2002; Tierney, 1997). Fiscal capacity is a predictor of a government's ability to cope and adapt to exogenous shocks, in addition to specifying the availability of resources to rebuild, restore, and repair (Adger et al., 2005; Rose & Liao, 2005; Rose, 2004).

Other empirical work conducted on the economics of disasters has examined economic recovery at the national and international levels, rather than the fiscal response of state and local governments (Ewing, 2005; Fomby, Ikeda, & Loayza, 2013). While these studies provide valuable information on the impact of disasters on a nation's economic growth, they leave unaddressed their impact at the subnational level where residents directly feel the effects of the disaster. Furthermore, the empirical studies provide inconclusive evidence to answer the question of how disasters affect states' fiscal health (Benson & Clay, 2004; Cuaresma, Hlouskova, & Obersteiner, 2008; Skidmore & Toya, 2002).

Table 1.1 State Demographics and Gross Domestic Product (GDP) from 2000-2014

State	Alabama	Florida	Louisiana	Texas
Total Hurricanes (1851-2014)	23	114	54	63
Major Hurricanes	6	37	20	19
Population (2000)	4,447,092	15,982,349	4,468,976	20,851,820
Population (2010)	4,779,736	18,801,310	4,533,372	25,145,561
Population (2014 estimate)	4,849,377	19,893,297	4,649,676	26,956,958

Population % Change (2000-2010)	7.48	17.64	1.44	20.59
Population % Change (2000-2014)	9.05	24.47	4.04	29.28
GDP Per Capita (2000)	32,289	36,641	41,693	43,364
GDP Per Capita (2014)	37,593	38,690	46,448	54,433
GDP Per Capita % Change	16.43	5.59	11.4	25.53

Source: Author's computations from data obtained from the U.S. Census of Governments (2000,2010, census.gov). The data for GDP (in millions) were obtained from Moody Analytics, and the hurricane data were collected from the National Oceanic & Atmospheric Administration (NOAA, www.aoml.noaa.gov)

The Meteorology of Hurricanes

The intensity of hurricanes and tropical cyclones is measured using the Saffir-Simpson scale. Developed in 1971 at the National Hurricane Center, the Saffir-Simpson hurricane wind scale (hereinafter referred to as SSHWS) was established by Herbert Saffir and Robert Simpson to measure intensity of damage caused by hurricanes (Simpson and Riehl, 1981). It is worth noting that a different scale is used to measure typhoons and cyclones. This categorical classification of maximum sustained winds or knots (kt) ranges from 1 to 5. Hurricanes with sustained winds of at least 74 miles per hour fall into category one, whereas hurricanes at sustained winds of at least 157 miles per hour are in category five. Categories three through five are considered major hurricanes because of their potential for significant loss in life and property damage (National Hurricane Center, 2015).

Table 1.2 Saffir-Simpson Hurricane Wind Scale

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 kt 119-153 km/h	**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph	**Extremely dangerous winds will cause extensive**

	83-95 kt 154-177 km/h	**damage:** Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: Simpson, Robert H. and Riehl, Herbert, *The Hurricane and Its Impact.* Louisiana State University Press, Baton Rouge London, 1981. Appendix C pg. 366
http://www.aoml.noaa.gov/general/lib/laescae.html

The Role of Government in Managing Disasters

In a federalist system of government, authority is shared among local, state and federal governments. In the context of emergency management, federalism gives all levels of government a role in disaster response and recovery from the president, to Congress, to governors, and to federal, state, and local agencies. While the federal government provides resources that exceed state and local government capacity, local governments are primarily responsible for the implementation and success of mitigation, emergency preparedness, initial response and recovery efforts (McEntire, 2007). States serve as facilitators to assist local

governments in implementing federal policies, providing training to communities, and allocating federal grant funding.

Evolution of the Federal Role in Disasters

The early 1800s saw the first record of the federal government taking action to rectify a natural disaster. A series of great fires occurred in December of 1802, 1806 and 1813. The city of Portsmouth, New Hampshire, experienced the great fire of 1802, which occurred a day after Christmas destroying every building except the courthouse and the North Church (Brighton, 1973). The great fire of the 1800s resulted in over $130,000 (approximately $6.5 million today) of damages to stores and shops, homes, and public buildings and roads. With little insurance and no government assistance, the city had to request funding from private charities and churches from other congregations (www.cityofportsmouth.com, 2009).

The New Hampshire legislature eventually acted in 1814 passing legislation mandating that all new buildings be constructed with brick since wooden shingle roofs played a significant role in the spread of fire. The Congressional Act was passed in 1803 to provide financial assistance to Portsmouth. This is the first piece of natural disaster legislation passed by U.S. Congress (Islam & Ryan, 2016). The act gave authority to the federal government to provide financial assistance to aid the state in rebuilding and restoring public facilities.

The administration of Franklin Roosevelt viewed government as a tool to stimulate the economy, which provided the impetus for the federal government to invest in emergency management functions (Haddow and Bullock, 2006). By the 1930s, the federal government incorporated natural disasters across legislations in order to rebuild the U.S. economy from disasters such as the great fires of New York City in 1835, the great fire of Chicago in 1871, and

the Galveston Hurricane in 1900. During this time, laws were in place to provide federal funds from entities such as the Reconstruction Finance Corporation and the Bureau of Pubic Roads to make disaster loans available for reconstruction and repairs to public facilities, highways, and bridges damaged by natural disasters.

The Cold War of the 1950s and 1960s created a shift in government's role in disasters to emphasize civil defense (Haddow and Bullock, 2006). The primary focus was on the potential occurrence of a nuclear war or nuclear attack from the Soviet Union. The concern shifted from individuals and communities protecting themselves from natural disasters to building bomb shelters to protect families from man-made attacks. The federal focus shifted from funding for natural disasters to preparing for the possibility of a nuclear attack.

The Office of Civil Defense was created within the Department of Defense (DoD) to quickly mobilize and provide resources in the event of a war. While state and local governments were preparing for nuclear attacks, natural disasters were causing significant damage in Virginia and North Carolina (Hurricane Hazel 1954), the mid-Atlantic and northeastern states (Hurricane Diane 1955), Louisiana and Texas (Hurricane Audrey 1957), and along the west coast of Florida (Hurricane Donna, 1960). In 1961, the Kennedy administration responded to catastrophic disasters by creating the Office of Emergency Preparedness within the White House to handle natural disasters.

In 1974, Congress passed the Disaster Relief Act to provide a process for presidential declarations of natural disasters (Bea, 2010). Despite the federal government's attempt to provide assistance to state and local governments, there were organizational issues that reduced effectiveness and efficiency in providing disaster relief. Prior to FEMA, the federal government's emergency management structure was complex, unstable, and slow with regards to

disaster response. This was the result of fragmentation with over 100 agencies involved in emergency and disaster activities. In addition, state and local governments had many programs and policies similar to those of the federal government, creating duplication, inefficiency, and confusion on the appropriate roles of each level of government.

President Carter created a plan in 1978 to consolidate the multiple agencies handling emergency preparedness, mitigation, and response into one federal emergency management organization. Consolidation was intended to provide stability and direction to the highly fragmented and ineffective emergency management process. On April 1, 1979, President Jimmy Carter signed Executive Order 12127 establishing the Federal Emergency Management Agency (FEMA). This organization had a director that would report directly to the President. However, this change did not come about without controversy. The executive order (12127) mandated reassignment of agencies, programs, policies, and personnel into one new agency—FEMA. The problem with consolidation is one entity giving up authority while another entity gains authority.

Based on the concept "under-one-roof," in 1979 agencies in the Departments of Housing and Urban Development (HUD), Defense (DOD) and Commerce were consolidated to form FEMA. Conner (1986) provides a historical context of FEMA. Although newly consolidated and lacking a FEMA director, each entity continued to report and take direction from their different Congressional supervisors. FEMA lacked the administrative direction to focus its resources on the regions of the country most vulnerable to disasters. The disjointedness of FEMA was not evident until Hurricane Hugo struck the Carolinas in 1989. With over $15 billion in damages and 85 deaths (Haddow and Bullock, 2006), FEMA's response to this natural disaster was delayed. In 1992, Hurricane Andrew impacted Florida and Louisiana illustrating FEMA's slow response and ill preparation.

In 1988, Senator Robert Stafford (R, VT) shepherded through Congress legislation that put into place the current system for requesting federal assistance in times of disaster. The Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (Stafford Act), was supported by Congress because disasters continuously caused loss of life, human suffering, property loss and damage, loss of income, and interrupted the normal functioning of governments and communities (sec. 101, Stafford Act). The Stafford Act is a federal law designed to create a systematic process of federal natural disaster assistance for state and local governments in carrying out their responsibility to aid citizens.

Then on September 11, 2001, the terrorists' attacks on the World Trade Centers in New York City shattered the nation's complacency and riveted its attention on preventing such an attack from reoccurring. President George W. Bush created the Office of Homeland Security shortly after 9/11. Then in November 2002 Congress passed the Homeland Security Act creating the Department of Homeland Security (DHS Website, http://www.dhs.gov/history). Amidst great controversy, FEMA was among the 22 agencies merged into the new cabinet-level department.

Proponents of FEMA being moved into DHS maintain that emergency management and national security policies require coordination and administration at the highest level of government. While opponents of FEMA's move to DHS maintain that activities, such as hazard mitigation, not associated with Homeland Security would suffer because of differing missions. In other words, natural disasters would not receive sufficient attention in a large department primarily concerned with national security and the prevention of terrorist attacks (Bea, 2002). FEMA's clumsy response to Hurricane Katrina in 2005 rekindled the debate about the institutional arrangements that best serve the nation in dealing with major disasters.

Federal Cost-Share

After a Presidential declaration has been made, FEMA publishes in the Federal Register the President's decision on which areas are eligible for assistance and the types of assistance available (Boswell, Deyle, Smith & Baker, 1999). The Federal share is at least 75 percent of the eligible costs and may be more, depending on the severity of the disaster or emergency. All applicants, including private non-profit (PNP) organizations, are subject to the cost share outlined in the FEMA-State Agreement. This cost sharing applies to all eligible work. The FEMA-State Agreement also describes the cost share provisions that apply to Direct Federal Assistance (for example, Mission Assignments) provided by a federal agency, including any administrative costs of the federal agency's assistance.

Evolution of the States' Role in Disasters

State emergency management offices were established in 1950 under the Federal Civil Defense Act. This act was passed by Congress and signed by President Harry S. Truman in 1951 to provide the framework for the nation's response to the growing threats created by the Cold War. The first state-level emergency management offices were located in departments of civil defense as extensions of the national agency to provide relief for areas impacted by disasters. However, natural disasters were continuously damaging property and resulting in the loss of many lives.

Although President John F. Kennedy advocated strongly for protection of lives from attacks, he issued an Executive Order (10952) in July of 1961 dividing the Office of Civil Defense into two offices. The new organization was the Office of Emergency Preparedness, which was responsible for advising and assisting the President with policy for nonmilitary

emergency preparedness, while the Office of Civil Defense maintained its responsibility of advising the President on policies pertaining to military attack preparedness. Currently, with the increase of frequency and severity of natural disasters, state emergency management offices chiefly serve as coordinating agencies for disaster preparedness, recovery, and response. In other words, these agencies serve as a liaison between federal and local government to improve the coordination of resources.

Alabama

The Alabama Emergency Management Agency (AEMA) was established in 1983 to administer the emergency management policies and procedures for the state. AEMA is a cabinet-level agency whose director is appointed by and reports directly to the governor. AEMA serves as a coordinating agency for the state in times of disaster with regards to cooperating with departments and other agencies such as the Department of Public Safety and the Department of Environmental Management. In addition, the coordinating agency is responsible for the plans, rules, and procedures being implemented and carried out in the state of Alabama. Based on Alabama law, it is mandatory for each county to either individually or jointly with another county have an emergency management office.

Florida

After a disaster, the Florida Division of Emergency Management conducts damage assessment surveys and advises the Governor on whether to declare an emergency and seek federal relief funds. The division implements training sessions to ensure that the state is able to respond to emergencies, recover from them, and mitigate against their impacts. In Florida, for

example, in order for counties to receive aid from state and federal funds it is mandatory that they submit a comprehensive mitigation plan.

Louisiana

In the state of Louisiana, the Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) was created in March 2006 in response to the lack of intergovernmental relations during Hurricane Katrina. Prior to that time, the state's disaster management agency was located with the department of military services. However, the state of Louisiana has undergone tremendous budget reductions resulting in an increased reliance on federal funding.

Texas

State governments chiefly serve as coordinating agencies. The emergency management office has not undergone substantial reform. The Division of Emergency Management (DEM) has remained within the Department of Public Safety since its creation in 1963. In the state of Texas, it is not mandatory for local governments to submit a comprehensive mitigation plan or to establish a contingency fund. However, there are a number of local governments that have a contingency fund designated for natural and man-made disasters. These contingency funds are implemented to help local governments continue with daily activities with little, if any, interference with the operating budget.

Institutional Arrangements for Disaster Response and Recovery

Institutional arrangements refer to the ways in which public organizations assign responsibility and their chain of command for carrying out those responsibilities. In the case of disaster management, considerable discussion surrounded the relocation of FEMA into the newly created Department of Homeland Security following the 9/11 attacks. Prior to 2002, FEMA was an independent federal agency whose director was appointed by the President subject to Senate confirmation. As part of the massive reorganization of the federal government's including the creation of the Department of Homeland Security (DHS), FEMA was relocated to the new department and its director is now appointed by the Secretary of DHS and, in turn, reports to the Secretary.

Although the local, state, and federal levels of government respond to multiple of natural disasters and technological or human-induced emergencies, organizational changes at the federal and state levels have generally stemmed from a lack of preparedness in responding to a major disaster, poor leadership, poor communications, and lack of coordination with other agencies, levels of government or first responders (Mener, 2007). The states of Florida and Louisiana, for example, have relocated their offices of emergency management three times since their inception in 1950 as stand-alone Departments of Civil Defense.

Alabama

Table 1.3 shows the transition of the emergency management office from the Office of Civil Defense in 1983 to the AEMA, a stand-alone agency, in 1983. The shift to the stand-alone agency was due to the federal government being pressured to shift its focus from civil defense to protecting citizens from natural disasters.

The coordination efforts of the stand-alone agency were tested October 4, 1995 when Tropical Storm Alberto made landfall in the state. Tropical Storm Alberto was one of the costliest storms since Hurricane Frederic (1979). The storm stalled over the state for five days, which generated 8 to 16 inches of rain causing massive flooding. This storm damaged or destroyed over 1,000 homes and businesses. A little over a year later, Hurricane Opal made landfall affecting almost every county in the state of Alabama. The category 3 hurricane caused more than $100 million in damages and 2.5 million people without electricity (http://www.srh.noaa.gov, 2009). Despite the destructions these disasters have caused the state, the AEMA currently remains as a stand-alone agency.

Table 1.3 Institutional Arrangement for Alabama

Year Start	Year End	Department/Division
1955	1983	Civil Defense
1983	Present	Alabama Emergency Management Agency

Florida

From 1950 to 1969, responsibility for emergency management was located in the Department of Civil Defense. The 1950s was the Cold War Era. During this era, government officials' primary concern was preparing for the potential threat of a nuclear war. Government officials advised citizens to build bomb shelters in preparation for a nuclear attack. Little attention was given toward natural disasters. However, the shift in focus began when natural disasters were reporting taking many lives and causing millions to billions of dollars in damages. Hurricane Betsy in 1965, for example, made landfall in The Bahamas, Florida, and Louisiana resulting in over $1.4 billion in damages (Sugg, 1966). Florida was greatly impacted by

Hurricane Betsy with $139.2 million in damages. Table 1.4 shows the shift in focus from civil defense to natural disasters.

Table 1.4 Institutional Arrangement for Florida

Year Start	Year End	Department/Division
1950	1969	Civil Defense
1969	1984	Community Affairs
1984	2006	Public Safety Planning and Assistance
2006	Present	Executive Office

Four years later, Hurricane Camille was deemed the most intense hurricane in the United States, making landfall as a category 5 hurricane that destroyed homes, businesses, and infrastructure. As a result of the substantial impacts from natural disasters, in 1969 Florida relocated its emergency management function to the Department of Community Affairs. The Department of Community Affairs was responsible for community planning, land-use regulations, development, and support for communities. Under this department, emergency management responded to a series of hurricanes that inflicted costly damage on communities—Hurricane Agnes in 1972 resulted in 122 deaths and over $3 billion in damages (NOAA, 2012), Hurricane Eloise in 1975 caused 80 deaths and over $430 million (NOAA, 2012), and Tropical Storm Isidore in 1984 killed 22 people and over $1.3 billion in damages (NOAA, 2012).

Then in 1984 in response to these costly events, Florida once again relocated its emergency management office to the Department of Public Safety Planning and Assistance. This move was intended to better align the mission of the emergency management office with that of its parent department. However, the division of emergency management was experiencing issues with communication and flow of information, with 1985 Hurricane Kate, 1992 Hurricane

Andrew, 1998 Hurricane Georges, Hurricane Jeanne, Hurricane Dennis, 2004 Hurricane Charley, and 2005 Hurricane Katrina. As a result of lingering dissatisfaction with the state's response to these numerous disasters, in 2006 the division of emergency management was relocated to the Executive Office of the Governor.

Louisiana

From 1950 to 1976, the Louisiana division for emergency management was located in the Department of Civil Defense. In 1965, Hurricane Betsy made landfall in the state with wind speeds of 125 mph destroying over 27, 000 homes (Roth, 2010). Damages totaled $1.4 billion and killed 58 people. Four years later, Hurricane Camille, a category 5 hurricane, hit the state of Louisiana. The hurricane resulted in $199 million in damages across the state.

These events elevated the visibility of disaster response and recovery in the state and as a result in 1976 emergency management was moved to the Department of Public Safety. Its relocation to the Department of Public Safety allowed access to more trained first responders, specifically police, ambulance, and fire safety officials who are equipped to handle response in emergency situations. Given the frequency and the severity of disasters in the state, the local, state, and federal government were still ineffective in responding to the aftereffect of these disasters. In 1979, for example, Hurricane Bob estimated damage was $2.6 billion, but aid was not delivered to the affected states immediately partly because President George Bush declared the storm as a disaster and not an emergency. Congress intervened to expedite the process to provide funds to the disaster stricken areas (Diamond, 1991). After Hurricane Bob, hurricanes became more frequent in the state of Louisiana. In 1985, Louisiana experienced three costly disasters, and Hurricane Florence in 1988.

In yet another attempt to better align the state's emergency response and recovery to major disasters, in 1990 emergency management was relocated to the Department of Military Affairs. During this time, disasters were ranked very low in comparison with activities related to national security such as terrorist attacks (Haddow and Bullock, 2006). The Bush Administration had deemed natural disasters as a local and individual problem as opposed to a federal concern (Haddow and Bullock, 2006). Although the state had experienced disasters such as Hurricane Andrew in 1992 causing seven deaths and $1 billion in damages across southern Louisiana, it was not until Hurricane Katrina came ashore in 2005 that resulted in the relocation of emergency management from the Department of Military to the Governor's Office.

Hurricane Katrina showed the imperfections with intergovernmental coordination among the local, state, and federal level. The communication was severely delayed and incorrect as it traveled through the bureaucratic process. As a result over 1,500 people died, thousands remained in city with no power or access to food or water while over hundreds of thousands of evacuees were displaced. In response to establishing better communication and effective response and recovery strategies, the emergency management agency was relocated to Governor's Office in March of 2006. It is assumed that centralized authority reflected the notion that the effectiveness of the program would be improved by keeping important decision-making powers within the head office.

As with all bureaucratic organizations, a key goal is communicating information accurately through the correct channels in order operate efficiently and effectively. The arrangement of emergency management offices can be placed on a continuum from those relying on a centralized approach to those using a peripheral approach. Emergency management offices

located at the highest level of government with direct access to the chief executive are characterized as institutionally centralized.

At the other end of the continuum are emergency management offices located in a larger department or agency without direct access to the executive office and are characterized as institutionally peripheral. As a result of the effects of a disaster, states change institutional arrangements of emergency management offices to accommodate competing goals of improved communication and quicker responsiveness. Of particular interest to this study is the effect these institutional changes have had on the effectiveness of state responses to hurricanes. Table 1.5 presents the relocation of the emergency management agency since 1950.

Table 1.5 Institutional Arrangement for Louisiana

Year Start	Year End	Department/Division
1950	1976	Civil Defense
1976	1990	Public Safety
1990	2006	Military
2006	Present	Governor's Office

Texas

From 1951 to 1963, Texas relied on its Office of Civil Defense for coordinating the state's response to natural disasters as well as its primary duty of preparing residents for a nuclear attack from the Soviet Union. In 1963, the state of Texas moved from a centralized location within the executive office to becoming the Division of Emergency Management (DEM) in the Department of Public Safety. DEM has a state emergency management council, which has representatives from twenty-seven state agencies and the American Red Cross. When a disaster occurs, DEM coordinates the resources and efforts of the council members to solve the problem

or prevent the situation from escalating. Another institutional arrangement that is more decentralized is the located in the state of Alabama. In 1983, for example, the Emergency Management Agency became its own entity. The DEM acts as the coordinating agency for the state. Table 1.6 outlines the changes in location of the emergency management agency over time.

Table 1.6 Institutional Arrangement for Texas

Year Start	Year End	Department/Division
1951	1963	Civil Defense
1963	Present	Department of Public Safety

Organizational Structure

Disasters such as floods, earthquakes, tornadoes are inevitable. However, the risk and impact from disasters can be reduced with improved systems for communication and coordination (Kettl, 2006; 273). Disasters constitute what Churchman called "wicked problems" (Churchman, 1967). Wicked problems have three characteristics. First, they are unstructured. The causes and effects are difficult to identify and model. Thus, the complexity and uncertainty causes little consensus on the problem or solution. Second, wicked problems cut across multiple policy domains and levels of government. In the case of the Texas DHS, the bureaucracy generated numerous issues among internal management. This can be a result of people with varying educational and professional backgrounds, political agendas, cultural traditions, and programmatic responsibilities.

Third, wicked problems are relentless. These problems do not necessarily have a solution. In other words, government must develop ways to reduce, prepare, and respond to disasters without the goal of reducing damages as opposed to eradicating damages from disasters. There is

little time to react, and the cost of failure is significant. We have bureaucracies designed for various duties that are routine from mailing social security checks to providing health services, but wicked problems fall outside of their regular duties. Organizational structure matters because "good leaders can bridge the boundaries of any bureaucracy, but they need a better structure" (Kettl, 2006, p.284).

Institutional Location of Emergency Management in State Government

In 2002, Congress established the Department of Homeland Security as part of the nation's response to the September 11, 2001, terrorist attacks. Prior to the creation of DHS, FEMA was established through the issuance of an Executive Order (12148) as an independent agency in 1979 because a civilian nuclear accident occurred on Three Mile Island near Harrisburg, Pennsylvania in March of 1979 (DHS Report, 2006). This disaster unveiled the delayed response for aid, poor local and federal coordination, and inaccurate information given the consolidation of civil defense and military defense. In 2005, the United States encountered the most costliest and deadliest disaster—Hurricane Katrina. The failure in response resulted in record numbers for casualties, billion dollar estimated costs in damages, dislocation of families, people stranded for days on top of roofs without food or water, and the closure of businesses. The critical issue to the failure of response was the chain of command was too tall. Hurricane Katrina revealed there was no connection with regards to emergency response efforts for communication and coordination strategies linking federal, state, and local officials. The level of uncertainty was evident among the varying levels of government, nonprofit organizations, first responders, and private organizations as to who ought, should, and could do what.

As a result, delayed responses to Hurricane Katrina resulted in more casualties and loss of property. Kettl (2006) claims moving FEMA into DHS was more "symbolic than operational" (2006, p.17). FEMA was moved into DHS to collaborate and establish good governance. The failure to respond to Hurricane Katrina showed that the department was unconnected. FEMA is considered the nation's coordinating arm for natural disasters and catastrophes. However, FEMA was lumped into the Department of Homeland Security along with over twenty other agencies. FEMA's inability to respond was due to DHS's internal problems. In 2004, the Century Foundation gave the internal management of FEMA a C (Kettl, 2006). It is imperative that state and local governments create a unified command.

Complex issues such as major disasters and restoring and increasing economic activity within a region demand coordination. Coordination should be interconnected with a vast array of functional areas and from different levels of government, not hierarchical control (Kettl, 2006; 279). Hierarchy provides a unifying structure to the capacity of complex organizations. Effective response requires horizontal relationships to put capacity to work. The Century Foundation produced a report card to illustrate the performance of DHS in 2004. DHS received an overall grade of a C+. Among the areas scored were coordination with state and local government, which received a grade of C due to lack of a national plan to help state and local governments deal with homeland security. In addition, there was a failure to identify the allocation of grant funding according to risk, and poor support for state training and for first responders.

An important lesson that was derived from Hurricane Katrina is that all homeland security events start as a local problem. When local governments are poorly prepared to respond to a disaster, regardless of its severity, the time for recovery is inevitably lengthened and with it

the cost of the disaster. From a purely economic perspective, states that invest in disaster preparedness and planning may recoup those costs through reduced losses and an accelerated timeline to economic recovery.

Overview of the Dissertation

This dissertation is organized as follows. In chapter two, I fully review the disaster and recovery literature and explain the roles that governments and emergency offices have played in aiding communities in returning to pre-disaster conditions. Following the review, I utilize the contingency approach to address the following questions: How do hurricanes affect states' economic recovery? Does the placement of emergency management offices matter? What effect do states' prior experiences have on recovery? The theoretical framework is developed from an assessment of numerous studies conducted on business continuity and community recovery.

In chapter three, I discuss the theoretical framework used in this study. In this chapter, I discuss why local governments in different states recover quicker than others, where and how data was collected, and explain the rationale for utilizing secondary data. Following this, I explain the weights used to standardized different units of interest. Lastly, I conclude this chapter with a discussion on the measurement of my key variables.

Chapter 5 discusses what factors affect economic recovery in each state. Chapter 6 discusses the institutional effect on economic recovery. Chapter 7 discusses the intergovernmental effect on economic recovery. Lastly, chapter 8 will discuss the implications of the findings and the conclusion.

CHAPTER 2

THE IMPACT OF NATURAL DISASTERS ON THE ECONOMIC RECOVERY OF LOCAL GOVERNMENTS

Economists have been at the forefront of research on understanding the micro- and macroeconomic impacts of disasters, particularly natural disasters. Since the early 1960s when scholars in several disciplines began to turn their attention to understanding the dynamics of disasters, no less than 60 studies by economists have been undertaken that evaluate the impact of natural disasters on national, regional, or local economies. One of the earliest of these was undertaken by Douglas Dacy and Howard Kunreuther (1969) in their pioneering study of the 1964 Alaskan earthquake *The Economics of Natural Disasters.* They conclude by noting that "a disaster may actually turn out to be a blessing in disguise. Aside from the economic boom that often follows because of the large amount of reconstruction, there is an opportunity for commercial establishments and homeowners to improve their facilities" (Dacy and Kunreuther, 1969, p.168).

Joseph Schumpeter (1942) was the first to identify what he called the creative destruction process, the stimulation of greater productivity in an economy as a result of external shocks. Old technology is replaced with newer production methods, and with this process economies experience greater growth over the long term following the external shock (Schumpeter, 1942). Additionally, the research on disasters helps to explain the role of economic development and technological upgrades on the rate of economic recovery.

Most research conducted on the economics of disasters has found that natural disasters, such as hurricanes, tornadoes, and earthquakes, can actually stimulate economic growth in a region or nation (Dacy and Kunreuther, 1969; (Ewing, Kruse, & Thompson, 2003). Disasters

also have a positive influence on economies through job and wealth creation (Belasen & Polachek, 2009; Ewing, Kruse, & Sutter, 2007; Guimaraes, Hefner, & Woodward, 1993).

However, other studies have called into question the long-term economic gains from such destructive events (Noy & Nualsri, 2008; Raddatz, 2009; Strobl, 2012). The following two sections summarize the major studies that support the positive and the negative consequences of disasters on economies.

Disasters Positively Affect Economic Growth

Although natural disasters, and specifically hurricanes, create economic disturbances in the short-term, a number of studies find that they lead to economic growth over the long term as a local, state or national economy recovers from a major disaster (Guimaraes et al., 1993; Skidmore & Toya, 2002). For example, in an extension of the pioneering research by Dacy and Kunreuther, Yasuhide Okuyama (2003) suggests that, following a disaster, more resources are invested in the productivity of each worker to promote economic growth (Okuyama, 2003).

Ewing et al. (2014) used employment rates to measure the impact of disasters on the labor market. The authors utilize a times-series approach to examine regional economic resiliency to hurricanes in the Houston metro area. In addition, new building permits represent construction, building innovation, and infrastructure used to measure economic performance and change in built environment, which signals economic growth (Ewing, Liang, & Cui, 2014). The authors find employment rates and the number of building permits decrease in the short-term following a disaster, but building permits rise as the economy returns to normal, and over time employment levels return to pre-disaster levels. Employment increased following the disaster due to workers hired for reconstruction and cleanup.

A diverse local economy is often measured by the types of employment in the regions. The type of employment sector affects the speed of economic recovery in areas prone to disasters (Ewing et al., 2003). Regions that have a greater risk of destruction to their capital stock typically have less investment in physical capital (Skidmore & Toya, 2002; West & Lenze, 1994). That is, disaster-prone regions lag in economic growth because of the added risk to businesses from investing in the region. Rose and Lim (2002) argue the economic impact of natural disasters could be compounded by disruption to business activity. The volatility of the labor market in disaster-prone regions may discourage investment by private business because of greater costs of repairing, restoring, and rebuilding due to damage caused from disasters. Such regions also have higher insurance premiums, adding to the cost of doing business.

Employers may not migrate to disaster prone areas because of the higher cost of doing business in those areas vulnerable to natural disasters. In other words, the probability of businesses remaining in an area has an effect on employers and the creation of jobs, on the growth in population, and on investment in production facilities. Ewing et al. (2003) use a time-series approach to examine employment growth and stability following the tornadoes that struck Fort Worth in 2000. Construction and manufacturing industries take longer to return to growth levels because tornadoes are persistent (Ewing et al., 2003). However, employment in the construction, finance, insurance and real estate, government, and transportation and public utilities was not affected by the tornado. The service, retail, and wholesale trade industries experienced the lowest employment growth rate post-tornado. This may be because the service industry experienced the fewest losses in employment from the tornadoes, and consequently had less of a gap in recovering lost jobs due to the disaster.

The magnitude of the disaster affects the length of time it takes for an economy to return to pre-disaster levels. As the destructive effects of a disaster increase, local governments look to the federal and state government for financial aid to fund their recovery. That aid often comes with stipulations to modernize capital improvements with newer equipment and technology and to take additional measures to reduce the negative effects of future disasters. For example, the federal government has committed $14.49 billion to upgrade and modernize the levee system that protects the City of New Orleans from the storm surges created by hurricanes (http://www.theneworleansadvocate.com/katrina/). The availability of private insurance to cover storm losses also has a bearing on the economic effects of disasters and the length of time to full economic recovery.

Newer technologies typically require a more educated and skilled workforce for their operation and maintenance. Skidmore and Toya (2002) utilize a cross-country dataset that finds countries that were impacted by climatic disasters had increased economic growth following the disaster while geological disasters negatively impacted economic growth. The authors find that, in the long term, disasters lead to implementation of new technologies and updates to the capital stock. Climatic disasters such as floods, hurricanes, and tornadoes, have a strong positive correlation with economic growth, which may be as a result of improved technology and updates of capital stock. Furthermore, climatic disasters may increase factor productivity (more capital, more productivity), which may lead to an increase in economic growth.

Cuaresma et al. (2008) examine the impact of catastrophic risk on technological upgrades. They found that only developed countries upgraded their technological equipment following a disaster. Less developed countries did not upgrade their technical capabilities, and the less developed the country the more pronounced the deficit in post-disaster upgrades.

Belasen and Polachek (2008) utilize a generalized-difference-in-difference (GDD) model to analyze Florida's county-level employment and average quarterly earnings per worker following 19 hurricanes that struck the state between 1988 and 2005. The authors compare county-level employment and average quarterly earnings per worker for counties directly hit by a hurricane to those that were unaffected as well as neighboring counties that were indirectly affected. They group hurricanes into two categories, depending on their severity, using the Saffir-Simpson Scale. Hurricanes in categories one, two or three on the Saffir-Simpson scale were classified as low-intensity storms. The hurricanes in category four or five were classified as high-intensity storms. They find that high-intensity storms have a positive impact on average earnings and a negative impact on employment levels for counties hit by a hurricane.

However, these effects disappear over the long-term. Low-intensity hurricanes also affect earnings and employment in the counties impacted by hurricanes, although the effect is lower than that of high-intensity storms. Of importance, they find that while hurricanes disrupt employment and wages in the short-term, they can lead to economic gains in the long-term (Belasen & Polachek, 2008, p. 52).

In another study of eight Florida counties affected by hurricanes, Harper and Hawkins (2006) use pre- and post-storm sales tax receipts to measure the economic impact of hurricanes. They find that all eight counties experienced increases in sales tax receipts in the months following the storms that exceeded what would have been expected in the absence of the storm. And the higher sales tax receipts persisted for at least three years after the storm as a result of reconstruction of the damaged properties.

Hallegatte and Dumas (2009) discuss productivity effects when disasters damage manufacturing plants, houses, and bridges and replaced with the most recent technologies, which

have higher productivities (Hallegatte & Dumas, 2009). Government agencies adapt new public infrastructure to meet a higher threshold of durability. Thus, capital losses can be compensated by higher productivity post-disaster.

Fomby et al. (2013) undertook a long-term study of 84 countries to test the yearly response in GDP following a natural disaster. Their cross-national comparison used data from 1960-2013. They evaluated the differential recovery rates, at the national level, of four types of disasters – droughts, floods, earthquakes, and storms. They further divided their sample of 84 countries into developing economies (N=60) and advanced economies (N=24). They find that different types of disasters can and do have different effects on GDP. Droughts, for example, have an overall negative effect on GDP growth. However, floods, earthquakes, and storms have a positive effect on GDP, although their effects seem to be greater for non-agricultural sectors, such as in the manufacturing, retail, and housing, than in the agricultural sector.

Lu and Dudensing (2015) studied the impact of Hurricane Ike on county-level sales tax revenue after it hit the Texas gulf coast in September 2008. They found that the hotel and restaurant sector performed the best during the recovery periods, driven mostly by what they speculate was caused by an influx of relief workers into the eight coastal counties. The return of tourism to the area, however, was slower to materialize. The study also found that service industries recovered much more quickly than manufacturing, largely as a result of their lower capital investment and the capacity to resume normal business activity more quickly (Lu & Dudensing, 2015).

Based on the forgoing summary of scholarly research, the preponderance of evidence finds that natural disasters promote economic development through reinvestment in more productive capital improvements and more modernized technology. Growth in GDP after

disasters can be attributed to destroyed capital being replaced by more efficient productive capacity in manufacturing, housing, and even public infrastructure. But reinvestment following a natural disaster requires an infusion of financial investment that may exceed the capacity of local governments.

Disasters Negatively Affect Economic Growth

From an economic perspective, disasters create market failure. Disasters interrupt normal market operations, and the more severe the disaster the longer it should take for markets to return to pre-disaster levels of production. Disaster-prone areas may further suffer from poor economic growth as businesses and households avoid the higher cost of building and insuring assets in such areas. The severity, geographic scope, and length in time of a disaster affects how quickly an impacted area will recover and the time required to return to normalcy, that is to pre-disaster levels of economic activity. We know from research, for example, that droughts are particularly destructive to local and regional markets due, in part, to their prolonged effects (Fomby et al., 2013; Raddatz, 2009; Stromberg, 2007).

An early study by Semoon Chang (1984) tests the impact of a major disaster, Hurricane Frederic, on sales tax revenues for Mobile, Alabama, following the September 1979 storm. The author finds that the hurricane had a positive effect on local sales tax revenues in the short-term. However, he finds that the hurricane adversely affected the environment and caused subsequent flooding that extended well beyond the direct effects of the hurricane. He concludes, without strong empirical support, that "the hurricane's long-term impact on the city's revenue was opposite of its short-term impact" (Chang, 1984).

Ewing et al. (2003) use pre- and post-employment to examine the impact of the tornadoes that hit Fort Worth, Texas, in the spring of 2000. The study finds that employment sectors such as service and wholesale-retail trade experienced a decline in employment growth following the tornado. This could be due to households, businesses and local governments focusing on repairing, restoring, reconstructing and rebuilding infrastructure and households as quickly as possible before spending on less essential items such as clothing or forms of entertainment that stimulate local employment rates.

Although many scholars contend that disasters provide opportunities for introducing new technologies during the reconstruction phase, Benson and Clay (2004) note the difficulty of implementing new technology and infrastructure because of the pressure to rebuild quickly, the limited financial capacity to acquire more costly technology, and the price and wage demands created by the shortage of skilled labor following a disaster. The authors find that disasters cannot increase economic growth because reconstruction adversely affects the rate of productivity growth. If reconstruction uses the same technologies prior to the destruction of the capital facilities, then the speed of recovery may be negatively impacted. This was evident in the levee systems in Louisiana after Hurricane Katrina in 2005. The outdated system was unable to hold back the storm surges, resulting in massive flooding, causing 1,517 deaths in Louisiana alone (1,836 fatalities total) and $50 billion dollars in direct damage to property.

Noy's (2009) results are opposite of those of Skidmore and Toya (2002). The author uses panel analysis on GDP growth for 1970 to 2003 for 109 countries to investigate the relationship between disasters and economic growth. He concludes from his analysis that developing countries and those with smaller economies incur much greater declines in GDP following a disaster when compared to those of larger or more developed countries.

Raddatz (2007) investigates the impact that a wide range of internal and external shocks, including natural disasters, have on economic growth on low-income countries. The author finds that natural disasters explain a small fraction of the variance in GDP of these countries. Strobl (2009) finds hurricanes have a negative impact on coastal county growth. Hurricanes decreased per capita income by 0.8 percent.

As noted in the previous section, Fomby et al. (2013) found that droughts have an overall negative effect on GDP growth for both agricultural and nonagricultural sectors. But the cumulative effects of droughts on agriculture growth persist in the following two years after the drought ends. That impact was not observed in nonagricultural sectors.

Before Hurricane Katrina (August 2005), Hurricane Andrew (August 1992) was the largest, most devastating hurricane to hit the United States. Katrina, however, resulted in an estimated death toll of 1,517 in Louisiana (1,836 for all states affected by the storm) and an aggregate financial loss of $40 to $50 billion in property damage and economic losses from lost business activity (Kates, et al. 2006). In the case of Andrew, the category 5 hurricane resulted in 65 fatalities and over $26 billion in damages. The question was raised whether south Florida could recover from the severe disaster.

Baade (2007) uses taxable sales at the county-level to explain economic recovery in Florida. He finds Miami recovered one month following Hurricane Andrew. However, the hurricane had a large, negative impact on south Florida's economy. Baade concludes that wealthier regions in the state benefited from insurance settlements, subsidized governmental loans and grants while poorer regions required more governmental intervention. He does raise the concern that citizens displaced by a hurricane are reluctant to return to their homes and less convinced that the risk of future losses is minimal.

Disasters Have Little to No Effect on Economic Recovery

A few studies find that natural disasters have little or no effect on economic recovery. These studies suggest that natural disasters are so infrequent and geographically specific that there is an insignificant impact on aggregate growth rates.

Albala-Bertrand (1993) examines the relationship between natural disasters and their effects on the growth rate of output for countries. The author finds that capital loss is unlikely to have an important effect on growth, and post-disaster spending may be sufficient to prevent the growth rate of output from falling. Ultimately, disasters do not affect a nation's economic growth rate because they typically impact only a localized geographical area (Albala-Bertrand, 1993).

Cavallo et al. (2010) find that unless a natural disaster triggers a radical political revolution, it is unlikely to affect economic growth. Wright et al. (1979) use county-level data from 1960 to 1970 to assess the effects of natural disasters on communities for the period beyond the immediate post-emergency phase. The authors use housing and population to examine the economic recovery at the community level. From their empirical analysis, the authors find natural disasters such as floods, tornadoes, and hurricanes have no effect on the changes in population or housing stock in counties between 1960 and 1970.

Impact of Disaster Severity on Economic Recovery

While much of the literature discusses the impact of hurricanes on economic recovery, the severity of a hurricane affects the speed of economic recovery. Large disasters may negatively impact economic growth both in the short term and, depending on the severity and type of disaster, in the long term. Cavallo and associates (2010) utilize cross-country

comparative case studies to reveal that large disasters have adverse effects on short-term and long-term economic growth because large disasters are assumed to cause greater loss in life and property. Belasen and Polachek (2008) find that high-intensity hurricanes (those in category 4 or 5) have a much greater impact on employment and earnings than lower-intensity hurricanes (those in category 1-3).

A catastrophic disaster is an event that results in a large number of deaths and injuries, causes extensive damage or destruction of facilities that provide and sustain human needs, produces an overwhelming demand on state and local response resources and mechanisms, causes a severe long-term effect on general economic activity, and severely affects state, local, and private-sector capabilities to begin and sustain response activities (FEMA**,** *FRP Appendix B*, 1992). Hurricane Katrina, for example, was deemed one of the most catastrophic disasters to strike the U.S. as a category 3 storm. More than 400,000 people in Louisiana, Mississippi, and Alabama were displaced from their homes, while 1,836 lives were lost, and the hurricane caused more than $150 billion in lost economic activity (U.S. Census Report, 2015).

Loayza et al. (2012) use a cross-country panel dataset to explore the impact of natural disasters on economic growth for sixty-eight developing countries from 1961 to 2005. Floods, for example, were shown to have a large, positive impact on growth in GDP, agriculture, industrial output, and services. The positive growth effect was reduced, if not negated, in the case of a severe flood. The authors show moderate disasters can have a positive impact on certain sectors. However, extreme disasters can negate those positive gains on growth.

Hurricane Katrina hit the Gulf Coast in September 2005 and is categorized as a catastrophic disaster as a result of loss of lives, costly damage to physical capital, and the destruction of the built environment (Cavallo et al., 2010). According to Rood (2005), the

difference between a catastrophe and a disaster is crucial. State and local officials can be counted on to assess their needs and direct federal response to a disaster. However, to receive governmental aid local governments must demonstrate the limitations of their resources to manage damages caused by the disaster or catastrophe.

Burrus et al. (2002) compared the cumulative impact of low-intensity hurricanes to high-intensity ones for the Wilmington, North Carolina region. They found that the low-intensity storms were 37 times more frequent than high intensity storms, and that the low-intensity storms have a cumulative effect over time that is equivalent to a major storm imposing $3.7 billion in damage (Burrus, Dumas, Farrell, & Hall, 2002).

Chapter Summary

While there is a vast amount of literature on economic recovery, there are several gaps in the disaster and economic research. First, economic recovery is chiefly based on business disruption (Tierney, 1997; Webb et al., 2000). The limitation with using business disruption as an indicator for economic recovery is that the composition of industries varies among cities, counties, states and countries making comparisons difficult. Also, the type and the size of business affect their capacity to recover from various types of natural disasters. Studies have indicated that there is limited information to determine whether businesses close following a disaster due to lack of resources to sustain operation or whether the storm precipitated the permanent closure of the business.

This study uses county level GDP to take into consideration the impact of hurricanes on total production. This allows for evaluating the impact of hurricanes on total business activity both pre and post disasters.

The second gap in the literature is the lack of attention to the financial capacity of disaster recovery from a sub-national perspective (Fomby et al., 2013; Raddatz, 2009; Skidmore & Toya, 2002). Much of the literature published on disaster recovery focuses on the economic recovery at a national and international level. Although research at these levels is valuable, as the Department of Homeland Security (DHS) has noted all disasters are ultimately local events. Local governments are at the front line of disaster response and recovery and bear much of the economic burden for the cost of recovery. Policies at the international level may not be feasible for local governments as their environmental composition varies (i.e., emergency management resources, population, and employment sectors). This study addresses the impact hurricanes have on local economies, and examines the factors that affect the rate of economic recovery by county governments.

Lastly, there is no conclusive evidence to suggest how disasters impact economic recovery. There is a long debate about the impact disasters have on economies and institutions (Chang, 1983; Dacy & Kunreuther, 1969; Noy & Nualsri, 2007; Skidmore & Toya, 2002). This study addresses this gap by acknowledging that natural disasters have varying impacts on economies. Because of their repetitive occurrence, hurricanes are used to examine their impact on economic growth. In addition, counties in separate states are used to help with generalizability to show that environmental and institutional factors may also play a role in economic recovery.

CHAPTER 3

A CONCEPTUAL MODEL OF PUBLIC MANAGEMENT RESPONSE TO DISASTERS

A disaster is a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that may exceed a community's capacity to cope using its own resources. Disasters disrupt individual coping patterns and alter the inputs and outputs of social systems (Quarantelli, 2005, p.339). The wind and storm surge from a hurricane do not constitute the disaster, per se, but their impact on lives, property, and the economic and social interaction that causes the destruction. Hurricane Katrina in Orleans Parish, Louisiana, is an example of a disaster that resulted in extensive loss of life and disruption in social systems. Another is Tropical Storm Arlene that struck Baldwin County, Alabama, in June 2005. Although there were no injuries or fatalities from this disaster, Tropical Storm Arlene caused $1.5 million in property damages. Residents were without power for hours, roads were impassable, and homes and businesses were damaged by flooding and wind.

A hazard is anything that has the potential to harm humans, other living organisms, the environment, or property (Lindell & Prater, 2003; K. Tierney, 1989). It is an unavoidable danger or risk. When people move to hazardous areas such as Houston/Galveston or New Orleans where tropical storms and massive flooding are more common, they place themselves at risk of experiencing a disaster.

Often the terms hazard and risk are used interchangeably in the research literature, but they are two distinct concepts. Risk is the probability that exposure to a hazard leads to an interruption in economic and social interchanges. Destruction of homes, commercial and industrial buildings or infrastructure for example, with deficiencies in building construction can

contribute to the economic losses caused by a disaster. In 1992, Hurricane Andrew made its initial landfall in south Florida as a category 5 hurricane resulting in $26 billion in damages in the state of Florida (NOAA, 2012, http://www.srh.noaa.gov/mfl/?n=andrew). FEMA prepared a report that concluded that much of the damage to residential structures was due to inadequate design, substandard workmanship, and/or misapplication of various building materials. The report also indicated inadequate county review of documentation for construction permits, county organizational deficiencies such as a shortage of inspectors and inspection supervisors, and the inadequate training of supervisors may have contributed to the poor-quality construction documented in the FEMA report (1992; p. 2-3).

Hazard vulnerability, often the subject of investigation by geographers, focuses on two main components—physical and social vulnerability. Physical vulnerability is the probability of damage occurring to exposed tangible assets such as physical structures, infrastructure, and the natural environment (Tierney, 1997; Rose, 2004). Often information such as characteristics of the buildings and occupancy rates expresses the level of vulnerability.

Social vulnerability refers to the probability of harm to individuals, households, communities and organizations and their ability to withstand adverse impacts. Measures of socio-economic vulnerability include the exposure to the hazard by vulnerable populations such as those with special needs populations (children, mentally-ill, drug addicts, prisoners, hospitalized, and the elderly), the proportion of the population that is below the poverty line, the per capita income of the community,, and its demographic characteristics including race, age, gender, and average education level (Cutter, 1996).

The Four Phases of Emergency Management

Figure 3.1 identifies the four phases of emergency management—preparedness, mitigation, response and recovery. Preparedness is the phase where the community and emergency managers partner to develop strategies to reduce the impact of disaster events. During this phase, community members and emergency managers establish emergency plans and inform residents of strategies to save their lives and protect their property. Also during the preparedness phase, officials acquire equipment, personnel, materials and supplies, and conduct routine exercises in the event of a disaster.

Mitigation involves planning by the community and experts to reduce the impact of future disasters on lives and property. Governments typically use technology such as levees and dams to reduce flooding. Response involves the coordination of various entities—governmental and non-governmental—to identify roles and responsibilities to save lives, reduce damage to property and begin the recovery process. The response phase is tasked with executing the emergency management plan identified in the preparedness phase. The response phase tends to disseminate warnings, evacuate residents, search and rescue residents, provide and provide emergency services.

Lastly, the recovery process focuses on rebuilding communities and organizations to ultimately return to operating or pre-disaster levels. Each phase is linked to each other to maintain the continuity of daily operations.

Figure 3.1 The Four Phases of Emergency Management

Institutional Vulnerability

Analysts segment the impact of disasters based on whether a community was directly or indirectly impacted. Direct impacts (i.e., physical damage to capital assets) and indirect impacts (i.e., no electricity or water), make it difficult for individuals to access their households and firms, which interferes with productivity (source?). Tierney and Niggs (1995) and Tierney (1995) find that disruption of services for telecommunication, transportation, natural gas, water, electricity, and sewer and wastewater are among the main reasons for business closure after disasters. Employees lose work, and customers go elsewhere for services causing, causing these types of firms to lose sales.

Businesses that were located in high, intense tremor zones reported more disruption of their operations than those firms that indicated they had recovered. Rose and Lim (2002) use data from cities affected by the 1994 Northridge earthquake in Los Angeles County to show that disruption in the supply of electricity was one of the top three reasons for firms' closing

temporarily and permanently. The literature has an extensive discussion of the psychological effects of disasters on individuals and communities. Cowan (2000) defines psychological wellness as the ability to help people avoid psychological distress or consequences by providing insights to cope and recover from disruptive events such as job loss, divorce, decline in health, financial losses, natural disasters and loss of a loved one.

While there is much discussion on the geographical, sociological and psychological aspects of disasters, much less empirical research has been conducted on the public management aspects of disasters. All four phases of a disaster, such as a hurricane, require administrative direction. The public management aspect includes the funding for disasters from preparation to recovery, the institutional arrangements used by state and local agencies that are responsible for disaster administration, and the experience of local communities in responding to and recovering from disasters.

In the case of hurricane-prone areas, someone must manage the annual appropriations from state and local governments for preparation and mitigation. When a hurricane strikes, those same administrators must change hats and now administer funding for disaster response and recovery. Disaster administration requires developing policies for disasters (notification, evacuation, hazardous materials, and reentry into the affected area). Depending upon on the magnitude of the storm, someone must be responsible for executing proper procedures for disseminating information to the proper channels to receive intergovernmental disaster aid. The role of the public manager is a critical component when examining the speed of economic recovery post-disasters.

In 2005, the National Science Foundation (NSF) approached the National Research Council (NRC) to undertake an appraisal of the contributions by social scientists to the

knowledge on hazards and disasters, especially those studies funded by grants from the NSF (Committee on Disaster Research in the Social Sciences; p. vii-viii). The NRC appointed a Committee on Disaster Research in the Social Sciences: Future Challenges and Opportunities to prepare a compilation of the relevant research on hazards and disasters. The end product was an extensive report on "Facing Hazards and Disasters: Understanding Human Dimensions" published in 2006 by The National Academies Press.

The Committee undertook an exhaustive inventory of research by sociologists, and geographers, but missing from the research was the substantial amount of research by economists on the economic impact of disasters. Furthermore, the Committee's report reveals the significant and glaring gap in research by public administration and public finance scholars on disasters. Ultimately, all disasters require some degree of administrative intervention at any and all of the four stages. That intervention may be confined to local emergency managers or it may require the involvement of state and federal officials as the magnitude expands.

The importance of the administrative capacity for responding to and recovering from disasters has been reinforced with every major disaster. The response by the New York City Fire and Police Departments to the 9/11 terrorist attacks in 2001 demonstrated the economic and political benefits to investing in professional emergency responders. By contrast, the dysfunctional response to Hurricane Katrina in 2005 illustrated the costliness of poor preparation and inadequate response by emergency managers. And the continuing recovery from Katrina illustrates the long-term economic consequences when the administrative side of emergency management is neglected.

The Committee's report left open one of the most fundamental questions in disaster research: Does pre-impact preparation and post-impact disaster aid accelerate the time to

economic recovery following a disaster? The ultimate justification for the public sector's investment in disaster management is to facilitate economic recovery from the disruptive event, whether caused by nature or human action. And economic recovery means returning to the pre-disaster level of economic activity as measured by GDP.

While communities are an amalgam of social, political, and economic systems, the assumption made in this research is that economic recovery must occur first in order for the other social systems to recover. Resumption of market activity makes possible the resumption of social and political systems. And the restoration of market activity requires the rehabilitation of infrastructure such as roads, bridges, electric power, water, wastewater, and communication networks. It also requires restoration of public safety and public health, all of which is under the purview of the public administrator.

In the case of hurricanes, communities along the Gulf Coast in the United States are particularly vulnerable when those storms make landfall. And those communities with previous experience likely have a heightened sense of vulnerability. A reasonable assumption is that, the more experience a community has with hurricanes, the greater the pre-impact investment it will make in preparation. Such preparation includes both the financial investment and institutional arrangements (organizational location of emergency management offices, degree of centralization of emergency management duties in state government) made by both the local and state governments.

Once a hurricane makes landfall, the amount of aid flowing into the community affects the speed with which it recovers economically. Depending on the magnitude of the hurricane, federal aid may be released in order to accelerate recovery. A community's prior experience with hurricanes may be particularly important in knowing how to tap federal money and how to

effectively distribute those funds to accelerate economic recovery. Conversely, a community with prior experience may also be less dependent on federal aid and more administratively adept at responding to more destructive hurricanes.

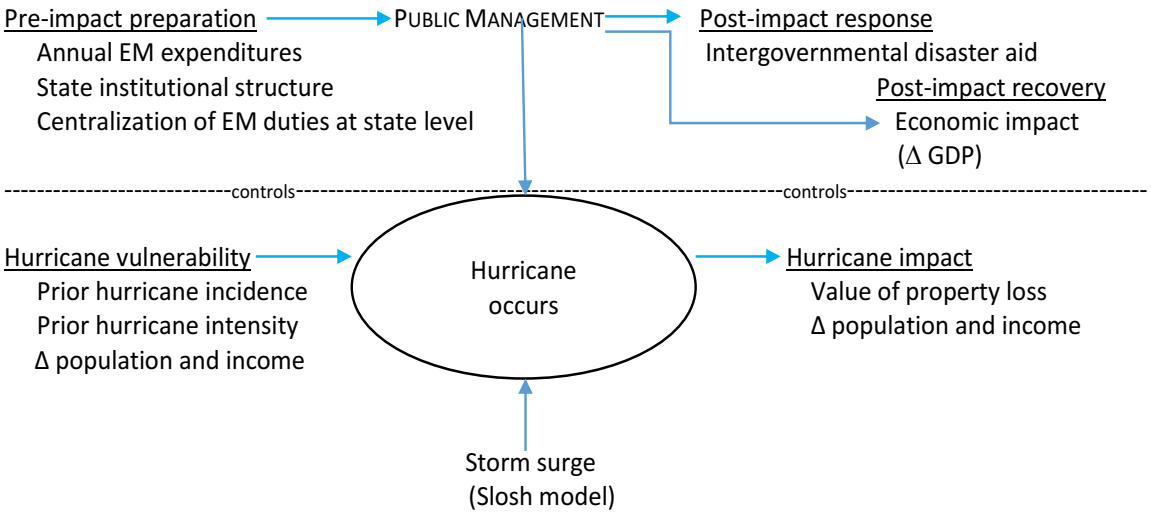
The basic research question for this dissertation is whether pre-impact preparations and post-impact disaster aid accelerate the return to pre-disaster levels of GDP. If they do, then it will provide strong support for state and local investment in disaster preparation, especially for communities along the Gulf Coast that have the greatest exposure to the destructive effects of hurricanes.

These relationships are summarized in Figure 3.2, which is adapted from the report prepared by the Committee on Disaster Research in the Social Sciences. The Committee's model has been modified to explain the role of public management in pre-impact conditions and post-impact responses. Specifically, the factors that are the subject of this analysis are above the dashed line, and the control variables are below the line. The dependent variable is the length in time between when a hurricane impacts a county and when that county's GDP returns to a pre-disaster level. The variables subjected to analysis in this dissertation are (1) the pre-impact preparation undertaken by the county (annual expenditures for emergency management, the institutional location of the emergency management agency in state government, and the degree of centralization of emergency management duties at the state versus county levels), and (2) the post-impact response (the amount of state and/or federal aid committed to responding to the hurricane).

The model also controls for several factors that affect the speed of economic recovery including (1) a county's prior experience with either a direct or indirect hit by a hurricane, (2) the intensity of each prior hurricane, (3) the rate of change in the county's population and personal

income prior to and following the hurricane, (4) the magnitude of the storm surge created by the hurricane, and (5) the total value of property destroyed or damaged by the hurricane.

Figure 3.2 Theoretical Model of a Community's Economic Recovery From a Hurricane



Adapted from *Facing Hazards and Disasters: Understanding Human Dimensions*, National Academy of Sciences, 2006.

Pre-Impact Conditions

Because local governments provide the front-line response to disasters, they typically must have in place the strategies to mitigate the impact of disasters. This is particularly the case for populated regions in hurricane-prone regions. State and local governments have limited resources and limited economic capacities to rebuild, repair, and restore damaged and destroyed capital assets. One common mitigation strategy is establishing a contingency fund to provide a financial cushion to reduce the disruption in their operating budgets caused by the direct or indirect impact of a hurricane. Public officials use these funds for disasters, economic downturns, or other unexpected events to offset costs incurred outside the normal budget process.

State and local governments establish these funds, which may contain 10 percent or more of their operating budget. However, not all governments have the financial capacity to create such reserves. Although FEMA provides up to 75 percent of funds for disaster relief, FEMA does not advance funds. Local governments are responsible for the expenses prior to reimbursement by FEMA. As a result, state and local governments must turn to other sources such as their general funds, rainy day stabilization funds, or diverting funds from existing capital improvement projects, or increasing taxes on taxpayers outside the disaster region.

In 2005, the Multi-hazard Mitigation Council conducted a study on emergency management, specifically mitigation, which found that every $1 spent on mitigation saved an average of $4 in costs from disaster-induced damages. Thus, it can be hypothesized

H1: The greater the local spending on emergency management, the more quickly a county recovers economically from a hurricane-caused disaster.

Prior to Hurricane Andrew making landfall in August 1992, Dade County had an estimated 796,800 homes. After Hurricane Andrew, 429,100 units were damaged or uninhabitable (54 percent of the housing stock). Two years later, an estimated 39,200 people never returned to Miami/Dade County (Rincon et al., 2001, p.278). In addition to the suffering and psychological costs and the disruption to businesses, the hurricane also extracted a heavy toll in lost property and sales tax revenues.

Communities that exhibit declining population or income during the pre-disaster period tend to have more difficulty increasing the population size and income post-disaster. Lower population and income limits the availability of resources such as supplemental revenue for contingencies and trained staff and personnel. Structural changes in the local economy before

disasters tend to be accelerated during the period following a disaster. Specifically, pre-event changes in population and personal income are accelerated by the incidence of a hurricane. Therefore, it can be hypothesized that

H2: Counties experiencing loss in either or both population or income prior to a hurricane will take longer to recover economically than counties experiencing growth in both population and income.

The dissemination of information can become inconsistent depending on the time it is released, and the number of channels it must go through until it reaches its designated location (McGuire & Schneck, 2010). Kapucu and Garayev (2014), for example, assessed two emergency management systems—hierarchical and network structure—in the state of Florida at the county-level to explain which was more efficient in emergency response. The authors found that the command-and-control approach (i.e. hierarchical) may have a negative impact on recovery when decision- making at higher levels is dependent on information and actions from lower levels in the organization.

This may result in the delay of decision making, mobilizing resources, and responding to time-sensitive information during extreme events. In other words, there is little, if any, capability for improvisation and alternative sources of support when utilizing the command-and-control approach in disaster environments.

Recovery is not a final phase, but evolves from decisions made over time, and recovery is achieved quicker when local organizations have the flexibility to respond to their specific situations (Olshansky, 2006; Yukl & Lepsinger, 2005). Although disasters can be extreme and costly, Kapucu (2003) argues there is a need for formalized cooperation and response regardless of the magnitude of the disaster. Disaster scholars generally view this formalized, hierarchical approach as rational under normal conditions, but in the case of extreme, tumultuous

environments it is important for decisions that be made at the local level (Quarantelli & Dynes, 1977). Decisions made at the local levels allow officials to adjust their protocols to dealing with differing conditions in real time. Thus, it can be hypothesized that

Hypothesis 3: The decentralization of responsibility to counties for emergency management is more important to reducing the length of time to economic recovery than the location of the state's emergency management office.

The network approach is a commonly utilized strategy for dealing with disasters because disasters affect multiple entities—governments, non-profits, and businesses. It provides a more flexible, adaptive approach when managing uncertainties and constantly changing environments. Network governance is the idea that organizations are inter-dependent, and should work together to achieve mutual desired outcomes. In other words, decision-making is among multiple stakeholders, governmental and non-governmental actors. State emergency management agencies serve as coordinating entities between federal and multiple local governments affected by a random and wide-ranging event such as a hurricane. Thus, state governments are positioned in a structure, which reflects intergovernmental relationships in either a centralized or decentralized capacity.

The integration principle is the notion that federal mitigation, response, preparedness and recovery programs should be integrated with other levels of government in hopes to better managing disasters. The underlying assumption is that multi-governmental experience or response to more frequent disasters would help governments deal better with low-probability disasters, if or when they occur. Experience with disasters allows for emergency assessment, the implementation of hazard mitigation techniques, population protection, and the coordination of emergency response (Perry & Lindell, 1992).

Recovery funds are pivotal indicators to local and state economies' ability to recover and to the speed of economic recovery. Given the severity and the classification of the disaster (i.e., federally declared), federal assistance and insurance funding are disbursed to immediately rebuild and repair homes, businesses, and infrastructure to pre-disaster levels. Dacy and Kunreuther (1969) use a case study of the Great Alaska Earthquake of 1964 to examine the impact on economic recovery. The authors conclude that a community can benefit economically from a disaster because capital rapidly flows into the community for rebuilding purposes. However, under the Stafford Act states and counties must reach a financial threshold before receiving aid from the federal government. Often smaller local governments have difficulty meeting this threshold given their limited administrative capacity and small population. Consequently, the following hypothesis is tested:

H4: The greater the federal and state assistance following a hurricane, the more quickly a county recovers economically from the disaster.

Poor coordination is one of the major problems during the response to a hurricane because of inefficient communication between organizations, and lack of up-to-date information through emergency response networks (McGuire & Schneck, 2010). Abbasi and Kapucu (2012) examine organizational position and role changes over time as a result of dynamic the structural dynamics of organizations during the evolution of inter-organizational response networks over time. Based on these studies, the following hypothesis is tested:

H5: Economic recovery by a county from a major hurricane will be faster where a state's emergency management agency is located centrally in the governor's office than those located peripherally.

Disasters set into motion a complex array of responses involving multiple governments,

volunteers, and households, and businesses. While disaster drills provide a basic level of competency in responding to and recovering from a major event, no substitute exists for the actual experience of dealing with the aftermath of a disaster. Hurricanes, in particular, reoccur in the same region although their frequency and intensity are less easily predicted. As such local governments gain experience with each hurricane and that experience becomes particularly important to mobilizing resources to reduce injuries and fatalities as well as the loss of property.

From the business or organization level, previous disaster experience influences business disaster preparedness. Drabek (1994) found that businesses with previous disaster experience had engaged in more evacuation planning than business with little or no disaster experience. Mileti et al. (1993) found experience to be significantly related to preparedness.

Rincon et al. (2001) distributed 340 surveys to households in 1999 with regards to hurricane preparation and readiness in the wake of Hurricane Andrew (1992). During hurricane Andrew, the Miami Children's Hospital was the only pediatric hospital serving the Dade County population. Preparation for a major disaster has proven to be the most effective way to reduce damage suffered by individuals and states (Rincon et al, 2001). Although Rincon et al. (2001) examines the effect of prior experience in the wake of major disasters on recovery at the individual or household level, this can easily be applied to organizations and states. Prior experience with a severe storm is one of the contributing factors that impact the speed of recovery.

Experience matters. When disasters are perceived as temporary or having a temporary effect on economic activity, there may be no change in organization structure reporting procedures, management style, or investment in mitigation efforts to improve the speed of recovery for future disasters. Organizations may focus on rare events such as Hurricane Camille

or Hurricane Katrina because the probability of it recurring is likely (Kunreuther, Novemsky, & Kahneman, 2001; Lampel, Shamsie, & Shapira, 2009).

State emergency management agencies will respond based on their experience handling disasters. Emergency management agencies will choose at least two options when handling the pressures of a disaster. First, they will utilize the current structure and determine how to make it more effective in the wake of disasters. Second, managers will utilize new strategies or create structures that are better suited to deal with the impact of disasters due to the changing pressures from the environment. Poor preparation causes more loss than the actual disaster (Gerber & Robinson, 2009). McGuire and Schneck (2010) utilize the former management structure from the case of New Orleans during Hurricane Katrina to argue preparedness, recovery, and response depend on strategic management capacity. The authors provide a framework that indicates leadership and management matters before and after disasters like Hurricane Katrina.

Organizations learn from previous events. They develop strategies based on learning, intervening in current operations with developed strategies, and seek resilient evolution over the long term (Oh, 2012). Organizations set new standards for operations (Carley & Harrald, 1997) and align capacities with changing factors in their environment.

Organization learning pertains to two models—single loop process and double loop process. Organizations detect error through feedback and adjust its operation strategies according to their internal values and norms. The double loop process allows for members to question operation strategies, values, and norms to change their actions accordingly. Regardless of stable or dynamic environments, organizations change their actions in terms of achieving their mission (Weick, 1995).

Comfort et al. (2013) use content analysis to identify actors engaged in response

operations for each disaster. From their analysis, Texas' fragmented system illustrated lack of learning between two hurricanes (2005 and 2008). Despite the changes at the national level following Hurricane Katrina, Texas did not change their basic preparedness and response procedures. This could be explained because of the positive perception the way Texas handled Hurricane Rita. Bland and Overton (2016) found that public organizations acquire both institutional and operational knowledge from their experience. Institutional knowledge refers to the knowledge gained from successive events such as the establishment of tax increment financing districts. The repeated events allow for public organizations to tap previous collaborators and with each successive event the collaborators become more proficient at working together. Operational knowledge, by contrast, is acquired from the experience of operating a particular program or agency. Over time, managers gain experience from understanding internal and external procedures, thereby increasing organizational efficiency. Bland and Overton found that both forms of experience increased economic value of the TIF districts.

In a thoughtful discussion of the lack of adequate preparation for Hurricane Katrina, Robert Meyer (2006) noted that local governments may be loath to learn from prior experience. Coastal cities are often placed under a hurricane watch only for it to be a false alarm. Meyer notes that "we are much better in learning from the mistakes we actually make than those we almost make" (p. 154-55). Low probability but high consequent evens like hurricanes make local governments and their residents especially vulnerable to the false alarm result. Another factor Meyer's notes is that the efforts at preparation and mitigation by coastal communities may create a sense of overconfidence in their capacity to withstand a hurricane. A third consequence

is what he calls projection bias – the tendency to underestimate the time to recover from a disaster.

Within a three-year time span, inter-organizational learning improved Louisiana's preparedness and response between Hurricane Katrina and Hurricane Gustav. It can be assumed that organizations with previous disaster experience have familiarity with other agencies who have resources such as funding, expertise, legal authority, and information that organizations need to achieve their desired outcomes (Agranoff & McGuire, 2003). It can be suggested that organizations experiencing a decline will try to resolve problems they face as managers respond to the pressure generated by poor performance.

H6: The more experience that a local government has with responding to hurricanes, the more quickly it will recover economically from the direct or indirect impact of a hurricane.

Empirical studies have attempted to explain the impact the severity of hurricanes have on economic recovery through the use of the Saffir Simpson Hurricane Wind Scale. This scale measures the speed of the sustained winds to categorize the strength of a storm. The severity of disasters has been known to cause destruction to residential areas, industries, infrastructure and services that may result in temporary or permanent closures. Although the wind scale can express the severity of the storm based on the potential damaging winds, the scale is not the most accurate in measuring the impact of a disaster.

The Saffir-Simpson Hurricane Wind Scale does not include storm surges, the source of most of the damage along the coastline from a hurricane. Hurricane Katrina, for example, was category 3 at landfall in Louisiana, and produced catastrophic damage with a 28 feet storm surge. Hurricane Irene was a category 1 hurricane at landfall in North Carolina and produced damage with an 8 to 11 feet storm surge.

The National Weather Service has established the Sea, Lake and Overland Surges from Hurricanes (SLOSH) model. The SLOSH models acknowledges multiple factors that cause storm surges such as atmospheric pressure, size, forward speed and track data which contributes to the severity of disasters. The physical impact of disasters can negatively affect residential, commercial, infrastructure or community services through temporary or permanent closures, which can reduce or prevent the delivery of goods and services causing a loss of economic activities. This may decrease revenue from loss or deferral of sales taxes, business taxes, property taxes, user fees, and personal income taxes. There is little systematic research on the effect-damaged property has on the speed of economic recovery. Thus, it can be hypothesized

H7: The greater the magnitude of a hurricane, the slower the economic recovery.

While the literature provides insight on the advantages and disadvantages disasters have on economic recovery, the literature is lacking on the role public management has on the speed of economic recovery. Public managers have a responsibility to manage annual emergency management funds, adjust to changes in population and income, continuously assess institutional structures, and evaluate the effectiveness of centralized and decentralized infrastructures used to execute tasks to develop tools to maximize efficiency and effectiveness during issues.

Research has not examined important management factors in the disaster recovery process, a gap in the literature that has not been recognized. However, we know from major disasters like Katrina, Ike, and Charley that management factors play an essential role in disaster response and recovery. The dissertation focuses on recovery from hurricanes using four sates and hurricane data between 2000 and 2014.

CHAPTER 4

DATA AND METHODOLOGY

The hypotheses proposed in Chapter 3 are tested using data from 46 counties in four states (Alabama, Florida, Louisiana, and Texas) that border the Gulf Coast and that have been directly affected by at least one hurricane between 2000 and 2012. However, the financial data used in the analysis is for the 2000 to 2014 period. The two additional years were to allow for the delayed effects of hurricanes to be reflected in the financial data.

While scholars such as Wright (1979) argue that observing the impact of disasters at the county level is not insightful because the unit is considered large, this study utilizes the county level because of the accessibility of historical data on disasters and on county finances and economic indicators. Furthermore, counties carry primary responsibility for disaster preparedness and response in these states, and counties encompass both incorporated and unincorporated areas, providing a larger geographic area to assess the economic impact of a hurricane.

Data Sources

Table 4.1 reports the percentages of the coastal counties in the sample out of the total coastal counties in each state. These four states were selected because of their long and varied history of responding to hurricanes. They were also selected because of the different institutional arrangements each uses at the state level for administering its emergency management operations.

Of the 138 coastal counties in these four states, many of which are sparsely populated, complete data were available on 46 counties. Each of the counties had been impacted by a hurricane between 2000 and 2012, the sampling time period chosen to test the hypotheses. And

each county varies in its demographics, the size and professionalism of the county emergency management office, and the amount of disaster aid provided from local, state, and federal sources.

Table 4.1 Percentage of Coastal Counties in the Sample by State

State	Alabama	Florida	Louisiana	Texas	Total
No. of Coastal Counties	8	61	38	31	138
Percent of Coastal Counties in Sample	50%	27.9%	31.6%	41.9%	---
No. of Counties in Sample	4	17	12	13	46

The following section discusses the dependent and independent variables used in the analysis. Table 4.2 provides a snapshot of the variables used for each of the four states and the sources for each.

Table 4.2 Variables Descriptions and Sources of Data

Variables	Description	Source of Data
County GDP	Annual gross domestic product (GDP) for county	Moody's Analytics (prepared by Bureau of Economic Analysis)
Severity of Hurricane	Estimated property damage	National Oceanic and Atmospheric Administration (NOAA)
	Wind speed of hurricane on Saffir-Simpson scale	National Oceanic and Atmospheric Administration (NOAA)
	Duration of hurricane in county (days)	National Oceanic and Atmospheric Administration (NOAA)
Disaster Experience	Number of hurricanes to strike county between 1800 and 2014	National Hurricane Center (NOAA)
	Number of months since last hurricane made landfall in county	National Oceanic and Atmospheric Administration (NOAA)

County Government Expenditures on Emergency Management	Annual expenditures for emergency management operations	States' county emergency management agency
Organizational Location of State EM Agency	State EM office location relative to Governor's Office	States' website; email with state officials
Recovery Funds (Federal, State, Local)	Total funding from federal, state, and local governments allocated to counties for recovery	State Government Official (Email Communication)
Employment by sector	Percent of county employment in agriculture, mining, manufacturing, construction, retail	Bureau of Labor Statistics
Poverty Rate	Percent of county population at the poverty level (Annual)	U.S. Census Bureau
Renter	Percent of county with non-homeownership (Annual)	U.S. Census Bureau
Recession	Year(s) of economic recession	National Bureau of Economic Analysis

Dependent Variable: County Gross Domestic Product

The dependent variable is the log of each county's annual GDP adjusted for inflation to 2009 chained-dollars. GDP is used to measure the economic impact of a hurricane. The stronger and longer lasting the hurricane, the greater the impact on GDP. This measure then provides a basis for assessing the impact on hurricanes on the capacity of a county to recover.

According to the Bureau of Economic Analysis (BEA), Real gross domestic product (GDP) is an inflation-adjusted measure of each county's gross product. The inflation for Real GDP is adjusted to chained (2009) dollars. The gross product is based on the prices for goods and services produced within the county. The goods and services produced within each county

include, but are not limited to professional and business services, wholesale and retail trade, finance, insurance, real estate, natural resources and mining, manufacturing and agriculture (BEA, 2016).

Economic recovery has been operationalized in numerous ways. Chang (1983) is the first empirical study to measure the effect of hurricanes on economic recovery. The author uses city sales tax to measure economic recovery for Mobile, Alabama. Ewing, Kruse and Thompson (2003, 2004) measure economic recovery using the labor market. However, measures such as sales tax and employment rates limit the generalizability because not all cities rely equally on the sales tax and their labor markets vary considerably, casting doubt on the merit of these indicators for the impact of hurricanes. Also, sales tax and employment rates are exogenous variables, which means there are other unexplained factors that can affect the interpretation of their outcomes.

Fomby et al. (2013) used annual GDP from 84 countries to measure the cross-national impact of four types of disasters—droughts, floods, earthquakes and storms -- on economic recovery. The change in GDP provides a good measure of the impact of hurricanes because economic recovery occurs only as governments spend resources during the recovery process to restore the economy to pre-disaster levels. Second, GDP is a good measure of economic recovery because the U.S. Bureau of Economic Analysis (BEA) tracks GDP annually and quarterly at the state level and annually at the county level. This provides consistently accessible and comparable data over time.

Although Alabama, Florida, Louisiana, and Texas have a long history of damaging and deadly hurricanes, this data shows the fluctuation of GDP prior to the hurricane, when the hurricane struck, and post-hurricane. The data were obtained from Moody's Analytics and

adjusted in chained 2009 million dollars. Annual GDP data were available for the 46 counties used in this analysis for the fifteen-year (2000-2014) study period. Further discussion of each variable is provided in the next section.

Independent Variables

Disaster Severity

The severity of hurricane may be a critical factor in the ability of counties to recover economically from the disaster. That impact may be direct or indirect and it may involve both property damage and injury or loss of human life (Drury & Olson, 1998; Kroll, Landis, Shen, & Stryker, 1990; Tierney, 1997). However, there is a debate in the research literature whether the intensity of disasters negatively or positively affects state and local economies (Cavallo & Noy, 2010; Noy & Nualsri, 2007; Raddatz, 2009).

The data used in this study for the intensity of the hurricane are obtained from the National Hurricane Center of the National Oceanic and Atmospheric Administration (NOAA) website. NOAA is a federal agency located within the Department of Commerce. Their chief responsibility is to evaluate ecosystems, climatic changes, weather and water cycles, and commerce and transportation. For each tropical storm or hurricane, NOAA reports the maximum sustained wind speeds, the number of deaths and injuries, and the amount of property damage by county.

The severity of a hurricane is operationalized using the amount of property damaged. Table 4.3 presents the federally declared hurricanes and tropical storms by state and their intensity. Intensity of hurricanes is categorized using the Saffir-Simpson scale based on their maximum sustained wind speeds. However, the maximum sustained wind speeds do not account

for damages caused by storm surges once wind speeds decrease over time. Thus, severity is operationalized by the amount of property damaged from the hurricane, hurricane duration, and wind speeds as reported on the Saffir-Simpson scale. Also, the sample accounts for whether the storm was classified as a hurricane, tropical storm, or tropical depression.

Table 4.3 Hurricane Intensity by State

Number	Declaration Date	State	Major Declared Disaster	Category
1438	10/9/02	Alabama	Tropical Storm Isidore	0
1549	9/15/04	Alabama	Hurricane Ivan	3
1605	8/29/05	Alabama	Hurricane Katrina	1
1593	7/10/05	Alabama	Hurricane Dennis	1
1797	9/26/08	Alabama	Severe Storms and Flooding from Hurricane Ike	0
1789	9/10/08	Alabama	Hurricane Gustav	0
1866	12/22/09	Alabama	Tropical Storm Ida	0
4082	9/21/12	Alabama	Hurricane Isaac	0
1344	10/3/00	Florida	Tropical Storm	0
1393	9/28/01	Florida	Tropical Storm Gabrielle	0
1381	6/17/01	Florida	Tropical Storm Allison	0
1561	9/26/04	Florida	Hurricane Jeanne	3
1551	9/16/04	Florida	Hurricane Ivan	3
1545	9/4/04	Florida	Hurricane Frances	2
1539	8/13/04	Florida	Hurricane Charley and Tropical Storm Bonnie	4
1609	10/24/05	Florida	Hurricane Wilma	3
1602	8/28/05	Florida	Hurricane Katrina	1
1595	7/10/05	Florida	Hurricane Dennis	3
1806	10/27/08	Florida	Hurricane Gustav	0
1785	8/24/08	Florida	Tropical Storm Fay	0
4084	10/18/12	Florida	Hurricane Isaac (Tropical Storm)	0
4068	7/3/12	Florida	Tropical Storm Debby	0
1380	6/11/01	Louisiana	Tropical Storm Allison	0
1437	10/3/02	Louisiana	Hurricane Lili	1
1435	9/27/02	Louisiana	Tropical Storm Isidore	0
1548	9/15/04	Louisiana	Hurricane Ivan (Tropical Depression)	0

1607	9/24/05	Louisiana	Hurricane Rita	3
1603	8/29/05	Louisiana	Hurricane Katrina	3
1601	8/23/05	Louisiana	Tropical Storm Cindy	0
1792	9/13/08	Louisiana	Hurricane Ike	1
1786	9/2/08	Louisiana	Hurricane Gustav	2
4041	10/28/11	Louisiana	Tropical Storm Lee	0
4080	8/29/12	Louisiana	Hurricane Isaac	1
1434	9/26/02	Texas	Tropical Storm Fay	0
1479	7/17/03	Texas	Hurricane Claudette	1
1606	9/24/05	Texas	Hurricane Rita	2
1730	10/2/07	Texas	Tropical Storm Erin	0
1791	9/13/08	Texas	Hurricane Ike	2
1780	7/24/08	Texas	Hurricane Dolly	1
1931	8/3/10	Texas	Hurricane Alex	0

Source: FEMA website and data for the categories were collected from NOAA disaster reports 2000-2012.

Disaster Experience

Prior experience at responding to and recovering from a disaster is one of the key factors used to explain how quickly individuals, communities, and organizations can return to normalcy following a disaster or environmental hazards (Meyer, 2006; Bland & Overton, 2015). Scholars commonly measure disaster experience by the frequency of major disaster declarations (Cutter et al., 2008; Cutter, Burton, & Emrich, 2010; Webb, Tierney, & Dahlhamer, 2002). For this analysis, the number of hurricanes to impact a county between 1851 and 2014 was used to measure the institutional knowledge acquired by the county's emergency management office and its residents to build the capacity and acquire resources for responding to future hurricanes.

Bland and Overton (2016) identify another dimension of knowledge – operational knowledge – that public organizations acquire from the frequency of an event. Counties that are affected by a hurricane more frequently have a heightened sense of preparedness and its residents likely have a heightened capacity to cope with a disruptive event like a hurricane. This

operational knowledge helps to explain why some local and state economies recover quicker after a disaster compared to others.

Local and state governments that frequently experience disasters have an increased incentive to enhance their collaborative efforts with first-responders, private organizations, and other government entities. They learn from prior experiences to improve the collection and disbursement of information through established and dependable communication channels. And they learn how to efficiently tap into local, state and federal assistance, thereby expediting the county's recovery from the disaster.

Comfort et al. (2013) use quantitative analysis to identify the structure change (organizational learning) between Louisiana and Texas. The authors suggest inter-organizational learning improved in preparedness and response operations in Louisiana in the three years between Hurricane Katrina and Hurricane Gustav. The experience of disasters helps individuals, communities, and public organizations with the speed of recovery for future disasters by identifying and dealing with vulnerabilities to make entities more resilient when disaster strikes again. In order to measure the effect of such operational knowledge on the rate of recovery from a hurricane, this study uses the amount of time between hurricanes for this sample of 46 counties to assess the occurrence of capacity building by public organizations and their administrators. The source of data for this variable was the NOAA website.

Types of Institutional Arrangements

The theoretical discussion in Chapters 1 to 3 noted the importance of the institutional placement of agencies in public organizations. Chief executives indicate the priority of an initiative by the placement of a program in proximity to the CEO's office on the organizational

chart. Public administration scholars have long noted that the visibility of an agency is key to obtaining resources in the budget process and in managing high-priority activities. From 1979 to 2003, FEMA was an independent agency whose director reported directly to the President. Following the terrorist attacks on 9/11, FEMA was relocated to the new Department of Homeland Security in 2003 and its director now reports to the Secretary of DHS. This institutional change precipitated considerable questioning by emergency management scholars who saw the reorganization as a diminution of FEMA's clout in the political arena. Anecdotal evidence suggests that FEMA's much criticized response to Hurricane Katrina was as a direct result of this institutional realignment.

As noted in Chapter 3, one of the key hypotheses of this study is to assess the effect of the institutional placement of the emergency management office in state government on the capacity of counties to recover more quickly from a hurricane. From disaster experience organizations learn about the failures of communications and vulnerabilities among individuals, businesses, communities, and organizations that impact state and local economies ability to recover from hurricane-induced damages.

As a result of a major disaster, organizations learn by modifying their structures to try to improve their effectiveness and efficiency in managing future events, especially if they are in areas prone to repeat events, such as the counties along the Gulf Coast. Comfort et al (2013) use small network analysis to measure organizational learning. This method identifies the speed of information delivered to actors based on their betweenness or closeness to one another. The closer actors are to one another the more likely information is accurate and timely, which helps to produce desired outcomes (Andrew, 2009; Feiock, 2007, 2009; Kapucu et al., 2010). It is important to identify more than just the characteristics of dyads (Agranoff & McGuire, 1998;

Shrestha & Feiock, 2009) but to also understand the structure of institutions and what motivates organizations to form specific structural networks.

Tables 1.3 to 1.6 presented in Chapter 1 show the historical placement of emergency management agencies from 1960 to the present in the four states. However, the data for this dissertation is from 2000 to 2014. The obvious way to adjust for the time frame is to create a binary variable that captures the changes from 2000 to 2014. The historical placement of emergency management agencies in the four states is categorized into three locations: stand-alone agency, division in a larger department, or unit in the executive office of the governor. This measure contributes to our understanding of whether the locations of the institution in specific divisions matter regarding the speed of recovery post-hurricane. The data are collected from state government websites and e-mail communications with each state and county emergency management agency impacted by a major declared hurricane from 2000-2014.

County Spending on Emergency Management Operations

Annual expenditures on emergency management services measure a county's investment in preparing for disasters. As a pre-impact measure, counties that are susceptible to repeated disasters, such as counties along the Gulf Coast, are more likely to invest in emergency management. But does that investment pay off in the form of greater gains post disaster in the county's GDP?

Research indicates that emergency management is primarily a responsibility of local governments, particularly municipal and county governments (Cutter, 2001; Waugh, 2007). However, no empirical studies focus on the impact of annual spending on emergency administration on economic recovery. In counties with a greater risk from recurring disasters,

residents and their elected leaders should know whether and how important such annual expenditures are to facilitating the economic recovery of their county. Data on county expenditures for emergency management were collected using public information requests to officials in each of the original 46 counties. Public information requests were emailed to these officials between November 3 and December 31, 2015. Responses were received from 46 counties that provided available information on annual expenditures for each year between 2000 and 2014. It is worth noting that one county in the sample indicated they do not have an EM budget. St. Helena Parish, LA was kept in the sample. Tables 4.5 to 4.8 present the average for the sample of 46 counties from 2000 to 2014.

Recovery Funds

The availability of funding for recovery is pivotal to state and local governments' ability to recover economically. Although scholars have investigated the impact of recovery funds at the national and state levels, their analyses are inconclusive regarding its negative or positive effect on economic recovery (Cavallo et al., 2010; Raddatz, 2009). Studies utilize primary data specifically focusing on utility loss or business closure (Rose & Liao, 2004, Tierney, 1997; Webb et al, 2000), or their findings limit economic recovery at the state or national levels (Fomby et al., 2013).

This study operationalizes recovery funding using total amounts of federal, state, or local aid reported being distributed to the county following a hurricane that impacted a county during the sample time period. This indicator measures the amount of funds distributed by each level of government to aid county governments in recovering from hurricane-induced damages. The data were obtained from state and local government officials through public information requests via

email communications. The disaster aid was averaged at each level (federal, local and state), and then divided by the respective county's population to control for the size of the county.

Employment Sector and Disaster Recovery

The type of business matters when explaining what makes economies recover from disasters. Firms that tend to generate lower earnings such as retail and personal service sectors are less likely to recover from disasters compared to manufacturing and construction industries (Bruderl et al., 1992; Loscocco & Robinson, 1991). Dahlhamer and Tierney (1998) found that firms that recovered from a disaster more quickly were in the manufacturing and construction sector. Also, research has consistently found that firms in finance, insurance, and real estate were generally better prepared than businesses in other sectors such as retail and service sector when it came to disaster recovery. This could be attributed to the regulations and scrutiny businesses in the financial service receive. In addition, Zhang et al. (2009) found that those sectors where employees could relocate or work for home, for example in the financial sector, were more likely to recover more quickly.

However, the impact disasters have on each type of businesses will likely vary. Gillespie (1991) found that although Hurricane Hugo had a negative impact on employment, it was short-lived. The demand for the construction industry following Hugo added over 8,000 jobs by the spring, which offset the loss of jobs in the tourism and trade sectors. This is important with regards to recovery because although some businesses may recover quickly, others may not because of the goods and services produced may not be disaster-insulated.

Control Variables

Like natural disasters, a recession is an exogenous shock to a local economy that is usually unexpected and causes a decline in GDP. But recessions affect different local economies differently depending on the extent to which the local economy is insulated from economic trends occurring beyond its borders. For example, a coastal county that relies heavily on tourism for its GDP will likely show greater sensitivity to a national recession than one that depends on retirees. The characteristics of recessions are the slowing down of economic activity, downturn in the business cycle, and the reduction in the amount of goods and services produced. From 2000 to 2014, the U.S. economy experienced two recessions – one in 2001 and the other, the Great Recession, between 2007 and 2009.

According to the National Bureau of Economic Research, the recession at the beginning of the millennium lasted eight months. It began March 2001 and ended in November 2001 (www.bls.gov, 2006). The second recession in that decade, the Great Recession, was from December 2007 to June 2009 (www.bls.gov, 2012). Utilizing a binary variable is a common technique for controlling for economic downturns. Thus, this procedure is conducive to control for the recession periods from 2000 to 2014. The recessions are operationalized using binary variables -- 0 indicates that a recession did not occur that year, and 1 indicates a recession did occur that year. (Because the Great Recession began in very late in 2007, that year is coded 0.)

County-wide demographic characteristics such as the percentage of impoverished population and homeownership, affects post disaster redundancy, robustness, resiliency, and rapidity (Bruneau et al., 2003; Cutter et al., 2010). State and local governments with communities that are vulnerable to disasters tend to suffer greater loss of life, injuries and displacement (Drabek & McEntire, 2003; Drabek, 1994; McEntire, 2012), disruption in utilities

and businesses (Rose & Liao, 2005; Tierney, 1997; Webb et al, 2000), and damages to physical property (Hallegatte & Dumas, 2009).

Much of the literature on disaster recovery utilizes primary data from national surveys that shows that older populations, less educated populations, greater percent of renters, and minorities are negatively affected by disasters (Cutter et al., 2003, 2010; Vigdor, 2008). This study controls for community characteristics using two key factors-the percentage of a county's population renting their homes, and the percentage of the population below the poverty level. These data were collected from the U.S. Census Bureau for 2000 and 2010. Data for years other than 2000 and 2010 were collected from the U.S. Census Bureau population estimates. The population estimates program produces estimates of the population for the United States, its states, counties, cities and towns. Estimates are commonly used for per capita time series and as indicators for demographic changes (U.S. Census Bureau, 2016). Counties with greater percentages of renters and households below the poverty level will likely exhibit greater delay in recovery from a hurricane, exhaust local resources more rapidly, and have greater recovery assistance from state and federal governments.

Model Specification

The results of the models used in this study are estimated using panel data. The advantage of using panel data over a cross section is its ability to allow greater flexibility in modeling differences in behavior across time (Greene, 2012). Panel data contains more informative and efficient estimates due to more variability, less collinearity, and more degrees of freedom. Panel data also limits the potential for unobserved heterogeneity. The Hausman test is utilized to illustrate the significantly different estimates from random effects and fixed effects

models. Fixed-effects models are used because it controls for time-invariant differences between the municipal observations, so that the estimated coefficients of the fixed-effects models are not biased because of omitted time-invariant characteristics.

The same specification was used for all four states to test the impact of the pre- and post-disaster variables discussed in Chapter 3 on county GDP. A log transformation of the county GDP was used in order to capture the effects, if any, of changes in GDP over time. The log transformation is also generally used by other researchers to measure the nonlinear effects of GDP over time. Table 4.4 reports the expected signs of the coefficients. Any variations in the estimates among the four states may reflect differences in a state's culture, institutional support for disaster preparation, and administrative capacity.

A one-year lag of the dependent variable is included as a predictor, which is recommended by Wooldridge (2009) for serial data in order to reduce bias introduced by autocorrelation. The prior year's GDP is a strong predictor of the current GDP for a county.

Table 4.4 Variables and Expected Effect on County (log) GDP

Variables	Description	Hypothesized Effect on Change in GDP
Severity of Hurricane:	Estimated Property Damage	Negative
	Wind Speed of Hurricane on Saffir-Simpson Scale	Negative
	Duration of hurricane in county (days)	Negative
Disaster Experience:	Number of hurricanes to strike county between 1800 and 2014	Positive
	Number of months since last hurricane made landfall in county	Negative
County Expenditures on Emergency Management	Annual Expenditures for EM	Positive
Organizational Location of State EM Agency	EM's office relative to Governor's Office	Negative/Positive

Recovery Funds (Federal, State, Local)	Total funding from federal, state, and local governments allocated to counties for recovery	Positive
Employment by sector	Percent of county employment in agriculture, mining, manufacturing, construction, retail	Positive
Poverty Rate	Percent of county population at the poverty level (Annual)	Negative
Renter	Percent of county with non-homeownership (Annual)	Negative
Recession	Year(s) of economic recession	Negative

Profile of the Four States

Summary statistics on each of the variables used in the analysis for each of the four states are reported in Tables 4.6 to 4.9. The following table summarizes the means for the key variables. Florida with the longest and most exposed coast line has the highest history of hurricanes to make landfall at almost 24 on average for the sample of counties compared to just 13.1 for the Texas counties along its coast. Likewise, average per capita expenditures on emergency management also show a wide variation among the counties in the four states. Both Alabama and Texas have relatively low levels of operating expenditures for their counties. Louisiana has significantly more but Florida counties invest heavily in emergency operations.

Table 4.5 Summary of Profile of Four States

	Alabama	Florida	Louisiana	Texas
Disaster experience	17.60	23.90	13.40	13.10
EM budget/capita	2.70	87.40	16.30	1.04
Federal Disaster Aid/capita	179.10	338.00	1560.00	0.81
GDP/capita	0.04	0.04	0.05	0.06

Table 4.6 Descriptive Statistics for Alabama (n=60)

Variable	Mean	Std. Dev.	Min	Max
GDP per Capita	0.04	0.003	0.03	0.04
Hurricane Duration	1.43	0.51	1.0	2.0
No. of Months-Last Hurricane	27.43	17.22	8.0	82.0
Property Damage per Capita	68.08	396.98	0.0	2839.3
Saffir Simpson(Wind Speed)	0.67	1.07	0.0	3.0
Disaster Experience	17.65	5.76	7.0	25.0
EM Budget per Capita (Logged)	2.75	1.87	0.72	12.30
Federal Disaster Aid per Capita	179.05	496.38	0.0	2667.01
State Disaster Aid per Capita	13.37	45.23	0.0	275.50
Local Disaster Aid per Capita	2.01	4.59	0.0	25.91
Renter (%)	27.64	5.61	17.93	37.0
Poverty (%)	13.66	4.71	5.69	20.64
Agriculture Establishments (%)	0.78	0.30	0.36	1.54
Mining Establishments (%)	0.20	0.13	0.0	0.46
Construction Establishments (%)	11.60	2.57	7.66	16.55
Manufacturing Establishments (%)	4.34	0.685	3.15	5.66
Retail Establishments (%)	17.64	2.95	13.23	21.89
Recession	0.27	0.45	0.0	1.0

*Disaster aid is adjusted in millions

Table 4.7 Descriptive Statistics for Florida (n=255)

Variable	Mean	Std. Dev.	Min	Max
GDP per Capita	0.04	0.01	0.02	0.06
Hurricane Duration	1.24	0.47	1.0	3.0
No. of Months-Last Hurricane	31.23	31.83	8.0	171.0
Property Damage per Capita	96.86	778.24	0.0	10985.0
Saffir Simpson(Wind Speed)	0.49	1.018	0.0	3.0
Disaster Experience	23.87	8.15	5.0	38.0
EM Budget per Capita (Logged)	87.37	331.19	0.08	1686.01
Federal Disaster Aid per Capita	338.0	843.0	0.0	2840.0
State Disaster Aid per Capita	11.4	35.1	0.0	141.0
Local Disaster Aid per Capita	9.1	27.2	0.0	109.0
Renter (%)	0.25	0.08	0.0	0.41
Poverty (%)	13.12	2.99	7.53	21.69
Agriculture Establishments (%)	0.01	0.02	0.0	0.17

Mining Establishments (%)	0.0	0.0	0.0	0.0
Construction Establishments (%)	0.08	0.03	0.0	0.19
Manufacturing Establishments (%)	0.06	0.03	0.02	0.18
Retail Establishments (%)	0.17	0.02	0.12	0.24
Recession	0.27	0.44	0.0	1.0

*Disaster aid is adjusted in millions

Table 4.8 Descriptive Statistics for Louisiana (n=180)

Variable	Mean	Std. Dev	Min	Max
GDP per Capita	0.04	0.02	0.01	0.16
Hurricane Duration	1.45	0.64	1.0	3.0
No. of Months-Last Hurricane	38.871	42.67	8.0	191.0
Property Damage per Capita	53.93	419.53	0.0	3929.33
Saffir Simpson(Wind Speed)	1.19	1.56	0.0	5.0
Disaster Experience	13.37	7.43	3.0	32.0
EM Budget per Capita (Logged)	16.26	35.47	0.0	239.46
Federal Disaster Aid per Capita	1560.0	5360.0	0.0	21500.0
State Disaster Aid per Capita	24.4	44.5	0.0	134.0
Local Disaster Aid per Capita	0.0	0.0	0.0	0.0
Renter (%)	0.31	0.08	0.15	0.54
Poverty (%)	19.73	3.29	12.72	32.55
Agriculture Establishments (%)	0.01	0.01	0.0	0.08
Mining Establishments (%)	17.65	236.25	0.0	3169.61
Construction Establishments (%)	0.08	0.05	0.0	0.3
Manufacturing Establishments (%)	0.13	0.24	0.0	2.12
Retail Establishments (%)	0.18	0.25	0.0	2.79
Recession	0.27	0.44	0.0	1.0

*Disaster aid is adjusted in millions

Table 4.9 Descriptive Statistics for Texas (n=194)

Variable	Mean	Std. Dev.	Min	Max
GDP per Capita	0.04	0.02	0.02	0.09
Hurricane Duration	1.55	1.11	1.0	5.0
No. of Months-Last Hurricane	43.0	31.93	9.0	124.0

Property Damage per Capita	93.76	638.3	0.0	6093.29
Saffir Simpson(Wind Speed)	0.89	1.11	0	3.0
Disaster Experience	13.14	5.164	5.0	26.0
EM Budget per Capita (Logged)	1.04	0.908	0.0	4.15
Federal Disaster Aid per Capita	0.81	2.423	0.0	11.06
State Disaster Aid per Capita	0.0	0.0	0.0	0.01
Local Disaster Aid per Capita	0.69	2.08	0.0	9.28
Renter (%)	30.34	5.7	21.52	44.35
Poverty (%)	18.09	7.47	1.21	40.35
Agriculture Establishments (%)	0.02	0.03	0.0	0.1
Mining Establishments (%)	0.01	0.01	0.0	0.05
Construction Establishments (%)	0.09	0.03	0.0	0.15
Manufacturing Establishments (%)	0.04	0.02	0.0	0.11
Retail Establishments (%)	0.14	0.04	0.0	0.21
Recession	0.27	0.44	0.0	1.0

*Disaster aid is adjusted in millions

Methodological Issues

Multiple Imputation for Missing Values

The data in various areas of interest used to conduct this research are incomplete for a period of time between 2000 and 2014 due to the implementation of new technology or the limitation on data accessibility. The American Community Survey, for example, is an ongoing survey that provides information on an annual basis about the nation and its people. However, this survey only has annual data starting from 2005 leaving missing values for 2000 through 2004. The problem of missing data is reconciled using multiple imputation. Multiple imputation is a common technique used to reduce uncertainty by treating imputations for missing values as if they were known (Rubin, 1987). King et al. (2001) define multiple imputation as imputing *m* values for each missing item and creating *m* completed data sets (2001; 53). These imputations are based on expectation-maximization (EM) algorithms to compute the observed data likelihood

and take random draws from it. Unlike list wise deletion, the advantage of multiple imputation is it allows for researchers to obtain valuable information, and omits the possibility of selection-bias.

While the conventional techniques for filling in missing values are often used, there are limitations to the type of data being analyzed. MissForest imputation is an ideal imputation technique because it can be applied to any data. There are at least three advantages to MissForest that compensate for other imputation methods. First, MissForest does not make parametric assumptions. Parametric assumptions are based on the distribution of the underlying population from which the sample was taken. As reported in Table 4.X, the sample in this study for each state is relatively small compared to the population, which nonparametric procedures can be applied to this case. Second, MissForest can account for unspecified interactions and non-linear relationships. Lastly, MissForest has the ability to generate numbers regardless of the number of missing variables. The algorithm is based on fitting a random forest on the known or observed data. The algorithm repeats until a specified maximum number of iterations is reached, then predicts the missing value (Stekhoven, 2011).

Adjusting for Inflation

When dealing with financial data, over time, dollar amounts must be adjusted for inflation in order to make comparisons meaningful.. If adjustment for inflation is not conducted, this could obscure the real value of revenue, property damage, and expenditures. Since the variables used for counties in all four states occur over a fifteen-year time span, adjusting for inflation is necessary to interpret the changes over time. The data are converted to 2009 constant dollars by multiplying each dollar amount by the ratio of price indexes (comprised of the

consumer price index (CPI) from 2000 to 2014). To convert the financial data to constant 2009 dollars, 2009 CPI is used as the base year, which is defined as:

$$\text{Adjusted Inflation}=(CPI_{\text{base year}}/CPI_{\text{data year}})*N_{\text{data year}}$$

The 2009 constant dollars base is selected to be as consistent as possible to the dependent variable. Generally, the year that is selected as the base year is the latest year that will not be revised until the next comprehensive revision. For the 2013 comprehensive revision, real estimates were rebased from 2005 dollars to 2009 dollars (Bureau of Economic Analysis, 2015). The effect of rebasing is to produce dollar estimates that are closer to additive for periods near the new base year.

Standardizing the Data Using Per Capita

The standardization of data is important to allow for adequate comparison among units that are different in size. Standardizing variables such as GDP, property damage, disaster aid, and local emergency management budgets are key to understanding the relative difference among each county and state. In this sample, a number of the counties vary significantly in size. To control for size differences selected variables are divided by each of the county's population. GDP and emergency management budgets were skewed with most of the counties at the lower end of the scale. One way to correct for non-normality is to log GDP per capita and the emergency management budgets (Krueger et al., 2009).

Heteroscedasticity and Serial Correlation

Heteroscedasticity is a common issue in panel data. Heteroscedasticity occurs when variance in the error term is not constant. Heteroscedasticity can produce biased or misleading

parameter estimates in logistic regressions. The modified Wald test for groupwise heteroscedasticity in the fixed effects model was used to test for heteroscedasticity in each model. Each of the fixed effects models tested positive for the presence of heteroscedasticity. The discussion for how this issue is corrected is presented in the following section.

Serial correlation is when error terms from different time-periods or cross-section observations are correlated (Williams, 2015). Serial correlation causes the standard errors of the coefficients to be smaller than they actually are and higher R-squared, which affects their efficiency. The Woolridge autocorrelation test is used to detect serial correlation, which showed positive for this sample. To correct for serial correlation the panel-corrected standard error (PCSE) function was performed in Stata 14. PCSE assumes that the errors are heteroscedastic and contemporaneously correlated across panels.

CHAPTER 5

AN ANALYSIS OF ECONOMIC RECOVERY BY LOCAL GOVERNMENTS FROM HURRICANES

The following sections report the results from analyzing the changes in GDP for 46 counties in four coastal states that were all affected by at least one hurricane between 2000 and 2014. The same model specification is used for each state to facilitate comparing the robustness of the test variables across the four states. The dependent variable in each case is the log of the annual per capita GDP, adjusted for inflation, for each county for the 15 year sample period. Logging the GDP enables interpreting the coefficients as their impact on changes in GDP.

Alabama

The research literature has mixed results as to the impact that natural disasters have on local economies. Table 5.1 reports the Fixed Effects estimates for the four counties in Alabama that were affected by a hurricane during the study period. The results show evidence that the interval in months between hurricanes has a negative impact on local economies' ability to recover economically from a hurricane. That is changes in GDP decline in counties that had a greater time lapse between hurricanes.

Several possibilities could explain this outcome. As the time lapse increases from the last hurricane to impact a county, that local government may lose qualified personnel who have experienced a hurricane and consequently lose institutional memory. Local and state government officials, along with residents, can also become apathetic toward hurricanes as the probability of a severe hurricane to make landfall in the state decreases (Kunreuther et al., 2001;

McEntire & Myers, 2004). The results in Table 5.1 suggest that for each month a county goes since impacted by the last hurricane, the change in its GDP decreases by 0.1 percent.

To further assess the effect of prior disaster experience, the significant estimate for disaster experience in Table 5.1 (the number of hurricanes to have impacted the county between 1980 and 2014) suggests that the more hurricanes impacting a county, the greater the change in GDP. Local communities apparently adapt to their vulnerabilities and take measures to mitigate their effects. It is reasonable to expect that counties that have a greater incidence of hurricanes gain institutional and operational knowledge from the experiences that leads to reductions in the loss of lives and the loss of property damage, which in turn is a key factor in explaining the positive impact of economic recovery.

In 2011, the Alabama legislature passed the Strengthen Alabama Homes Act that mandated strengthening building codes and provided resources and incentives to residents and business owners to weatherize their homes and buildings. Baldwin County, for example, requires that properties build can withstand winds of 140 mph. Additionally, a state law passed in 2009 requires insurance companies to apply discounts to premiums of homes in Mobile and Baldwin counties that are built or retrofitted to meet building code standards.

In terms of the control variables, the results in Table 5.1 show that the percent of private establishments in agriculture is the only employment sector that shows statistical significant evidence of its effect on economic recovery. Agriculture is the state's top industry. With its vast production from livestock and farms, it is no surprise that when flooding or strong winds from a hurricane cause damage to crops and livestock, the hurricane has a negative impact on the county's change in GDP. Interestingly, an increase in the percent of the counties' population living at poverty levels shows a positive effect on changes in GDP. It is also important to

mention that recessions have a weak, negative effect on economic recovery in the state of Alabama. This implies that local economies in the state are not necessary recession insulated. Economic downturns can have an effect on economic recovery simultaneously as natural disasters. This could signify that the economic sector is not well diversified to offset economic declines caused by recessions.

Table 5.1 Economic Recovery by Alabama counties, 2000-2014

Alabama	**Panel corrected**	
Dependent: GDP per Capita (Log)	**Coef.**	**Std.Error**
Hurricane Duration	0.001	0.008
No. of Months-Last Hurricane	-0.001**	0.001
Property Damage per Capita	-4.331	3.639
Saffir-Simpson(Wind Speed)	0.000	0.077
Disaster Experience	0.005**	0.002
EM Budget per Capita (Log)	-0.021	0.021
Federal Disaster Aid per Capita	0.000	0.000
State Disaster Aid per Capita	0.000	0.000
Local Disaster Aid per Capita	0.000	0.001
Renter (%)	-0.003	0.003
Poverty (%)	0.009**	0.004
Agriculture Establishments (%)	-0.194	0.043
Mining Establishments (%)	-0.134	0.157
Construction Establishments (%)	0.004	0.005
Manufacturing Establishments (%)	-0.007	0.017
Retail Establishments (%)	0.010	0.008
Recession	-0.019*	0.011
Lagged GDP per Capita (Log)	0.394***	0.078
N	59	
Rho	0.156	
Constant	-2.04***	0.327
R-Squared (FE model)	0.9577	

***p-value<.001 **p-value<0.05 *p-value<0.1

Florida

In the case of Florida, some of the results parallel those of Alabama. Like Alabama, the study finds strong statistical support for the effect of prior disaster experience on the change in county GDP. That is counties that are more prone to hurricanes appear to recover more quickly and their GDP growth increases at a greater rate than counties affected less frequently by hurricanes.

But several findings from Florida differ from those of Alabama. This may be due to the larger number of Florida counties (n=17) for which data were available and the greater experience that Florida counties have with hurricanes. As with Alabama, the interval in months since the last hurricane affects the change in GDP for Florida's coastal counties. Unlike Alabama, however, that interval has a positive effect on the change in county GDP. But the intervals between hurricanes in Florida are likely much closer than for Alabama's narrow coastal strip creating the positive effect in the case of Florida.

Florida not only has more frequent hurricanes but it also experiences much more intense storms. Although the Saffir-Simpson index is not significant, the estimate for the duration of hurricanes (measured in days) is significant and negative. The assumption is that the longer a hurricane is in an area, the longer people are unable to go to work, and the longer services are not being rendered. Hurricanes often have indirect and direct damage causing disruption in the production of goods and services as well as physical damage to infrastructure.

In 1992, Hurricane Andrew, the costliest disaster for insured loss in history prior to Hurricane Katrina, prompted betting building code requirements for hurricane-prone areas in the state. Like Alabama, Florida law requires insurers to provide incentives to residential and commercial properties that adhere to mitigation strategies. The lessons learned from the 1992

and 2005 hurricanes are noticeable in legislation in order to reduce future losses. Federal aid was also positive and significant in the case of Florida's 17 coastal counties. Hurricanes can be said to have a positive effect on economic recovery given the amount of federal aid allocated to the state. Again, the intensity and greater frequency of hurricanes in Florida may partially explain the positive impact of federal aid for Florida counties but the insignificant impact in the case of Alabama. Federal aid in this case may offset much of the losses caused by hurricane-induced damages.

The results do not present statistical evidence to suggest that the percent of private establishments in agriculture and manufacturing have an effect on economic recovery. However, an increase in the percent of mining and retail establishments has a negative impact on economies ability to recover. Counties such as Miami-Dade and Palm Beach, for example, are known for its tourism industry. In the event of a hurricane, tourists and residents are often relocated, while businesses are temporarily or permanently closed preventing the production or sale of goods and services. The percent of establishments in construction have a weak, negative impact on economic recovery. Often residents hire contractors outside of the county or the state in order to save costs on repairs. As a result there may be an increase in rental properties for contractors. The recovery leakage as suggested by Chang (1984) may be used to explain the negative impact construction establishments have on local economies because recovery funds are not being kept inside of the county. Lastly, an increase in the percentage of population living at the poverty level, as expected, has a negative impact on economic growth.

Table 5.2 Economic Recovery in Florida Counties, 2000-2014

Florida	**Panel-corrected**	
GDP per Capita (Log)	**Coef.**	**Std.Err**
Hurricane Duration	-0.001**	0.0003

No. of Months-Last Hurricane	0.001**	0.0003
Property Damage per Capita	-1.502	1.505
Saffir Simpson(Wind Speed)	-1.00E-06	0.000
Disaster Experience	0.004***	0.001
EM Budget per Capita (Log)	-0.002	0.002
Federal Disaster Aid per Capita	2.61E-11**	1.38E-11
State Disaster Aid per Capita	3.00E-09	4.66E-09
Local Disaster Aid per Capita	-4.30E-09	5.96E-09
Renter (%)	0.418***	0.086
Poverty (%)	-0.008***	0.002
Agriculture Establishments (%)	-0.126	0.150
Mining Establishments (%)	57.556***	15.822
Construction Establishments (%)	-0.390*	0.232
Manufacturing Establishments (%)	-0.154	0.161
Retail Establishments (%)	-2.16***	0.433
Recession	-0.003	0.018
GDP per Capita Lag (Log)	0.69***	0.049
N	254	
Rho	0.2425	
Constant	-0.78	0.15
R-Squared (FE model)	0.8881	

***p-value<.001 **p-value<0.05 *p-value<0.1

Louisiana

Louisiana provides a culturally and institutionally different case for assessing local government recovery from hurricanes. In 2005, the state took the brunt of the impact of Hurricane Katrina, the nation's most destructive storm in terms of property loss. Louisiana parishes have a reputation for not being well prepared for hurricanes in spite of the frequency and intensity of the storms. The following analysis uses data from 11 urban parishes, most along the Louisiana coastline, for which data were provided.

Based on the estimated coefficients in Table 5.3, none of the hurricane-related variables – (hurricane duration, number of months since last hurricane, or disaster experience – was

significant in Louisiana. Some or all of these storm-related measures were significant in the other three states, which raises an interesting question: Are Louisiana's hurricane preparation measures sufficiently different from the other states as to result in a different response and recovery to hurricanes?

Based on the estimates in Table 5.3, Louisiana's disaster response is counterintuitive in two areas. First, the evidence suggests that hurricanes have a negative impact on change in parish GDP. Second, unlike Alabama and Florida, in Louisiana's coastal parishes the amount of federal aid allocated to the state does affect the change I GDP, but negatively. Interestingly, an increase in the allocation of federal aid shows a negative impact on economic growth. This could be on account of several reasons. First, the process to apply for federal funds could be long and tedious for the parishes with already limited resources. Second, given the condition of the infrastructure (i.e., levees, bridges, roads) in these parishes, federal assistance may not be applicable for replacements or upgrades if public facilities had been poorly maintained prior to the hurricane. The state did not provide local aid so the federal aid may have been insufficient in helping the parishes recover from the devastating losses (i.e., lives, homes, businesses, and infrastructure). Louisiana is a unique among the states in this study because of the severity of the hurricanes, particularly Katrina, that have hit the state. For example, several parishes affected by Karina, which made landfall more than 10 years ago, have not seen their GDP return to pre-Katrina levels. In an already devastated financial state, Louisiana was struck by two more storms in 2005 only months apart. The net effect may have been to have left the economies of these 11 parishes sufficiently devastated that they will unlikely ever fully recover. That effect may be further exacerbated by the higher cost of businesses and households relocating to the state because of the greater risk from hurricane-related hazards.

While oil, fishing, and agriculture are three of the state's top industries, there is no statistical evidence from Table 5.3 to suggest that the percentage of establishments from agriculture, mining, and manufacturing had an effect on changes in parish GDP. However, construction and retail have mixed effects on economic recovery. As the percentage of construction establishments increases, there is a positive effect on local governments' ability to recover economically. This could be due to the state relying on local construction companies to restore, rebuild and upgrade public and private facilities. The recovery funds are reinvested into reconstruction projects that benefit the parish economy.

The increase in the percentage of retail establishments has a negative effect on economic recovery. This is consistent with the depopulation of many Louisiana parishes. With that depopulation, retail establishments are slow to return as reflected in the negative coefficient for retail property. The finding also aligns with the literature suggesting that residents are less inclined to shop for personal items following a disaster and more concerned with repairing and rebuilding their property. Also, retail establishments may not be able to resume to normalcy given the condition of roads for employees to get to work, the loss of lives or relocation of residents should also be taken into consideration.

The percent of the renting population signifies a positive impact on economic recovery. This may be due to tourism or the influx of temporary construction workers from out-of-town that rent properties within the counties to perform their duties. There is no statistical significant evident that suggests the percent of the population living at the poverty level has any effect on economic recovery.

Table 5.3 Economic Recovery in Louisiana Counties, 2000-2014

Louisiana	**Panel-corrected**	
GDP per Capita (Log)	**Coef.**	**Std.Err**
Hurricane Duration	-0.021	0.018

No. of Months-Last Hurricane	0.000	0.000
Property Damage per Capita	0.080	4.705
Saffir Simpson(Wind Speed)	0.021	0.018
Disaster Experience	0.000	0.002
EM Budget per Capita (Log)	-0.032***	0.006
Federal Disaster Aid per Capita	-2.51E-11***	0.000
State Disaster Aid per Capita	1.91E-11	3.18E-10
Renter (%)	0.552**	0.303
Poverty (%)	-0.005	0.007
Agriculture Establishments (%)	1.454	2.269
Mining Establishments (%)	0.284	0.293
Construction Establishments (%)	1.243**	0.538
Manufacturing Establishments (%)	0.599	0.510
Retail Establishments (%)	-4.066***	0.587
Recession	0.012	0.031
GDP per Capita Lag (Log)	0.449***	0.065
N	164	
Rho	0.2415	
Constant	-1.297	0.210
R-Squared (FE model)	0.8306	

***p-value<.001 **p-value<0.05 *p-value<0.1

Texas

Data from 13 coastal counties in Texas were analyzed using the same specification as for the other three states. Texas offers a different approach to disaster preparedness in that responsibility rests largely at the county and city levels, rather than state government. This is due, in part, to the state's size and diversity but also to a political culture that empowers local government.

The results in Table 5.4 parallel; those for Alabama and Florida. The more hurricanes a county endure the greater the positive impact on economic recovery. However, federal aid demonstrates a negative impact on economic recovery. As with Louisiana, the negative effects may reflect the intensity of storms that affected these gulf coast counties during the 15 year

period of this study. The more intense the storm, the more the federal aid and quite likely the longer it will take for the county to recover economically from the devastation. The negative impact may also be a result of the arduous process to obtain federal aid. Also, there may be delays in when the request is submitted and when funds are received.

Local aid, however, shows a positive impact on the economic recovery in these Texas counties. The statistically significant coefficient adds support to the fact that local efforts matter when managing disasters (Cutter, 2001; Waugh, 2007). The results provide further evidence that local assistance, unlike federal aid, increases a county's growth in GDP. The positive coefficient may also be an artifact tat local aid is most likely concentrated in smaller disasters from which a county's economy will recover more quickly than those requiring federal assistance. Local governments are the first line of response once a hurricane occurs. These entities are responsible for disaster assessments, reporting information to the governor in situations that outside help is needed, warning and evacuating residents. Overall, hurricanes have a positive impact on Texas' ability to recover economically because of the disaster experience and local aid over compensates for the decrease in federal aid.

The control variables deserve discussion as well. Economic recovery may also be due to Texas' diversified economy. The results show that an increase in the number of agriculture and construction establishments has a negative impact on economies ability to recover. This could be due to the amount of damage caused to crops, which may have a long-term effect on crop production. As for construction, hurricanes may damage construction equipment and repair services, temporarily incapacitating them. Consequently, county residents and governments must seek contractors from outside the county. Chang (1984) stated that recovery funds contribute to economies if the recovery funds remained in the affected areas. Other employment sectors such

as mining, manufacturing, and retail demonstrated a strong, significant positive impact on economic recovery. As expected, an increase in the percent of the population living at the poverty level slows economic recovery. Interestingly, the findings for the percent of renters among the population contrast with much of the literature showing a positive impact on economic recovery. This may be as a consequence of the large concentration of vacation properties along the Texas coast. There was no statistical evidence to suggest the recessions had any effect on economic recovery during the time of hurricanes. This implies that the state is recession-insulated, which means that the economies in the state of Texas are negligibly affected by economic downturns such as recessions.

Table 5.4 Economic Recovery in Texas Counties, 2000-2014

Texas	**Panel-corrected**	
GDP per Capita (Log)	**Coef.**	**Std.Error**
Hurricane Duration	-0.004	0.010
No. of Months-Last Hurricane	-0.0001	0.0004
Property Damage per Capita	-6.673	5.137
Saffir Simpson(Wind Speed)	0.005	0.010
Disaster Experience	0.014***	0.002
EM Budget per Capita (Log)	0.017**	0.008
Federal Disaster Aid per Capita	-0.065**	0.027
Local Disaster Aid per Capita	0.077**	0.032
Renter (%)	0.024***	0.002
Poverty (%)	-0.003**	0.001
Agriculture Establishments (%)	-3.195***	0.367
Mining Establishments (%)	8.243***	1.170
Construction Establishments (%)	-2.523***	0.554
Manufacturing Establishments (%)	4.337***	0.605
Retail Establishments (%)	0.649***	0.219
Recession	-0.007	0.019
GDP per Capita Lag (Log)	0.372***	0.049
N	193	
Rho	0.375	
Constant	-3.030	0.238
R-Squared (FE model)	0.9226	

***p-value<.001 **p-value<0.05 *p-value<0.1

Chapter Summary

Disasters can devastate communities and local economies as a result of loss of lives and the amount of property damaged halting production. As discussed in chapter 4, there is a debate about whether the severity of disasters has a negative or positive effect on economic recovery. The findings in chapter 5 show that location matters when evaluating the effect hurricanes have on local economies. While there is no evidence to suggest that property damage and wind speed have an effect on economic recovery, there are several other disaster variables that have an effect on local economies' ability to recover economically.

In Alabama and Florida, the interval between hurricanes has an effect on their economic recovery. The interval between hurricanes increases the change in economic recovery for county governments in Alabama, while the interval between hurricanes decreases the change in economic recovery for county governments in Florida. Additionally, there is evidence to show that the length of time a hurricane is in an area decreases economic recovery for local economies in Florida. Lastly, county governments that experienced more hurricanes in Alabama, Florida and Texas show an increase in economic recovery, while the results do not show evidence to support the impact disaster experience has in Louisiana.

Disasters are costly. The ability of county governments to finance disasters depends on various sources. This study examines county emergency management budgets and recovery disaster aid. County governments' budgets are used in this study to measure local governments' capacity to prepare for disasters. Disaster recovery aid is disbursed when county governments exhaust their resources. From the findings, there is no evidence to suggest that local emergency management budgets or external recovery disaster aid have an impact on economic recovery for local economies in Alabama. While the findings for local economies in the state of Florida do

not show local emergency management budgets having an impact, Louisiana and Texas show different results. Local emergency management budgets for economies in Louisiana decreases the change in economic recovery, while local emergency management budgets increase the change of economic recovery in Texas. As for external disaster aid, only federal disaster aid impact local economies in Florida and Louisiana. The findings show that local economies benefit from federal disaster aid in Florida, while local economies in Louisiana experience a decrease in their economic recovery. The federal and state disaster aid impacted local economies in Texas. The federal disaster aid decreases economic recovery, while state disaster aid increases economic recovery for local economies.

Lastly, the diversity of the employment sector plays a role in economic recovery. For local economies in Alabama, there is no evidence to suggest that industries impact economic recovery. However, it is worth noting that the recession had a negative impact on economic recovery, which may explain the insignificant employment variables. In Florida, the establishments in mining increase economic recovery, while establishments in construction and retail decreases economic recovery for local economies. In Louisiana, local economies benefitted from construction, but experienced a decrease in the change of economic recovery from establishments in retail. Lastly, the local economies in the state of Texas experienced an increase in the change of economic recovery from establishments in mining, manufacturing and retail. However, the findings show establishments in agriculture and construction decrease the change in economic recovery for local economies in Texas.

CHAPTER 6

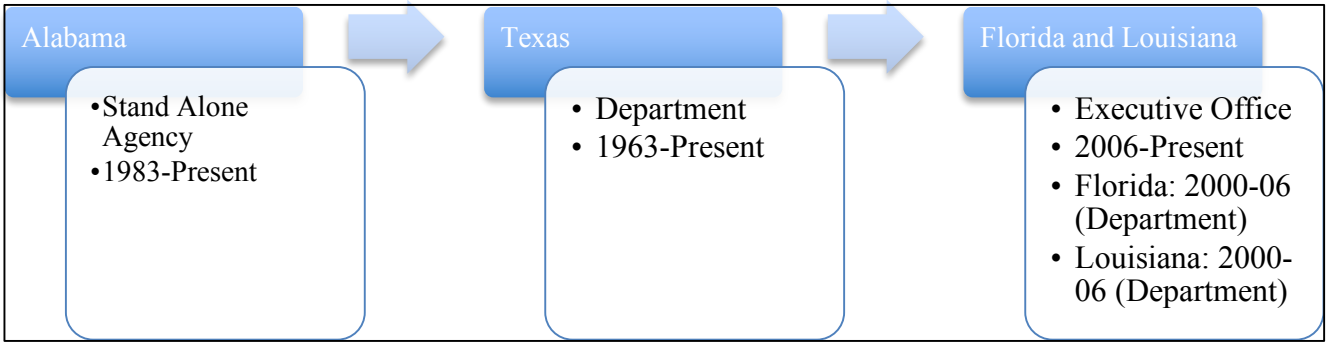
THE EFFECT OF INSTITUTIONAL ARRANGEMENTS ON ECONOMIC RECOVERY

As discussed in chapter 3 and formalized as hypothesis 5, the institutional placement of the disaster management function in state governments may affect the capacity of its local governments to recover from a hurricane. In chapter 4, the location of three institutional arrangements in the four states was proposed—stand-alone agency, division within a larger department, or in the governor's executive office.

For states where responsibility for emergency management is located in a stand-alone agency, managers have greater discretion to operate more independently from other governmental and non-governmental entities. In the case of emergency management agencies located as a division within a larger department, managers are dependent on the mission, policies and procedures set by the parent department. Last, emergency management agencies located within the executive office have direct access to resources, specifically to decision-makers, which is critical during times of disasters.

Figure 6.1 shows the institutional placement of emergency management agencies by state. As noted in chapter 1, only the emergency management agencies for Florida and Louisiana underwent changes from stand-alone departments to their current location in the executive office of the governor during the study period. In both states, the director is a political appointment and serves at the pleasure of the governor. In the state of Alabama, the emergency management agency transitioned out of the Department of Civil Defense in 1983.

Figure 6.1 Institutional Arrangements of Emergency Management Agencies by State



Two states, Florida and Louisiana, relocated their state emergency management operations in 2006 from divisions within larger departments to the executive office of the governor following Hurricane Katrina in 2006. Texas is the only state where the emergency management office is embedded in a larger state agency, in this case the Texas Department of Public Safety for all 15 years of the study. Alabama EMA is the only stand-alone agency for all 15 years of the study period.

To test hypothesis 5, the data were aggregated from the 46 counties in the four states and used to assess the impact of the state's institutional location of emergency management on a county's capacity to recover from a hurricane. Based on the state-specific results reported in chapter 5, there is no statistical evidence to suggest property-damage or hurricane wind speed has an effect on economic recovery. However, there is evidence to support H6 that a county's experience affects its recovery from a hurricane. Based on the theoretical discussion in chapter 3, it is expected that state governments that locate their emergency management agencies as subunits of a department have a strong, positive effect on economic recovery.

The Effect of Institutional Location on County GDP

Table 6.1 reports the fixed-effects estimates for the aggregated data for the 46 counties in the four states for the sample period from 2000 to 2014. The analysis includes the institutional transitions made by Florida and Louisiana in 2006 and reported in Figure 6.1 from being an imbedded division in a larger department (Public Safety in the case of Florida and the Military Department in the case of Louisiana). The estimates of interest in Table 6.1 are for the stand-alone agency and the executive office. The omitted category is the Division within a department. Because the dependent variable is lagged by one year, the sample size is reduced to 59 observations (four states X 15 years).

From the results reported in Table 6.1, the negative and significant estimates for the stand-alone agency and the executive office indicates that changes in county GDP were significantly lower in states with these institutional arrangements than in states with the emergency management function imbedded in another department, the omitted category. That is state emergency management agencies located in a larger department, such as in Texas, were more effective in aiding local governments to their return to pre-disaster conditions more quickly than the other two institutional arrangements. There may be at least two explanations for this finding.

Table 6.1 State Institutional Arrangements (Division in Department omitted category)

	Panel-corrected	
GDP per Capita (Log)	**Coef.**	**Std. Err.**
Hurricane Duration	-0.0001***	0.00
No. of Months-Last Hurricane	0.0000	0.00
Property Damage per Capita	5.0184	6.32
Saffir Simpson(Wind Speed)	0.0000	0.00
Disaster Experience	-0.0010**	0.00
Federal Disaster Aid	0.000	0.00
State Disaster Aid	0.000	0.00

Local Disaster Aid	0.000	0.00
Renter (%)	0.001	0.00
Poverty (%)	-0.001	0.00
Recession	-0.012	0.01
Stand Alone Agency	-0.034**	0.01
Executive Office	-0.020*	0.01
GDP per Capita Lag (Log)	0.814***	0.06
N	59	
Rho	-0.6688	
Constant	-0.563	0.212
R-Squared (FE model)	0.9677	

***p-value<.001 **p-value<0.05 *p-value<0.1

First, stand-alone emergency management agencies are more vulnerable because of their small size and thus may lack accessibility to resources to coordinate disaster preparedness and recovery. It is important to note that the distance and the number of hurricanes the agency and local officials encounter can affect their ability to establish effective trust or strategies based on prior experience. There has been an average of 18 hurricanes based on the four-county sample for Alabama. This implies that the amount and severity of these hurricanes may not be strong enough to warrant relationships or coordinating strategies among other agencies. McGuire and Silvia (2010) conducted a study using U.S. counties to show emergency managers only reach out to collaborate with other organizations when situations arise that are severe in nature or overwhelm the capability of the organization. Also, the literature states local governments have often struggled to identify key local actors to aid with recovery efforts (Lindell et al., 1996).

Second, Alabama EMA is located in the city of Clanton, which is approximately 372km (231 miles) from the Gulf Shores. Also, the Alabama EMA is not located in the capital. Communication from local officials to the Alabama EMA and the coordination efforts and vice versa can be delayed or the information can be misinterpreted given the levels to the chain of

command. It is imperative that information is accurate and timely and the amount of time from local officials to the governor's office may result in further delays in the delivery of services to areas in need.

Emergency Administration Imbedded in a Larger Department

In the case of Florida, the emergency management agency had undergone three transitions since its departure from the Office of Civil Defense in 1969. The emergency management agency resided in the Department of Community Affairs (1969 to 1984) and the Department of Public Safety Planning and Assistance (1984 to 2006) before its relation to the governor's office. The institutions resided in these departments for thirty-seven years. Similarly, Louisiana transitioned its emergency management agency three times since 1976. Prior to being relocated to the Governor's Office in 2006 following Hurricanes Rita and Katrina, the emergency management agency was located in the Department of Public Safety (1976 to 1990) and the state's Military Office (1990 to 2006). Texas, however, made one transition in 1963 when it created the Division of Emergency Management in the Department of Public Safety where it currently remains.

Based on the results in reported in Table 6.1, Texas DEM was more successful at aiding the state's coastal counties to recover from a hurricane than states with alternative institutional arrangements. This implies that emergency management agencies located in another department are more effective in helping local economies recover quickly post-hurricane.

Although agencies located within departments must compete for resources. They benefit from the political clout of the parent department in that competition. Their location in a larger department also places them in close proximity where collaboration and coordination must take

place to maximize limited resources. Police, fire, school districts, and emergency services, for example, often collaborate during times of disasters to help with warnings and evacuation of residents, search and rescue and other services.

In Texas, interlocal agreements and mutual aid agreements are often established to provide better delivery of services, and aid varying levels of government to return economies to pre-disaster levels. The location of emergency management agencies in departments could have a positive effect on economic recovery because its proximity to disasters, which means agencies located in departments must rely more heavily on county emergency management offices to be prepared for and to respond to a major disaster such as hurricanes. There is a quicker ability to respond and get more accurate information than the location other institutions. Thus, emergency management agencies located in departments demonstrate that coordination is a significant factor to quick recovery.

Emergency Administration Located in the Executive Office

Table 6.1 and 6.2 show that state emergency management located in the executive office and stand-alone departments are less effective at helping counties rebuild following a hurricane. In Table 6.1, executive agencies have a significantly lower effect on economic recovery compared to emergency management agencies located in departments.

Table 6.2 State Institutional Arrangements (Stand–alone agency omitted category)

	Panel-corrected	
GDP per Capita (Log)	Coef.	Std.Err
Hurricane Duration	-0.0001***	0.000
No. of Months-Last Hurricane	0.000	0.000
Property Damage per Capita	6.639	6.122
Saffir Simpson(Wind Speed)	0.000	0.000

Disaster Experience	-0.001**	0.000
Federal Disaster Aid	0.000	0.000
State Disaster Aid	0.000	0.000
Local Disaster Aid	0.000	0.000
Renter (%)	0.0001	0.001
Poverty (%)	-0.001	0.001
Recession	-0.010	0.009
Department	0.046***	0.010
Executive Office	0.009	0.010
GDP per Capita Lag (Log)	0.827***	0.038
N	59	
Rho	-0.023	
Constant	-0.543	0.140
R-Squared (FE model)	0.972	

***p-value<.001 **p-value<0.05 *p-value<0.1

Interestingly, from the results in Table 6.2, there is statistical evidence to support emergency management agencies located in the executive office has a greater positive effect on economic recovery compared to stand alone agencies. Florida and Louisiana represent the states that have transitioned their emergency management offices to the executive office. As discussed in the previous section, state coordination efforts are significant to the rate at which local economies recover from hurricanes. Debates often resurface regarding what went wrong in 2005 when Hurricane Katrina made landfall in Louisiana.

Regardless of the factors that contributed to the damages of the catastrophe, FEMA was constantly being blamed for failing to fulfill its role as the coordinator of relief and recover operations. As explained in chapter 1, FEMA lost its position as an independent agency whose director reported to the President after the September 11, 2001 terrorist attacks when it was moved into the newly created Department of Homeland Security. Also, FEMA lost one-third of its budget and had a director, Michael Brown, who had little emergency management experience. After Hurricane Katrina, Gulf Coast states began to relocate their emergency management

operations. Both Florida and Louisiana transitioned the emergency management agencies' subunits in departments to the governor's office in 2006. This implies that location of emergency management institutions matters from a state perspective.

Coordination and access to resources are key to recovery. Disasters often cross into multiple jurisdictions albeit cities, counties and even states. In such cases, relying on a single entity to provide resources to aid in recovering is impossible (Drabek and McEntire, 2002). This implies that intergovernmental coordination is essential to manage the larger disasters. Each level of government plays a critical role in responding to disasters (DHS, 2008, 4). Within executive offices the internal structure is presumed to be hierarchical. Hierarchical structures may be more effective in Florida and Louisiana given the number of hurricanes and the reliance on federal and state assistance than in Alabama and Texas. Multiple organizations are often involved in responding to disasters to aid in recovery. Therefore to get adequate response, the hierarchical system may be beneficial to hold entities accountable and provide clarity on their roles and responsibilities. It remains unclear whether the lessons learned from Hurricane Katrina will prove valuable when a similar large-scale hurricane hits a gulf coast state. The response and ability to recover from Hurricanes Gustav and Ike in 2008 suggests that the changes in the institutional location of emergency management may have facilitated a smoother and more effective response.

Chapter Summary

Overall, the location of emergency management agencies matters. These results help to provide clarity to the underlying assumptions about agencies relocating to the executive office. The placement of emergency management agencies matters because of their access to resources,

specifically decision-makers, financial support, and the capability to have more direct and accurate responses to disasters. The level of response is important because emergency managers and officials can reduce the amount of miscommunication in order to protect more lives and reduce damage to property. It is assumed that relocating agencies to a hierarchical structure helps communication become more direct and accurate.

From the findings, it can be concluded that agencies located in a larger department, such as in Texas, improve local economies' rate of economic recovery better than stand-alone agencies and emergency management agencies located in the executive office. But we lack sufficient experience with agencies in the governor's office to definitively say that that institutional arrangement offers the optimum arrangement for state emergency management operations.

The next chapter discusses the role intergovernmental assistance has on economic recovery. As stated in chapter 4, the ability of states and local governments to access funding for the disaster recovery process is critical for their ability to recover. The operating budgets for some state and local governments are very tight, thus reallocating funding for disaster relief can stifle the essential delivery of services of goods to residents. In chapter 7, the effect of intergovernmental disaster aid is empirically tested to determine what effect disaster aid has on economic recovery for local economies.

CHAPTER 7

INTERGOVERNMENTAL AID

Intergovernmental aid is a critical component for municipalities and county governments to recover from damages caused by severe and catastrophic tropical storms and hurricanes. As stated in the previous chapter, hurricanes are a multi-jurisdictional and multi-agency problem that no single entity can manage alone. Intergovernmental assistance is necessary for local governments and states to return to pre-disaster conditions quickly. Based on the results shown in Table 7.1, there is no statistical evidence to suggest that federal, state and local disaster aid has an effect on the change on a county's GDP. This could be for at least three reasons.

Table 7.1 The Effect of Intergovernmental Aid on Economic Recovery

	Panel-corrected	
GDP per Capita (Log)	Coef.	Std.Err
Hurricane Duration	-0.0001***	0.000
No. of Months-Last Hurricane	0.0002	0.000
Property Damage per Capita	3.650	7.748
Disaster Experience	-0.001**	0.000
Federal Disaster Aid (%)	0.0001	0.000
State Disaster Aid (%)	-0.0002	0.001
Local Disaster Aid (%)	0.000	0.000
Renter (%)	0.0002	0.001
Poverty (%)	-0.002	0.001
Recession	-0.017*	0.009
GDP per Capita Lag (Log)	0.905***	0.033
N	59	
Rho	-0.033	
Constant	-0.260**	0.127
R-Squared (FE model)	0.965	

***p-value<.001 **p-value<0.05 *p-value<0.1

First, the repeated occurrences of hurricanes and tropical storms in counties can counter the effect state and local recovery aid has on the change in economic recovery. There is statistical evidence to suggest that disaster experience has a negative effect on economic recovery. These finding indicate that the more a state encounter hurricanes, there is a reduction in the change in GDP. This implies the number of events as opposed to the severity of the events matter. Local economies may struggle to recover from multiple hurricane occurrences, hindering public officials' ability to learn from each event to develop and implement better policies.

Second, the duration of hurricanes and tropical storms is important. Based on the findings, the duration of hurricanes has a negative effect on the change in economic recovery. The longer a hurricane or tropical storm is in an area, the longer it takes for public officials to restore water, roads, and other public services to support other recovery efforts.

Third, economic recessions play a factor in changes on economic recovery. Economic recessions have a negative effect on the change in economic recovery. This implies that economic downturns among county governments can counter any effect disaster aid provides to promote economic growth. During the Great Recession between January 2008 and February 2009, employment decreased by 8.8 million (Goodman and Mance, 2011). Local governments began reducing employment after September 2008 to over budget shortfalls (National League of Cities, 2011). This is critical because local economies rely on their industries to stabilize the economy during setbacks such as recessions and natural disasters.

The Effect of Intergovernmental Aid on County GDP

The intergovernmental response to disasters in the United States takes a bottom-up approach. Response to disasters begins at the local level, then through multiple steps proceeds to

the state level, and ultimately if local governments and the state's resources are exhausted or overwhelmed, the process moves up to the national level (Schneider, 1995). Local governments are responsible for bearing the cost of replacing and repairing facilities and infrastructure until they can be reimbursed by state and federal aid. The issue is not municipalities and county governments having the authority to make decisions, but the amount of resources allocated to adequately respond to disasters. Higher levels of governments provide financial resources and technical advice for local governments to maintain their emergency management plans (Scavo, Kearney, and Kilrol, 2007). This assumes that public officials understand their responsibilities, the structure and the operation of the governmental response system during every emergency situation. State and local governments must have experience dealing with disasters so that can properly communicate with federal officials (Townsend, 2006). The results could also be explained by county governments' reliance on external aid inability to match their local needs or the aid is ineffective unless there is intra-local or intergovernmental collaboration and cooperation (Berke et al., 1993).

The more disasters a state encounters the more exhausted resources become. The assumption is that each level of government has funds (albeit contingency funds) designated for disaster-relief situations, and each level of government has trained staff to develop and administer plans. However, county governments often respond to disasters with limited resources. Table 7.2 provides information about the local emergency management from the aggregated counties' budget from 2000 to 2014 by state. Interestingly, Florida and Texas have the greatest number of hurricane occurrences in this sample, yet these county budgets for emergency management operations declined from 2000 to 2014.

Table 7.2 Aggregated Counties Emergency Management Budget by State, 2000-2014

State	Year	EM Budget (per capita)	State	Year	EM Budget (per capita)	State	Year	EM Budget (per capita)	State	Year	EM Budget (per capita)
AL	2000	1.84	**FL**	2000	56.80	**LA**	2000	6.45	**TX**	2000	0.68
AL	2001	2.14	**FL**	2001	55.55	**LA**	2001	6.99	**TX**	2001	0.66
AL	2002	2.12	**FL**	2002	54.71	**LA**	2002	7.07	**TX**	2002	0.66
AL	2003	2.13	**FL**	2003	57.10	**LA**	2003	7.83	**TX**	2003	0.64
AL	2004	2.32	**FL**	2004	58.03	**LA**	2004	15.51	**TX**	2004	0.59
AL	2005	3.45	**FL**	2005	54.95	**LA**	2005	12.02	**TX**	2005	0.58
AL	2006	2.66	**FL**	2006	55.50	**LA**	2006	14.10	**TX**	2006	0.58
AL	2007	2.81	**FL**	2007	49.57	**LA**	2007	17.73	**TX**	2007	0.60
AL	2008	3.67	**FL**	2008	44.61	**LA**	2008	12.79	**TX**	2008	0.73
AL	2009	3.14	**FL**	2009	41.60	**LA**	2009	60.74	**TX**	2009	0.73
AL	2010	2.62	**FL**	2010	41.61	**LA**	2010	64.05	**TX**	2010	0.75
AL	2011	2.51	**FL**	2011	39.12	**LA**	2011	44.12	**TX**	2011	0.61
AL	2012	2.22	**FL**	2012	35.92	**LA**	2012	35.02	**TX**	2012	0.61
AL	2013	2.81	**FL**	2013	35.99	**LA**	2013	40.45	**TX**	2013	0.60
AL	2014	2.20	**FL**	2014	36.89	**LA**	2014	52.39	**TX**	2014	0.61

Alabama

When financing disasters, it is important to address the factors that affect the emergency management budgets for county governments. Table 7.3 presents findings, which help to explain why some county governments can recover quicker from hurricanes than others. Hurricane duration has a strong, positive effect on Alabama's emergency management budget. This may be because the longer a hurricane is in an area, the greater the damage qualifying counties in the state to receive disaster aid. Disaster aid can be viewed as additional resources outside of the operating budget and can help to stimulate local economies. However, an increase in the number of months since the last hurricane actually has a negative effect on the change in the emergency management budget per capita. Also, hurricane severity matters. The greater the wind speed shows a decrease in the change in emergency management budget per capita. However, the more county governments experience disasters, there is an increase the change in emergency management budget per capita. Federal and local disaster aid increases the change in emergency management budget per capita, while the state disaster aid has a negative effect on the change in emergency management budget per capita.

It is also worth noting the control variables in this table. The percentage of agriculture establishments has a negative effect on the change in emergency management budgets. The percentage of construction and retail establishments tend to have a positive effect on the change in emergency management budgets given during disasters residents are more inclined to repair or restore their homes or businesses and buy materials to weatherproof their homes.

Table 7. 3 Emergency Management Budget for Alabama Counties, 2000-2014

	Panel-corrected	
Dependent: EM Budget per Capita (Log)	**Coef.**	**Std.Error**
GDP per Capita (Log)	-0.807	0.502
Hurricane Duration	0.118***	0.032
No. of Months-Last Hurricane	-0.008***	0.002
Property Damage per Capita	6.063	19.88
Saffir Simpson(Wind Speed)	-0.110***	0.031
Disaster Experience	0.046***	0.016
Federal Disaster Aid	0.001***	0.000
State Disaster Aid	-0.006***	0.001
Local Disaster Aid	0.028***	0.007
Renter (%)	0.008	0.019
Poverty (%)	0.029	0.027
Agriculture Establishments (%)	-0.623***	0.233
Mining Establishments (%)	0.891	0.709
Construction Establishments (%)	0.072***	0.027
Manufacturing Establishments (%)	0.075	0.114
Retail Establishments (%)	0.204***	0.042
Recession	0.080	0.052
EM Budget per Capita (Log)	0.205***	0.097
N	59	
Rho	0.113	
Constant	-7.914	1.825
R-Squared (FE Table)	0.894	

***p-value<.001 **p-value<0.05 *p-value<0.1

Florida

In Table 7.4, several variables have an effect on the change in emergency management budgets in Florida. The change in GDP per capita has a strong, positive effect on the change in emergency management budgets. This implies that as GDP increases, we can expect an increase in the emergency management budgets among county governments. Additional resources are being directed to emergency management agencies to potentially reduce the amount of damages caused by hurricanes. The findings also suggest that the longer hurricanes last in an area, there is

a positive impact on the change in emergency management budgets. The length of time a hurricane is in an area could hinder services such as water and access to transportation from being provided to residents. This may serve as a justification to invest more resources in emergency management to promote technological advances and update infrastructure to help economies return to a level of productivity. The amount of time between disasters and federal aid have a negative effect on the change in local emergency management budgets. Public officials have often justified reductions in emergency management budgets by the probability of disasters occurring. Given this justification, federal funds may be reallocated to other areas where disasters are more prevalent.

The control variables also warrant discussion. The percent of the population who rent property in Florida has a positive effect on the change in emergency management budgets. Coastal counties in Florida are well known for their fishing and tourism industry. There are a large number of rental properties along the coast, which can be used to stimulate local economies. Also, as for the employment sector in the state, an increase in mining establishments and retail establishments promote a strong, positive effect on emergency management budgets. These industries may play a vital role in sustaining economic stability during disasters, which helps with funding departments such as emergency management.

Table 7.4 Emergency Management Budget for Florida Counties, 2000-2014

	Panel-corrected	
Dependent: EM Budget per Capita (Log)	**Coef.**	**Std.Error**
GDP per Capita (Log)	0.463***	0.175
Hurricane Duration	0.006***	0.002
No. of Months-Last Hurricane	-0.006***	0.002
Property Damage per Capita	9.376	22.95
Saffir Simpson(Wind Speed)	0.000	0.000
Disaster Experience	-0.007	0.005
Federal Disaster Aid	-8.96E-11*	0.000
State Disaster Aid	0.000	0.000

Local Disaster Aid	0.000	0.000
Renter (%)	0.949**	0.520
Poverty (%)	0.020	0.013
Agriculture Establishments (%)	-2.241	1.424
Mining Establishments (%)	483.28***	123.04
Construction Establishments (%)	1.611	0.903
Manufacturing Establishments (%)	1.137	0.729
Retail Establishments (%)	3.541***	1.378
Recession	-0.010	0.048
EM Budget per Capita (Log)	0.860***	0.031
N	254	
Rho	0.083	
Constant	0.694	0.559
R-Squared (FE Table)	0.855	

***p-value<.001 **p-value<0.05 *p-value<0.1

Louisiana

In Table 7.5, there is only statistical evidence to support the effect disaster experience has on the change in emergency management budgets. In this case, the more parish governments in the state of Louisiana experience disasters, it can be expected to have a strong, positive effect on the change of emergency management budgets. As stated earlier in this chapter, public officials prepare for the likelihood that an event will happen as opposed to the likelihood of an event not happening. If a parish experiences more disasters, the probability of costly damages will also occur. To reduce the impact of hurricanes and potential damages, public officials invest in emergency management techniques. Similar to Florida, some parishes in Louisiana are known for its tourism and fishing industry. The renter percentage may be a stimulant for local economies and produces additional resources to provide to emergency management agencies.

Table 7.5 Emergency Management Budget for Louisiana Parishes, 2000-2014

	Panel-corrected	
Dependent: EM Budget per Capita (Log)	**Coef.**	**Std.Error**
GDP per Capita (Log)	-0.064	0.166
Hurricane Duration	-0.076	0.063
No. of Months-Last Hurricane	0.000	0.003
Property Damage per Capita	5.341	15.120
Saffir Simpson(Wind Speed)	0.076	0.065
Disaster Experience	0.020***	0.008
Federal Disaster Aid	0.00	0.000
State Disaster Aid	0.00	0.000
Renter (%)	3.171**	1.488
Poverty (%)	-0.008	0.027
Agriculture Establishments (%)	1.650	7.298
Mining Establishments (%)	-0.0001	0.000
Construction Establishments (%)	2.234	1.908
Manufacturing Establishments (%)	-0.251	0.524
Retail Establishments (%)	0.035	0.419
Recession	0.032	0.133
EM Budget per Capita (Log)	0.577***	0.097
N	179	
Rho	0.154	
Constant	-0.659	0.945
R-Squared (FE Table)	0.472	

***p-value<.001 **p-value<0.05 *p-value<0.1

Texas

The results in Table 7.6, suggest the change in GDP has a positive effect on the change in local emergency management budgets. Similar to the counties in Florida, an increase in GDP implies additional resources are invested in local emergency management agencies. As expected an increase in disaster experience implies an increase in the change in emergency management budgets. Given the frequent occurrences of hurricanes, federal disaster aid can provide additional assistance to offset costs. External assistance can be beneficial because local governments do not have to use reduce regular activities that were already budgeted for in their operating budget to cover unexpected costs. However, local aid has a negative effect on the

change in emergency management budgets. This could be a result of the lack of resources set aside for unexpected events, which causes local emergency management agencies to exhaust resources.

As for the control variables, the percent of the population who rent and live at the poverty level indicate a negative effect on the change in emergency management. These populations are known to be vulnerable and hinder recovery efforts (Cutter, 2008). Agriculture establishments and retail establishments have a positive effect on the change in emergency management while construction and manufacturing have a negative effect on the change in the emergency management budgets. The negative effect construction and manufacturing establishments have on the change in emergency management budgets may be due to funds be used for outside vendors and not being reinvested in the counties in the state (Chang, 1984).

Table 7.6 Emergency Management Budget by Texas Counties, 2000-2014

	Panel-corrected	
Dependent: EM Budget per Capita (Log)	**Coef.**	**Std.Error**
GDP per Capita (Log)	0.662**	0.273
Hurricane Duration	0.019	0.055
No. of Months-Last Hurricane	-0.001	0.002
Property Damage per Capita	19.831	23.202
Saffir Simpson(Wind Speed)	-0.018	0.055
Disaster Experience	0.044***	0.013
Federal Disaster Aid	0.368***	0.139
Local Disaster Aid	-0.473***	0.174
Renter (%)	-0.040**	0.017
Poverty (%)	-0.020***	0.008
Agriculture Establishments (%)	17.611***	4.096
Mining Establishments (%)	11.510	8.257
Construction Establishments (%)	-8.932**	4.682
Manufacturing Establishments (%)	-25.528***	5.912
Retail Establishments (%)	7.186***	2.110
Recession	0.139	0.101
EM Budget per Capita (Log)	-0.255***	0.060
N	193	
Rho	0.507	

Constant	3.029**	1.402
R-Squared (FE Table)	0.299	

***p-value<.001 **p-value<0.05 *p-value<0.1

Chapter Summary

Overall, intergovernmental aid does not impact economic recovery among local economies. As stated in chapter 3, federal, state and local assistance are critical to economic recovery because it provides additional assistance to help state and local economies recovery quicker. The level of aid is important because county governments must meet a financial threshold, which is dependent upon the cost of property damaged, and initiate the request for additional resources to the appropriate agencies. It is assumed that counties and state governments have adequate resources and experience completing process for external resources. Based on the findings in this chapter, intergovernmental aid does not affect economic recovery for county governments.

However, the findings suggest that external aid have varying effects based on the state. In the state of Alabama, federal and state disaster assistance have increases the change in the emergency management budget, while the state disaster aid has decrease the change in local emergency management budgets. Local economies in the state of Florida had the only local emergency management budgets negatively impacted by federal disaster aid. Interestingly, the disaster aid allocated to local economies in Louisiana showed no effect on local emergency management budgets. Local economies' emergency management budgets in Texas benefit more federal disaster aid than local disaster aid. Local disaster aid decreases the change in emergency management budgets.

CHAPTER 8

CONCLUSION

Discussion

Disasters have costly effects on physical and human capital affecting the delivery of goods and services. This study investigated the effect hurricanes have on the rate of recovery for local economies. While there is an abundant amount of research conducted on the impact of natural disasters on national economies, this study focuses specifically on one type of natural disaster and its impact at a micro-level. This study also provides a conceptual and empirical analysis that can be used for analyzing national-level economic recovery. Overall, the effect of hurricanes on local economies is measured using disaster occurrence, disaster magnitude, institutional arrangements and internal and external financial assistance.

Economic Recovery

The results show that hurricanes impact on county governments' economies vary by state. Each of the county governments experiences various factors that had a positive, negative or no effect on economic growth. The counties in Alabama, for example, showed five variables that had an impact on economic growth. First, the intervals in months between hurricanes had negative impact on local economies' ability to recover economically. The longer the interval between disasters, there was a decrease in the change in GDP by 0.1 percent at the county-level. Second, the findings indicate that disaster experience has a positive impact on county-level GDP. The findings also indicate that counties in Alabama that experienced more disasters showed an increase in GDP by 0.5 percent. Poverty, in the cases of the four counties, increases the county GDP by .9 percent. The findings show the recession had a negative impact on economic growth.

Recessions decreased the county-level GDP by 1.9 percent. Given the impact the recession, the employment sector has no impact on the county-level during years of disasters. There is no evidence that county-level GDP is influenced by financial assistance both internal and external in any significant manner. Overall, these findings suggest that while hurricanes may cause economic losses, it is due to locally-determined factors.

In Florida, the duration of a hurricane in a county matters. There is a negative impact on county governments' economies by 0.1 percent. The interval of months between hurricane impacts in Florida increases the change in GDP. Disaster experience increases the change in county GDP by 0.4 percent. External assistance, specifically federal disaster aid, has a very small impact on the county GDP. The findings suggest the percent of the population that rent in Florida increases the county GDP, while the percent of the population living at the poverty level decreases the county GDP. The employment sector plays a role on local economies. The percent of mining establishments increases county GDP, while the percent of establishments in construction and retail has a negative impact on county GDP.

For the parishes in Louisiana, the emergency management budget per capita decreases the county GDP by 3.2 percent. Although the findings indicate that federal disaster aid decreases the change in GDP, the coefficient is negligent. The percent of the renter population accounted for over 52.5 percent of the growth in county GDP. Only two types of establishments in the employment sectors have an impact on economic growth. The percent of construction establishments have a positive effect on local economies while the percent of retail establishments have a significant, negative effect on economic growth. The findings also suggest when GDP is lagged one year there is a 4.5 percent increase in the overall GDP.

The findings in this study show a significant number of factors that affect county GDP in Texas. Of the disaster variables, disaster experience increases county GDP by 1.4 percent. Local and external financial assistance have mixed impacts on local economic growth. The findings indicate that county government emergency management budgets per capita and state disaster aid increases county GDP (1.7 percent and 7.7 percent, respectively). Federal disaster aid, on the other hand, has a negative impact on economic growth, decreasing county GDP by 6.5 percent. However, the percent of the population that rents increases the county GDP by 2.4 percent while the percent of the population at poverty level decreases county GDP by 0.3 percent. In the employment sector, the findings propose establishments in agriculture and construction decreases economic growth, while establishments in mining, manufacturing and retail increases county GDP.

Institutional Arrangements

While holding departments constant, stand-alone agencies decrease the change n county GDP by 3.4 percent. Executive agencies also decrease the change in GDP by 2 percent compared to divisions in larger departments. The findings suggest disaster experience and the duration of hurricanes increases county GDP. The greater experience counties have with disasters the more each county can learn and mitigate accordingly to reduce damages and loss of lives. As for the duration of hurricanes having a positive impact on county GDP, it can be assumed that disasters that last longer in counties cause more damage (or stoppage of the delivery of goods and services), which can promote additional assistance from internal and external sources to cover losses.

Stand-alone agencies were also held constant to get a better understanding of the impact institutional arrangements have on economic growth in regards to hurricanes. The findings show

that departments increase the change in county GDP by 4.6 percent. Also, agencies located within the executive office also increase county GDP by 1 percent. The GDP lagged in this case increased county GDP by 82.7 percent. Overall, local economies benefit more from agencies located in departments compared to agencies that are stand alone and located within the executive office.

Intergovernmental Assistance

From the results, it can be concluded that county experience decreases the change in GDP by 0.1 percent. The duration of hurricanes in an area also decreases the change in GDP by 0.1 percent. However, recessions have an impact overall and decreases the change in GDP by 1.6 percent. The GDP once lagged by one year shows an increase in GDP by 90.7 percent. There is no evidence to suggest that state and local governmental assistance has an impact on economic growth.

However, this study also examines the factors that affect the change in the county governments' emergency management budget. This study provides empirical evidence of how hurricanes impact county governments in each state differently. In Alabama, the length of time a hurricane is in an area has a positive impact (1.8 percent) on county governments' change in emergency management budgets. The intervals between hurricane strikes and the magnitude of a hurricane displays a decrease in the counties' emergency management budget (0.8 and 1.1 percent, respectively), while those counties with greater experience with disasters increase emergency management budgets by 4.6 percent. The external financial assistant has mixed findings. While federal disaster aid increases the counties' change in emergency management budgets (0.1 percent), local disaster aid had the greatest impact on the change in county emergency management budgets (2.8 percent). State disaster aid decreases the change in

emergency management by 0.6 percent. The employment sector also provides mixed findings. The percent of establishments in agriculture decreases change in county emergency management budgets by 6.2 percent, while the percent of establishments in construction, (7.2 percent) and retail (20.4 percent) increases county emergency management budgets.

County governments in Florida show different factors affecting local emergency management budgets. The change in GDP increases county emergency management budgets by 46.3 percent. The duration of hurricanes in an area increases emergency management budgets by (0.6 percent) while the intervals between hurricane strikes decrease county emergency management budgets by 0.6 percent. Federal disaster aid was the only external financial variable that impacted county emergency management budgets in Florida. The findings suggest the federal aid assistance decreases the change in emergency management budgets. Meanwhile, mining and retail establishments increase the county emergency budgets.

In the case of Louisiana, there is no evidence to suggest that financial assistance have any impact on county emergency management budgets. Parishes that experience greater disasters show an increase of 2 percent in local emergency management budgets. Also, the findings indicate the percent of the population that rent tend to increase parish emergency management budgets. When the parish emergency management budget is lagged one year, there is a decrease in the parish emergency management budgets by 5.7 percent.

Lastly, the findings for Texas provide great insight on which factors have a significant impact on local emergency management funding. The change in county GDP increases the change in local emergency management budgets by 66 percent. Disaster experience increases local emergency management budgets by 4.4 percent. As for the financial components, federal disaster aid increases county emergency management budgets by 37 percent, while local disaster

aid decreases it by 47 percent. The percentages of the population who rent and live at the poverty level decrease the change in the county emergency management budgets (4 percent and 2 percent, respectively). However, the recession insulated employment sector shows mixed results as to its impact on county emergency management budgets. The percentage of establishments in agriculture and retail increases the county emergency management budgets while the percentages of establishments in construction and manufacturing decrease local emergency management budgets. Interestingly, when the county emergency budget is lagged one year in the state the state of Texas, there is a decrease in county emergency management budgets by 2.5 percent. Overall, this indicates that hurricanes have a negative impact on funding county emergency management budgets, probably as a result of the lost tax revenue from a decrease in sales and property taxes.

Limitations to the Study

These results should be interpreted with caution. The data is analyzed annually. Although this study takes into consideration exogenous factors such as economic recessions, there are many endogenous and exogenous factors that can occur over the course of one year. Second, the sample size is relatively low to draw generalized conclusions about the impact hurricanes have on coastal counties. The sample size is this study comprises of 33 percent of the total coastal counties in Alabama, Florida, Louisiana and Texas. Third, this study does not include insurance claims. Insurance for renters can be relatively inexpensive and can cover various types of property, which may be used to explain why the greater the percent of renters in some states show a positive impact on the change in county governments' GDP. Insurance claims can also be long, tedious process, which causes residents or county governments to rely

on their personal income or debt to finance post-disaster repairs, replacements and upgrades. This is important because the amount of debt organizations have may hinder the likelihood of receiving a loan or propose higher borrowing costs. These are additional factors that could explain the changes in GDP.

Practitioner Points

Findings from this study do suggest policy implications. Emergency managers should be aware that hurricanes affect local economies differently. The use of external disaster aid, investing in local emergency management and the location of institutions can have varying affects. Therefore, a one-size-fits-all approach does not necessarily work, and should be applied with caution. Local government officials should learn from previous disasters to develop realistic strategies to recovery from disasters. From this study, institution location matters.

Agencies located in departments tend to perform better regarding response and managing hurricanes compared to stand alone agencies and agencies located within the executive office. This could be due to disasters being identified as local responsibility (Lindell, 1994) because local communities experience these disasters first. With this being the case, local emergency managers are often tasked with the responsibility to use local funds and personnel to manage disasters. However, given the nature of disasters, external assistance is often required.

Although external disaster aid can provide additional resources without utilizing local emergency management operating budgets, empirical evidence states that in the state of Texas, which does not receive local disaster aid recovers economically with the use of state disaster aid as opposed to federal disaster aid. In the state of Louisiana, federal disaster aid has a negative impact on economic growth, while state disaster aid does not have an impact. Florida shows

federal aid helps with economic growth, while in Alabama there is no evidence to suggest that external assistance has any effect on economic recovery. Therefore, local emergency managers should be cognizant about requesting disaster aid from external sources as they may actually delay economic growth. Decision makers from all levels should be aware of the gains and losses from hurricanes to know what pre-disaster mitigation tools to request and which techniques to implement.

Table 8.1 Hypotheses Result by State

State / Hypotheses	AL	FL	LA	TX
The greater the local spending on emergency management, the more quickly a county recovers economically from a hurricane-caused disaster	Not Supported	Not Supported	Supported (-)	Supported (+)
Counties experiencing loss in either or both population or income prior to a hurricane will take longer to recover economically than county's experiencing growth in both population and income	Not Tested	Not Tested	Not Tested	Not Tested
The decentralization of responsibility to counties for emergency management is more important to reducing the length of time to economic recovery than the location of the state's emergency management office	Not Tested	Not Tested	Not Tested	Not Tested
The greater the federal and state assistance following a hurricane, the more quickly a county recovers economically from the disaster	Not Supported	Supported (+)	Supported (-)	Supported (-)
Economic recovery by a county from a major hurricane will be faster where a state's emergency management is located centrally in the governor's office than those located peripherally.	Support (-)	Supported (+)	Supported (+)	Supported (+)
The more experience that a local government has with responding to hurricanes, the more quickly it will recover economically from the direct or indirect impact of a hurricane	Supported (+)	Supported (+)	Not Supported	Supported (+)
The greater the magnitude of a hurricane, the slower the economic recovery	Not Supported	Not Supported	Not Supported	Not Supported

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