EXOGENEOUS RESPONSES AND ENDOGENOUS RECOVERY:

HOW FEDERAL DISASTER RELIEF AFFECTS DISASTER RECOVERY

by

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Ernest Hemingway once said, “It is good to have an end to journey toward; but it is the journey that matters, in the end.” This dissertation is dedicated to my life partner, Lee Sammons, who has traveled this journey with me. Throughout these years, you have exhibited more patience and support than I will ever deserve, and I hope to use the remainder of our life together striving to deserve you. Thank you for getting me two cats. I might love them more than you.

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Natural disasters have become increasingly severe and frequent in the United States. The result of this has been an outpouring of federal aid to support communities impacted by these disasters. However, there has been little literature that explores the effectiveness of these federal monies. This study addresses this by using a hierarchical model to measure the effectiveness of several federal aid programs, including monies from the U.S. Small Business Administration, the U.S. Department of Agriculture, and the Federal Emergency Management Agency, on a variety of economic indicators for the state of Louisiana. In addition, the modeling structure examines whether these effects differ between economic regions. The results show a robust positive impact for federal aid programs across all measures. While variance in these results can be attributed to between-region differences, these results suggest that federal government has put together an overall effective response to natural disasters.

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CHAPTER 1

INTRODUCTION

In the United States, natural disasters have become more frequent and increasingly severe events, requiring widespread response efforts by local, state, and federal officials. The increased severity has resulted in impacted communities requiring more time to recover from a single event and the increased frequency has led to communities being unable to recover from one event before being impacted by another event. These factors have expanded the dependence of local governments on federal assistance and have pushed the federal government into playing a larger role in disaster response and recovery. The inflow of federal aid following the impact of natural disasters has become such a commonplace reaction by the federal government that few researchers have stopped to question whether the aid is effective at mitigating the impact of the natural disaster and recovering communities. This is especially important given the size of federal aid distributed after the disasters. For example, the federal government distributed three separate emergency relief packages to Texas following Hurricane Harvey. The first of these response packages totaled $15.25 billion and was followed by second $36.5 billion package (which included additional funding for the California wildfires), and a third package totaling $89.3 billion in emergency funding for various jurisdictions impacted by natural disasters (Rebuilding After the Storm). Beyond response, $16 million in funding was given to Texas to protect against future natural disasters (Rebuilding After the Storm). These figures provide a good picture of the sheer size of federal response to natural disasters. The dissertation, beyond academic contributions, holds significance in it's being an "audit" of these large-scale, high-dollar federal programs. Adding to the narrative of federal spending on natural disasters, there have been calls to reduce federal involvement in disaster response, recovery, and mitigation. In 2019, the Federal Emergency Management Agency's (FEMA's) Administrator, Peter Gaynor, had “ described current federal spending on natural disasters as ‘unsustainable’” (How States Pay for Natural Disasters in an Era of Rising Costs, 2020). In order to have a debate about the federal government’s role in the response to natural disasters, there must first be a clear understanding of the effectiveness of this current “fiscal federalism” and its contributions to the impacted communities.

In addition, while federal relief programs can be personalized, to a certain extent, to the communities receiving the monies, it has yet to be questioned whether these monies have the same impact across all communities. That is, does a program’s dollar spent on disaster recovery in one city or parish have the same effect as that program’s dollar spent in a nearby city or parish? This dissertation includes a secondary perspective on the topic, introducing the question of whether differences between jurisdiction change the impact of disaster-related aid monies and challenging the idea that this “one size fits all” approach works within the context of natural disaster response and recovery.

The contribution of this dissertation to the field begins with a review of the effectiveness of the tools used in disaster-recovery activities and the answering of a basic question: is federal aid an effective form of relief? Beyond filling this gap in the literature and expanding the academic perspective on natural disasters in the United States, the conclusions from this research will provide important information for the economic development practitioners and the public policy community on the frontlines of post-disaster economic recovery. Through this “audit” of the federal programs involved in the recovery process, these practitioners will have a clearer picture of how well different federal disaster relief programs recover various spheres within the local economy. These responders will then have the knowledge and the tools to design a better and more tailored response package for each community. More broadly, by understanding the *effectiveness* of these programs, there can be improvement in the *efficiency* post-disaster economic recovery efforts.

This dissertation is organized into several chapters. First, conceptual and theoretical foundations of disaster response and recovery are introduced, with an overview of the current theories that drive the literature and the introduction of new perspective to the field: the rational expectations theory. Second, an overview of the current literature will be presented, with considerations given to the macroeconomic and microeconomic studies, as well as that research which exists within the realm of political science and political economy. Third, the research design will be introduced, with discussion on the unit of analysis, data sources, research questions, and variables. Fourth, model specifications will be discussed, with a focus on the statistical model and the relevant of a multi-level model structure within this research. Fifth, the results of the research are presented and organized by dependent variable. Last, there will be a discussion of the policy implications of the results and how these conclusions push forward the understanding of disaster recovery and open the field to future explorations.

CHAPTER 2

CONCEPTUAL AND THEORETICAL FOUNDATIONS

The term “natural disasters,” or “natural hazards,” usually refers to a naturally occurring event that causes significant damage to a community. Although the definition can become nuanced between organizations, there is an almost inherent understanding of what dictates a natural disaster. For example, the Department of Homeland Security (DHS), a federal organization, defines a natural disaster as including “all types of severe weather, which have the potential to pose a significant threat to human health and safety, property, critical infrastructure, and homeland security,” noting that, “natural disasters occur both seasonally and without warning, subjecting the nation to frequent periods of insecurity, disruption, and economic loss” (Natural Disasters, 2018). Meanwhile, the International Foundation of Red Cross and Red Crescent Societies (IFRC), a non-profit organization, uses the term “natural hazards” and defines them as “naturally occurring physical phenomena caused either by rapid or slow onset events which can be geophysical (earthquakes, landslides, tsunamis and volcanic activity), hydrological (avalanches and floods), climatological (extreme temperatures, drought and wildfires), meteorological (cyclones and storms/wave surges) or biological (disease epidemics and insect/animal plagues)” (Types of Disasters: Definition of Hazard, n.d.). Despite the DHS limiting its definition of natural disasters as “severe weather”, the Federal Emergency Management Agency (FEMA), an agency under the DHS, has responded to both meteorological events, like hurricanes, and biological events, such as the recent COVID-19 outbreak in the United States. Thus, even with subtle differences in how a natural disaster is defined, there is an almost fundamental understanding of what a natural disaster amongst the “responders” and emergency organizations.

2.1 FEDERAL RESPONSE

Within the United States, response to natural disasters follows a standard formula of federal intervention: response, recovery, and resilience. With the context of this dissertation being hurricane events, I will specifically address this response formula to hurricanes. Unlike other disaster events, hurricanes do not produce a sudden and unexpected impact. Often, states, counties, and cities have adequate time to prepare for the landfall of the hurricane and have highly accurate information on the size and strength of the storm. For example, supplies were brought to Texas and stored outside of anticipated flood zones before Hurricane Harvey ever made landfall and were ready to transport hours after the rain subsided (Roberts, 2017). In short, hurricanes, upon impact, are "expected" events.

Although states can request federal assistance for an anticipated event, most of the federal assistance occurs in a response phase centered around evacuation and the safety of citizens. Organizations like the Federal Emergency Management Agency (FEMA) and the National Guard assist with evacuations and emergency management coordination. When residents are able to return to their homes safely, federal response shifts to a recovery stage, with agencies like the U.S. Small Business Administration providing financial assistance to businesses. Following Hurricane Katrina's damage throughout the Gulf Coast in 2005, agencies like FEMA and the U.S. Department of Housing and Urban Development began to incorporate resiliency into their disaster-related missions (Roberts, 2017). This dissertation has a narrow scope in that it focuses, not only on just the recovery stage, but on the economic recovery stage specifically. To cover topics related to response and whether the federal government is the most useful actor in local disaster management would go beyond this dissertation. Resiliency, though important, engages a different group of organizations and an alternate perspective.

2.2 THEORETICAL FOUNDATIONS TO ECONOMIC RECOVERY

Research that explores the economic impacts of natural disasters has tended to closely follow a conventional theoretical framework oriented toward the view that a natural disaster represents a disruption of the steady-state equilibrium in economic performance. From this perspective, the search for causal mechanisms leads primarily to considerations of how a disaster impacts an economy as a whole and invites considerations of policy tools to restore a pre-disaster steady-state.

2.2.1 A NEOCLASSICAL PERSPECTIVE ON NATURAL DISASTERS

Neoclassical theory, with its principal focus on aggregate economic growth, attributes primacy to three driving forces: labor, capital, and technological innovation. We can see the architecture of this dominant perspective in the Solow-Swan Model (Banton, 2019). The neoclassical framework sets its goal at maintaining a steady-state economy with stable or mildly fluctuating Gross Domestic Product (GDP) (Steady State Economy Definition, n.d.). As a result, within the disaster literature, Felbermayr and Groschl (2014) reflect this operating framework when they note,

> If a natural disaster (e.g., an earthquake) destroys part of a country's capital stock, then the production possibility frontier shifts inwards, leading to lower total output per capita. Subsequently, increased investment replenishes the capital stock again and, asymptotically, puts it back to its steady state level. Similarly, a disaster (e.g., a drought) lowers the average productivity of productive assets such as land, output per capita must fall. In terms of growth rates, theory predicts growth to be lower than trend on impact and, under the right institutions, higher than trend thereafter (p. 93).

The authors find that the impact of natural disasters lowers per capita GDP in the short run, after which there is a period of above average growth resulting from the economy's push to resume its pre-disaster steady state (Felbermayr & Groschl, 2014, p. 102). Strulik and Trimborn (2014) corroborate this view by noting the positive growth rates seen after a disaster impact may derive from a “catch-up growth” that enables an economy to recover from a diminished post-disaster economic performance to its pre-disaster performance (Strulik & Trimborn, 2014, p. 2).

The literature review in the previous chapter, however, reveals the emergence of evidence that may signify a weakening of the conventional neoclassical perspective for understanding the economic consequences associated with natural disasters. While an earlier framework for detecting economic effects looked for, and found, negative impacts on macroeconomic performances, as that body of work has evolved to consider impact metrics beyond aggregate growth (GDP), evidence of positive impacts began to be uncovered. Similarly, as other researchers redirected their inquiries from a macro-level focus to a more micro-level focus, they began to discover that both firm-level and community-level dynamics occurring both before, and following, a natural disaster revealed processes of rejuvenation. The evidence explored in the wake of natural disasters appear to reveal self-healing dynamics of the sort characterized by Schumpeter (1934), depicted as “creative destruction" dynamics and codified as New Growth Theory or Innovation Economics (Atkinson & Audretsch, 2008). Creative destruction dynamics are rooted in a macroeconomy’s or organization’s capacity for innovation (innovation potential), characterized by Caballero (2008) as an “incessant product and process innovation mechanism by which new production units replace outdated ones...[which] permeates major aspects of macroeconomic performance, not only long-run growth but also economic fluctuations, structural adjustment and the functioning of factor markets" (p. 1). Relating this to the disaster literature, Skidmore and Toya (2002) find that disasters "provide an opportunity to update the capital stock, thus encouraging the adoption of new technologies," which then leads to natural disasters having a positive influence on the economy (p. 665). Cuaresma, Hlouskova, and Obersteiner (2008) expand on Skidmore and Toya's (2002) results, noting that countries impacted by natural disaster may be incentivized to replace damaged capital with new technology, which would "lead to higher rates of TFP [total factor productivity] and GDP per capita growth, and would render natural disasters a clear example of Schumpeterian 'creative destruction'" (p. 3).

2.2.2 RATIONAL EXPECTATIONS: AN ALTERNATIVE PERSPECTIVE

It is here that I propose an alternative viewpoint: the Rational Expectations Theory (hereafter, RET). There remains no clear consensus among researchers as to the effects of natural disasters on economies and whether these effects are driven by a return to the steady state, as presumed in a neoclassical framework, or are driven by product and process upgrades, as envisioned by innovation economics framework. However, the purely economic explorations of this topic often discount the influence of policy responses, including the fiscal and monetary policy tools to assist and/or accelerate economic recovery, whether it be from international sources or from federal programs. When outlining the causal mechanisms of their findings, they discount the influence of exogenous monies being injected into economies to assist with recovery activities. In addition, the neoclassical perspective applied to a disaster context focuses on the return of the economy to the steady state. However, it can be argued that a healthy economy does not always seek a single equilibrium (Atkinson & Audretsch, 2008, p. 10). Therefore, if a healthy economy does not seek a single equilibrium, a vulnerable economy recently impacted by a natural disaster would also not seek a single equilibrium during its recovery stage. Those studies published in the political economy field often take disaster assistance into consideration within the modeling, but do not consider the theoretical drivers of their results or lean too heavily on political theories rather than economic behavior. This dissertation seeks to contribute to the increasingly-diverse disaster-related literature by testing theoretical variants associated with RET.

Although established, RET has not yet been applied to a disaster-related context. Proposed by John F. Muth (1961), RET assigns primacy to the perceptions and actions of individuals, not to autonomous activity of economic aggregates, such as nations or regions. McCallum (1980) notes that RET "presumes that individual economic agents use all available and relevant information in forming expectations and that they process this information in an intelligent fashion," with these individuals "[reflecting] upon past errors and, if necessary, [revising] their expectational behavior" (p. 38). Applying this theory to public policy, the theory "asserts that consumers, workers, and firms will perceive what sort of policy is being followed and take the effects of this policy into account when forming expectations" (McCallum, 1875, p. 39). McCallum (1875) provides an example of inflation, noting that, "agents will expect more inflation in the near future, and consequently will act differently, if the policy makers are in fact pursuing an 'expansionary' policy, than they would under a regime of austerity" (p. 39).

These same principles can be applied to an agent's recovery from a natural disaster. In recent decades, federal response to natural disasters have become normal and expected. Agencies such as the Federal Emergency Management Agency (FEMA) and the Small Business

Administration (SBA) are regularly called to jurisdictions that have been impacted by a disaster, particularly those that have received a presidential disaster declaration. Given this regularity, residents, whether familiar with natural disasters or not, would have some expectation of receiving federal assistance. This expectation will impact the behavior of the agents, including their spending and investment behavior. If, then, it is to be believed that individuals in a disaster-impacted area will understand that they themselves, and others in their community, will receive federal response monies in the months after impact, this will be accounted for in their recovery behavior. Individuals within that recovering economy will react to the prospect of getting federal aid (that is, knowing that it will be given but not yet receiving it) and will then receive and invest that aid back into the economy. Their investment and spending behaviors will be different that those behaviors in an economy without the expectation of federal assistance.

Within the literature's economic models, though the models attempt to measure recovery activity, there is no consideration for the difference in behaviors of the agents within this recovering economy. After all, a recovering economy does not have the same expectations as a healthy economy. Thus, the research should account for this expectation of federal response. To account for this, the models of recovering economies should reflect these behaviors, both in the structure of the data and within the time effects. These two points and their application to theory are further defined below.

Structural Framework: A Multi-Level Model to Capture Economic Scale

According to the RET, economic agents will use all available information, including the *expectatio*n of receiving federal aid, to make decisions. In a post-disaster economy, then, these agents (investors, business owners) have an expectation of federal aid, not only for themselves, but also for their community. For example, within a business district, if the majority of businesses are applying for U.S. Small Business Administration loans, then that district is sending a message to surrounding communities that businesses within the district are intending on remaining in the area and are investing in the recovery of their businesses. Businesses surrounding that district may then decide to also remain in the community, given there will be a spur of investment and expectation of federal monies. Thus, through this example, it is shown that although the decisions of economic agents are singular, the expectations that are formed are taken form a much larger pool of information. This calls forth two needs within a post-disaster recovery model: 1) small units of analysis and 2) a community-level grouping. With the first, a smaller unit of analysis is needed to better capture the behavior of economic agents within an economy. At a larger scale, the nuanced behaviors of individuals may be aggregated out of significance. Secondly, if an economic agent is using their expectation, and their community's expectation, of federal aid to make decisions, then the community should be considered or "controlled" within the model. Thus, there should be a community-level grouping of the data structure. Both of these point to the use of a multi-level data structure and model to account for the application of RET in a post-disaster economy.

Temporal Framework: Expectation of Time Lags

As established above, economic agents in a post-disaster economy have an expectation of receiving federal response monies. These monies may occur at a larger scale, such as those given to communities for infrastructure repair, or at a smaller scale, such as flood insurance payouts.

Either way, an agent would expect to receive some benefit from the dispersion of the monies. If an agent is directly receiving funds, that agent may delay spending money on recovery activities until he or she has received the funds from the federal government. Conversely, that agent may immediately invest in recovery activities, knowing there will be reimbursement from the Government. Both scenarios result in a different economic behavior. Thus, when modeling these recovery activities, the model should account for these behaviors, whether it is immediate or delayed investment activities, that result from an individual's expectation of federal monies. Including time lags within the statistical model can account for these behaviors.

2.3 CONCLUSION

Here, Chapter 2 introduced a theoretical framework to a disaster recovery model. Unlike previous perspectives, this dissertation considers economic agents within the economic recovery process, paying attention to any effects their behavior may have on the recovery process. Chapter 3 will introduce the established literature and its conclusions on how natural disaster impact macro- and microeconomies.

CHAPTER 3

LITERATURE REVIEW

When exploring the effectiveness of federal monies in recovering hurricane-impacted economies, there are two types of literature to reference: economic and political-economic. The first section of this chapter provides an overview of those studies that seek to quantify the effects of natural disasters on economic outcomes. These are explored at the macro- and micro-economic levels. Disaster-related literature, however, explores more than just an impact, but also the recovery. Thus, the second section of this chapter outlines those political-economic studies which consider the determinants of government aid and their effectiveness.

3.1 MACROECONOMIC IMPACT OF NATURAL DISASTERS

There is a lack of consensus within the literature as to the effects of natural disasters on the macroeconomy, both in direction (whether these effects are positive or negative) and in scale (how much economies are affected). Within this context, the widely-accepted conclusion is that natural disasters have a substantially negative impact on economic growth in impacted areas (Hochrainer, 2009; Noy, 2009; Raddatz, 2009; Klomp & Valckx, 2014; Felbermayr & Groschl, 2014), with these studies considering various forms of Gross Domestic Product (GDP), such as counterfactual GDP, per capita GDP, and GDP growth. Hochrainer (2009) compares a counterfactual GDP (projected GDP given the economy had not been impacted by a disaster) with the actual GDP and find negative effects resulting from natural disasters in the medium-term (p. 23). Noy (2009) finds that property damage has a negative impact on GDP growth, which is attributed to the short-run impact of disasters on capital stock, transportation, and infrastructure (p. 224). Raddatz (2009) finds that climatic disasters (windstorms, floods, droughts, and extreme temperatures), specifically, have a negative impact on per capita GDP, with per capita GDP being 0.6 percentage points lower given the impact of a single climatic event (p. 9). Klomp and Valckx (2013) find there is an increasing negative relationship between natural disasters and economic growth, with the magnitude differing across disaster types and between countries. Felbermayr and Groschel (2014) show an overwhelmingly negative effect of natural disasters over a 30-year period and across multiple disaster types (storms, volcanos, droughts, earthquakes, etc).

Within disaster-related literature, however, there is a growing body of work that suggests that, when looking at dependent variables other than Gross Domestic Product (GDP), there are a variety of potential economic impacts of a natural disaster that may not necessarily be negative. For example, Skidmore and Toya (2002) provide evidence that disasters may lead to increased human capital, total factor productivity, and economic growth, which the researchers believe occur through investment and productivity growth, suggesting dynamics akin to Schumpeter's "creative destruction." Loayza, Olaberria, Rigolini, and Christiaensen (2012) distinguish between different sectors of the economy, noting the impacts of natural disasters are not always negative. For example, their study finds that moderate flooding may increase growth in agricultural sectors, which the researchers justify by explaining that "localized flooding reflects broader nationwide abundance of rainfall, which in turn induces positive interlinkages to the rest of the economy" (Loayza et al., 2012). Indeed, Cavallo, Galiani, Noy, and Pantano (2013) find that disasters, overall, have no effects beyond very localized and specific circumstances. Using synthetic controls to test the effects of natural disasters on short- and long-term growth, measured through GDP, Cavallo et al. (2013) find that “only very large natural disasters followed by radical political revolution show long-lasting negative economic effects on economic growth” (p. 1550).

In addition to the above, the literature is beginning to expand into more micro units of analysis. For example, Strobl (2011) uses a hurricane destruction index to study the impact of hurricanes on coastal counties, finding evidence that a county's annual economic growth will fall by at least 0.45 percentage points given the impact of a hurricane, with a significant portion of this decline resulting from the permanent migration of the richer population away from the impacted area (p. 588). He also points to the issues of aggregation, noting that “the fact that hurricanes are generally spatially very limited means that in the long term, they have no net annual impact at the state level and do not show up in the national growth volatility at all” (Strobl, The Economic Growth Impact of Hurricanes: Evidence from U.S. Coastal Counties, 2011, p. 588). Xiao (2011) attests to the resiliency of local economies to natural disasters, with there being little to no long-run effects. In his analysis of the 1993 Midwest Flood, there were minimal impacts on employment and long-run personal income (Xiao Y. , 2011). Coffman and Noy (2012) consider the ability of a region to recover to pre-disaster levels. Using a synthetic control to measure the impact of Hurricane Iniki on the Hawaiian island of Kauai, the researchers find that “even in a fairly developed region and with the backing of a deep-pocket fiscal authority...seven years after the hurricane, income per capita returned to its pre-hurricane level, [but] the overall economy has never fully recovered” (Coffman & Noy, 2012, p. 201).

3.2 MICROECONOMIC IMPACT OF NATURAL DISASTERS

Within the microeconomic perspective, Dahlhamer and D'Souza (1997) focus on disaster preparedness, focusing their case study on two major metropolitan areas (Memphis, Tennessee and De Moines, Iowa). They find that disaster experience is a significant predictor of disaster preparedness, which “suggests the importance of prior experience in reinforcing the value of disaster preparedness” (p. 277). Alesch, Holly, Mittler, and Nagy (2001) suggest that only weak firms will fail after being impacted by a disaster, with most only doing so because they are struggling to recover from the damage (p. 1). In their comprehensive analysis on the effects of natural disasters on small businesses and not-for-profit organizations, the researchers find that business owners do not understand the shifting consumer base of a community following an impact of a natural disaster (Alesch, Holly, Mittler, & Nagy, 2001). Webb, Tierny, and Dahlhamer (2002) follow the long-term recovery of businesses following Hurricane Andrew and the Loma Prieta earthquake, finding that factors such as economic sector, age, and financial condition affect the ability of businesses to recovery. Leiter, Oberhofer, and Raschky (2009) study the effects of floods on European companies, particularly focusing on physical capital accumulation, employment, and productivity. They find that regions experiencing a major flood event had higher employment growth and capital accumulation, regardless of whether the company had a large share of “intangible assets,” such as research, patents, and trademarks (Leiter, Oberhofer, & Raschky, 2009, p. 334). However, a major flood event was shown to have a negative effect on productivity, with this effect decreasing as the share of intangible assets increases within a company (Leiter, Oberhofer, & Raschky, 2009, p. 334). Xiao and Van Zandt (2012) introduce another covariate into the disaster-related literature by addressing the mutually dependent relationship between the return of households and the return of businesses in a disaster impacted area. In their case study of Hurricane Ike (2008), the return of households and businesses were periodically assessed to track return patterns of both entities. The study's results support that business and household return are spatially linked, with business re-openings influencing household decisions to return to the impacted area.

3.3 POLITICS AND THE POLITICAL ECONOMY OF NATURAL DISASTERS

From the purely economic modeling of natural disasters emerges a body of literature that considers the *political* economy of natural disasters. Cohen and Werker (2008) open their article with, “natural disasters occur in a political space. They are not driven by politics, nor are they immune from politics” (p. 795). Therefore, any exploration of the effects of natural disasters on an economy should inherently consider political influences and how those influences may impact aid.

In general, there is an overwhelming consensus that politics plays an important role in whether a state will receive a presidential disaster declaration (Garrett & S.Sobel, 2003; Sylves & Buzas, 2007; Reeves, 2011). For example, Garrett and Sobel (2002) find evidence that politics affects the rate and allocation of disaster declarations. More particularly, their models “predict that nearly half of all disaster relief is motivated politically rather than by need” and “reject a purely altruistic model of FEMA assistance” (Garrett & S.Sobel, 2003). Sylves and Buzas (2007), using alternative measures and variables, show findings consistent with that of Garrett and Sobel (2002), in that “political factors do matter in presidential decisions regarding disaster declarations” (p. 13). Reeves (2011) finds that electorally competitive states “[are] expected to receive over twice the number of disaster declarations as a noncompetitive state” (p. 1148-1149).

In addition, the literature explores how these funds are used once they are distributed to the entities. Overall, this topic is the least developed within disaster-related literature. As one of the earliest studies on disaster recovery and the effectiveness of aid, Chang (1983) explores Hurricane Frederic's impacts on Mobile, Alabama and finds that with the hurricane's property and other damages being estimated at approximately $1.6 billion, and with the influx of $670 million in recovery funds, there was a short-run increase of municipal revenue of $2.5 million, but that the long-term impact was negative (p. 511). More specifically,

> when recovery dollars start flowing in, the disaster area may appear to experience a financial gain. However, it is unlikely that a disaster area as a whole benefit financially from natural disasters in the long run. Although the influx of hurricane dollars into coastal counties of Alabama was very substantial, their leakage was almost instantaneous. (Chang S. , 1983, p. 520)

Alesch et al. (2001) find that, “financing through government grants, interest free loans, and low interest loans are tied to special conditions,” which can place restrictions on business owners that hinder economic recovery (p. 71). More specifically, the authors note, “more than one owner we talked with found that relocating their business was essential to recovery, but relocation was contrary to the provisions of their loan from the municipality” (Alesch, Holly, Mittler, & Nagy, 2001, p. 72). Cohen and Werker (2008) focus on mitigation and find that those governments with higher social welfare priorities will spend more money on disaster prevention and mitigation (p. 4). In addition, they find that parties in power tend to spend more money on disasters as a way to redistribute power (Cohen & Werker, 2008, p. 4). In Strobl's (2011) study, although he found that the negative effects at the local level are often not seen in the larger state and national models, he does not imply that local disasters have no effects at the state or national levels (p. 588). For example, there are opportunity costs with insurance reimbursements and federal disaster assistance and, “while perhaps not coming directly from the affected state, [the money] will have to come from somewhere, and thus sacrificed from other potentially more nationally growth-enhancing areas” (Strobl, The Economic Growth Impact of Hurricanes: Evidence from U.S. Coastal Counties, 2011, p. 588). Outside of the United States, Janvry, Valle, and Sadoulet (2016) focus their analysis on Mexico and find that those municipalities receiving disaster monies grew between 2 percent and 4 percent the year after impact compared to those who did not receive the funds. However, this expansion peaks at about 15 months after the disaster, after which other municipalities that did not receive funds catch up to the growth (Janvry, Valle, & Sadoulet, 2016).

3.4 CONCLUSION

Where Chapter 2 focused on the theoretical drivers of this research, Chapter 3 has provided an overview of the current literature and the conclusions arising from this body of work, including both economic and political perspectives. It is from the marriage of these two chapters, theory and literature, that the research design of this dissertation evolves. The following chapter discusses the research design and model development of this dissertation, including variable selection, data sources, and data structure.

CHAPTER 4

RESEARCH DESIGN AND MODEL DEVELOPMENT

The following chapter outlines the research design of this dissertation, including a discussion of the unit of analysis, variable selection, database development, and the structure of the data.

4.1 DATABASE AND CONCEPT MEASUREMENT

This dissertation utilizes publicly-available and FOIA-requested[1] federal data, with the exception of the Gross Domestic Product (GDP) measure. These variables and their original sources are shown in Table 4.1. Established literature informed a substantial amount of variable selection within this design. One example is Chang and Rose's (2012) outline of core disaster recovery variables. Of the author's suggested dependent variables, three variables are included within this analysis to represent economic recovery: employment, income, and number of businesses. The authors also suggest two response-type measures, inflow of insurance payments and inflow of disaster assistance, which are the two broad federal response types included in this dissertation.

4.2 UNIT OF ANALYSIS AND TIME PERIOD

The target population for this analysis is the state of Louisiana (64 parishes). Although data will be collected at parish-level, the data will be subset into multi-parish regions as defined by the

[1] Federal response data from the U.S. Small Business Administration (SBA), Federal Emergency Management Agency (FEMA), and the U.S. Department of Agriculture (USDA) were requested through the Freedom of Information Act (FOIA) in the Spring of 2019. Since the approval of the requests, some agencies have made the data publicly available.

Table 4.1: Original Data Sources

Type	**Federal Policy Program and Contextual Data**	**Source**
Federal Response Measures	SBA Advantage Loan Program (7a)	U.S. Small Business Administration (SBA)
	SBA Grow Loan Program (504)	U.S. Small Business Administration (SBA)
	National Flood Insurance Program	Federal Emergency Management Agency (FEMA)
	Business and Industry Loan	U.S. Department of Agriculture (USDA)
	Public Assistance Funded Projects	Federal Emergency Management Agency (FEMA)
Control Variables	Per Capita Personal Income	Bureau of Labor Statistics (BLS)
	Presidential Election Year	
	Hurricane Impact	
Regional Economic Indicators	Establishments	U.S. Census Bureau – *County Business Patterns*
	Employment	U.S. Census Bureau – *County Business Patterns*
	Per Capita GDP	See Equation 1
	Residential Building Permits (Unit and Value)	US. Census Bureau – *Business Permit Survey*

Table 4.2: Louisiana Regional Planning and Development Commissions

District Name	**Parishes in District**
Regional Planning Commission (RPC)	Orleans, Jefferson, St. Tammany, St. Bernard, Plaquemines
Capital Regional Planning Commission (CRPC)	Ascension, East Baton Rouge, East Feliciana, Iberville, Livingston, Pointe Coupee, St. Helena, Tangipahoa, Washington, West Baton Rouge, West Feliciana
South Central Planning and Development Commission (SCPDC)	Assumption, Lafourche, St. Charles, St. James, St. John the Baptist, St. Mary, Terrebonne
Acadiana Planning Commission (APC)	Acadia, Evangeline, Iberia, Lafayette, St. Landry, St. Martin, Vermilion
Imperial Calcasieu Regional Planning and Development District (IMCAL)	Allen, Beauregard, Calcasieu, Cameron, Jefferson Davis
Kisatchie-Delta Regional Planning and Development District (KDRP)	Avoyelles, Catahoula, Concordia, Grant, LaSalle, Rapides, Vernon, Winn
Coordinating and Development Commission (CDC)	Bienville, Bossier, Caddo, Claiborne, DeSoto, Lincoln, Natchitoches, Red River, Sabine, Webster
North Delta Regional Planning and Development District (NDRP)	Caldwell, East Carroll, Franklin, Jackson, Madison, Morehouse, Ouachita, Richland, Tensas, Union, West Carroll

National Association of Regional Councils (NARC). These aggregations are outlined in Table 4.2. The aggregation of parishes into economic regions created a multilevel data structure. Although the use of multilevel model, as opposed to the standard linear model, will be justified in a later section, there should be some explanation for the inclusion of regions within the economic context. Theoretically, multi-parish regions better reflect economic relations at the sub-state level and outline geographical regions of which individuals and businesses collect information to make economic decisions. Regional units also allow the model to group parishes by similarity, with regards to coastal proximity, primary industrial sectors, and socioeconomic qualities.

This study considers a nineteen-year, annual time period, from 1998 through 2016. This time period is defined by three parameters: industrial classification, active hurricane seasons, and federal data availability. First, the beginning of this time period is defined by the transition from the Standard Industrial Classification (SIC) to the North American Industry Classification System (NAICS), which is a useful start point for business-related variables and opens this dissertation to future research on industry-specific effects. Second, this period incorporates Louisiana's most "active" decade for hurricanes. Since 2016, Louisiana has seen few hurricane events, with the exception of Hurricane Laura in August of 2020. Third, all federal response measures were requested and provided through their respective agencies per the Freedom of Information Act (FOIA) requests. While some federal agencies have made the datasets publicly available since the approval of the requests, there are some agencies that still do not provide the data outside of FOIA requests. Therefore, the any extension of the time period for this dissertation would require additional FOIA requests which would not be approved in time to be included within this study. It should be noted, however, that not extending the time period to the current year does not diminish the quality, robustness, or reliability of this research design.

4.3 DATA SOURCES

The independent and dependent variables derive from three federal datasets, as well as FOIA-requested data from federal agencies. Per capita personal income (PCPI) data is taken from the Bureau of Economic Analysis. Additional data is taken from the *County Business Patterns* and the *Building Permits Survey* programs, both belonging to the U.S. Census Bureau. The *County Business Patterns* program is an annual series that includes the following variables: number of establishments, employment during the week of March 12, first quarter payroll, and annual payroll. The data is taken from the Business Register (BR), which includes within it all single and multi-establishment companies and includes most NAICS[2] industries. Both the employment and establishment dependent variables are sourced from this program, as well as the Gross Domestic Product (GDP) value. The U.S. Census Bureau's *Building Permits Survey* is an annual[3] survey of new, privately-owned residential construction permits and collects information on the number of buildings, number of housing units, and the permit valuation. Data is collected only for permit-issuing areas; however, the Census Bureau notes that this the vast majority of jurisdictions (County Business Patterns, n.d.). This dataset is the only publicly available source for consistent micro-

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[2] The following industries are not considered within the employment and establishment variables: crop and animal production, rail transportation, National Postal Service, pension, health, welfare, and vacation funds, trusts, estates, and agency accounts, private households, and public administration. This dataset also excludes those businesses with government employees.

[3] The U.S. Census Bureau selects 9,000 permit-issuing areas for a monthly survey and expands the selection to all 11,000 areas for an annual sample of permits. A permit-issuing place is defined as those places that issue building or zoning permits for residential construction. These may be municipalities, counties, or a combination of both. The U.S. Census Bureau notes that "over 98 percent of all privately-owned residential buildings constructed are in permit-issuing places" (Building Permits Survey, n.d.).

area data on new authorizations for residential construction and is used by multiple agencies, such as The Conference Board, the Federal Reserve Board, and the Department of Housing and Urban Development, as well as financial institutions and private businesses (County Business Patterns, n.d.). The Building Permits Survey provides both residential construction independent variables.

4.4 DATA DIAGNOSTICS

All data is collected as a count and is reported in hundreds or thousands of dollars. Monetary variables are reported as logs, given the disproportionate funding between parishes and between years. Dependent variables are not reported as growth rates, but, rather, or measures of levels. Levels have more practical application in studies that compare similar entities, as in this dissertation, versus comparing unequal entities, such as regional and national economic growth (Growth Rates Versus Levels, n.d.). In addition, the Federal Reserve Bank of Dallas notes that levels "help answer questions about the relative economic health of a country or state," whereas growth rates "can be used as a measure of comparison with other time periods, answering questions such as, Has job growth in Texas picked up in 2012, compared with 2011?" (Growth Rates Versus Levels, n.d.). This dissertation is not seeking to explore whether the impact of a natural disaster increases or decreases economic growth. Rather, it is exploring whether the distribution of federal aid recovers the economy following natural disasters (i.e. returns that economy to its pre-disasters levels). Therefore, levels are the better measurement for this dissertation. Growth rate models will be included in the Appendix for additional considerations.

Several temporal lags are included in the model. First, with the Hurricane dummy variable, adding a year-of and a one-year lag to the model takes into consideration two different possible effects: 1) hurricane seasons occurring later in the year and 2) longer lasting effects beyond initial year of impact. Given that hurricane season typically occurs between June and November, there are hurricanes that make landfall during the fourth quarter of the year. For those late hurricanes, having “year” as the time unit could result in that given year not representing the full effects of the storm. By lagging this variable, the model is able to account late hurricane effects that are felt in the following year. Secondly, the recovery stage of a hurricane can be expected to last between one and six months, depending on the jurisdiction, federal aid, and the severity of the storm. A lagged hurricane variable is also able to account for those recovery periods that extend into the following year. Federal aid variables also include a year-of and a lagged variable. Again, this considers two effects: 1) a delay in the distribution of the funds and 2) a delay in the spending of the funds. Given that the agencies distributing the funds are doing so at a larger scale than usual, given the size of areas impact by hurricanes, there are likely to be delays in the processing times of the applications. In addition, once the individual or business receives the funds, there may be obstacles to the individual or business spending those funds they received (e.g., limited material or labor available to make repairs).

One-year lags were deployed, compared to a two- or three- year lag, for several reasons, both theoretical and statistical. Theoretically, though the influence of these monies may show beyond that first lagged year, it would not be realistic to believe that the disbursement of the federal monies would go beyond the following year. Statistically, the number of years within the design limits the extent to which additional lags can be included within the model. That is, the inclusion of a lagged variable “eliminates” one year from the design’s time period. With this study’s time period of nineteen years, eliminating more time points through the inclusion of additional lagged variables will weaken the model’s explanatory power and robustness. Thus, to ensure the quality of the design, only one year of lagged variables are included within the models, with additional lags being used a robustness check.

4.5 RESEARCH QUESTIONS

This dissertation is exploratory in nature, with the goal of addressing two research questions:

1) Does federal response mitigate the effects of natural disasters and by how much?

2) Do these effects differ between geographical regions?

This first question is addressed through the research design and modeling processes. The second question is addressed through the use of a multi-level data structure and statistical technique. There are two testable hypotheses associated with these research questions. First, it is hypothesized that federal response measures will have a positive impact on economic recovery and will mitigate much of the effects of the natural disaster, though the size of the effect will vary between programs. Second, the impacts of the program will vary between regions in the state.

4.6 DEPENDENT VARIABLES

There are three categories of dependent variables, with each category representing different "spheres" of the economy. These categories include:

a. broad economic performance measures, which focus on overall economic activity and vitality,

b. residential sector measures that focus on housing and related physical infrastructure, and,

c. business sector dynamics, which concentrates on businesses and employment.

This study recognizes that there is no single best measure of economic performance. Rather, economic vitality is measured by looking at different "spheres" comprehensively and concurrently. Measures for these categories are further described in Table 4.3. In this study, per capita personal income (PCPI) serves as both an independent and dependent variable, as seen in the literature.

4.6.1 ECONOMIC PERFORMANCE MEASURES

There are two economic performance measures included within this analysis: Gross Domestic Product (GDP) of non-farm industries and per capita personal income (PCPI).

Gross Domestic Product

Gross Domestic Product (GDP) is a common dependent variable, not only within the disaster literature, but in macroeconomic studies. Table 4.4, adapted from Felbermayer and Groschel (2014), outlines the studies that use GDP growth as the dependent variable, along with their jurisdictional unit of analysis and findings. While GDP is one of many economic measures available, the Federal Reserve Bank of San Francisco notes that GDP is, "probably the best measure of the overall condition of the economy because it includes the output of all sectors of the economy" (What is the single most important economic indicator for policymakers?, 1999). In addition to it being a good overall measure, GDP is one of the few measures that can be found for micro units of analysis. With there being no consistent county-level measure of GDP available during the time period of the study, parish-level GDP will be approximated using the state productivity method established by Barreca, Fannin, and Detre (2012) and shown Equation 1, where *p = parish*, *st = state,* and *y = year*.

Table 4.3: Dependent Variables

Category	Variable	Unit	Description	Population	Range
Economic Performance	Per Capita Personal Income	Hundreds of U.S. Dollars ($), Inflation-Adjusted to 2016 Dollars	Average Income Earned Per Person; Measure of Standard of Living	All Parishes in Louisiana	Greater Than $0
	Gross Domestic Product	Hundreds of U.S. Dollars ($), Inflation-Adjusted to 2016 Dollars	Measure of Jurisdiction's Economic Output	Output for All Businesses, Except Agricultural Production, Rail Transportation, Public Administration, and Government; All Parishes in Louisiana	Greater Than $0
Residential Development	Residential Building Permits (Units)	Count	Measure of New, Privately-Owned Residential Construction, Reported in Number of Units	Permit-Issuing Areas in Louisiana; All Parishes in Louisiana	Greater Than or Equal To 0
	Residential Building Permits (Value)	Hundreds of U.S. Dollars ($), Inflation-Adjusted to 2016 Dollars	Measure of New, Privately-Owned Residential Construction, Reported in Dollar Value of the Permit	Permit-Issuing Areas in Louisiana; All Parishes in Louisiana	Greater Than or Equal To $0
Business Dynamics	Establishments	Count	A Single Location where Business, Services, or Operations Are Conducted	Output for All Businesses, Except Agricultural Production, Rail Transportation, Public Administration, and Government; All Parishes in Louisiana	Greater Than 0
	Employment	Count	A Single Location where Business, Services, or Operations Are Conducted	Output for All Businesses, Except Agricultural Production, Rail Transportation, Public Administration, and Government; All Parishes in Louisiana	Greater Than 0

Table 4.4: Journal Articles with GDP Growth as Dependent Variable

Study	**Sample**	**Unit of Observation**	**Main Effect on the Dependent Variable**
Albala-Bertrand (1993)	Latin America	Events	Neutral or positive.
Skidmore and Toya (2002)	World	Countries	No effect for geophysical disasters, positive for climatic disasters.
Hochrainer (2009)	World	Countries	Negative effects, depending on size of shock.
Noy (2009)	World, Developing	Countries	Negative effect with monetary damage, no effect with alternative measures.
Raddatz (2009)	World	Countries	Negative effect of climate disasters.
Strobl (2011)	World, Developing	Countries	Negative effect of hurricanes.
Loayza et al. (2012)	World, Developing	Countries	Positive impact of floods, negative effect of droughts (in developing countries), no effect of earthquakes and storms.
Source: (Felbermayr & Groschl, 2014)			

Equation 1: State Productivity Method

$$GDP_{p,y} = \frac{GDP_{st,y}}{Employment_{st,y}}\ x\ Employment_{p,y}$$

For the GDP estimation, employment levels from the *County Business Patterns* are used as the employment measure, versus data taken from other agencies, such as the Bureau of Economic Analysis (BEA) or the U.S. Bureau of Labor Statistics (BLS). Employment data between agencies may differ, depending upon their estimation. For this dissertation, the GDP estimated from the *County Business Patterns* is the output of non-farm and non-governmental businesses.

One limitation to using the state productivity method is that the approximation assumes the individual's productivity at the parish-level is the same as individual's productivity at the state-level, which may not necessarily be correct (Barreca, Fannin, & Detre, 2012). Despite this limitation, this method remains similar to the method used by the U.S. Census Bureau in their estimation[4] of county-level GDP. Given the majority of the data in the analysis comes from the U.S. Census Bureau, there is a benefit to mimicking their methods of GDP estimation. By using employment measures from the *County Business Program*, there is greater meaning in the GDP estimate as the measure is specific and targeted. For example, the *County Business Patterns* eliminates those businesses with government employees. When discussing the effects of a hurricane on a business, those government employees have little risk of the storm affecting the job

[4] The U.S. Bureau of Economic Analysis (BEA) does produce estimates of county-level GDP, but the data is not available for all years in the analysis. Therefore, alternative estimates are used in the analysis.

security. Therefore, the GDP estimated in this dissertation is that of those sectors vulnerable to natural disasters.

Figure 4.1 graphs Gross Domestic Product (GDP) aggregated by planning and development districts. The districts with the larger, anchor-like cities, such as the Regional Planning Commission (RPC) and the Capital Region Planning Commission (CRPC), have the highest GDP and appear to be the most affected by the impact of natural disasters. The Coordinating and Development District, located in the northwestern corner of the state, also shows a lagged effect following the 2005 hurricane season, despite not being a coastal region.

Per Capita Personal Income

Per capita personal income (PCPI) has a mixed place in disaster-related literature, as it has been used frequently on both sides of an estimation equation for economic models, dependent upon the discipline. For example, political science-based literature uses PCPI to control for the state's ability to recover from a natural disaster without federal assistance (Reeves, 2011). Alternatively, economic-based disaster studies use PCPI as a dependent variable to measure economic growth (Strobl, 2011). For this dissertation, PCPI will serve in both capacities. In the suite of dependent variables (Gross Domestic Product, employment, establishments, and residential construction), PCPI will be included as an independent variable to control for the county's economic capacity to recover from a natural disaster with its own resources. Income will also be included as a dependent variable as an additional measure of economic recovery. Theoretically, per capita personal income pairs well with a measure of Gross Domestic Product (GDP). It can be argued that although GDP measures "wealth," it does not measure how wealth is distributed within a jurisdiction. Including

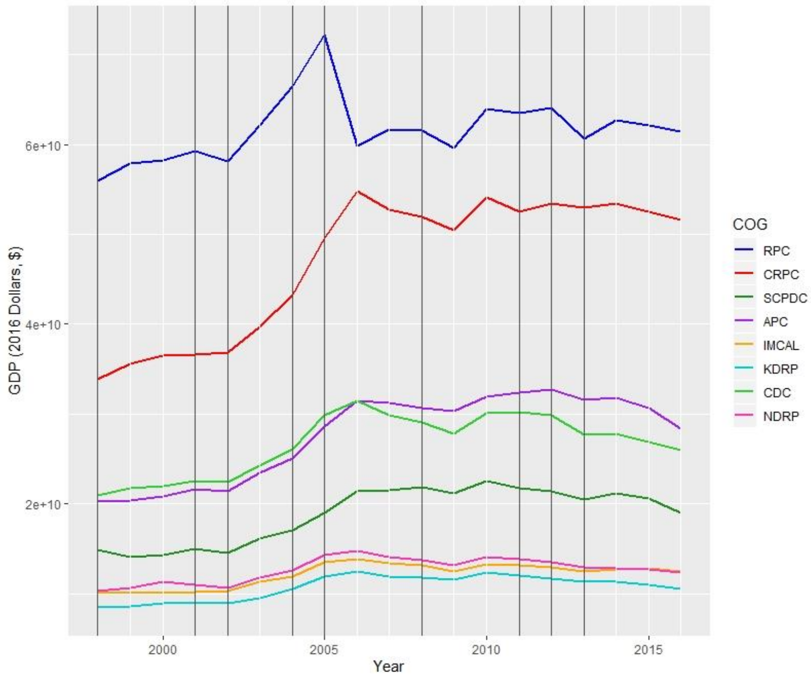

Figure 4.1: Gross Domestic Product (GDP)[5]

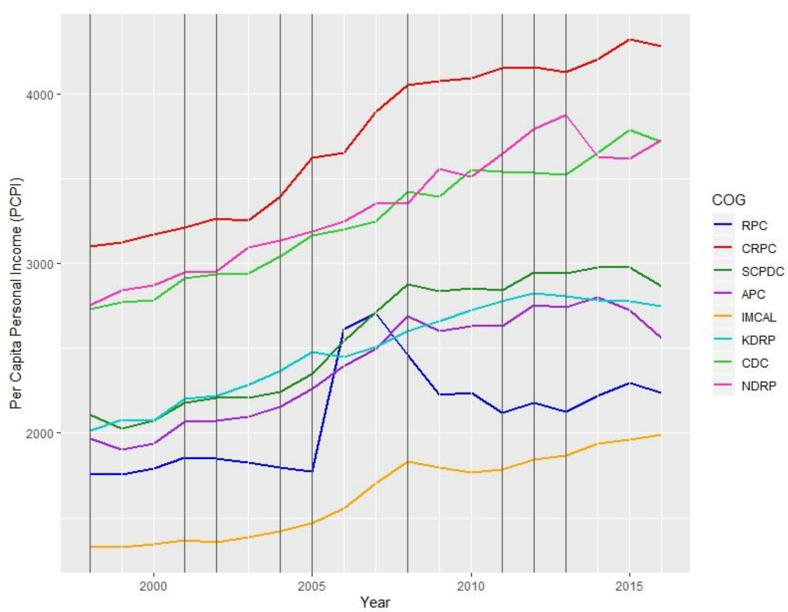

Figure 4.2: Per Capita Personal Income (PCPI)

[5]All line charts group the data by Planning and Development Commission, as abbreviated in the legend. Abbreviations can be found in Table 4.2.

PCPI in an economic analysis, along with GDP, allows for a measure of both wealth and the distribution of wealth.

Figure 4.2 displays the aggregated Per Capita Personal Income (PCPI) throughout the nineteen-year time period. With the exception of the Regional Planning Commission (RPC), which encompasses New Orleans, most development districts show minimal effects from hurricane impacts. Following the 2005 hurricane season, the RPC sees a temporary spike in the PCPI, which is likely to be driven by Orleans Parish, which saw an increase in PCPI from $29,504 in 2005 to $50,086 in 2006 (U.S. Bureau of Economic Analysis, 2020). Interestingly, while the RPC has the highest Gross Domestic Product (GDP) levels, it has the second lowest PCPI levels of the state.

4.6.2 **RESIDENTIAL CONSTRUCTION MEASURES**

There are two residential construction measures included within this analysis: total permit value of residential building permits (value) and the total number of units within residential building permits (units), which serve as a proxy for regional investment. Residential building permits are not used frequently in disaster-related literature. However, given that Xiao and Van Zandt (2012) provide evidence of an interconnected relationship between business and residential recovery, a current exploration of disaster recovery should consider residential, as well as economic, perspectives.

Figure 4.3 and Figure 4.4 graph the total number of units and the total value of residential building permits. The Capital Region Planning Commission shows the highest post-disaster spike in both the total units and total value of permits, with this increase following the 2005 hurricane season.

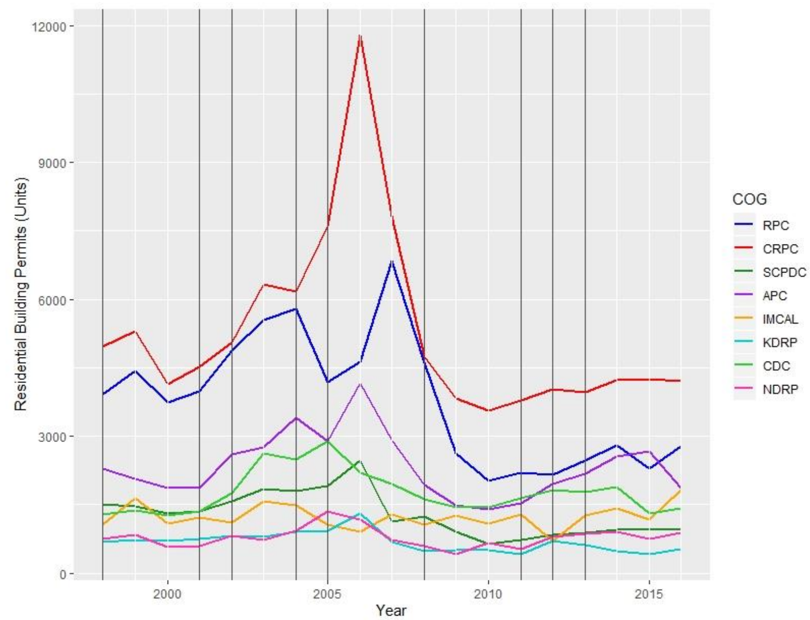

Figure 4.3: Residential Building Permits (Units)

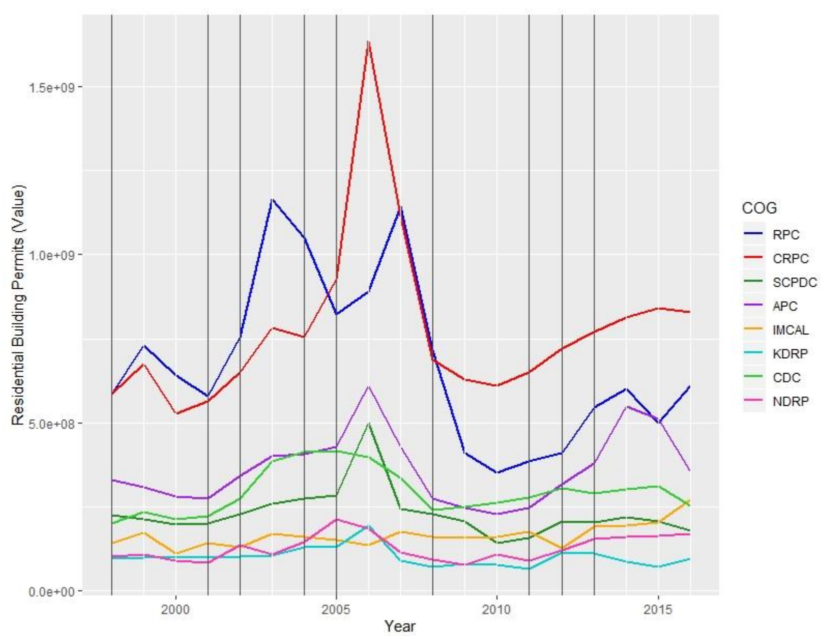

Figure 4.4: Residential Building Permits (Value)

4.6.3 BUSINESS DYNAMICS MEASURES

There are two business measures included within this analysis:

a. business establishments and,
b. employment

As mentioned in a previous section, all counts will be transformed into rates of change for robustness. However, the primary models will consider establishment and employment levels.

Employment

Employment reflects the health of the labor market, per the Federal Reserve, and often correlates with GDP (What is the single most important economic indicator for policymakers?, 1999). Including employment within the analysis further strengthens this design's ability to capture a full picture of economic recovery. This variable is defined as "employment during the week of March 12" (County Business Patterns, n.d.). It should be noted that this is not a measure of the employment rate, but rather a count of those individuals employed. Although not common within disaster-related studies, estimating employment effects has become more frequent in recent years. For example, employment levels are used create an index of long-term recovery in Webb et al.'s (2002) analysis of businesses and Cutter, Ash, and Emrich's (2014) study notes "general economic vitality is related to employment and home ownership rates" (Cutter, Ash, & Emrich, The Geographies of Community Disaster Resilience, 2014, p. 68).

Figure 4.5 displays total employment by regional planning commission. The Regional Planning Commission (RPC) and the Capital Regional Planning Commission (CRPC) have the highest employment of the state, although employment levels in all regions show little growth.

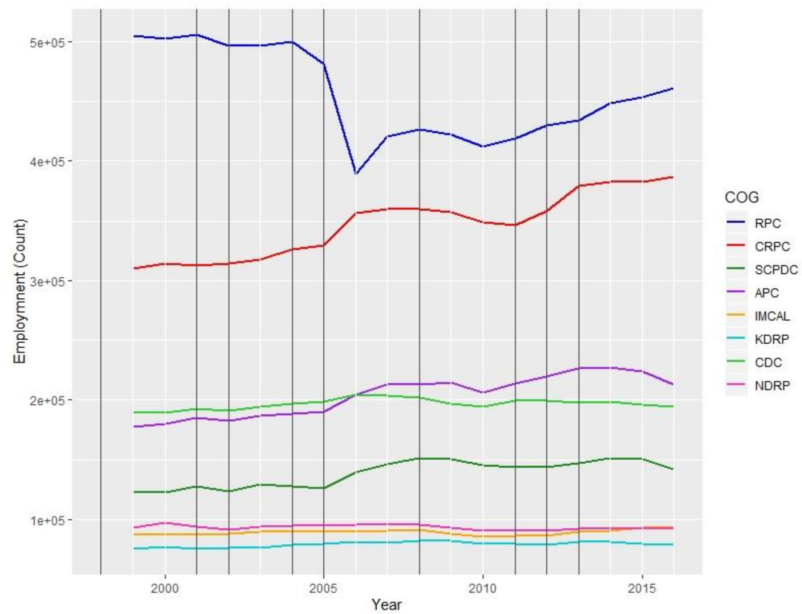

Figure 4.5: Total Employment

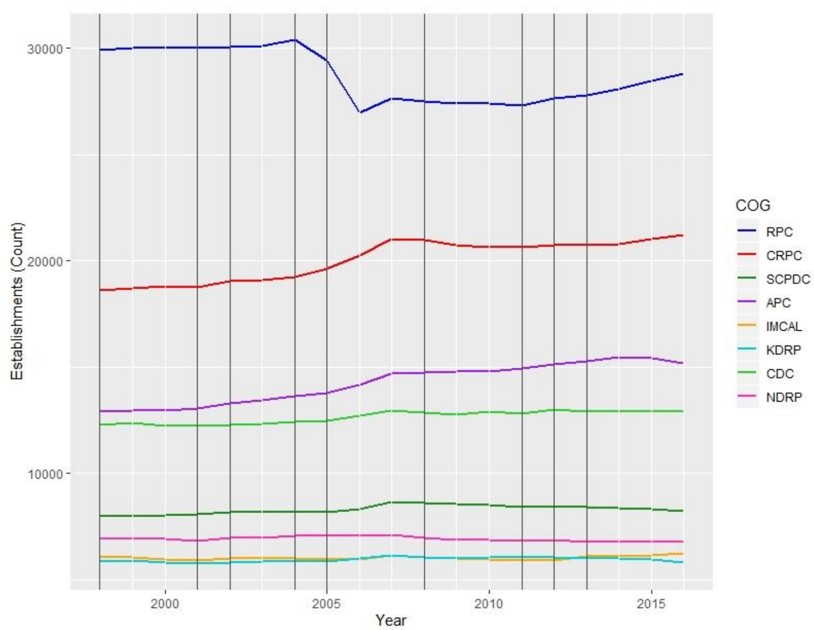

Figure 4.6: Total Establishments

The RPC, which includes New Orleans, shows a decline in employment following the 2005 hurricane season and the impact of Hurricane Katrina.

Establishments

Establishment counts, as a dependent variable, serves as a proxy for business growth within a jurisdiction. The U.S. Census Bureau defines establishments as "a single physical location at which business is conducted or services or industrial operations are performed. An establishment is not necessarily equivalent to a company or enterprise, which may consist of one or more establishments" (County Business Patterns, n.d.). Besides the practicality of the variable, establishments are seen frequently in the disaster literature, particularly in those analysis that consider smaller jurisdictions, such as counties or cities (Cutter et al., (2010), Cutter et al. (2014)).

Figure 4.6 depicts total establishment counts by planning and development districts. Similar to the employment counts, the Regional Planning Commission (RPC) has the highest levels, albeit with relatively low year-to-year growth, with a slight decline in establishments following the impact of Hurricane Katrina.

4.7 INDEPENDENT VARIABLES

With this dissertation's focus on recovery of parish-level businesses and the microeconomy, the federal programs selected for the analysis are those that are believed to have direct or indirect impacts on those entities. There are five categories of independent variables included within the model:

a. economic, and political controls,
b. natural disaster occurrence,

c. federal relief to businesses,
d. federal relief to individual households, and
e. federal relief to state and parish governments.

There are four key programs measured in this dissertation:

a. Small Business Administration's (SBA) loans programs (7a and 504),
b. U.S. Department of Agriculture's (USDA) Business and Industry loan program,
c. Federal Emergency Management Agency's (FEMA) Public Assistance program,
d. FEMA's National Flood Insurance program.

An overview of independent variables is shown in Table 4.5.

4.7.1 ECONOMIC AND POLITICAL CONTROLS

There are two economic and political controls included within the model: per capita personal income and presidential election.

Per Capita Personal Income (PCPI)

As mentioned in an earlier section, per capita personal income is included within the model to control for the parish's ability to recover from an economic shock, such as a hurricane, without federal assistance. Income is widely used within the disaster literature (Kriner & Reeves, 2012; Flores & Smith, 2012; Davis, Hansen, & Husted, 2018; Heersink, Jenkins, & Peterson, 2019) and is therefore justified, conceptually, in its use within these analyses. From a statistical perspective, using PCPI as the primary control in the model allows me include a control for the local economy

Table 4.5: Independent Variables

Category	Variable (Label)	Unit	Description	Population	Range
Economic, Political, and Geographic Control	Per Capita Personal Income (PCPI)	Hundreds of U.S. Dollars ($), Inflation-Adjusted to 2016 Dollars	Average Income Earned Per Person; Measure of Standard of Living	All Parishes in Louisiana	Greater Than $0
	Presidential Elections	Dummy Variable (1 = Election)	Indicator of Election Year	All Parishes in Louisiana	0 or 1
Natural disaster	Hurricane	Dummy Variable (1 = Hurricane Event)	Indicator of Hurricane or Tropical Storm Event	All Parishes in Louisiana	0 or 1
	2005 Hurricane Season	Dummy Variable (1 = 2005)	Indicator of the Year 2005	All Parishes in Louisiana	0 or 1
Business Dynamics Responses	SBA Loan (7a and 504) Program (SBA)	Thousands of Dollars ($), Inflation-Adjusted to 2016 Dollars	Combined Total Monies Distributed from SBA's 7a and 504 Loan Program	All Parishes in Louisiana	$0 or Greater
	USDA Business and Industry Loan Program (USDA)	Thousands of Dollars ($), Inflation-Adjusted to 2016 Dollars	Total Monies Distributed from the USDA's Business and Industry Loan Program	All Parishes in Louisiana	$0 or Greater
Recipient-Specific Response	FEMA National Flood Insurance Program (NFIP)	Thousands of Dollars ($), Inflation-Adjusted to 2016 Dollars	Total Monies Distributed from FEMA's National Flood Insurance Program	All Parishes in Louisiana	$0 or Greater
Government Policy Response	FEMA Public Assistance Program (PA)	Thousands of Dollars ($), Inflation-Adjusted to 2016 Dollars	Total Monies Distributed from FEMA's Public Assistance Program	All Parishes in Louisiana	$0 or Greater

without the use of multiple variables. For example, PCPI takes into consideration education, wealth, the general health of the local economy, and other socioeconomic indicators. Given the temporal component of the model, there should be great consideration in the number of variables within the model to prevent a "kitchen sink" effect and PCPI allows for the majority of the model to be centered on explanatory variables. Figure 4.7 shows the spatial distribution of PCPI throughout the state of Louisiana, with most of the wealth concentrated in the state's major cities, including New Orleans, Baton Rouge, Lafayette, and Shreveport, and with many of these cities being located near the coastal border.

Presidential Elections

Presidential elections, represented by a dummy variable, are included in the model to control for temporally-specific political influences. There is substantial evidence that politics play a significant role in presidential disaster declarations. More specifically, it had been shown that incumbent Presidents provide more federal disaster aid during elections years versus non-election years, irrespective of political parties (Garrett and Sobel, 2002; Sylves and Buzas, 2007; Reeves, 2011). Therefore, a dummy variable is included to control for any influences in the amount of aid attributed to election years. It should be noted that this variable is not interested in understanding the effects of *politics.* Rather, this variable acknowledges that presidential election years may produce more federal aid for disasters. In the time period of this analysis, there were five president elections: 2000, 2004, 2008, 2012, and 2016.

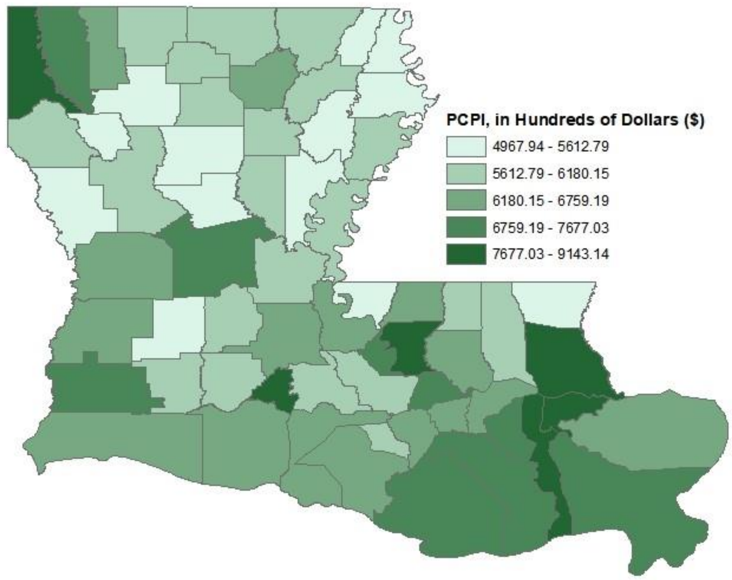

Figure 4.7: Average Per Capita Personal Income (PCPI),
1998 through 2016

4.7.2 NATURAL DISASTER OCCURRENCE MEASURES

Natural disasters are represented through a dummy variable within the model, with "1" indicating the impact of a hurricane or tropical storm. Although disaster declarations are provided for at the parish level, the dummy variables consider a statewide impact. That is, if a hurricane or tropical storm impacted at least one parish in the state, a "1" was indicated for all parishes in the state for that year. By doing this, the analysis recognizes that parishes are not independent economic units but are rather tightly-integrated components of the larger state economy. The impact of a hurricane in a southern parish will have economic consequences in the northern parishes. In addition, only those storm events were included in which a Major Disaster Declaration was issued by the

President of the United States, signaling only those storm events that had a substantial impact. Table 4.6 reports those storm events included within the model.

It is recognized that previous literature represents the natural disaster through a measure of severity (e.g., total damages) rather than a dummy variable. This project, however, will not include a measure of total damages per natural disaster occurrence. The amount of federal aid distributed after a disaster is contingent upon the amount of damage a jurisdiction received, calculated through preliminary damage assessments (PDAs). The more damage to a jurisdiction, the more federal funds the jurisdiction can be awarded. Therefore, a variable measuring damages for each disaster would be and is correlated with these aid measures. However, despite not including damages within the model, the severity of the natural disaster is inherently controlled for through the inclusion of the federal monies as independent variables.

For reference, Figure 4.8 shows the spatial distribution of total damages, with most damage being concentrated in the southwestern and the southeastern portions of the state.

Louisiana's 2005 Hurricane Season

Given the population is Louisiana and her parishes, emphasis should be given to two hurricane events which had major impacts on Louisiana, both on individual behavior and on the state's economy: Hurricane Katrina and Hurricane Rita, which made landfall in August and September of 2005, respectively. The uniqueness of these events lies in both being large (above Category 3) storms and both storms making landfall in the same state almost exactly one month apart from one another. In addition, Hurricane Katrina serves as a turning point in federal disaster relief and may

Table 4.6: Louisiana Tropical Storm and Hurricane Impacts

Natural Disaster	**Category**	**Impact Year**	**Property Damages***	**Crop Damages***
Tropical Storm Frances	Tropical Storm	1998	$30,092,000	$0
Hurricane Georges	2	1998		
Hurricane Lili	1	2002	$518,580,000	$168,000,000
Hurricane Ivan	3	2004	$11,825,000	$0
Hurricane Katrina	5	2005	$20,978,480,000	$54,800,000
Hurricane Rita	5	2005		
Hurricane Gustav	4	2008	$818,607,500	$220,000,000
Hurricane Ike	5	2008		
Hurricane Isaac	1	2012	$117,340,500	$0
*Damage estimates are taken from the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information Storm Events Database				

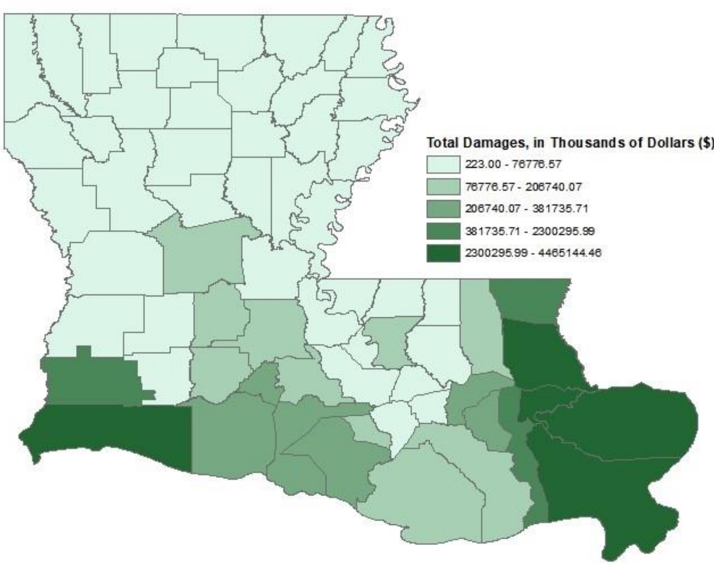

Figure 4.8: Total Property Damages, 1998 through 2016

influence the impact of the federal programs on later hurricanes. A dummy variable is included in the model for this specific hurricane season.

4.7.3 BUSINESS DYNAMICS RESPONSES

There are two types of business policy responses measured in this analysis:

a. the Small Business Administration's (SBA) 7a, and,
b. 504 loan programs and the U.S. Department of Agriculture's (USDA) Business and Industry loan program.

Both programs represent direct federal aid responses to business owners impacted by the natural disaster. The distribution of these loan programs is not directly tied to natural disasters and Presidential Disaster Declarations. However, these programs are frequently used to assist businesses with their post-disaster economic recovery.

Small Business Administration's 7a and 504 Loan Programs

The Small Business Administration (SBA) is a cabinet-level federal agency dedicated to the success of small businesses through the provision of business counseling, financial capital, and contract assistance (About SBA, n.d.). Two of the administration's loan programs are considered: the 7a Loan Program and the 504 Loan Program. Differences between these programs are further described in Table 4.7, taken from the SBA Reference Guide[6]. Both programs are aggregated into

[6] Information is taken from the SBA Reference Guide. However, the full table provides an overview of all U.S. SBA programs, with additional column information for each program. Information in this table was selected based on its applicability to this dissertation. Source: https://www.sba.gov/sites/default/files/files/SBA%20Lending%20Chart.pdf

a single measure within the model, with the values representing the first disbursement date of the loan monies. Figure 4.9 shows the spatial distribution of SBA loan distribution, with the highest concentrations of business-related aid centered around the most urban regions of the state.

U.S. Department of Agriculture's Business and Industry Loan

The U.S. Department of Agriculture's (USDA) Business and Industry Loans provides sixty to eighty percent federal guarantee, depending on the size of the loan amount, with loan amounts ranging from $200,000 to $5 million. Businesses eligible for loans include those located in "rural areas that save or create jobs," including "manufacturing, wholesale, retail, and service industries" (Business & Industry Loan Program Frequently Asked Questions). This is especially applicable to Louisiana's population considering the rural presence[7] within the state, particularly in the southern, most vulnerable parishes to natural disasters. The variable in the model represents the total loan amount distributed in a given year. Figure 4.10 displays the spatial distribution of USDA Business and Industry Loans throughout Louisiana. Where the distribution of SBA loans is concentrated in around the larger cities in the state, the distribution of USDA loans is scattered throughout the more rural regions of the state.

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[7] No matter the three rural definitions of Census-defined places, the state still has a large majority of rural population, shown at TexLa.org (Source: http://www.texlatrc.org/documents/RuralLandscapeLA.pdf). In addition, the rural presence permeates in those parishes directly hit by hurricanes.

Table 4.7: SBA 7a and 504 Loan Programs

Program	**Maximum Loan Amount**	**Percent of Gratuity**	**Use of Proceeds**	**Maturity**	**Qualified Applicants**	**Benefits to Borrowers**
7a	$5 Million	85% guaranty for loans of $150,000 or less; 75% guaranty for loans greater than $150,000	Expansion/renovation; new construction, purchase land or buildings; purchase equipment, fixtures, lease-hold improvements; working capital; refinance debt for compelling reasons; seasonal line of credit, inventory or starting a business	Depends on ability to repay. Generally, working capital & machinery & equipment (not to exceed life of equipment) is 5-10 years; real estate is 25 years.	Must be a for-profit business & meet SBA size standard; show good character, credit, management, and ability to repay. Must be an eligible type of business.	Long-term financing; Improved cash flow; Fixed maturity; No balloons; No prepayment penalty (under 15 years)
504	504 CDC maximum amount ranges from $5 million to $5.5 million, depending on type of business	Project costs financed as follows: CDC: up to 40% Lender: 50% (Nonguaranteed) Equity: 10% plus additional 5% if new business and/ or 5% if special use property	Long-term, fixed-asset loans; Lender (nonguaranteed) financing secured by first lien on project assets. CDC loan provided from SBA 100% guaranteed debenture sold to investors at fixed rate secured by 2nd lien.	CDC Loan: 10- or 20-year term fixed interest rate. Lender Loan: Unguaranteed financing may have a shorter term. May be fixed or adjustable interest rate.	Alternative Size Standard: For-profit businesses that do not exceed $15 million in tangible net worth, and do not have an average two full fiscal year net income over $5 million. Owner Occupied 51% for existing or 60% for new construction.	Low down payment – equity (10,15 or 20 percent); Fees can be financed; SBA /CDC Portion: Long-term fixed rate; Full amortization; No balloons
Source: Quick Reference to SBA Loan Guaranty Programs (U.S. Small Business Administration)						

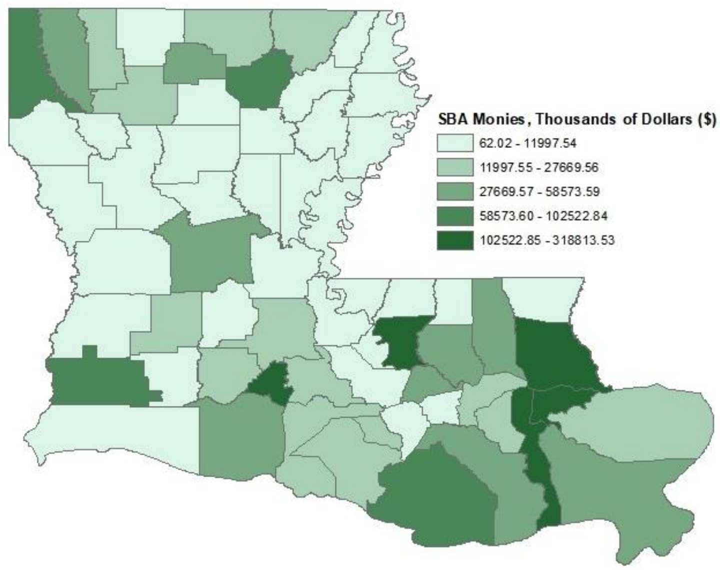

Figure 4.9: Total Small Business Administration (SBA) Loan Payouts, 1998 through 2016

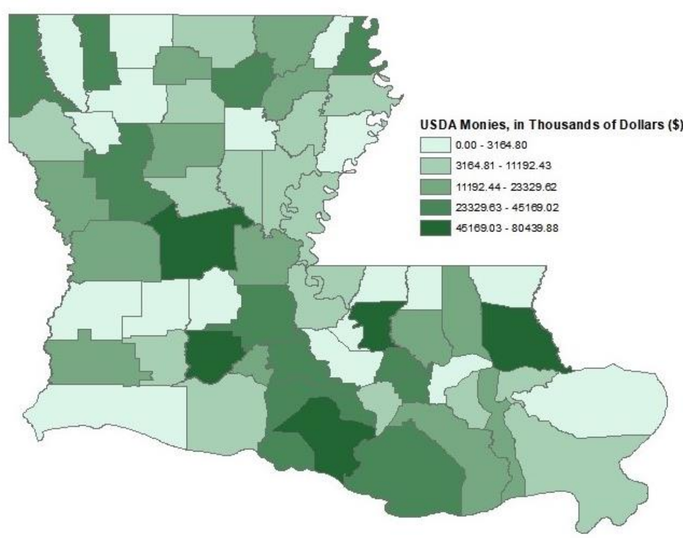

Figure 4.10: Total U.S. Department of Agriculture Loan Payouts, 1998 through 2016

4.7.4 RECIPIENT-SPECIFIC POLICY RESPONSE

Next, individual policy responses include the Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP) which provides subsidized flood insurance to property owners, renters, and businesses. Unlike the previous section, this policy response is given to individuals with the flood insurance policy, regardless of whether they are business owners or not. In addition to insurance, the NFIP also encourages “communities to adopt and enforce floodplain management regulations” which “help mitigate the effects of flooding on new and improved structures” and “reduces the socioeconomic impact of disasters by promoting the purchase and retention of general risk insurance, but also of flood insurance, specifically” (The National Flood Insurance Program). Following the impact of a natural disaster, NFIP Authorized Adjusters inspect the damaged structure, determine whether the structure has been substantially damaged, and submits an Adjuster Preliminary Damage Assessment (Adjuster Preliminary Damage Assessment Overivew) for approval. Once approved, funds are distributed to the individual or businesses for repairs. For the program, FEMA defines “substantial damage” as “a structure that has had flood damage in which the cost to repair equals or exceeds 50% of the market value of the structure at the time of the flood” (Adjuster Preliminary Damage Assessment Overivew). The variable in the model represents the total amount of flood insurance payouts to residents in a given parish within a given year. Figure 4.11 maps the spatial distribution of NFIP monies throughout the state, with there being a heavy concentration of payouts in the New Orleans region.

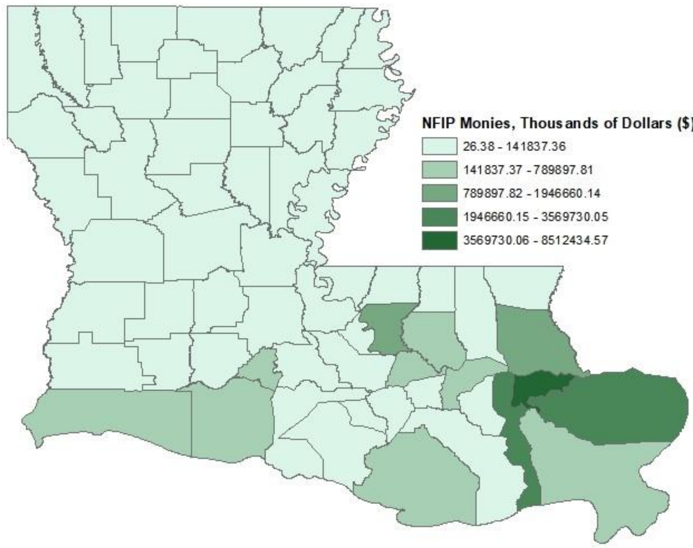

Figure 4.11: Total National Flood Insurance Program Payouts, 1998 through 2016

4.7.5 GOVERNMENT POLICY RESPONSES

The final category of response measures are those government policy responses, or, rather, those response measures given directly to state and local governments. While individuals in impacted communities will receive indirect benefits from the use of the funds, they will not receive the direct payments. FEMA's Public Assistance Program (PA) is an example of this and provides monies for repairing and replacing facilities damaged by the disaster, including debris removal, emergency protective measures, roads and bridges, water control facilities, buildings and equipment, utilities, and parks and recreational facilities (The Disaster Declaration Process). Unlike the previous federal aid programs which monies directly to those entities, whether individuals or businesses, directly and through an application process, these funds become available to county governments through a Presidential Disaster Declaration[8] as per the Robert T Stafford Disaster Relief and Emergency Assistance Act of 1988 (Stafford Act). According to the Public Assistance Program and Policy Guide, FEMA uses six factors to determine whether there should be provision of Public Assistance to jurisdictions following the impact of a natural disaster. These factors include: 1) estimated cost of assistance, 2) localized impacts, 3) insurance coverage, 4) hazard mitigation, 5) recent multiple disasters, and 6) other federal assistance programs" (Preliminary Damage Assessments for Major Disasters: Overview, Analysis, and Policy Observations, 2017, p. 6). These factors are described in Table 4.8. It should be noted that this variable is reported as the total project amount. It does not distinguish between federal obligation and total obligation. Figure 4.12 presents the spatial distribution of PA monies, with most of the funding being concentrated among the coastal and near-coastal parishes. Given this variable is connected to disaster-related damage, this spatial distribution would be expected.

4.8 CONCLUSION

The above chapter provides an outline of the conceptual model and justifications for the selection of the unit of analysis, variables, and data structure. These selections improve upon the previous literature and incorporate real world observations to build a model that better reflects the local economy and more accurately captures post-disaster economic recovery. In addition, this

[8]Presidential Disaster Declarations also open up funding from the Individual Assistance Program and Hazards Mitigation Grant Program. There are two types of Presidential Disaster Declarations: emergency declaration and major disaster declaration. The Hazards Mitigation Grant Program is only available through a major disaster declaration. Within this analysis, both emergency declarations and major disaster declaration public assistance monies are considered. The Individual Assistance program is not considered as these monies are expected to have little influence on the business community. In addition, the Hazard Mitigation Grant Program will not be considered as this analysis focuses on disaster recovery and not disaster mitigation.

conceptual model is driven by the desire to create a design that can be used by economic development practitioners and local leaders in their development activities. Chapter 5 introduces the statistical aspect of the modeling and discuses statistical tests and elaborations.

Table 4.8: Public Assistance Damage Factors

Factor	Description
Estimated Cost of Assistance	Per capita impact calculated as the cost of federal and public assistance compared to statewide population.
Localized Impacts	The level of excessive damages at the county- and local-levels, compared to the statewide measure.
Insurance Coverage in Force	The amount of insurance coverage that is, or should have been, in place prior to the disaster.
Hazard Mitigation	The contribution of the state and local governments in disaster mitigation efforts.
Recent Multiple Disasters	History of disaster impacts within the state.
Programs of Other Federal Assistance	The assistance provided by other programs in response to the impact of the natural disaster.
Source: Legal Information Institute at Cornell Law School	

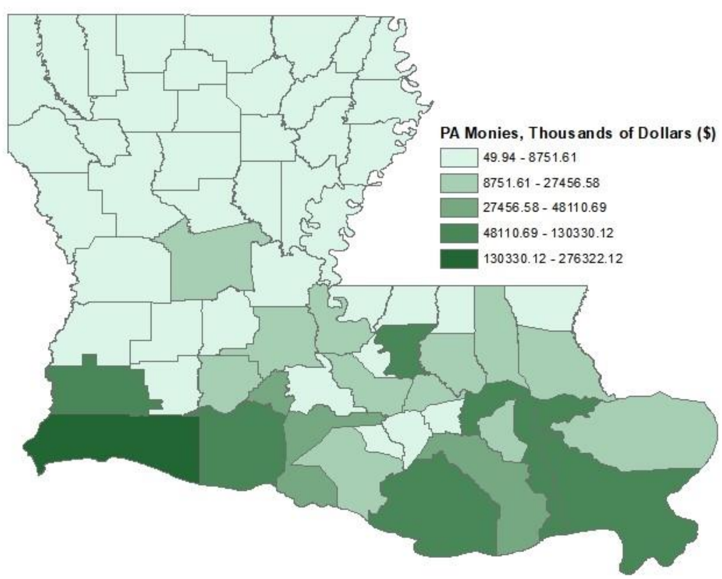

Figure 4.12: Total Public Assistance Program Payouts, 1998 through 2016

CHAPTER 5

MODEL SPECIFICATIONS, TESTS, AND ELABORATION

The following chapter outlines the statistical model developed and tested in this dissertation, including alternative model specifications, causality tests for spuriousness, and model elaboration strategies.

5.1 MODEL SPECIFICATIONS

Given the multi-level structure of the data (counties nested in regions), a multi-level model will be used for the analysis. A previous section provided a theoretical justification for a multi-level data structure, grouping counties into economic, interdependent regions that reflect the real-world economic structure seen in Louisiana's economy. Here, I will provide a statistical justification for the use of a multi-level data structure, and thus a multi-level statistical model. With a standard linear model, there is an assumption that,

> there are no relationships among individuals in the sample for the dependent variable once the independent variables in the analysis are accounted for…nothing link[s] their dependent variable values other than the independent variables included in the linear model" (Finch, Bolin, & Kelley, 2014, p. 23).

When considering of the population selected for this analysis, however, this assumption does not hold. As Finch, Bolin, and Kelley (2014) write, "in many cases the method used for selecting the sample does create correlated responses among individuals," which would violate the independent errors assumption, with sample selection exerting "an additional impact on the outcome variable" (p. 23). For example, the economic success of a parish is likely to impact the economic success of a neighboring parish or parishes within the same region. Coastal, more urban parishes will have different levels of residential construction compared to the more rural Central Louisiana. A multi-level data structure accounts for the *between-unit* correlations within each of the economic regions. Statistically, a random-intercept multi-level statistical model is used to explore these two-level relationships, providing parish-specific information, as well as an intraclass correlation, which measures the amount of variation attributed to between-region differences (Finch, Bolin, & Kelley, 2014, p. 24). Ignoring the multi-level structure within this economic analysis could lead to an underestimation of the standard errors and an overestimation of the test statistic, as well as the overlooking of key relationships at the second level of the structure (Finch, Bolin, & Kelley, 2014, p. 28).

All models presented in Chapter 6 are multi-level models with statistically significant likelihood ratio tests, indicating that the multi-level model structure is preferred to a standard linear model. This also proves that the model, itself, is statistically significant.

5.1.1 MULTICOLLINEARITY AND SERIAL CORRELATION

A correlation matrix showed no indication of multicollinearity among the independent variables. This helps ensure the statistical significance of the variables selected for the model. However, there is evidence of serial correlation within the model, as shown through a Woodridge Test. Serial correlation can lead to Type I errors, or a false positive, where the null hypothesis is rejected when it should not be. This was present in all variations of the model. To address this issue, all coefficients are computed using robust standard errors. Correlation matrices and serial correlation tests are included in the Appendix.

5.1.2 EFFECT SEQUENCING AND TESTING FOR CAUSAL ORDER

To understand the causal mechanisms behind the recovery process, a sequence of model specifications is used to "build" models logically guided by prior results. Variables are added to the model individually to test for spuriousness, as shown in the Chapter 5. This method allows the models to reflect which variables are "explaining away" the effects of other variables. By doing this, however, extensive consideration is needed as to the order of the variables in the model. The conceptual recovery process and distribution of federal aid is shown in Figure 5.1. Within this conceptual "roadmap," the federal monies are organized by the sequence in which those monies would enter the economy. According to a report from the Congressional Research Service, Small Business Administration (SBA) loan money would be the first to enter the economy. Given the similarities between the U.S. Department of Agriculture's Business and Industry loans and the SBA 7a loans, one can assume that both programs would enter the economy at approximately same time. Next, Federal Emergency Management Agency (FEMA) aid would enter the economy. Two FEMA programs are included in the model, the National Flood Insurance Program (NFIP) and the Public Assistance (PA) Program. Both programs require an assessment of damage. However, NFIP monies are paid directly to the individuals and businesses, while PA monies are given to the state governments, which then allocate funds to the county governments, which then may allocate additional monies to the cities. In addition, given these are local governments, determining and approving use for the funding may take additional time given internal processes. Thus, it is assumed NFIP payouts would enter the economy prior to the investment of PA funding.

Based on the sequencing described above, five iterations of the model are presented for each of the dependent variables. Model 1 is included as a base model, with only the single year impacts of the federal monies and with a lagged hurricane variable to account for both the timing of the hurricane season and delayed impacts. Models 2 through 5 add the lagged effects to the federal monies, a single variable at a time. This ordering reflects the understanding that disaster recovery is dynamic economic process. As this process unfolds, tests for spuriousness among policy influences are appropriate as the recovery process is revealed across model specifications. Finally, Model 5 is selected as the final model for interpretation based on both the Akaike information criterion (AIC) values and theoretical considerations.

5.2 CONCLUSION

With the above chapters providing both the conceptually-driven research design and the statistical application of this design within the context of this dissertation, the following chapter presents the results of the analysis.

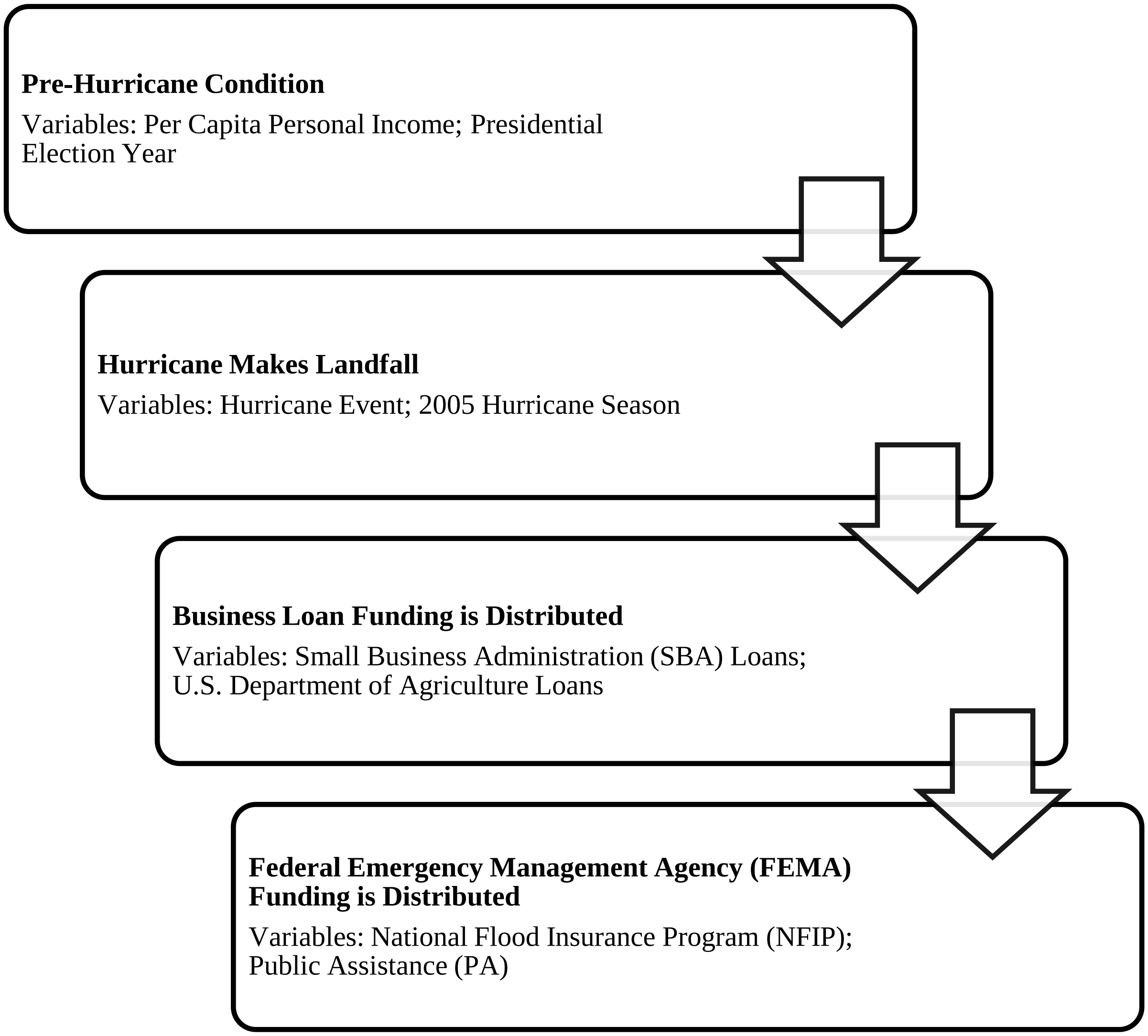

Figure 5.1: The Recovery Process

CHAPTER 6

RESULTS AND INTERPRETATIONS

Two distinct research questions motivate this dissertation. The first question seeks to understand how federal disaster relief policy and program responses affect economic recovery at the sub-state level. The second question continues from the first, asking whether these effects differ among sub-state regions. The empirical findings of our econometric analyses are reported and interpreted in the following sections.

6.1 RESEARCH QUESTION #1: FEDERAL RESPONSE EFFECTS

This section discusses the effects of the independent variables on the six dependent variables of interest. Chapter 5 organizes the independent variables by federal response policy type and orders them according to when the funds they provide enter the economy following a natural disaster. To reiterate, of the four federal programs considered, the U.S. Small Business Administration (SBA) monies are typically the first to enter an affected economy, based on the administration's capacity and procedures. U.S. Department of Agriculture monies, which similar to U.S. Small Business Administration's loan program, will enter either with, or shortly after, those of the SBA. These will be followed by insurance payouts from the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program. Last, FEMA's Public Assistance monies will be filtered through the local economy, being given to the state government and passed through to the county and local governments. The lagged measures of each variable in the models tested will follow the same sequencing. The hierarchical model output is available at the end of tables 6.1 through 6.7, but will not be discussed until Section 6.2 of the chapter.

6.1.1 DV 1: GROSS DOMESTIC PRODUCT (GDP)

As mentioned, Gross Domestic Product (GDP) is a general measure of wealth. While Per Capita Personal Income (PCPI) is a measure of the distribution of wealth, the two variables, GDP and PCPI, are not endogenous and therefore can be included within the same model. Table 6.1 explores the effects of these independent variables on Gross Domestic Product (GDP).

In Table 6.1, two control variables are included to account for economic pre-conditions prior to the impact of the natural disasters. As expected, PCPI has a persistent positive and significant impact on GDP across all five specifications. As additional controls are introduced, there is no evidence of spuriousness to attenuate the influence of PCPI on GDP. This suggests that one of the most important factors enabling a sub-state economy's economic rebound is the level of its economic potential prior to a natural disaster event. Relatively wealthy economies have a built-in capacity for economic recovery. By contrast, the political dynamics related to periods that include presidential elections have no influence on GDP. Although Table 6.1 provides evidence that PCPI positively attributes to GDP, it is not necessarily true that an increase in PCPI will lead to an increase in GDP. As the Center for American Progress explains,

> In the modern economy, benefits are shared unequally. As economic benefits have gone increasingly to those at the top, overall economic growth tells us less than it once did about how the living standards of all Americans are changing. To be sure, economic growth is an important goal, but it's naïve to ignore the growing disconnect between changes in economic output and living standards for the vast majority of workers—especially when there are much more applicable measures of how workers are faring. (Madowitz & Hanlon, 2018)

Table 6.1: Gross Domestic Product (ln) ($000s)

		Model 1	Model 2	Model 3	Model 4	Model 5
Control Variables	PCPI (ln) ($00s)	2.429*** (0.429)	2.097*** (0.318)	2.094*** (0.324)	1.970*** (0.322)	1.980*** (0.319)
	Presidential Election	-0.034 (0.038)	-0.034 (0.028)	-0.028 (0.027)	-0.027 (0.028)	-0.034 (0.028)
Natural Disaster Events	Hurricane	-0.026 (0.078)	-0.068 (0.074)	-0.073 (0.075)	-0.000 (0.081)	-0.006 (0.079)
	$Hurricane_{t-1}$	0.143*** (0.028)	0.099*** (0.022)	0.096*** (0.022)	-0.034 (0.049)	-0.002 (0.051)
	2005 Hurricane Season	-0.098 (0.067)	-0.014 (0.059)	0.008 (0.059)	0.049 (0.048)	0.033 (0.055)
Businesses Policy Responses	SBA (ln) ($000s)	0.182*** (0.021)	0.129*** (0.012)	0.127*** (0.012)	0.117*** (0.011)	0.117*** (0.012)
	SBA_{t-1} (ln) ($000s)		0.120*** (0.012)	0.118*** (0.012)	0.108*** (0.011)	0.108*** (0.011)
	USDA (ln) ($000s)	0.040*** (0.010)	0.037*** (0.009)	0.034*** (0.009)	0.030*** (0.008)	0.029*** (0.008)
	$USDA_{t-1}$ (ln) ($000s)			0.021*** (0.006)	0.022*** (0.005)	0.021** (0.005)
Individual Policy Response	NFIP (ln) ($000s)	0.080*** (0.014)	0.065*** (0.013)	0.064*** (0.013)	0.056*** (0.012)	0.057*** (0.013)
	$NFIP_{t-1}$ (ln) ($000s)				0.068*** (0.007)	0.071*** (0.008)
Government Policy Response	PA (ln) ($000s)	0.000 (0.013)	-0.003 (0.012)	-0.003 (0.012)	-0.003 (0.013)	-0.003 (0.013)
	PA_{t-1} (ln) ($000s)					-0.011 (0.011)
	_cons	5.601** (1.852)	7.306*** (1.755)	7.321*** (1.790)	7.952*** (1.778)	7.889*** (1.757)
	Random-Effects Parameters					
	sd(_cons)	0.163 (0.059)	0.125 (0.057)	0.125 (0.058)	0.128 (0.044)	0.128 (0.045)
	sd(Residual)	0.747 (0.032)	0.681 (0.028)	0.679 (0.029)	0.659 (0.029)	0.659 (0.029)
	AIC	2,637.51	2,425.34	2,417.82	2,352.75	2,353.35
	Between Region Variability (ICC)	0.045	0.033	0.033	0.036	0.037

Note: All variables are reported with robust standard errors.
Significance Codes: '***' 0.001, '**' 0.01, '*' 0.05

Thus, GDP and PCPI do not suffer from endogeneity bias and PCPI stands as the most influential variable within the model.

Given these pre-conditions, the disaster events themselves appear to be largely insignificant. The lagged Hurricane retains its significance throughout Models 1 through 3, having a positive impact, as suggested by the literature. For example, Skidmore and Toya (2002) note a positive correlation between climatic disasters, particularly, and subsequent economic growth, human capital investment, and productivity growth (p. 682). The authors do address insurance and government relief, noting that data limitations prevent the inclusion of insurance, but that “a substantial percentage of disaster damages are not insured” (Skidmore & Toya, 2002, p. 677). Skidmore and Toya (2002) seem to suggest that although insurance and government relief are factors within the recovery process, they may not be significant enough to alter the outcomes. However, Table 6.1 suggests otherwise. The influence of a Hurricane event is explained away with the inclusion of the lagged National Flood Insurance Program (NFIP) variable, suggesting that disaster relief in the form of flood insurance may mitigate the economic effects of hurricane events (see Col. 5). Despite the severity of the legacy disasters – in this case the entire 2005 Hurricane season – these disasters did not register lingering negative economic effects on parish-level economies over the longer-term.

Overall, federal disaster relief funding from multiple government sources -- Small Business Administration (SBA), U.S. Department of Agriculture (USDA), and NFIP – have statistically significant positive influences on post-disaster economic outcomes in models tested both with and without lags. The sole exception involves the impact of federal Public Assistance programs with a one-year lag (see Model 5). That these separate policy responses reveal a pattern of independent and significant impacts suggests that the overall federal disaster policy response is relatively efficient in that these policies do not cannibalize one another despite their common temporal and spatial targeting. The loans provided by the U.S. Small Business Administration (SBA) have the largest impact, with a 0.117 percentage point effect in the first year and a 0.108 percentage point effect in the lagged year. This study is one of the few that tests for the effect of SBA loan following a natural disaster on economic growth (GDP), with most of the previous literature focused on income, business growth, or employment. The U.S. Department of Agriculture (USDA) loans, which are similar to the SBA loans in form but are more targeted to rural jurisdictions, has a 0.029 percentage point effect, with a lagged value of 0.021 points. Given the significance of the rural loans in a model with larger, more general federal response program influences controlled suggests the importance of rural communities in the recovery process and their contribution to the larger economic output of the State.

Next, the National Flood Insurance Program (NFIP), like the previous response measures, has a robust and positive impact on GDP, with a 0.057 percentage point effect in the year of distribution and a 0.071 percentage point effect in the lagged year. We note especially that this particular program has a larger impact on the GDP in the lagged year of distribution versus the year of payment distribution. This lagged impact may reflect local dynamics related to increased demand for construction services. With the jurisdiction having a temporarily inflated demand for construction sector businesses, individual households or businesses may be unable to locate and hire a contractor in a timely manner even after receiving insurance payouts. This will further delay an individual household or business from reinvesting recovery assistance funds in the local economy. Given these dynamics, it may be justified, and perhaps expected, that insurance monies have a larger impact in the lagged year and beyond.

6.1.2 DV 2: PER CAPITA PERSONAL INCOME (PCPI) MODEL

The results for the model with per capita personal income (PCPI) as the dependent variable are shown in Table 6.2Table 6.2. Again, although PCPI will be included in the other models as a control variable, it is included in this model as a dependent variable. In considering Table 6.2Table 6.2, presidential elections are known to have an influence on the amount federal disaster aid made available following a natural disaster and subsequent publicity. However, presidential elections are seen to have a robust negative influence on PCPI levels within the state, an outcome that may be attributed to decreased or delayed investment emerging from the uncertainty of an election cycle.

The Hurricane impact variable – past and present, with or without a lag – is statistically significant, negative, and robust across model specifications. The initial impact has a negative 0.057 percentage point effect, with a larger negative 0.079 percentage point effect in the following year. This indicates that the impact of a hurricane, regardless of the influx of federal monies into an economy, negatively affects PCPI. Also, the larger lagged effect shows that this negative influence is not isolated to a single year, but, rather, there is a negative spillover effect that appears to be amplified as more controls are put into place. This negative relationship, at the parish-level, is consistent with the results reported by Strobl (2011), who found that "hurricanes may cause large economic growth losses and disruption to economic activity at the local level in any year." While Strobl (2011) considered economic growth and this analysis considers levels, both dependent variables suggest that studies with larger units of analysis, like those that focus on state-

Table 6.2: Per Capita Personal Income (ln) ($00s)

		Model 1	Model 2	Model 3	Model 4	Model 5
Control Variables	Presidential Election	-0.016** (0.005)	-0.015** (0.006)	-0.015** (0.006)	-0.015** (0.006)	-0.012* (0.006)
Natural Disaster Events	Hurricane	-0.065*** (0.013))	-0.067*** (0.012)	-0.067*** (0.013)	-0.059*** (0.012)	-0.057*** (0.013)
	$Hurricane_{t-1}$	-0.050*** (0.009)	-0.052*** (0.009)	-0.052*** (0.009)	-0.066*** (0.012)	-0.079*** (0.013)
	2005 Hurricane Season	-0.046** (0.016)	-0.038** (0.015)	-0.038** (0.015)	-0.033** (0.015)	-0.026 (0.018)
Businesses Policy Responses	SBA (ln) ($000s)	0.012*** (0.002)	0.007*** (0.001)	0.007*** (0.001)	0.006*** (0.001)	0.006*** (0.001)
	SBA_{t-1} (ln) ($000s)		0.010*** (0.002)	0.010*** (0.002)	0.009*** (0.001)	0.009*** (0.001)
	USDA (ln) ($000s)	0.003 (0.003)	0.002 (0.003)	0.002 (0.003)	0.002 (0.003)	0.002 (0.003)
	$USDA_{t-1}$ (ln) ($000s)			0.001 (0.002)	0.000 (0.003)	0.001 (0.002)
Individual Policy Response	NFIP (ln) ($000s)	0.012*** (0.001)	0.010*** (0.001)	0.010*** (0.001)	0.009*** (0.001)	0.009*** (0.001)
	$NFIP_{t-1}$ (ln) ($000s)				0.007*** (0.002)	0.006** (0.002)
Government Policy Response	PA (ln) ($000s)	0.006*** (0.001)	0.005*** (0.001)	0.005*** (0.001)	0.005*** (0.001)	0.006** (0.001)
	PA_{t-1} (ln) ($000s)					0.005** (0.002)
	_cons	5.763*** (0.027)	5.745*** (0.024)	5.745*** (0.024)	5.736*** (0.024)	5.737*** (0.023)
	Random-Effects Parameters					
	sd(_cons)	0.056 (0.016)	0.051 (0.014)	0.051 (0.014)	0.046 (0.012)	0.044 (0.012)
	sd(Residual)	0.156 (0.007)	0.154 (0.007)	0.154 (0.007)	0.153 (0.007)	0.153 (0.007)
	AIC	-966.83	-997.00	-955.11	-1,006.99	-1,010.14
	Between Region Variability (ICC)	0.114	0.098	0.098	0.082	0.077

Note: All variables are reported with robust standard errors.
Significance Codes: '***' 0.001, '**' 0.01, '*' 0.05

level impacts, will show natural disasters as having "no net annual impact at the state level" and to "not show up in national growth volatility at all," despite there being significant impacts at the sub-state level (Strobl, The Economic Growth Impact of Hurricanes: Evidence from U.S. Coastal Counties, 2011, p. 588). That is, state-level models may not present the truest picture of natural disaster impacts. There may be significant, sub-state impacts that are aggregated away with a wider research lens.

This model also considers legacy disasters, represented by the 2005 Hurricane Season and finds that although the variable was robustly significant across specifications (Models 1 through 4), the inclusion of the lagged federal public assistance variable in Model 5 renders the legacy effects of the entire 2005 hurricane season insignificant. While the legacy effects of a disaster can further depress PCPI beyond that of the "typical" disaster, the distribution of public assistance monies appears able to mitigate such lingering influences.

Next, we consider the disaster response assistance provided by the federal government. The first funds to enter the economy are the business-related federal policy responses, or, rather, those monies that are given directly to businesses that apply for them. Considering the two sources of business loans, only the U.S. Small Business Administration (SBA) loans have a significant impact PCPI, with the effect being positive and robust across the models. SBA loans have a positive 0.006 percentage point effect in the year of distribution, amplified to a larger 0.009 percentage point effect the following year. The larger lagged effect of the small business loans may be attributed to the delay between business owners receiving funds and their spending those funds on rebuilding and recovery activities. For example, when a hurricane makes landfall, there is a sudden increase in the need for residential and commercial repairs, increasing the overall demand for construction services. Therefore, despite the business owner receiving the funds to make the repairs, there may be a delay in that owner being able to spend those funds given the heightened demand for construction services by others in the community. Of note, the positive effects of these federal funds on PCPI contradicts the findings in the extant literature. For example, Cortes (2010), in his panel data analysis on SBA lending and state-level economic performance, found that,

> The estimated coefficients for SBA lending were found to be small, insignificant, and had the unexpected negative signs with respect to its relationship with income. On the other hand, SBA loans had a positive and significant impact on the growth of small businesses and by consequence, the number of workers employed in small firms. (p. 55)

Although these positive and significant coefficients contradict the findings by Cortes (2010), the choice of unit of analysis may explain the discrepancy between these two findings. While Cortes (2010) explores this relationship at the state-level, the present study considers a county-level relationship, which may be more relevant. As suggested by Strobl (2011), state-level studies may aggregate away the significance of smaller unit relationships given that hurricanes, and other natural disasters, directly target only a limited number of jurisdictions.

FEMA's National Flood Insurance Program (NFIP) distributes insurance payments shortly after the entrance of the business loans. Like the SBA loan monies, Table 6.2 provides evidence that, with regards to PCPI, the NFIP is another positive federal response, with these funds registering a small but significant 0.009 percentage point impact on PCPI in the year of distribution and a 0.006 percentage point impact in the lagged year. Existing literature examining FEMA's NFIP program is focused on procurement of insurance and the socioeconomic factors that drive home and business owners to purchase flood insurance. Other literature that addresses insurance in a broad sense considers the effects on the storm's damages, largely ignoring the relationship between insurance and the recovering economy. These studies, although useful in advocating for insurance as a mitigator of natural disasters, are short-sighted. Both a natural disaster and the distribution of insurance monies are not isolated events. Each will ripple through a local economy and have influences beyond the repair of a single home or business. Table 6.2 provides evidence of these effects, with the NFIP having positive impacts on income, controlling for both the storm and other federal responses. Following this, FEMA's Public Assistance program is the last tranche of federal response funds to enter the local economy. Once again, the response package provided by the federal government appears to be successful in promoting economic recovery, at least with regards to the distribution of wealth measured through PCPI. Public Assistance increases PCPI by 0.006 percentage points in the first year, with a 0.005 percentage point impact in the lagged year. These impacts mirror the year-of impacts, with these effects hovering around a 0.006 percentage point effect throughout.

6.1.3 DV 3: RESIDENTIAL BUILDING PERMITS (VALUE)

Table 6.3 presents the findings for the first dependent variable related to activity associated with the actual rebuilding process. The aggregate value of Residential Building Permits is viewed as a potentially important indicator of the physical reconstruction in the residential sector. As we can see, the two economic background factors, per capita personal income (PCPI) and presidential elections, reveal their significance in diametrically opposed patterns across model specifications. PCPI has a significant and positive impact in Model 1 through 3 specifications, after which the variable retreats into statistical insignificance as a lagged control for flood insurance (National Flood Insurance Program) is introduced in Model 4. Meanwhile, the political contextual influence

Table 6.3: Residential Building Permits (Value) (ln) ($000,000s)

		Model 1	Model 2	Model 3	Model 4	Model 5
Control Variables	PCPI (ln) ($00s)	4.329** (2.154)	3.561* (2.075)	3.552* (2.068)	3.220 (2.007)	3.265 (2.036)
	Presidential Election	0.288 (0.174)	0.290 (0.164)	0.301* (0.163)	0.299** (0.129)	0.269* (0.139)
Natural Disaster Events	Hurricane	-0.173 (0.298)	-0.269 (0.290)	-0.279 (0.286)	-0.074 (0.319)	-0.096 (0.300)
	$Hurricane_{t-1}$	0.642** (0.228)	0.542** (0.210)	0.536** (0.204)	0.151 (0.286)	0.295 (0.415)
	2005 Hurricane Season	0.134 (0.375)	0.329 (0.323)	0.372 (0.317)	0.484 (0.353)	0.414 (0.404)
Businesses Policy Responses	SBA (ln) ($000s)	0.424*** (0.097)	0.302*** (0.070)	0.298*** (0.068)	0.269*** (0.068)	0.268*** (0.067)
	SBA_{t-1} (ln) ($000s)		0.280*** (0.070)	0.276*** (0.070)	0.246** (0.071)	0.246*** (0.071)
	USDA (ln) ($000s)	0.101** (0.061)	0.094 (0.059)	0.088* (0.053)	0.075 (0.046)	0.074* (0.045)
	$USDA_{t-1}$ (ln) ($000s)			0.042 (0.034)	0.042 (0.034)	0.039 (0.021)
Individual Policy Response	NFIP (ln) ($000s)	0.226*** (0.059)	0.189** (0.061)	0.187** (0.059)	0.166** (0.049)	0.171** (0.050)
	$NFIP_{t-1}$ (ln) ($000s)				0.200** (0.072)	0.212** (0.070)
Government Policy Response	PA (ln) ($000s)	-0.017 (0.051)	-0.025 (0.53)	-0.024 (0.052)	-0.021 (0.052)	-0.024 (0.054)
	PA_{t-1} (ln) ($000s)					-0.051 (0.061)
	_cons	-13.402 (13.649)	-9.468 (13.151)	-9.425 (13.112)	-7.771 (12.780)	-8.043 (12.962)
	Random-Effects Parameters					
	sd(_cons)	1.606 (0.533)	1.629 (0.551)	1.633 (0.552)	1.526 (0.477)	1.534 (0.403)
	sd(Residual)	4.149 (0.748)	4.086 (0.740)	4.084 (0.738)	4.059 (0.733)	4.057 (0.731)
	AIC	6,596.07	6,563.37	6,564.36	6,550.94	6,552.19
	Between Region Variability (ICC)	0.130	0.137	0.138	0.124	0.125

Note: All variables are reported with robust standard errors.
Significance Codes: '***' 0.001, '**' 0.01, '*' 0.05

of presidential elections years do not appear to register significant effects on post-disaster resident reconstruction, as indicated in Models 1 and 2. However, once the influence of the U.S. Department of Agriculture (USDA) and flood insurance are controlled within the parish-level economies (Models 3-5), we can see that the influence of presidential elections had been suppressed. When these latter funding influences are controlled, significant and positive effects associated with presidential election years emerge.

Since hurricanes can be associated with both immediate and lingering influences on communities and those who live in hurricane-prone areas, it is notable that there is no significant impact on the value of residential building permits issued in the year of a hurricane event. The lagged Hurricane variable, however, enters the model with a positive and significant in Model specifications 1 through 3, only to have that effect explained away in Models 4 and 5. Meanwhile, there is no evidence of lingering legacy effects as represented by the entire 2005 hurricane season. In the fully-specified model, Model 5, no disaster event variable retains statistical significance at all. Hurricane-related natural disasters appear to have no effect on the value of building permits, residential sector reinvestment begins. Having a null effect within the model goes against the previous literature concerning hurricanes and residential building permits. In contrast to previous studies, the effect of these natural disasters in this study is measured with respect to value of residential building permits, a metric that takes into consideration the construction value of single- and multifamily-structures, rather than the market value of a single-family home. Established literature on the market values of single family homes show mixed results, which may help account for the null result found in the value of residential permits. Beracha and Prati (2008) find that, "…when examining changes in our measures one full year following a hurricane, little evidence emerges suggesting a lingering effect on residential real estate prices, as prices have generally corrected back to their prior trend-line. However, a study conducted by the Federal Reserve Bank of Dallas found that in coastal communities a hurricane will raise real housing prices for several years following the impact (Murphy & Strobl, 2010).

The two federal loan programs, the U.S. Small Business Administration's (SBA) and the U.S. Department of Agriculture's (USDA), are associated with robust, but decidedly distinct, effect patterns. The SBA's business loan programs have an overall positive impact on the total value of residential building permits, with a 0.268 percentage point effect in the year of distribution and a 0.246 percentage point effect in the lagged year. The basic pattern persists across all five specifications (Models 1 through 5) with and without a lag. Meanwhile, the USDA loan program is less robust, with a smaller 0.074 percentage point effect in the distribution year, but with no significant lagged variable. Nonetheless, both business loan programs do appear to increase the value of residential construction, and in so doing offer evidence of effective federal disaster policy responses that contribute to the recovery and rebuilding of business and the residential sector vitality. As these more immediate federal disaster policy responses are initiated, flood insurance payments begin to flow to both individual households and business owners. Once again, the statistically significant flood insurance effects are robust and persistent, with a larger effect in the lagged variable versus the year-of variable. In Table 6.3, the National Flood Insurance Program as a 0.171 percentage point impact in the year of distribution and a 0.212 percentage point effect in the lagged year. Meanwhile, conventional public assistance funds appear to have no effect whatsoever on this dependent variable.

6.1.4 **DV 4: RESIDENTIAL BUILDING PERMITS (UNITS)**

While Table 6.3 (shown above) explored the impact of federal monies on the total *value* of residential building permits, this section, and the subsequent Table 6.4Table 6.4, considers the total *units* in the residential building permits. Put another way, while Table 6.3 considered the monetary investment in post-disaster residential construction, Table 6.4 considers the number of residential building permits issued at the parish level. As noted before, Per Capita Personal Income (PCPI) is introduced as an economic contextual factor representing the existing recovery capacity of a local economy prior to the impact of the natural disaster. The persistent positive and statistically significant PCPI effects reported in Table 6.4 document the powerful influence of pre-existing income – and likely wealth -- differences on a locality's ability to rebound from a natural disaster. In contrast, Presidential elections represents a potentially influential political contextual factor capable of influencing whether, when and to what extent federal disaster funds are made available following a natural disaster. That said, Table 6.4 offers no evidence of such an influence on the number of residential building permits issued, in contrast to the statistically significant positive influence (see Table 6.3) of this political contextual factor on the value of those permits. This difference may indicate that while the aggregate value of the residential reconstruction investment within a locality may not be affected by presential election year factors, it may influence both the number of units being permitted and rebuilt as well as the price per unit. Within the timeframe of this dissertation, there were two changes in presidential leadership. In 2001, President George W. Bush (R) succeeded President William J. Clinton (D) and in 2009, President Barack Hussein Obama (D) succeeded President George W. Bush (R). The increase in the value

Table 6.4: Residential Building Permits (Units) (ln)

		Model 1	Model 2	Model 3	Model 4	Model 5
Control Variables	PCPI (ln) ($00s)	2.428** (0.857)	1.996** (0.841)	1.991** (0.836)	1.758** (0.810)	1.791** (0.814)
	Presidential Election	0.026 (0.057)	0.026 (0.055)	0.033 (0.054)	0.033 (0.044)	0.010 (0.047)
Natural Disaster Events	Hurricane	-0.108 (0.126)	-0.163 (0.113)	-0.169 (0.115)	-0.024 (0.128)	-0.041 (0.124)
	Hurricane $_{t-1}$	0.310*** (0.043)	0.253*** (0.036)	0.250*** (0.035)	-0.021 (0.080)	0.085 (0.101)
	2005 Hurricane Season	-0.032 (0.142)	0.077 (0.121)	0.104 (0.124)	0.183 (0.121)	0.132 (0.137)
Business Policy Responses	SBA (ln) ($000s)	0.236*** (0.037)	0.167*** (0.022)	0.165*** (0.022)	0.144*** (0.025)	0.144*** (0.025)
	SBA $_{t-1}$ (ln) ($000s)		0.157*** (0.024)	0.155*** (0.025)	0.134*** (0.023)	0.134*** (0.023)
	USDA (ln) ($000s)	0.050*** (0.013)	0.046*** (0.013)	0.043*** (0.012)	0.034*** (0.009)	0.033*** (0.009)
	USDA $_{t-1}$ (ln) ($000s)			0.026** (0.011)	0.026** (0.010)	0.023** (0.010)
Individual Policy Response	NFIP (ln) ($000s)	0.149*** (0.029)	0.128*** (0.030)	0.127*** (0.029)	0.112*** (0.025)	0.115*** (0.025)
	NFIP $_{t-1}$ (ln) ($000s)				0.141*** (0.024)	0.149*** (0.023)
Government Policy Response	PA (ln) ($000s)	-0.014 (0.020)	--0.018 (0.020)	-0.017 (0.020)	-0.015 (0.021)	-0.018 (0.021)
	PA $_{t-1}$ (ln) ($000s)					-0.038* (0.022)
	_cons	-11.840** (5.244)	-9.631** (5.146)	-9.604** (5.116)	-8.446* (4.969)	-8.645* (4.991)
	Random-Effects Parameters					
	sd(_cons)	0.058 (0.083)	0.541 (0.093)	0.544 (0.094)	0.497 (0.070)	0.505 (0.070)
	sd(Residual)	1.416 (0.138)	1.358 (0.139)	1.356 (0.138)	1.315 (0.132)	1.313 (0.132)
	AIC	4,119.526	4,025.006	4,023.601	3,954.724	3,952.888
	Between Region Variability (ICC)	0.134	0.137	0.139	0.125	0.129

Note: All variables are reported with robust standard errors.
Significance Codes: '***' 0.001, '**' 0.01, '*' 0.05

of residential investment may reflect a broader quest for the economic stability associated with an incumbent being re-elected and a subsequent increase in investor confidence.

As was true in Table 6.3, the Hurricane variable influence is highly variable across model specifications. The hurricane effects in the year of the event are insignificant. However, while the lagged independent Hurricane effect is positive and significant throughout the first three model specifications, that influence of the lagged variable is explained away with the inclusion of the lagged flood insurance variable. These findings are in distinct contrast to those reported in the literature in which natural disasters decrease residential investment in those affected communities. For example, Cui, Liang, Ewing (2015) find that a hurricane,

> …can have either a temporary or permanent impact on a community but not both. In the former case, the level of construction activities was lowered following hurricane landfall but quickly recovered to the pre-storm norm. In contrast, the permanent impact shifted the mean value of the time series and, as a result, the loss will stay with the community in the foreseeable future (p. 9).

In the present analysis there could well be temporary impacts that would not be evident in the results reported in Table 6.4, given the time period covered and the varied model specifications. However, these results do suggest that the permanent impact may not be true and that this shift in mean value is mitigated by insurance.

Continuing the comparison with the previous dependent variable, the value of residential building permits, given that both dependent variables provide alternative perspectives on the same basic measure, the federal policy responses overall have smaller impacts on the number of residential building permits issued than on the aggregate value of the permits. For example, U.S. Small Business Administration (SBA) loans have a 0.144 percentage point impact in the final model iteration compared to the 0.268 percentage point impact shown in the same model for the value of residential building permits. The lagged SBA loan variable follows a similar pattern. U.S. Department of Agriculture (USDA) loans have a smaller -- although still positive and robustly significant -- impacts on residential units, with a 0.033 percentage point impact and a lagged impact of 0.023 percentage points. Overall, federal response in the form of SBA and USDA business loans is effective at increasing residential construction, although there is a greater effect on the value of residential building permits compared to the volume of the building permits issued.

The individual household-targeted response, the Federal Emergency Management Agency's (FEMA) flood insurance program, has a robust and positive impact on the number of units encompassed in the building permits, with a 0.115 percentage point impact and a lagged impact of 0.149. Comparatively, this is smaller than the impact and lagged impact of the residential value variable, with the impacts being 0.071 percentage points and 0.212 percentage points, respectively.

Up to this point the federal response measures have shown an overwhelmingly positive influence on a variety of dependent variables. Those variables that reflected a negative relationship generally lacked statistical significance. However, Table 6.4 reports the first negative and statistically significant impact of a federal disaster-response program. In Model 5, FEMA's Public Assistance is associated with a negative 0.038 percentage point lagged impact on the number of units in the residential building permits. This suggests that those communities receiving Public Assistance funds have seen a decline in residential investment, largely reflected in a longer-term decrease in the number of residential units being permitted for rebuilding in a given location. This negative relationship may suggest that the receipt of Public Assistance funding may cause a year-of surge in residential building permit issuances that steadily declines in subsequent years. We also know that Public Assistance funds tend to be bundled with other matching funds from the federal government and must wind their way through multiple agency bureaucracies before becoming available locally. To add perspective to the size of this relationship, the Public Assistance program' negative impact is larger than the USDA's positive impact.

Residential Permits: Price Per Unit

It is reasonable to suggest that price-per-unit would be a better reflection of residential re-investment than the measures used in previous analyses. Table 6.5 addresses this possibility and considers price per unit for residential building permits through the lens of the final model iteration show in the previous tables. It should be noted that this is not the price-per-unit for each individual building permit, but rather an aggregated price-per-unit that is derived by dividing the total value of the permits by the total number of units in the given permits. All values are reported in a non-logged form and in dollars ($) per unit. Table 6.5 reports fewer significant policy impacts than we have seen in Tables 6.3 and 6.4. Economically stronger communities, which likely boast higher Per Capita Personal Income (PCPI) will also see higher price-per-unit investments. Theoretically, a one percentage point increase in PCPI translates into a $118,014 price-per-unit increase in the value of residential building permits. As expected, the Hurricane variable, which had inconsistent influences on the previous variables, has an average negative $12,000.00 impact on the price-per-

Table 6.5: Residential Building Permits (Dollar Per Unit)

		Model
Control Variables	PCPI (ln) ($00s)	118,013.800*** (28,702.740)
	Presidential Election	4,836.869 (3,409.854)
Natural Disaster Events	Hurricane	-12,176.750** (4,769.551)
	Hurricane $_{t-1}$	-40.127 (5,862.443)
	2005 Hurricane Season	7,802.281 (6,115.314)
Business Policy Responses	SBA (ln) ($000s)	593.627 (738.748)
	SBA$_{t-1}$ (ln) ($000s)	1,091.431 (885.659)
	USDA (ln) ($000s)	1,341.913 (1,052.045)
	USDA$_{t-1}$ (ln) ($000s)	963.070* (509.393)
Individual Policy Response	NFIP (ln) ($000s)	44.962 (897.762)
	NFIP$_{t-1}$ (ln) ($000s)	-1,994.615** (959.936)
Government Policy Response	PA (ln) ($000s)	93.924 (1,129.066)
	PA$_{t-1}$ (ln) ($000s)	1,122.751 (1,304.853)
	_cons	-535,703.600** (174,793.900)
	Random-Effects Parameters	
	sd(_cons)	15,546.380 (4,130.585)
	sd(Residual)	71,188.240 (8,942.000)
	AIC	29,060.260
	Between Region Variability (ICC)	0.046

Note: All variables are reported using robust standard errors.
Significance Codes: '***' 0.001, '**' 0.01, '*' 0.05

unit for residential permits, although the lagged Hurricane variable and legacy hurricane disasters impacts are insignificant.

Unlike the previous models, which have shown wide variation across a variety of federal disaster relief policies, there are only two response variables significant in Table 6.5: the lagged U.S. Department of Agriculture (USDA) business loan and the lagged National Flood Insurance Program (NFIP). USDA loans increases the average price-per-unit for residential investment by nearly $1,000.00, although this impact is small when considering the typical price of investment projects. The NFIP has a negative impact in the model, which is an unexpected relationship for this variable, especially considering the effects reported in previous models in this analysis. The lagged distribution of flood insurance payments decreases the average price-per unit for residential building permits by nearly $2,000.00. Again, similar to the relationship with USDA loans, this figure is quite small in the "grand scheme" of residential investment, but it still speaks to the fact that there appears to be a negative relationship between these two variables. This suggests that the distribution of flood insurance payouts, which are only provided for when an homeowner or businessowner had purchased flood insurance, received flood damage, and filed an insurance claim for that damage, may send a negative signal to investors who may be considering a residential investment in that community.

6.1.5 DV 5: ESTABLISHMENT COUNT

Sections 6.1.5 and 6.1.6 explore the relationship between federal response and two business-related dependent variables: establishment and employment counts. The dependent variable for the establishment model presented in Table 6.6 is measured as a log of the total count of establishments within a given parish. Per Capita Personal Income (PCPI), which represents the

Table 6.6: Establishments (ln)

		Model 1	Model 2	Model 3	Model 4	Model 5
Control Variables	PCPI (ln) ($00s)	1.741*** (0.291)	1.434*** (0.277)	1.431*** (0.281)	1.308*** (0.272)	1.327*** (0.269)
	Presidential Elections	-0.027 (0.034)	-0.027 (0.028)	-0.020 (0.027)	-0.019 (0.026)	-0.032 (0.027)
Natural Disaster Events	Hurricane	-0.021 (0.067)	-0.060 (0.061)	-0.065 (0.062)	0.008 (0.069)	-0.001 (0.066)
	Hurricane $_{t-1}$	0.147*** (0.018)	0.107*** (0.014)	0.104*** (0.013)	-0.029 (0.044)	0.028 (0.043)
	2005 Hurricane Season	-0.212** (0.066)	-0.135** (0.057)	-0.111* (0.058)	-0.070 (0.046)	-0.098* (0.052)
Business Policy Responses	SBA (ln) ($000s)	0.167*** (0.020)	0.118*** (0.011)	0.116*** (0.012)	0.106*** (0.011)	0.105*** (0.011)
	SBA $_{t-1}$ (ln) ($000s)		0.111*** (0.012)	0.109*** (0.012)	0.098*** (0.010)	0.099*** (0.010)
	USDA (ln) ($000s)	0.040*** (0.008)	0.037*** (0.008)	0.033*** (0.007)	0.029*** (0.006)	0.029*** (0.006)
	USDA $_{t-1}$ (ln) ($000s)			0.023*** (0.004)	0.023*** (0.003)	0.022*** (0.003)
Individual Policy Response	NFIP (ln) ($000s)	0.083*** (0.012)	0.068*** (0.011)	0.067*** (0.011)	0.059*** (0.010)	0.061*** (0.011)
	NFIP $_{t-1}$ (ln) ($000s)				0.069*** (0.007)	0.074*** (0.008)
Government Policy Response	PA (ln) ($000s)	-0.003 (0.011)	-0.006 (0.010)	-0.010 (0.010)	-0.005 (0.011)	-0.006 (0.011)
	PA $_{t-1}$ (ln) ($000s)					-0.021** (0.010)
	_cons	-4.697** (1.609)	-3.124** (1.536)	-3.106** (1.557)	-2.486* (1.505)	-2.599* (1.482)
	Random-Effects Parameters					
	sd(_cons)	0.169 (0.037)	0.130 (0.029)	0.130 (0.030)	0.129 (0.025)	0.127 (0.025)
	sd(Residual)	0.669 (0.026)	0.607 (0.022)	0.603 (0.023)	0.580 (0.022)	0.578 (0.022)
	AIC	2,385.372	2,159.604	2,147.36	2,060.27	2,056.377
	Between Region Variability (ICC)	0.060	0.044	0.045	0.047	0.046

Note: All variables are reported with robust standard errors.
Significance Codes: '***' 0.001, '**' 0.01, '*' 0.05

parishes' economic preconditions has a robust and positive impact on establishment counts, with a 1.327 percentage point effect in the final model specification (Model 5). The positive and robust relationship across specifications is somewhat expected considering that a higher PCPI might indicate a vibrant economy which would be conductive to business investment. The other pre-condition, presidential elections, has no apparent effect. This contrasts with the previous model set for which the value of residential building permits was the dependent variable.

The impact of recent and past natural disasters, represented through the Hurricane variable, also has no initial, or year-of, effect on businesses. The lagged Hurricane variable enters the model with a statistically significant relationship in the initial model specifications (Models 1-3). However, once the flood insurance variable is controlled for (Model 4) the original hurricane effect is explained away in the lagged specification (Model 5). However, this pattern is different for the legacy disasters in which the 2005 Hurricane Season is the covariate. The variable shows a significant independent negative effect across the first three models, with a negative 0.111 percentage point impact on establishments in Model 3. The inclusion of the lagged flood insurance control in Model 4 temporarily suppresses this negative effect, however a negative 0.098 percentage point effect re-emerges in Model 5 once the lagged Public Assistance program influence is controlled. This suggests that the more influential legacy disasters can diminish a parish business population, perhaps through the discouragement of business investment. Other studies have cited the positive influences of natural disasters on the business community, with Jarmin and Miranda (2009) claiming local economies to have a strong resiliency in response to natural disasters (Jarmin & Miranda, 2009, p. 15). However, the results in the above model suggest otherwise, at least with respect to legacy disasters like Hurricane Katrina in 2005. In addition, previous literature has shown a relationship between the business community and the residential community, with both sectors contributing to each other's successful recoveries. Table 6.6, however, may suggest that although the business community contributes to the recovery process of the residential community, and vice versa, these two communities are not equally impacted by natural disasters. In Table 6.6, where legacy disasters had no impact on the number of units or the value of residential building permits, there is a significant negative influence on the number of establishments within a parish. That is, although these two communities are connected within an economy (and within the recovery process), the residential community is more resilient to these more impactful natural disasters than the business community.

Looking broadly at the influence of federal disaster relief on business activity, it is apparent that both sources of targeted disaster relief – SBA and USDA programs – have statistically significant robust and independent positive impacts on business establishment counts. While the effect of SBA business loans is positive across Models 1-5, the size of the effect is smaller than the effects associated with other dependent variables such as Gross Domestic Product (GDP). This seems reasonable since establishment counts are conceptually prior to measures of the value of levels of aggregate economic activity. The final iteration of the model, Model 5, shows SBA loans as having a 0.105 percentage point impact on establishment counts, with a 0.099 percentage point impact in the lagged year. A smaller, though still robust and significant, impact is shown in the U.S. Department of Agriculture (USDA) loans, with a 0.029 percentage point impact in the year of distribution and a 0.022 percentage point impact in the lagged distribution year in Model 5.

Consistent with the results reported in previous models, flood insurance payouts exert a robust, positive, and significant influence on establishment counts. The Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP) has been a consistently positive influence on all the previous dependent variables. The NFIP's larger impact in the lagged impact versus the non-lagged impact is also consistent with previous models. In the final model, Model 5, the NFIP registers a 0.061 percentage point impact during the year in which insurance payments are disbursed, with a larger 0.074 percentage point impact in the lagged year.

Similar to the effect on residential building permits issued, Federal Emergency Management Agency's Public Assistance program exerts a negative 0.021 percentage point impact on establishment (Model 5). This effect represents one of the few significant negative effects registered on our selected dependent variables, and Public Assistance payments are associated with negative effect in each instance. This may suggest that across a variety of federal disaster assistance policy responses, the Public Assistance program is the one program most likely to discourage potential investors in the business and residential sectors.

6.1.6 DV 6: EMPLOYMENT COUNT

Table 6.7 presents the results for federal disaster aid impacts on parish-level employment counts (logged). The first economic contextual factor, Per Capita Personal Income (PCPI), is associated with an independent positive influence on employment counts across all model specifications, with a 1.621 percentage point impact in Model 5. Similar to the pattern across models predicting establishment counts, this relationship would be expected, as healthier economies are likely to host healthier job markets and fuller employment levels. Another similarity between the employment

Table 6.7: Employment (ln)

		Model 1	Model 2	Model 3	Model 4	Model 5
Control Variables	PCPI (ln) ($00s)	2.068*** (0.325)	1.731*** (0.304)	1.727*** (0.311)	1.604*** (0.306)	1.621*** (0.304)
	Presidential Elections	-0.022 (0.037)	-0.022 (0.027)	-0.015 (0.027)	-0.014 (0.026)	-0.026 (0.027)
Natural Disaster Events	Hurricane	-0.030 (0.080)	-0.073 (0.074)	-0.078 (0.075)	-0.006 (0.082)	-0.014 (0.079)
	Hurricane $_{t-1}$	0.155*** (0.026)	0.110*** (0.020)	0.107*** (0.020)	-0.024 (0.048)	0.029 (0.048)
	2005 Hurricane Season	-0.231*** (0.066)	-0.146** (0.057)	-0.122** (0.058)	-0.081* (0.048)	-0.108* (0.057)
Business Policy Responses	SBA (ln) ($000s)	0.187*** (0.021)	0.133*** (0.011)	0.131*** (0.012)	0.121*** (0.012)	0.121*** (0.012)
	SBA_{t-1} (ln) ($000s)		0.123*** (0.011)	0.121*** (0.012)	0.110*** (0.011)	0.111*** (0.010)
	USDA (ln) ($000s)	0.041*** (0.009)	0.039*** (0.009)	0.035*** (0.009)	0.031*** (0.008)	0.030*** (0.008)
	$USDA_{t-1}$ (ln) ($000s)			0.023*** (0.005)	0.023*** (0.004)	0.022*** (0.005)
Individual Policy Response	NFIP (ln) ($000s)	0.086*** (0.014)	0.070*** (0.013)	0.069*** (0.013)	0.061*** (0.013)	0.063*** (0.013)
	$NFIP_{t-1}$ (ln) ($000s)				0.068*** (0.008)	0.073*** (0.010)
Government Policy Response	PA (ln) ($000s)	-0.002 (0.012)	-0.010 (0.011)	-0.005 (0.011)	-0.005 (0.012)	-0.010 (0.013)
	PA_{t-1} (ln) ($000s)					-0.019* (0.011)
	_cons	-4.164** (1.803)	-2.438 (1.690)	-2.419 (1.727)	-1.796 (1.697)	-1.899 (1.681)
	Random-Effects Parameters					
	sd(_cons)	0.174 (0.063)	0.133 (0.062)	0.124 (0.062)	0.132 (0.048)	0.134 (0.049)
	sd(Residual)	0.758 (0.030)	0.691 (0.027)	0.688 (0.028)	0.668 (0.028)	0.667 (0.028)
	AIC	2,672.71	2,458.279	2,449.53	2,385.798	2,384.004
	Between Region Variability (ICC)	0.050	0.036	0.037	0.038	0.039

Note: All variables are reported with robust standard errors.
Significance Codes: ‘***’ 0.001, ‘**’ 0.01, ‘*’ 0.05

and establishment models is the pattern seen in the Hurricane variable. The year-of impacts of a hurricane disaster show no effect across model specifications. The lagged Hurricane variable only shows significance in Models 1 through 3, after which the inclusion of the lagged flood insurance payouts explains away the lagged Hurricane's effect in the remaining models. The 2005 Hurricane Season, representing the impact of two legacy disasters, does, however, exert a robust and significant relationship with employment. The impact of legacy disasters, like Hurricanes Katrina and Rita, decrease employment levels by 0.108 percentage points, despite controlling for economic pre-conditions and the influx of federal aid.

These findings both contradict and corroborate previous understandings within the literature. Belasen and Polachek (2008), in their evaluation of Florida's local labor markets, find that "employment decreases by as much as 4.76 percent and earnings rise by up to 4.35 percent in counties directly hit" by a natural disaster (p. 53). This analysis suggests that, while employment levels decline in the wake of a natural disaster such as a hurricane, this effect is reserved for relatively severe natural disaster events. Those events not categorized as a "legacy disaster" will not trigger significant employment effects. Put another way, the relationship found in Belasen and Polachek's (2008) analysis is also seen within study, but with this study suggesting a caveat to the findings: a natural disaster must be severe for negative effects to be registered.

The overall effectiveness of federal response in recovering employment shows robust and positive relationships throughout the different model specifications. Model 5 shows the U.S. Small Business Administration (SBA) business loans having a 0.121 percentage point impact in the first year, with a 0.111 percentage point impact in the lagged year. These figures are similar to those for the establishment count model, although slightly larger in size. The U.S. Department of

Agriculture (USDA) loans also have a positive influence on employment, with a 0.030 percentage point impact in the year of fund distribution, followed by a 0.022 percentage point lagged impact, as shown in Model 5. Again, given the direct link between business loans and establishments, and the link between establishments and employment, these positive and robust relationships are expected. Simply put, these findings suggest that at the most basic level SBA business loans are successful in promoting business-related investments that increase employment within the parish.

Insurance payouts from the National Flood Insurance Program (NFIP) follow the same pattern as the previous models in this study, with a larger lagged impact than non-lagged impact, and with the variable displaying robustness and a positive coefficient across model specifications. The final model iteration in Table 6.7 shows the NFIP having an initial 0.063 percentage point impact, followed by a lagged 0.072 percentage point impact. The Federal Emergency Management Agency's (FEMA) other response program, the Public Assistance program, shows a negative lagged relationship with employment counts. This reflects the same relationships seen earlier with the establishment counts and residential building permit (units) models. Entering the model in the fifth iteration, Model 5, the lagged Public Assistance variable has a negative 0.019 percentage point impact on employment counts. As discussed in previous sections, the negative sign before this relationship is unusual when considering all the other relationships in the model, although it appears to follow a pattern found in the previous three dependent variables. This suggests that some aspect of the program inhibits, rather than promotes, local economic recovery, a pattern which reflects either how the funds are distributed, the signal the funds send to investors, or some other influence tested in this model.

6.1.7 OVERVIEW OF THE MODEL RESULTS

To understand the broader implications of the results, Table 6.8 provides an overview of the final model specifications (Model 5) for all dependent variables. As discussed in Chapter 4, although each of the dependent variables provide its own perspective for understanding specific mechanisms at work in a recovering economy, additional understanding can be gained by viewing economic recovery as a complex system where the whole is "greater than the sum of its parts."

Overall, the local economies explored in this analysis show tremendous resiliency in response to natural disasters, with there being few significant enduring effects from the Hurricane variable. For most of the models, significant Hurricane effects were explained away with the inclusion of the lagged flood insurance variable. The impact of a legacy disaster, like Hurricane Katrina, also had no major influence on the local economies, with the exception of the two business-related dependent variables, establishments and employment, which boasts a negative relationship with the 2005 Hurricane Season. In short, this dissertation has sought to explore the relationship of federal disaster assistance funds from multiple sources on economic recovery responses. However, the overall resiliency of parishes to hurricane impacts, coupled with the fact that the hurricane variable had a positive coefficient in many instances before being explained away through the model specification process, may suggest that these economies should not be viewed as "recovering," given their ability to absorb much of the impact of the natural disaster with very little consequences. This does not suggest that there are not those households and businesses within the communities which do face post-disaster challenges, but rather that at the aggregated parish level, there is a real resiliency in response to natural disaster events.

Table 6.8: Overview of All Models

		Economic Performance		Residential Construction		Business Dynamics	
		Per Capita Personal Income (00s) (ln)	Gross Domestic Product (000s) (ln)	Residential Building Permits (000,000s) (ln)	Residential Building Permits (ln)	Establishments (ln)	Employment (ln)
Control Variables	PCPI (ln) ($00s)		1.980*** (0.319)	3.265 (2.036)	1.791** (0.814)	1.327*** (0.269)	1.621*** (0.304)
	Presidential Elections	-0.012* (0.006)	-0.034 (0.028)	0.269* (0.139)	0.010 (0.047)	-0.032 (0.027)	-0.026 (0.027)
Disaster Event	Hurricane	-0.057*** (0.013)	-0.006 (0.079)	-0.096 (0.300)	-0.041 (0.124)	-0.001 (0.066)	-0.014 (0.079)
	$Hurricane_{t-1}$	-0.079*** (0.013)	-0.002 (0.051)	0.295 (0.415)	0.085 (0.101)	0.028 (0.043)	0.029 (0.048)
	2005 Hurricane Season	-0.026 (0.018)	0.033 (0.055)	0.414 (0.404)	0.132 (0.137)	-0.098* (0.052)	-0.108* (0.057)
Business Policy Responses	SBA (ln) ($000s)	0.006*** (0.001)	0.117*** (0.012)	0.268*** (0.067)	0.144*** (0.025)	0.105*** (0.011)	0.121*** (0.012)
	SBA_{t-1} (ln) ($000s)	0.009*** (0.001)	0.108*** (0.011)	0.246*** (0.071)	0.134*** (0.023)	0.099*** (0.010)	0.111*** (0.010)
	USDA (ln) ($000s)	0.002 (0.003)	0.029*** (0.008)	0.074* (0.045)	0.033*** (0.009)	0.029*** (0.006)	0.030*** (0.008)
	$USDA_{t-1}$ (ln) ($000s)	0.001 (0.002)	0.021** (0.005)	0.039 (0.021)	0.023** (0.010)	0.022*** (0.003)	0.022*** (0.005)
Individual Policy Response	NFIP (ln) ($000s)	0.009*** (0.001)	0.057*** (0.013)	0.171** (0.050)	0.115*** (0.025)	0.061*** (0.011)	0.063*** (0.013)
	$NFIP_{t-1}$ (ln) ($000s)	0.006** (0.002)	0.071*** (0.008)	0.212** (0.070)	0.149*** (0.023)	0.074*** (0.008)	0.073*** (0.010)
Government Policy Response	PA (ln) ($000s)	0.006** (0.001)	-0.003 (0.013)	-0.024 (0.054)	-0.018 (0.021)	-0.006 (0.011)	-0.010 (0.013)
	PA_{t-1} (ln) ($000s)	0.005*** (0.002)	-0.011 (0.011)	-0.051 (0.061)	-0.038* (0.022)	-0.021** (0.010)	-0.019* (0.011)
	_cons	5.737*** (0.023)	7.889*** (1.757)	-8.043 (12.962)	-8.645* (4.991)	-2.599* (1.482)	-1.899 (1.681)
	Between Region Variability (ICC)	0.077	0.037	0.125	0.129	0.046	0.039

Note: All variables are reported with robust standard errors.
Significance Codes: '***' 0.001, '**' 0.01, '*' 0.05

The federal response package, which includes different levels of aid provided through multiple departments and administrations, has an overwhelmingly positive and robust relationship with the dependent variables. The U.S. Small Business Administration's (SBA) loan program and the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP) are the "heavy hitters" of the federal response, displaying consistent, positive, and relatively large impacts across all dependent variables. FEMA's Public Assistance (PA) program was the only program, of those tested in the model, to indicate a negative relationship with the dependent variable. This negative relationship was seen only in the lagged PA variable and only for those dependent variables displayed as "counts" and not monetary units: total units for residential building permits, employment counts, and establishment counts.

Among the six dependent variables, the largest program impacts are seen in the model exploring the value of the residential building permits, with the size of the impact five to ten percentage points higher than the other dependent variables. Other dependent variables that saw larger comparative effects include Gross Domestic Product (GDP) and Employment.

Size of the Coefficients

There should be comment on the size of the coefficients given that the coefficients, though abundantly significant, may be considered small. Having relatively small coefficients, especially within the context of these independent variables, does not indicate irrelevance or diminish the empirical significance of the results. Rather, the statistical significance of an impact is by far the most important indicator of the efficacy of a disaster assistance program. In those studies that address the effectiveness of government programs, especially programs from executive branch administration, like the U.S. Small Business Administration, coefficients often show impacts to the tenth or the hundredth of a decimal point, despite having a wide variety of dependent measures (Craig, Jackson, & Thomson, 2007; Young, Higgins, Lacombe, & Sell, 2014). Therefore, the size of the coefficients in these analyses should not signal a relative irrelevance, but, rather, that the size of these coefficients are consistent with previous literature.

6.2 RESEARCH QUESTION #2: DIFFERENCE IN REGIONAL EFFECTS

This analysis sought to understand, not only the impact of federal response on economic recovery, but also to determine there were regional differences between the local economies that could impact the success of the federal aid programs. The multi-level model structure allows for this question to be answered. Section 6.1 focused on the relationships of the independent variables, largely ignoring the between-region variation measured through a multi-level model. However, this section, Section 6.2, will bring that variation into the narrative and explore whether there are regional differences in the impact of these independent variables on the dependent measures.

First, the statistical significance of the multi-level model suggests that there are, indeed, between-region differences in the model. This variation is reported in the "Between-Region Variation" line in the model, otherwise known as the intraclass correlation coefficient (ICC), which represents the portion of variation in the dependent variable that is attributed to regional differences. Explained differently, the ICC value "reports on the amount of variation unexplained by any predictors in the model that can be attributed to the grouping variable" (Multilevel Modeling Tutorial Using SAS, Stata, HLM, R, SPSS, and Mplus, 2015).

Between the two traditional economic dependent variables, Per Capita Personal Income (PCPI) sees the larger between-region variables, 7.7 percent, compared to Gross Domestic

Product's (GDP) 3.7 percent. This difference in variation is reflective of a previous comment on wealth: while GDP measures the wealth of a region, it does not account for the distribution of this wealth. Here, regional differences account for little variation in the GDP measure, but PCPI, which focuses on the *distribution* of this wealth being measured with GDP, sees much larger regional differences and suggest that there are disparities in wealth among Louisiana regions. NOLA.com published an article of the fifty richest places in Louisiana by zip code, using data from 2014 U.S. Internal Revenue Service (IRS) tax returns, and of the zip codes, the majority of wealth was concentrated in five of the eight regions in the state (Evans, 2017). This concentration of wealth may be reflecting this larger between-region variance value seen in the PCPI and may also be suggestive of the patterns see among the residential investment variables, which boast the largest ICC values. The residential building permit variables attribute about thirteen percent of the variation to between-region differences for both the value and unit measures. These values are significant and are suggestive of, again, concentrations in wealth and investment among the state, and may also reflect concentrations of population. Within the context of this dissertation, this variation provides evidence that "not all region is made the same" within the state. Thus, it would be logical to assume that if there are discrepancies in wealth and investment between the states, that the effectiveness of these federal programs within these different regions would also differ. For example, business loan programs in a wealthier and healthier region are going to function much differently, and probably more successfully, than a business loan program in a weaker region. The caveat to this conclusion is that those regions seen as being wealthier (and with likely more investment in businesses and real estate) are those regions situated along the coast of the Gulf of Mexico, with the exception of the Shreveport (Coordinating and Development District) region. They are likelier to both be impacted by a hurricane and to receive more substantial federal aid. The business-related dependent variables, establishment and employment counts, have some of the smallest variation attributed to between-region differences, with 4.4 percent and 3.9 percent values, respectively. Here, the size of the variation is similar, suggesting that regional variations that impact the number of establishments will impact employment in equal measure.

6.2.1 SIZE OF BETWEEN-REGION VARIATION

With three of the six final models having ICC values smaller than five percent, there should be some comment to the size of the between-region variation. It may be criticized that ICC values smaller than five percent are theoretically insignificant and reduce the need for the multi-level model. For example, Thomas and Heck (2001) argue

> in the absence of substantial ICC (e.g., where the ICC is somewhat less than .05), there is little need to adjust for the design effect associated with this clustering. In such cases where the observations are nearly independent, traditional multiple regression analysis using appropriately weighted data will provide accurate estimates of the parameters and standard" (Thomas & Heck, 2001).

However, others within the literature still argue for the use of a multi-level model within this context and hold it as a best practice, given that the multi-level model will account for a clustering effect, should there be one and will result in unbiased coefficients and standard errors (Huang, 2018). Thus, this analysis stands by the use of a multi-level model.

6.3 ALTERNATIVE MODELS

This dissertation has taken several measures to ensure the validity of the models and conclusions. First, with the research design, most of the included variables, with the exception of the federal response measures are taken from established literature. Second, with the model iterations, the lagged measures are added independently to test for spuriousness among the variables. Third, with model selection, the "best" model, displayed as Model 5 in the above tables, are chosen based on their Akaike Information Criterion (AIC) value, which measures the quality of the statistical model. Beyond these, additional robustness checks in the form of alternative control variables and alternative models provide additional validity to the research design.

6.3.1 ALTERNATIVE MODEL #1: COASTAL AND COASTAL ADJACENT

Development literature alludes to the socioeconomic differences between coastal communities, such as New Orleans, Louisiana, and non-coastal communities, like Shreveport, Louisiana. It is often cited that coastal communities will see increased investment, with these activities often undeterred by hurricane impacts. For example, Saginor and Ge (2017) note that, "despite taking multiple direct hits from hurricanes, the willingness of people to pay more for homes close to or on the waterfront only diminishes after major hurricanes during times of slow or moderate growth" (Saginor & Ge, 2017, p. 365). It is also true that coastal parishes see direct impacts and increased damages from hurricanes compared to their non-coastal counterparts. Strobl (2011) adds, "only a small proportion of the total geographic area of the United States, that relatively close to the coast, is affected by hurricanes since these quickly lose speed once they hit landfall. Moreover, storm surges generally cause most of the damages due to hurricanes, and this again is most relevant for coastal areas" (Strobl, The Economic Growth Impact of Hurricanes: Evidence from U.S. Coastal Counties, 2011, p. 577). Therefore, the distinction between coastal and non-coastal parishes is important and should be accounted for within the research design. Although the regional nesting may subtly address this issue, two dummy variables are included within the model as a robustness check to ensure the distinction between coastal and non-coastal proximity. These variables are "Coastal Parish" and "Coastal Parish Adjacent," with "Coastal Parish" presenting a "1" for those parishes located along the Gulf of Mexico and "Coastal Parish Adjacent" presenting a "1" for those parishes contiguous to coastal parishes but are not directly adjacent to the Gulf of Mexico. Adjacency to coastal parishes is included, in conjunction with immediate coastal proximity, for two reasons: topography and spillover effects. First, with topography, much of the Louisiana coast is marsh land and, of those parishes that immediately boarder the Gulf of Mexico, significant portions of the parish are inhabitable. For example, although Cameron Parish has the largest total area of the state, it holds the second smallest population. Secondly, in considering spillover effects, it is likely that those parishes that do not directly border the Gulf of Mexico will still gain economic benefits from being near coast. For example, two of the state's major metropolitan areas, Lake Charles and Lafayette, are not considered coastal parishes, but are adjacent to coastal parishes. The model results are shown in Table 8.1 of the Appendix. Despite the inclusion of the coastal dummy variables, the size, sign, and significant of the coefficients remain largely unchanged, with the coastal variables having no significance in the models.

6.3.2 **ALTERNATIVE MODEL #2: ONE-YEAR AND TWO-YEAR LAG LENGTHS**

As mentioned in Chapter 4, a one-year lag length was implemented over longer lag lengths both because of the *n* data points and because of the lack of practicality of longer lag lengths in real-world application. However, it may still be argued that, with these being federal programs and with natural disasters being an event that will likely delay application processing times due to the drastic increase in demand for aid, a two-year lag length may be applicable to this research question. As a robustness check, a two-year lag length is added to the previous models, shown in

Table 8.2 of the Appendix. Overall, those federal monies that had positive and significant relationship in the both the first and the lagged year measures also show a positive and significant relationship in the second lagged variables. The coefficients of the federal aid measures are slightly smaller, but this likely arises from the additional lag. A significant difference between the models occurs in the Federal Emergency Management Agency's Public Assistance (PA) program. While a lagged PA measure is significant and negative for Per Capita Personal Income (PCPI), all other measures are insignificant. That is, previously significant relationships disappear with the extended lag lengths. Beyond this difference, the federal aid measures are largely robust, including in their size, sign, and significant.

6.3.3 ALTERNATIVE MODEL #3: EXCLUDING PUBLIC ASSISTANCE MONIES

In reviewing the four programs selected for the research design, it may be argued that, while there are commonalities between the business loan programs and the flood insurance program, the Federal Emergency Management Agency's Public Assistance program is the "odd man out." Although the inclusion of the Public Assistance program was driven by theory and is preferred to be included in the model, the mode of distribution does differ significantly from the other three programs and its use may be criticized within this context. Put another way, the other programs provide financial aid directly to individuals, whether they be business owners or homeowners. The Public Assistance program provides financial aid to governments and for specific uses outlined by the program. To address this concern, an additional model is provided which excludes public assistance monies from the design, as shown in Table 8.3 of the Appendix. The impact of the federal aid monies remains largely similar to those impacts shown in Table 6.8These findings both contradict and corroborate previous understandings within the literature.

Belasen and Polachek (2008), in their evaluation of Florida's local labor markets, find that "employment decreases by as much as 4.76 percent and earnings rise by up to 4.35 percent in counties directly hit" by a natural disaster (p. 53). This analysis suggests that, while employment levels decline in the wake of a natural disaster such as a hurricane, this effect is reserved for relatively severe natural disaster events. Those events not categorized as a "legacy disaster" will not trigger significant employment effects. Put another way, the relationship found in Belasen and Polachek's (2008) analysis is also seen within study, but with this study suggesting a caveat to the findings: a natural disaster must be severe for negative effects to be registered.

The overall effectiveness of federal response in recovering employment shows robust and positive relationships throughout the different model specifications. Model 5 shows the U.S. Small Business Administration (SBA) business loans having a 0.121 percentage point impact in the first year, with a 0.111 percentage point impact in the lagged year. These figures are similar to those for the establishment count model, although slightly larger in size. The U.S. Department of Agriculture (USDA) loans also have a positive influence on employment, with a 0.030 percentage point impact in the year of fund distribution, followed by a 0.022 percentage point lagged impact, as shown in Model 5. Again, given the direct link between business loans and establishments, and the link between establishments and employment, these positive and robust relationships are expected. Simply put, these findings suggest that at the most basic level SBA business loans are successful in promoting business-related investments that increase employment within the parish.

Insurance payouts from the National Flood Insurance Program (NFIP) follow the same pattern as the previous models in this study, with a larger lagged impact than non-lagged impact, and with the variable displaying robustness and a positive coefficient across model specifications.

The final model iteration in Table 6.7 shows the NFIP having an initial 0.063 percentage point impact, followed by a lagged 0.072 percentage point impact. The Federal Emergency Management Agency's (FEMA) other response program, the Public Assistance program, shows a negative lagged relationship with employment counts. This reflects the same relationships seen earlier with the establishment counts and residential building permit (units) models. Entering the model in the fifth iteration, Model 5, the lagged Public Assistance variable has a negative 0.019 percentage point impact on employment counts. As discussed in previous sections, the negative sign before this relationship is unusual when considering all the other relationships in the model, although it appears to follow a pattern found in the previous three dependent variables. This suggests that some aspect of the program inhibits, rather than promotes, local economic recovery, a pattern which reflects either how the funds are distributed, the signal the funds send to investors, or some other influence tested in this model.

6.3.4 **OVERVIEW OF THE MODEL RESULTS**

To understand the broader implications of the results, Table 6.8 provides an overview of the final model specifications (Model 5) for all dependent variables. As discussed in Chapter 4, although each of the dependent variables provide its own perspective for understanding specific mechanisms at work in a recovering economy, additional understanding can be gained by viewing economic recovery as a complex system where the whole is "greater than the sum of its parts." Overall, the local economies explored in this analysis show tremendous resiliency in response to natural disasters, with there being few significant enduring effects from the Hurricane variable. For most of the models, significant Hurricane effects were explained away with the inclusion of the lagged flood insurance variable. The impact of a legacy disaster, like Hurricane Katrina, also had no major influence on the local economies, with the exception of the two business-related dependent variables, establishments and employment, which boasts a negative relationship with the 2005 Hurricane Season. In short, this dissertation has sought to explore the relationship of federal disaster assistance funds from multiple sources on economic recovery responses. However, the overall resiliency of parishes to hurricane impacts, coupled with the fact that the hurricane variable had a positive coefficient in many instances before being explained away through the model specification process, may suggest that these economies should not be viewed as "recovering," given their ability to absorb much of the impact of the natural disaster with very little consequences. This does not suggest that there are not those households and businesses within the communities which do face post-disaster challenges, but rather that at the aggregated parish level, there is a real resiliency in response to natural disaster events.

Table 6.8. The impact of the legacy disasters, or the 2005 hurricane season, is the only relationship to alter with this exclusion. The significant effect on establishments becomes insignificant without Public Assistance monies included within the model and the 2005 season's impact on employment, though remaining significant, declines about 0.20 percentage points. Despite these differences, the size, sign, and significance of the federal aid variables remain unchanged within this alternative model.

6.4 DEPENDENT VARIABLES AS GROWTH RATES

Within the context of this dissertation, the dependent variables taking the form of levels is preferred the their being reported as growth rates. This preference derives from a theoretical justification an from statistical considerations, as growth rates absorb more degrees of freedom compared to levels.

It is recognized, however, that, growth rates have their place within the literature, are useful in understanding economic recovery, and are often preferred. Table 6.9 presents the same final model specification as the previous tables (Model 5) with the dependent variables reported in growth rates. Here, the analysis reflects growth rates from 1999 (change from 1998) through 2016 (change from 2015). It is important to note that these are random-effect panel regression models and not a multi-level model. Although the multi-level model was statistically significant for the dependent variables reported in levels, this model type was not statistically significant for those same dependent variables reported as growth rates. Adding to this, these models have overall r-squared values that are very low, which should be taken into consideration when interpreting the coefficients.

Prior to discussing the statistical significance of the independent variables, attention should be called to the differences in models between levels variables and growth variables. The difference in model type is suggestive to the there being *regional* differences in the economic levels across the state, but that the endogenous economic processes are similar between regions. To explain, while the variance in the levels of economic activities within the state can be attributed to regions, or these local economies grouped by socioeconomic and industrial similarities, this is not true for economic growth within the state. Variance within the growth rate models is caused by other factors not related to the second-level regional groupings discussed in this dissertation.

In addition, the models with dependent variables reported as levels displayed widespread robustness and significance in the covariates. The growth rate models are more reserved in their significance. The Hurricane variable shows more significance in the growth models than the level

Table 6.9: Dependent Variables as Growth Rates

		Economic Performance		**Residential Construction**		**Business Dynamics**	
		Per Capita Personal Income	Gross Domestic Product	Residential Building Permits Value	Residential Building Permits Units	Establishments	Employment
Control Variables	PCPI (ln) ($00s)		-0.087*** (0.014)	0.413 (0.533)	0.193 (0.455)	-6.884 (18.149)	-0.014 (0.013)
	Presidential Elections	-0.006 (0.005)	-0.010 (0.006)	0.647* (0.392)	0.321 (0.167)	-2.890 (5.167)	-0.009 (0.005)
Disaster Event	Hurricane	0.009 (0.006)	0.005 (0.006)	1.004* (0.560)	0.557** (0.187)	-6.590 (5.962)	0.000 (0.006)
	$Hurricane_{t-1}$	0.002) (0.006)	-0.007 (0.007)	0.542 (0.487)	0.489* (0.195)	3.189 (6.464)	0.004 (0.006)
	2005 Hurricane Season	0.014 (0.011)	0.100*** (0.011)	-0.275 (0.254)	-0.358 (0.329)	-9.548 (10.584)	-0.035*** (0.010)
Business Policy Responses	SBA (ln) ($000s)	0.000 (0.001)	0.002** (0.001)	-0.014 (0.045)	-0.001 (0.026)	1.590 (0.827)	0.001 (0.001)
	SBA_{t-1} (ln) ($000s)	-0.001 (0.001)	0.001 (0.001)	0.010 (0.058)	0.003 (0.026)	1.577 (0.826)	0.000 (0.001)
	USDA (ln) ($000s)	-0.001 (0.001)	0.000 (0.001)	-0.018 (0.013)	-0.018 (0.024)	0.301 (0.775)	0.000 (0.001)
	$USDA_{t-1}$ (ln) ($000s)	0.000 (0.001)	-0.001 (0.001)	-0.016 (0.018)	-0.001 (0.023)	-0.576 (0.767)	-0.001 (0.001)
Individual Policy Response	NFIP (ln) ($000s)	-0.002* (0.001)	-0.001 (0.001)	0.016 (0.052)	0.018 (0.027)	-0.681 (0.863)	0.000 (0.001)
	$NFIP_{t-1}$ (ln) ($000s)	0.004*** (0.001)	0.001 (0.001)	-0.029 (0.038)	-0.015 (0.029)	-2.132** (0.925)	-0.002* (0.001)
Government Policy Response	PA (ln) ($000s)	0.001 (0.001)	-0.001 (0.001)	-0.193** (0.095)	-0.110*** (0.033)	0.524 (1.087)	0.000 (0.001)
	PA_{t-1} (ln) ($000s)	-0.003* (0.001)	0.000 (0.001)	-0.005 (0.052)	-0.025 (0.035)	-1.130 (1.153)	0.000 (0.000)
	_cons	0.016** (0.005)	0.511*** (0.083)	-2.455 (3.231)	-1.189 (2.613)	42.687 (103.795)	0.091 (0.072)
	R-Squared (Overall)	0.031	0.013	0.022	0.023	0.015	0.025

Note: Per Capita Personal Income (PCPI), Gross Domestic Product (GDP), and Establishments Growth Rates are reported in robust standard errors.
Significance Codes: ‘***’ 0.001, ‘**’ 0.01, ‘*’ 0.05

models, with the impact of a hurricane spurring growth in residential investment. These findings reflect the conclusions presented in the current literature, with natural disaster spurring endogenous growth in economies. The 2005 Hurricane Season, representing legacy disasters, also increases the growth of Gross Domestic Product (GDP). However, this variable decreases the growth of employment, which may be attributable to permanent outward migration and challenging recovery conditions that persist for years following these severe storms. U.S. Small Business Administration has a positive relationship with GDP growth but with the coefficients smaller than what is seen in the previous models. The U.S. Department of Agriculture (USDA) loans, which target rural businesses, largely falls out of significance. This relationship may be expected given that, although Louisiana has an abundance of rural towns throughout its landscape, rural businesses are often not seen as drivers of economic growth in the larger jurisdiction, like a parish. The significance of the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP) is not as widespread and robust as with the models that consider levels as the dependent variable. Business-related dependent variables see negative coefficients related to NFIP, while Per Capita Personal Income (PCPI) shows a positive relationship in the first year and a negative relationship in the lagged year. This relationship suggests a disinclination of business owners to invest in flood-prone areas with a history of flooding, as disbursement of funds from this program is a result of flood damage. In addition, prolonged disbursement by this program may signal more permanent damage to a jurisdiction, lowering wealth. The growth of residential building permits sees little significance amongst the federal aid variables, with the exception of FEMA's Public Assistance monies. While Hurricanes have a positive and significant relationship with the two residential investment variables, the Public Assistance program has a negative and statistically significant relationship. Again, this finding may stem from the Public Assistance program being a negative signal, dissuading investment and growth in the jurisdiction.

6.5 MODEL LIMITATIONS

The models presented, though robust, have several limitations, with most of these limitations resulting from limited data availability. First, the annual data points limit the model's precision with regards to the exact impact of the natural disaster and the distribution of the federal aid. For example, Hurricane Katrina only had an impact on five months during 2005, however the variable indicates an impact in the overall year. This limitation primarily results from there being a limited number of datasets available at the county-level, especially county-level data in monthly or quarterly increments. Second, this model is limited in its consideration of only four federal aid programs, despite there being a dozen or more avenues through which the federal government can provide aid to individuals and governments after the impact of a natural disaster. Other aid programs could not be included in the model because of data availability issues and model fit. Most federal aid data in this dissertation was requested through the Freedom of Information Act (FOIA), with some requests not being fulfilled by the agency. Although federal agencies may report aggregated state figures on their websites, most do not provide downloadable, count-level data. Beyond this, this research design utilizes extensive temporal lags. Adding additional covariates could lead to an overfit regression, especially considering there are only nineteen years of data collected for each county.

6.6 CONCLUSION

This analysis provides evidence that the economic recovery package employed by the federal government, with the exception of the Public Assistance program, has a robust and positive impact on regional economies recently impacted by natural disasters. The federal aid distributed through the U.S. Small Business Administration, the U.S. Department of Agriculture, and the Federal Emergency Management Agency is highly effective at mitigating the impact of the natural disaster on the economic indicators, excluding those legacy disaster events. These models also speak to the complexity of economic recovery. There is no single solution to mending an impacted jurisdiction and any given solution is not expected to have the same effect on each of the economic spheres. Although federal aid has success, this "success" looks different across different economic measures. These findings, however, do not suggest that federal response counteracts all damage from the hurricanes. Strobl and Walsh (2008) discuss this within the context of the construction industry,

> Since hurricanes reduce the stock of capital to a suboptimal level, their costs include not only the lost capital but also the loss in output incurred while capital readjusts to its optimal level…thus, any increase in construction employment from increased economic activity devoted to restoring damaged capital should not be thought of as offsetting the losses associated with the hurricane since this activity reflects resources being utilized to replace the destroyed capital" (p.1).

In this dissertation, these findings do not indicate that the receipt of federal aid counteracts the impact of the hurricane, thereby rendering the event a "null" and concluding no negative impacts on communities. Indeed, there are studies that find that it is only all small jurisdictions will see vulnerability to natural disaster, with larger counties having only a small portion of jurisdiction impacted (French, Lee, & Anderson, 2010). Rather, the provision of federal aid mitigates the direct and broad economic consequences of the event, as measured by these six variables. There may be indirect effects, such as a loss in output during the readjustment period and funded by federal aid, that are not reflected within the model.

CHAPTER 7

THEORETICAL CONCLUSIONS AND POLICY IMPLICATIONS

Emerging from the conclusions of this dissertation are two broad understandings of post-disaster economic recovery. First, the economic recovery process is complex and multifaceted. Each "sphere" of the economy feels a different impact from the natural disaster and these differences translate to unique recovery patterns that require differing collections of recovery programs. In addition, there is no "one-size-fits-all" program, with the effects varying between different regions. Second, despite damage to physical infrastructure and the temporary displacement of residents, local economies are generally resilient to the impacts of natural disasters. This holds true for legacy disasters, or those severe natural disaster that have long-lasting impacts to the community's physical and cultural landscapes and is especially relevant to those communities with previous experience recovering from natural disasters. In addressing the research questions, this dissertation has shown that the recovery package developed by the federal government to respond to these severe weather events is overall effective at mitigating the negative impacts caused by the disaster events and promotes local economic recovery in those communities impacted.

Although the focus of this dissertation is hurricane events in Louisiana, the findings are able to be generalized, to a certain extent, to other disaster events in other states. That is, while the nature of the event may differ from hurricanes, it would be expected that similar relationships between federal response and post-disaster economic recovery would be seen in other meteorological (e.g., thunderstorms, tornados, hailstorms, and blizzards) and hydrological events (e.g., floods). The qualities encompassed by these other disaster events and the jurisdictions they frequently impact, such as the geographical extent of damage, the type of federal response issued, the homeowners insurance rate of the communities, and the predictability of the events, reflect the same or similar qualities as hurricanes or tropical cyclones. It can be argued, however, that the generalizability of these findings becomes limited with post-disaster recoveries from geological disasters, like avalanches, earthquakes, and volcanic eruptions, given the lack of comparability to hurricanes.

7.1 POLICY IMPLICATIONS

With this dissertation providing empirical evidence to the effectiveness of federal aid in recovering jurisdictions, government leaders and economic development practitioners should seek to encourage the use of the federal programs within their own communities. In knowing that these “tools” work, practitioners should utilize these tools in their recovery activities and engage in the recovery process. The federal monies are designed to, and do, help the jurisdiction receiving them and it is up economic developers and local leaders to be involved in the recovery of their communities. In addition, with flood insurance being important in mitigating damages from natural disaster, local leaders should seek higher insured rates, even in those areas not directly located in flood zones. Although encouraging residents in non-flood zones to purchase flood insurance may prove to be a challenge, a higher insured rate can lead to “economic insurance” for future disasters, resulting in more successful economic recoveries for local communities.

7.2 FUTURE RESEARCH

The research presented in this dissertation extends the disaster literature into considering federal response as an actor in the disaster recovery process and focuses on the relationship between the government and the economy. Future research should continue these considerations. Disaster research, as an academic field, cannot be furthered without accepting the role of government in the economic recovery and shifting the focus to understanding whether this role is a positive or negative influence. In addition, whereas this dissertation considers the recovery of levels, future research should focus on economic growth and determine the impacts of exogenous federal monies on local growth rates. Finally, with the local economy being a complex engine, future research to seek to understand more specific aspects of the economy and how federal monies impact these, instead of measuring aid against these broad economic measures. For example, industry-specific models could assist economic developers with creating a targeted recovery approach to the industries within their jurisdictions.

APPENDIX

ADDITIONAL FIGURES AND TABLES

	PCPII	HURR	PRES	I	SBAI	USDAI	PAI
PCPII	1.0000						
HURR	-0.1515	1.0000					
PRES	0.0432	0.2166	1.0000				
I	-0.0669	0.2764	-0.1409	1.0000			
SBAI	0.5009	-0.0186	-0.0187	-0.0099	1.0000		
USDAI	0.1040	0.0252	-0.0608	-0.0194	0.1321	1.0000	
PAI	0.0870	0.1558	0.1087	0.1487	0.0673	-0.0161	1.0000

Figure A.1: Correlation Matrix for PCPI Model

	ESTAB	PCPII	HURR	PRES	I	SBAI	USDAI	NFIBI	PAI
ESTAB	1.0000								
PCPII	0.5446	1.0000							
HURR	-0.0065	-0.1515	1.0000						
PRES	0.0017	0.0432	0.2166	1.0000					
I	-0.0005	-0.0669	0.2764	-0.1409	1.0000				
SBAI	0.8739	0.5009	-0.0186	-0.0187	-0.0099	1.0000			
USDAI	0.1453	0.1040	0.0252	-0.0608	-0.0194	0.1321	1.0000		
NFIBI	0.1451	0.0321	0.0572	-0.0120	0.2106	0.0873	-0.0158	1.0000	
PAI	0.0954	0.0870	0.1558	0.1087	0.1487	0.0673	-0.0161	0.0228	1.0000

Figure A.2: Correlation Matrix for Establishment Model

	ESTEMP	PCPII	HURR	PRES	I	SBAI	USDAI	NFIBI	PAI
ESTEMP	1.0000								
PCPII	0.5195	1.0000							
HURR	-0.0072	-0.1515	1.0000						
PRES	0.0025	0.0432	0.2166	1.0000					
I	-0.0008	-0.0669	0.2764	-0.1409	1.0000				
SBAI	0.8510	0.5009	-0.0186	-0.0187	-0.0099	1.0000			
USDAI	0.1415	0.1040	0.0252	-0.0608	-0.0194	0.1321	1.0000		
NFIBI	0.1554	0.0321	0.0572	-0.0120	0.2106	0.0873	-0.0158	1.0000	
PAI	0.0973	0.0870	0.1558	0.1087	0.1487	0.0673	-0.0161	0.0228	1.0000

Figure A.3: Correlation Matrix for Employment Model

	PERMV	PCPII	HURR	PRES	I	SBAI	USDAI	NFIBI	PAI
PERMV	1.0000								
PCPII	0.5507	1.0000							
HURR	-0.0493	-0.1515	1.0000						
PRES	-0.0078	0.0432	0.2166	1.0000					
I	0.0229	-0.0669	0.2764	-0.1409	1.0000				
SBAI	0.6430	0.5009	-0.0186	-0.0187	-0.0099	1.0000			
USDAI	0.1172	0.1040	0.0252	-0.0608	-0.0194	0.1321	1.0000		
NFIBI	0.0908	0.0321	0.0572	-0.0120	0.2106	0.0873	-0.0158	1.0000	
PAI	0.0659	0.0870	0.1558	0.1087	0.1487	0.0673	-0.0161	0.0228	1.0000

Figure A.4: Correlation Matrix for Value of Residential Building Permits Model

	PERMU	PCPII	HURR	PRES	I	SBAI	USDAI	NFIBI	PAI
PERMU	1.0000								
PCPII	0.4663	1.0000							
HURR	-0.0020	-0.1515	1.0000						
PRES	-0.0169	0.0432	0.2166	1.0000					
I	0.0432	-0.0669	0.2764	-0.1409	1.0000				
SBAI	0.6204	0.5009	-0.0186	-0.0187	-0.0099	1.0000			
USDAI	0.0735	0.1040	0.0252	-0.0608	-0.0194	0.1321	1.0000		
NFIBI	0.0676	0.0321	0.0572	-0.0120	0.2106	0.0873	-0.0158	1.0000	
PAI	0.0653	0.0870	0.1558	0.1087	0.1487	0.0673	-0.0161	0.0228	1.0000

Figure A.5: Correlation Matrix for Units in Residential Building Permits Model

	CTYGDPI	PCPII	HURR	PRES	I	SBAI	USDAI	NFIBI	PAI
CTYGDPI	1.0000								
PCPII	0.5437	1.0000							
HURR	-0.0110	-0.1515	1.0000						
PRES	0.0012	0.0432	0.2166	1.0000					
I	0.0129	-0.0669	0.2764	-0.1409	1.0000				
SBAI	0.8386	0.5009	-0.0186	-0.0187	-0.0099	1.0000			
USDAI	0.1495	0.1040	0.0252	-0.0608	-0.0194	0.1321	1.0000		
NFIBI	0.1716	0.0321	0.0572	-0.0120	0.2106	0.0873	-0.0158	1.0000	
PAI	0.1077	0.0870	0.1558	0.1087	0.1487	0.0673	-0.0161	0.0228	1.0000

Figure A.6: Correlation Matrix for GDP Model

```
. xtserial PCPII HURR PRES I SBAI USDAI PAI

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      63) =    157.053
           Prob > F =      0.0000

. xtserial ESTAB PCPII HURR PRES I SBAI USDAI NFIBI PAI

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      63) =   1030.282
           Prob > F =      0.0000

. xtserial ESTEMP PCPII HURR PRES I SBAI USDAI NFIBI PAI

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      63) =   1550.022
           Prob > F =      0.0000

. xtserial PERMV PCPII HURR PRES I SBAI USDAI NFIBI PAI

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      63) =     22.001
           Prob > F =      0.0000

. xtserial PERMU PCPII HURR PRES I SBAI USDAI NFIBI PAI

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      63) =     45.999
           Prob > F =      0.0000

. xtserial CTYGDPI PCPII HURR PRES I SBAI USDAI NFIBI PAI

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      63) =     86.717
           Prob > F =      0.0000
```

Figure A.7: Stata Code and Test Results for Autocorrelation Tests

Table A.1: Alternative Model #1: Coastal and Coastal Adjacent Variables

		Economic Measures		Residential Measures		Business Measures	
		Per Capita Personal Income (00s) (ln)	**Gross Domestic Product (000s) (ln)**	**Residential Building Permits Value (000,000s) (ln)**	**Residential Building Permits Units (ln)**	**Establishments (ln)**	**Employment (ln)**
Control Variables	PCPI (ln) ($00s)		1.962*** (0.318)	3.180 (2.022)	1.738** (0.806)	1.318*** (0.263)	1.601*** (0.302)
	Presidential Election	-0.012* (0.007)	-0.034 (0.027)	0.266* (0.139)	0.009 (0.050)	-0.033 (0.025)	-0.025 (0.026)
	Coastal Parish	-0.012 (0.043)	-0.025 (0.207)	-0.202 (0.781)	-0.119 (0.615)	-0.093 (0.161)	-0.018 (0.204)
	Coastal Parish Adjacent	0.019 (0.034)	0.174 (0.163)	0.679 (0.576)	0.445 (0.480)	0.028 (0.170)	0.187 (0.160)
Natural Disaster Event	Hurricane	-0.057*** (0.013)	-0.007 (0.076)	-0.109 (0.302)	-0.049 (0.125)	-0.003 (0.064)	-0.016 (0.076)
	Hurricane_{t-1}	-0.080*** (0.013)	-0.005 (0.046)	0.274 (0.414)	0.072 (0.100)	0.024 (0.040)	0.027 (0.044)
	2005 Hurricane Season	-0.026 (0.018)	0.034 (0.054)	0.413 (0.403)	0.131 (0.138)	-0.099* (0.052)	-0.107* (0.056)
Business Policy Responses	SBA (ln) ($000s)	0.006*** (0.001)	0.116*** (0.011)	0.266*** (0.068)	0.142*** (0.026)	0.105*** (0.011)	0.120*** (0.011)
	SBA_{t-1} (ln) ($000s)	0.009*** (0.001)	0.109*** (0.011)	0.248*** (0.070)	0.135*** (0.022)	0.099*** (0.010)	0.111*** (0.010)
	USDA (ln) ($000s)	0.002 (0.003)	0.030*** (0.008)	0.078* (0.044)	0.035*** (0.009)	0.029*** (0.006)	0.031*** (0.008)
	USDA_{t-1} (ln) ($000s)	0.001 (0.002)	0.022*** (0.005)	0.042 (0.031)	0.025** (0.010)	0.022*** (0.004)	0.023*** (0.004)
Individual Policy Response	NFIP (ln) ($000s)	0.009*** (0.001)	0.057*** (0.013)	0.173*** (0.049)	0.117*** (0.023)	0.061*** (0.010)	0.063*** (0.013)
	NFIP_{t-1} (ln) ($000s)	0.006** (0.002)	0.071*** (0.008)	0.216** (0.071)	0.152*** (0.022)	0.075*** (0.007)	0.073*** (0.009)
Government Policy Response	PA (ln) ($000s)	0.006*** (0.002)	-0.003 (0.012)	-0.021 (0.053)	-0.016 (0.022)	-0.006 (0.011)	-0.006 (0.012)
	PA_{t-1} (ln) ($000s)	0.005** (0.002)	-0.011 (0.011)	-0.049 (0.061)	-0.036* (0.021)	-0.020** (0.010)	-0.019* (0.011)
	_cons	5.736*** (0.031)	7.968*** (1.723)	-7.661 (12.905)	-8.410* (4.996)	-2.544* (1.438)	-1.817 (1.638)
	Between Region Variability (ICC)	0.086	0.038	0.113	0.106	0.049	0.040

Note: All variables are reported in robust standards errors. Significance Codes: '***' 0.001, '**' 0.01, '*' 0.05

Table A.2: Alternative Model #2: One-Year and Two-Year Lag Lengths

		Economic Measures		Residential Measures		Business Measures	
		Per Capita Personal Income (00s) (ln)	**Gross Domestic Product (000s) (ln)**	**Residential Building Permits Value (000,000s) (ln)**	**Residential Building Permits Units (ln)**	**Establishments (ln)**	**Employment (ln)**
Control Variables	PCPI (ln) ($00s)		1.814*** (0.331)	2.693 (1.913)	1.531** (0.778)	1.206*** (0.271)	1.485*** (0.314)
	Presidential Election	-0.018** (0.008)	0.035* (0.021)	0.409** (0.178)	0.103** (0.053)	0.030 (0.020)	0.039* (0.022)
Natural Disaster Events	Hurricane	-0.079*** (0.013)	0.038 (0.079)	-0.101 (0.312)	-0.018 (0.124)	0.044 (0.067)	0.034 (0.077)
	$Hurricane_{t-1}$	-0.009 (0.010)	-0.016 (0.066)	0.375 (0.378)	0.129 (0.080)	-0.012 (0.056)	-0.023 (0.068)
	2005 Hurricane Season	-0.059** (0.020)	0.14** (0.057)	0.606 (0.392)	0.234 (0.148)	0.016 (0.056)	0.020 (0.060)
Business Policy Responses	SBA (ln) ($000s)	0.004** (0.002)	0.090*** (0.007)	0.195** (0.069)	0.105*** (0.017)	0.079*** (0.007)	0.092*** (0.007)
	SBA_{t-1} (ln) ($000s)	0.006*** (0.001)	0.080*** (0.008)	0.168** (0.068)	0.098*** (0.018)	0.071*** (0.007)	0.082*** (0.008)
	SBA_{t-2} (ln) ($000s)	0.006** (0.002)	0.072*** (0.008)	0.197*** (0.047)	0.088*** (0.021)	0.067*** (0.008)	0.074*** (0.008)
	USDA (ln) ($000s)	0.002 (0.002)	0.018** (0.006)	0.050 (0.035)	0.016** (0.007)	0.018*** (0.005)	0.020** (0.006)
	$USDA_{t-1}$ (ln) ($000s)	0.002 (0.002)	0.018** (0.007)	0.039 (0.027)	0.015* (0.008)	0.018*** (0.005)	0.018** (0.007)
	$USDA_{t-2}$ (ln) ($000s)	0.000 (0.002)	0.024*** (0.003)	0.061 (0.042)	0.034*** (0.009)	0.025*** (0.002)	0.026*** (0.003)
Individual Policy Response	NFIP (ln) ($000s)	0.010*** (0.001)	0.044*** (0.010)	0.146*** (0.039)	0.101*** (0.023)	0.046*** (0.008)	0.047*** (0.010)
	$NFIP_{t-1}$ (ln) ($000s)	0.004** (0.002)	0.049*** (0.009)	0.142** (0.060)	0.109*** (0.018)	0.055*** (0.005)	0.053*** (0.011)
	$NFIP_{t-2}$ (ln) ($000s)	0.003 (0.002)	0.052*** (0.009)	0.167** (0.066)	0.110*** (0.019)	0.054*** (0.008)	0.053*** (0.010)
Government Policy Response	PA (ln) ($000s)	0.004** (0.002)	0.005 (0.013)	0.000 (0.049)	-0.001 (0.018)	0.002 (0.011)	0.002 (0.013)
	PA_{t-1} (ln) ($000s)	-0.006** (0.003)	0.006 (0.013)	-0.024 (0.061)	-0.015 (0.020)	-0.002 (0.012)	0.001 (0.014)
	PA_{t-2} (ln) ($000s)	0.001 (0.002)	0.013 (0.009)	-0.004 (0.037)	0.000 (0.015)	0.001 (0.008)	0.003 (0.009)
	_cons	5.729*** (0.029)	8.587*** (1.821)	-5.421 (12.302)	-7.550 (4.775)	-2.139 (1.494)	-1.356 (1.735)
	Between Region Variability (ICC)	0.088	0.057	0.121	0.125	0.074	0.053

Note: All variables are reported in robust standards errors. Significance Codes: '***' 0.001, '**' 0.01, '*' 0.05

Table A.3: Alternative Model #3: Excluding Public Assistance Monies

		Economic Measures		Residential Measures		Business Measures	
		Per Capita Personal Income (00s) (ln)	**Gross Domestic Product (000s) (ln)**	**Residential Building Permits Value (000,000s) (ln)**	**Residential Building Permits Units (ln)**	**Establishments (ln)**	**Employment (ln)**
Control Variables	PCPI (ln) ($00s)		1.968*** (0.321)	3.203 (1.979)	1.746** (0.799)	1.304*** (0.270)	1.600*** (0.304)
	Presidential Election	-0.010 (0.006)	-0.030 (0.030)	0.279** (0.138)	0.017 (0.047)	-0.024 (0.028)	-0.019 (0.031)
Natural Disaster Event	Hurricane	-0.044*** (0.008)	-0.088 (0.057)	-0.134 (0.196)	-0.069 (0.084)	-0.007 (0.051)	-0.020 (0.059)
	$Hurricane_{t-1}$	-0.063*** (0.011)	-0.036 (0.050)	0.139 (0.276)	-0.030 (0.079)	-.0.032 (0.045)	-0.026 (0.049)
	2005 Hurricane Season	-0.026 (0.016)	0.045 (0.051)	0.453 (0.372)	0.160 (0.117)	-0.078 (0.047)	-0.089* (0.052)
Business Policy Responses	SBA (ln) ($000s)	0.006*** (0.001)	0.117*** (0.012)	0.269*** (0.069)	0.145*** (0.025)	0.106*** (0.011)	0.121*** (0.011)
	SBA_{t-1} (ln) ($000s)	0.009*** (0.001)	0.108*** (0.011)	0.246** (0.071)	0.134*** (0.023)	0.098*** (0.011)	0.110*** (0.011)
	USDA (ln) ($000s)	0.002 (0.003)	0.030*** (0.008)	0.075 (0.046)	0.034*** (0.009)	0.029*** (0.006)	0.031*** (0.008)
	$USDA_{t-1}$ (ln) ($000s)	0.000 (0.002)	0.022*** (0.005)	0.042 (0.034)	0.026** (0.010)	0.023*** (0.003)	0.023*** (0.004)
Individual Policy Response	NFIP (ln) ($000s)	0.010*** (0.001)	0.055*** (0.012)	0.162*** (0.046)	0.109*** (0.024)	0.058*** (0.009)	0.060*** (0.012)
	$NFIP_{t-1}$ (ln) ($000s)	0.007*** (0.002)	0.068*** (0.007)	0.200** (0.072)	0.141*** (0.024)	0.069*** (0.007)	0.068*** (0.008)
	_cons	5.731 (0.024)	7.969*** (1.765)	-7.653 (12.585)	-8.359 (4.897)	-2.455 (1.491)	-1.767 (1.681)
	Between Region Variability (ICC)	0.088	0.036	0.123	0.123	0.047	0.037

Note: All variables are reported in robust standards errors. Significance Codes: '***' 0.001, '**' 0.01, '*' 0.05

REFERENCES

About SBA. (n.d.). Retrieved from U.S. Small Business Administration: https://www.sba.gov/about-sba

Adjuster Preliminary Damage Assessment Overivew. (n.d.). Retrieved from FEMA - National Flood Insurance Program: https://nfipservices.floodsmart.gov/home/claims/apda

Albala-Bertrand, J. M. (1993). Natural Disaster Situations and Growth: A Macroeconomic Model for Sudden Disaster Impacts. *World Development, Vol. 21, Issue 9,* 1417-1434.

Alesch, D., Holly, J. N., Mittler, E., & Nagy, R. (2001). Organizations at Risk: What Happens when Small Businesses and Not-for-Profits Encounter Natural Disasters. *Public Entity Risk Institute PERI*.

Atkinson, R. D., & Audretsch, D. B. (2008). Economic Doctrines and Policy Differences: Has the Washington Policy Debate Been Asking the Wrong Questions? *The Information Technology & Innovation Foundation*, 1-38.

Banton, C. (2019). *Neoclassical Growth Theory*. Retrieved from Investopedia: https://www.investopedia.com/terms/n/neoclassical-growth-theory.asp

Barreca, J. D., Fannin, J. M., & Detre, D. D. (2012). Estimating GDP at the Parish (County) Level: An Evaluation of Alternative Approaches. *LSU AgCenter Research Bulletin, Number 890*.

Belasen, A., & Polachek, S. (2008). How Hurricanes Affect Wages and Employment in Local Labor Markets. *American Economic Review: Papers and Proceedings*, 49-53.

Beracha, E., & Prati, R. (2008). How Major Hurricanes Impact Housing Prices and Transaction Valume. *Real Estate Issues*, 45-57.

Building Permits Survey. (n.d.). Retrieved from U.S. Census Bureau: https://www.census.gov/construction/bps/

Business & Industry Loan Guarantees. (n.d.). Retrieved from Rural Development - U.S. Department of Agriculture: https://www.rd.usda.gov/programs-services/business-industry-loan-guarantees

Business & Industry Loan Program Frequently Asked Questions. (n.d.). Retrieved from United States Department of Agriculture: https://www.rd.usda.gov/files/BCP_BI_LEAP_LEAPfaqs.pdf

Caballero, R. (2008). Creative Destruction. *The New Palgrave Dictionary of Economics, Second Edition*.

Cavallo, E., Galiana, S., & Noy, I. (2013). Catastrophic Natural Disasters and Economic Growth. *The Review of Economics and Statistics, Vol. 95, Issue 5*, 1549-1561.

Chang, S. (1983). Disasters and Fiscal Policy: Hurricane Impact on Municipal Revenue. *Urban Affairs Review*.

Chang, S. E., & Rose, A. Z. (2012). Towards a Theory of Economic Recovery from Disasters. *International Journal of Mass Emergencies and Disasters, Vol. 32, No. 2*, 171-181.

Coffman, M., & Noy, I. (2012). Hurricane Iniki: measuring the long-term economic impact of a natural disaster using synthetic control. *Environment and Development Economics*, 187-205.

Cohen, C., & Werker, E. D. (2008). The Political Economy of "Natural" Disasters. *Journal of Conflict Resolution*.

Cortes, B. S. (2010). Impact of Small Business Administration Lending on State-Level Economic Performance: A Panel Data Analysis. *The International Journal of Business and Finance Research, Vol. 4(3)*, 55-65.

County Business Patterns. (n.d.). Retrieved from U.S. Census Bureau: https://www.census.gov/programs-surveys/cbp.html

Craig, B. R., Jackson, W., & Thomson, J. (2007). Small Firm Finance, Credit Rationing, and the Impact of SBA-guaranteed Lending on Local Economic Growth. *Journal of Small Business Management 45*, 116-132.

Cui, Y., Liang, D., & Ewing, B. T. (2015). Empirical Analysis of Building Permits in Response to Hurricane Landfalls. *Natural Hazards Review*, 1-10.

Cutter, S. L., Ash, K. D., & Emrich, C. T. (2014). The Geographies of Community Disaster Resilience. *Global Environmental Change, 20 (2014)*, 65-77.

Cutter, S. L., Burton, C. G., & Emrich, C. T. (2010). Disaster Resilience Indicators for Benchmarking Baseline Conditions. *Journal of Homeland Security and Emergency Management, 7(51)*.

Dahlhamer, J. M., & D'Souza, M. J. (1997). Determinants of Business-Disaster Preparedness in Two U.S. Metropolitcan Areas. *International Journal of Mass Emergencies and Disasters, Vol. 15, No. 2*, 265-281.

Davis, M., Hansen, M. E., & Husted, T. (2018). The Impact of Political Influence on Appointees; Evidence from the Small Business Administration Disaster Loan Program. *Southern Economic Journal, 84(3)*, 771-785.

Disaster Assistance Overview in Advance of the 2019 Hurricane Season. (2019). *Congressional Research Service, Government and Finance Division* .

Evans, B. (2017, March 21). *The 50 richest places in Louisiana, by ZIP code*. Retrieved from NOLA.com: https://www.nola.com/news/business/article_40d091a6-5648-5618-9577-3b658b5c4fca.html

Felbermayr, G., & Groschl, J. (2014). Naturally negative: The growth effects of natural disasters. *Journal of Development Economics, Vol. 211*, 92-106.

Finch, W. H., Bolin, J. E., & Kelley, K. (2014). *Multilevel Modeling Using R.* Boca Raton: CRC Press, Taylor and Francis Group.

Flores, A. Q., & Smith, A. (2012). Leader Survival and Natural Disasters. *British Journal of Policial Science 43*, 821-843.

French, S., Lee, D., & Anderson, K. (2010). Estimating the Social and Economic Consequences of Natural Hazards: Fiscal Impact Example. *Natural Hazards Review, Vol. 11, Issue 2*.

Garrett, T. A., & S.Sobel, R. (2003). The Political Economy of FEMA Disaster Payments. *Economic Inquiry, 41(3)*, 496-509.

Gary R. Webb, K. J., & Dahlhamer, J. M. (2002). Predicting long-term business recovery from disaster: a comparison of the Loma Prieta earthquake and Hurricane Andrew. *Global Environmental Change Part B: Environmental Hazards, Vol. 4, Issue 2*, 45-58.

Growth Rates Versus Levels. (n.d.). Retrieved from Federal Reserve Bank of Dallas: https://www.dallasfed.org/research/basics/growth.aspx

Heersink, B., Jenkins, J. A., & Peterson, B. .. (2019). Natural Disasters, 'Partisan Retrospection,' and U.S. Presidential Elections. *Working Paper, University of Southern California*, 1-33.

Hochrainer, S. (2009). Assessing the Macroeconomic Impacts of Natural Disasters: Are There Any? *The World Bank.*

How States Pay for Natural Disasters in an Era of Rising Costs. (2020, May 12). Retrieved from The Pew Charitable Trusts: https://www.pewtrusts.org/en/research-and-analysis/reports/2020/05/how-states-pay-for-natural-disasters-in-an-era-of-rising-costs

Huang, F. L. (2018). Multilevel Models Myths. *School Psychology Quarterly*.

Insurance Information Institute. (2020, 3 15). Retrieved from Facts + Statistics: U.S. catastrophes: https://www.iii.org/fact-statistic/facts-statistics-us-catastrophes

Janvry, A. d., Valle, A. d., & Sadoulet, E. (2016). Insuring Growth: The Impact of Disaster Funds on Economic Reconstruction in Mexico. *The World Bank Policy Research Working Paper*.

Jarmin, R., & Miranda, J. (2009). The Impact of Hurricanes Katrina, Rita and Wilma on Business Establishment. *Journal of Business Valuation and Economic Loss Analysis*, 1-27.

Johnson, J. (2009). Rural Economic Development in the United States: An Evaluation of the U.S. Department of Agriculture's Business and Industry Guaranteed Loan Program. *Economic Development Quarterly, Vol. 23, No. 3*, 229-241.

Josephson, A. L., & Marshall, M. I. (2014). The Effectiveness of Post-Katrina Disaster Aid: The Influence of SBA Loans on Small Businesses in Mississippi. *10th International Conference of the International Institute for Infrastructure Resilience and Reconstruction (I3R2)*, 141-145.

Klomp, J. G., & Valckx, K. (2014). Natural disasters and economic growth: A meta-analysis. *Global Environmental Change, 26(1)*.

Kriner, D. L., & Reeves, A. (2012). The Influence of Federal Spending on Presidential Elections. *American Political Science Review*, 348-366.

Leiter, A. M., Oberhofer, H., & Raschky, P. A. (2009). Creative Disasters? Flooding Effects on Capital, Labour, and Productivity Within European Firms. *Environmental and REsource Economics, Vol. 43*, 333-350.

Loayza, N. V., Olaberria, E., Rigolini, J., & Christiaensen, L. (2012). Natural Disasters and Growth: Going Beyond the Averages. *World Development, Elsevier, vol. 40(7)*, 1317-1336.

Madowitz, M., & Hanlon, S. (2018, July 26). *GDP Is Growing, but Workers' Wages Aren't*. Retrieved from Center for American Progress: https://www.americanprogress.org/issues/economy/reports/2018/07/26/454087/gdp-growing-workers-wages-arent/

McCallum, B. (1875). Rational Expectations and the Predictive Efficiency of Economic Models. *The Journal of Business, Vol. 48, No. 3*, 331-343.

McCoy, S. J., & Zhao, X. (2016). A City under Water: A Geospatial Analysis of Storm Damage, Changing Risk Perceptions, and Investment in Residential Housing. *Journal of the Association of Environmental and Resource Economists, Vol 5, No. 2*.

Mihajlov, T. P. (2012). SBA 504 Loans Help Improve Balance Sheets: A Micro Analysis. *Journal of Marketing Development and Competitiveness, Vol 6(1)*, 22-33.

Multilevel Modeling Tutorial Using SAS, Stata, HLM, R, SPSS, and Mplus. (2015, March). Retrieved from The department of Statistics and Data Sciences, The University of Texas at Austin: https://stat.utexas.edu/images/SSC/documents/SoftwareTutorials/MultilevelModeling.pdf

Murphy, A., & Strobl, E. (2010). The Impact of Hurricanes on Housing Prices: Evidence from US Coastal Cities. *Federal Reserve Bank of Dallas*, 1-31.

Natural Disasters. (2018, May 4). Retrieved from Department of Homeland Security: https://www.dhs.gov/natural-disasters

Noy, I. (2009). The Macroeconomic Consequences of Disasters. *Journal of Development Economics, Vol. 88, Issue 2*, 221-231.

Okuyama, Y. (2003). Economics of Natural Disasters: A Critical Review. *North American Meeting, Regional Science Association International*.

(2017). *Preliminary Damage Assessments for Major Disasters: Overview, Analysis, and Policy Observations.* Congressional Research Service.

Raddatz, C. (2009). The Wrath of God: Macroeconomic Costs of Natural Disasters. *The World Bank*.

Rebuilding After the Storm. (n.d.). Retrieved from John Cornyn, United States Senator for Texas: https://www.cornyn.senate.gov/content/page/hurricane-harvey-resources#:~:text=February%208%2C%202018%3A%20The%20third,Cornyn%20voted%20for%20this%20bill.

Reeves, A. (2011). Political Disaster: Unilateral Powers, Electoral Incentives, and Presidential Disaster Declarations. *The Journal of Politics, Vol. 73, No. 4*.

Roberts, P. (2017, September 12). *5 things that have changed about FEMA since Katrina – and 5 that haven't*. Retrieved from The Conversation: https://theconversation.com/5-things-that-have-changed-about-fema-since-katrina-and-5-that-havent-83205

Rupasingha, A., & Pender, J. (2019, September 3). *Rural Businesses That Receive USDA Business and Industry Guaranteed Loans Less Likely To Fail.* Retrieved from United States Department of Agriculture Economic Research Service: https://www.ers.usda.gov/amber-waves/2019/september/rural-businesses-that-receive-usda-business-and-industry-guaranteed-loans-less-likely-to-fail/

Saginor, J., & Ge, Y. (2017). Do Hurricanes Matter? A Case Study of the Residential Real Estate Market in Brunswick County, North Carolina. *International Journal of Housing Markets and Analysis*, 352-370.

Skidmore, M., & Toya, H. (2002). Do Natural Disasters Promote Long-Run Growth? *Economic Inquiry, Vol. 4, Issue 4*.

Steady State Economy Definition. (n.d.). Retrieved from Center for the Advancement of the Steady State Economy: https://steadystate.org/discover/definition/

Stewart, F. (1995). Political Economy of Large Natural Disasters: With Special Reference to Developing Countries. *Journal of Economic Literature, Vol. 33, No. 1*, 268-269.

Strobl, E. (2011). The Economic Growth Impact of Hurricanes: Evidence from U.S. Coastal Counties. *Review Economics and Statistics, Vol. 93, Issue 2*, 575-589.

Strobl, E., & Walsh, F. (2008). The re-building effect of hurricanes: evidence from employment in the US construction industry. *IZA Discussion Papers,* 1-12.

Strulik, H., & Trimborn, T. (2014). Natural Disasters and Macroeconomic Performance: The Role of Residential Investment. *Environmental Resource Economics SSRN Elecontric Journal*.

Sylves, R., & Buzas, Z. I. (2007). Presidential Disaster Declaration Decisions, 1953–2003: What Influences Odds of Approval? *State and Local Government Review, Vol. 39, No. 1*, 3-15.

The Disaster Declaration Process. (n.d.). Retrieved from FEMA: https://www.fema.gov/disaster-declaration-process

The National Flood Insurance Program. (n.d.). Retrieved from FEMA: https://www.fema.gov/national-flood-insurance-program

Thomas, S. L., & Heck, R. H. (2001). Analysis of Large-Scale Secondary Data in Higher Education Research: Potential Perils Associated with Complex Sampling Designs. *Research in Higher Education, Vol. 42, No. 5*.

Types of Disasters: Definition of Hazard. (n.d.). Retrieved from Internaitonal Federation of Red Cross and Red Crescent: https://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/definition-of-hazard/

U.S. Bureau of Economic Analysis. (2020). *Per Capita Personal Income in Orleans Parish, LA [PCPI22071]*. Retrieved from Federal Reserve Bank of St. Louis: https://fred.stlouisfed.org/series/PCPI22071

Webb, G. R., Tierney, K. J., & Dahlhamer, J. M. (2002). Predicting long-term business recovery from disaster: a comparison of the Loma Prieta earthquake and Hurricane Andrew. *Environmental Hazards, 4(2),* 45-58.

What is the single most important economic indicator for policymakers? (1999, November). Retrieved from Federal Reserve Bank of San Franscisco: https://www.frbsf.org/education/publications/doctor-econ/1999/november/economic-indicators-policy/

Xiao, Y. (2011). Local Economic Impacts of Natural Disasters. *Journal of Regional Science, Vol 51, Issue 4*.

Xiao, Y., & Zandt, S. V. (2012). Building Community Resiliency: Spatial Links between Households and Business Post-disaster Return. *Urban Studies 49(11),* 2523-2542.

Young, A. T., Higgins, M. J., Lacombe, D. J., & Sell, B. (2014). The Direct and Indirect Effects of Small Business Administration Lending on Growth: Evidence from U.S. County-Level Data. *NBER Working Paper Series*.

BIOGRAPHICAL SKETCH

Jasmine Rae Latiolais was born in Rayne, Louisiana. After graduating from Acadiana High School in 2011, Jasmine entered the University of Louisiana at Lafayette in Lafayette, Louisiana, where she worked in the Vice President for Advancement while attending school. After earning a Bachelor of Arts in Moving Image Arts and a minor in Business Administration, Jasmine pursued a Master of Business Administration at the University of Louisiana at Lafayette. During this time, Jasmine obtained a graduate assistantship position at the Vice President for Research, Innovation, and Economic Development's office. In August of 2017, she relocated to Dallas, Texas and entered the Public Policy and Political Economy program at The University of Texas at Dallas. In the summer of 2018, Jasmine worked as an intern for the International Economic Development Council in Washington, D.C. and in the summer of 2019, she worked as an intern for the U.S. Government Accountability Office in Dallas, Texas.

CIURRICULUM VITAE

EDUCATION

UNIVERSITY OF TEXAS AT DALLAS · Richardson, TX

Doctorate of Public Policy and Political Economy · Expected Completion: Fall 2020

Concentration in Development and Urban Studies · GPA 3.9 / 4.0

Master of Public Policy · Completed May 2020

Concentration in Analytic Methods · GPA 3.9 / 4.0

UNIVERSITY OF LOUISIANA AT LAFAYETTE · Lafayette, LA

Master of Business Administration · Completed December 2016

Bachelor of Arts in Moving Image Arts · Completed December 2014

Minor in Business Administration · GPA 3.8 / 4.0

INTERESTS

Local and Regional Economic Development · Post-Disaster Economic Recovery · Program Evaluation · Data-Driven Economic Development · State-Level Public Policy Formation and Evaluation · Regional Economies Within and Across State Borders

ACADMIC RESEARCH

- Dissertation (Working Title: *Exogenous Responses and Endogenous Recovery: How Federal Relief Affects Post-Disaster Economic Growth*): a hierarchical, statistical exploration of the effectiveness of federal relief programs in recovering hurricane-impacted communities in Louisiana between 1998 and 2016, with special consideration given to economic regions.
- "To Return or Not to Return: An Analysis of the Income Differences of Displaced New Orleans Residents Following Hurricane Katrina": multivariate, survey-based regression comparing the post-Hurricane Katrina economic success of displaced New Orleans residents based on their relocation decisions.

- “Economic Development Vision and Strategy for the South Central Planning and Development Commission (SCPDC)”: economic development strategy for the South Central Planning and Development Commission (SCPDC) in south Louisiana, with special attention given to regional socioeconomic conditions and challenges, ensuring development in post-oil driven economy, and future investment in innovation and specialized technology, such as water management and drone technologies.
- (Working Title: “Beware of Thy Neighborhood: Exploration of the Effects of Damages in Contiguous Parishes on Local Labor Markets in a Post-Disaster Economy”): hierarchical analysis that explores how damage differentials between contiguous parishes impact local labor markets, while controlling for the influx of exogenous federal aid.

TECHNICAL SKILLS

Data Collection ∙ Data Analysis ∙ Data Visualization ∙ Technical and Academic Writing ∙ Research Design ∙ R Programming ∙ Stata Programming ∙ ArcGIS and Geospatial Analysis ∙ Multivariate Regression Analysis ∙ Time Series Analysis ∙ Survey Research ∙ Multilevel Modeling

PROFESSIONAL EXPERIENCE

UNIVERSITY OF TEXAS AT DALLAS ∙ Richardson, TX ∙ August 2020 – Present

Instructor / Teaching Assistant – American National Government

- Provides online class instruction, including preparing and recording lectures, designing homework and writing assignments to encourage student engagement, grading, and student management. Corresponding with students for assignments, lectures, and review sessions.

UNIVERSITY OF TEXAS AT DALLAS ∙ Richardson, TX ∙ May 2020 – August 2020

Research Assistant

- Developed concept and outline of a state and local government textbook for the Political Science Department, working in conjunction with two co-authors. Developed, researched, and wrote five of the fifteen chapters in the textbook, which include chapters related to the state executive branch, state and local criminal justice policies, welfare and health policies within the states, environmental and energy policies, and education policies.

UNIVERSITY OF TEXAS AT DALLAS · Richardson, TX · July 2017 – May 2020

Teaching Assistant

- Assisted faculty advisor with classroom instruction, grading assignments, papers, and exams, record keeping, student management, course development, and other duties as needed. Corresponded with students in person, via Blackboard, and by email for make-up exams and review sessions. Prepared and delivered lectures as assigned. Courses included American National Government, State and Local Government, American Political Institutions, and Politics and Policies of Energy and Environmental Issues.

GOVERNMENT ACCOUNTABILITY OFFICE · Dallas, TX · May 2019 – August 2019

Summer Intern – Physical Infrastructure Team

- Assigned to the small Unmanned Aircraft Systems (sUAS) Traffic Management engagement, auditing the Federal Aviation Administration (FAA) and their efforts to development a sUAS, or drone, traffic management system. Collaborated with team members in Washington, D.C.
- Assisted with the collection of background information and primary source information and with interview preparation, including outlining topics and questions to be addressed in the interview. Conducted qualitative analysis on public questions and public rulemaking associated with sUAS and the FAA. Collaborated with team on engagement activities and planning, including project management and technical writing and documentation. Presented engagement background and objectives to upper management and field office staff in Washington, D.C., Seattle, WA, Chicago, IL, and Atlanta, GA.

INTERNATIONAL ECONOMIC DEVELOPMENT COUNCIL · Washington, D.C**.** · June 2018 - August 2018

Summer Intern

- “Economic Recovery and Resiliency Strategies for the City of Minot, North Dakota Technical Report - June 2018” Report: Collected case studies and background information on Minot, ND and comparable cities. Researched and wrote technical sections in the report on local economic development finance options and economic development strategies.
- “Florida Keys Business Assessment of Hurricane Irma Impacts - July 2018” Report: Collected demographic and socioeconomic data for the Florida Keys. Contributed visual representations of the data to the report, including graphs and charts to represent population characteristics.
- “Future Ready” Report: Collected case studies and background information and disseminated the information for report sections. Assisted with the interview process, contributing questions and summarizing findings.

- Developed blog topics and published blog posts on current topics in economic development for “ED Now” blog, including publications on veterans and capital lending programs, automations and jobs, economic gardening. And an AEDO Profile of Louisiana Economic Development.
- Assisted the Vice President of Knowledge Management and Development, Lynn Knight, with a U.S. Economic Development Administration grant targeted toward assisting Sonoma County with their economic recovery following the 2017 wildfires. Contributed background information for the grant, including assisting with technical sections of the application.

UNIVERSITY OF LOUISIANA AT LAFAYETTE · Lafayette, LA · August 2015 – July 2017

Graduate Assistance / Office Assistance – Vice President for Research, Innovation, and Economic Development

- Assisted the Office of Research and Sponsored Program with grant applications, including recording application submission and organizing databases. Designed and implemented database for the University’s patent filings and approvals. Assisted the Vice President with miscellaneous projects, including the transfer of the LITE Center under the department’s jurisdiction.

ONEACADIANA · Lafayette, Louisiana · January 2017 – May 2017

Intern - Policy Team

- Researched and maintained updated state legislative information on ongoing reforms in the state, including criminal justice reform bills. Attended public forums on criminal justice issues, with the purpose of informing the Policy Team on public comment. Attended and recorded meetings with local business leaders regarding policy changes that could potentially impact local businesses. Collected demographic and socioeconomic data, as well as economic development case studies, on Lexington, KY and Lafayette, LA and compiled the information in a pamphlet for the One Acadiana leadership retreat.