LOCAL GOVERNMENT FISCAL STRESS AND FINANCIAL COPING STRATEGIES FOLLOWING DISASTERS

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This dissertation analyzes how local governments adapt to the fiscal stress of major disasters. Unifying theories of fiscal stress with emergency management theories, the dissertation presents a model of what influences local governments coping strategy use following disasters. Using new survey data and secondary financial data on cities, counties, and school districts that experienced Hurricane Harvey, findings show that local governments adapt in a variety of ways; of 137 local governments that responded, 66 percent used some number of coping strategies, with only 5 of 62 possible strategies not being used by any local governments. For those which did adapt, they on average used 7.06 strategies, and tended to show a preference towards revenue increasing strategies and rebuilding the community through new capital projects, with less emphasis on expenditure cuts compared to some prior literature findings on fiscal stress. The results indicate that local governments step up and provide new services necessary during the recovery process, to serve their community, despite fiscal stress. A negative binomial model shows partial support for the hypotheses that local governments with lower prior fiscal condition and greater hazard exposure will use more coping strategies. The findings show mixed results on whether institutional rules that restrict financial structures lead school districts to use more coping strategies than cities during the recovery process.

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CHAPTER 1

INTRODUCTION

Disasters are costly. Recent estimates suggest that total costs for Hurricane Harvey are near $125 billion (NOAA 2018). These costs chiefly revolve around repairing and rebuilding homes, infrastructure, and facilities that were destroyed or damaged from flooding, wind, or storm surge impact, as well as the costs associated with evacuation, sheltering, debris removal, search and rescue. Extreme costs and damages following disasters are not uncommon; in 2017 there were 16 separate large events that totaled up to a cost of $306.2 billion, breaking a previous record that was largely driven by the severe event of Hurricane Katrina in 2005 (NOAA 2018). But private insurance markets and federal grants are not the only sources of funding to support local recovery through infrastructure rebuilding. Local governments are often the first to respond to disasters, and thus, they also bear a sizable portion of the burden of cost in rebuilding.

For the most part, federal grants only cover 75 percent of the cost to repair public infrastructure, leaving local governments to secure 25 percent of the resources necessary. Local governments must have enough resources to begin the process and meet other obligations before reimbursements are received. Disasters also impact local government's finances through changes to spending demands and revenue streams that may make balanced budgets difficult to achieve. Evidence suggests that local governments experience shifts in revenue collections that follow multiyear patterns, and may never return to pre-disaster levels (Peacock et al. 2014; Ismayilov and Andrew 2016; Krueger, Winkler, and Schumann III 2019; Krueger and Winkler 2018).

Local governments already have an increased burden of responsibility to provide services and execute state and federal policies, while under more state and voter-imposed constraints to revenue raising and expenditure increasing abilities. Research has indicated that local

governments may take specific steps to maintain essential services and meet obligations, in the face of unexpected financial stress. Following recessions, local governments act strategically by pursuing revenue raising activities, making efforts to improve efficiency, and reprioritizing spending to make expenditure cuts while still providing essential services to residents (C. Levine 1985; 1978; Wolman and Davis 1980; C. Levine, Rubin, and Wolohojian 1982; Justice and Yang 2018). However, the research so far focuses primarily on economic events, like recessions, the loss of a major employer, or changes in population that can degrade the tax base.

The literature focuses on the ways that governments adapt during a period of retrenchment, when they must make cutbacks to align expenditures with revenues. Without further study we cannot be certain how similar local government experiences are for fiscal stress from disasters and from economic shocks. Furthermore, it is yet untested if local disasters treat these events the same way, resulting in similar adaptations to their fiscal structure, or whether the particulars of fiscal stress resulting from disasters lead local governments to pursue different types of strategies, adapting their fiscal structure in ways that account for the specific risks tied to experiencing disaster.

This dissertation seeks to study how local governments adapt their fiscal structure following disaster, and what aspects of their situation lead them to make adaptations. The descriptive analysis and statistical model herein provide a foundational understanding of variation in local government coping strategies following disasters. Such a foundation enables further research to determine if certain strategies lead to faster recoveries and more resilient fiscal structures.

Hurricane Harvey provides a prime research opportunity to study coping strategies for local governments that vary widely in terms of disaster experience, fiscal condition, size, and

type. Hurricane Harvey made landfall in south Texas in late August and resulted in extreme conditions, with residual flooding from heavy rainfall due to a slow-moving weather system and dam releases continuing through early September. Immediate impacts of the disaster were widespread, allowing for a large sample of local governments, and the development of a causal model to explain the selection of coping strategies that these local governments used to adapt to new challenges and demands placed on their organization and community. The wide area that is included in the study overlaps with local governments of different types, sizes, demographic and economic makeup, prior fiscal condition before the storm, and level of damage due to exposure to elements of the storm. Local governments are still adapting and recovering from the incident, so local government financial officers have knowledge about their local government's experience of disaster and the actions they have already taken to adapt. The experience is fresh in their minds, ensuring an accurate assessment on if the disaster was a motivation for adapting their fiscal structure.

Disaster recovery is often a multiyear process, making the entire scope of recovery difficult to process and research. Surveying the local governments at this time in the recovery process is necessary to determine the initial intentions of local governments shortly after the disaster, and how quickly and how much they adapt their fiscal structure following a disaster. It may be the case that local governments are overwhelmed with other aspects of recovery, and often fail to shape their fiscal structure in response to new information about their level of risk. Assessing the extent to which local governments can adapt to a new fiscal reality within the first 2 years following a disaster could inform policy recommendations aimed at making local governments more resilient.

1.1 Purpose of the Study

The purpose of this dissertation is to investigate the degree of adaptation that local governments pursue to shift their fiscal structure following fiscal stress from disasters. After developing a framework of the factors that influence the selection of coping strategies, the study focuses on the impact of hazard exposure, prior fiscal condition, environmental factors that shape the experience of fiscal stress these local governments endure. The aim of the study is to expand our understanding of local government coping strategies following fiscal stress, to examine what factors impact the selection of coping strategies, and how important these different aspects are when deciding to implement coping strategies from any one category. This dissertation focuses on answering the following research questions:

R1: What coping strategies did local governments use after Hurricane Harvey?

R2: What factors influence local governments' level of adaptation?

The findings in this dissertation advance the understanding of both the recovery process for local governments, and our understanding of how local governments adapt their fiscal structure during periods of fiscal stress.

1.2 Dissertation Outline

The dissertation proceeds as follows. The next chapter provides a literature review on the concepts of fiscal condition, fiscal stress, disasters and disaster finance, and how disasters may fit or differ from our current understanding of fiscal coping strategies during retrenchment following economic fiscal stress. Then, the proposal establishes a new framework for coping strategies following disasters, based on models of fiscal condition, disaster vulnerability, and models of retrenchment.

The theory section argues that local governments act strategically and change their fiscal structure relative to their hazard exposure, and prior fiscal condition. A framework is developed, which unifies theories about fiscal health with emergency management theories on risk to disasters, and social vulnerability. In the framework, fiscal stress for a local government is caused by a combination of the jurisdiction's prior fiscal condition, their experience of impact from the hazard, and aspects of the organization's environment, or institutional restrictions and socioeconomic factors that dictate constituent demand. Within a situation of fiscal stress, local governments make decisions on coping strategies they use to adjust their fiscal structure, in their response to the disaster, and to facilitate their own recovery as an organization, and the recovery of the community. The resulting adapted fiscal condition becomes the new fiscal condition, which may cyclically be adjusted as the local government undergoes future fiscal stress.

The fourth chapter details the design and descriptive finds of a survey sent to financial officers in cities, counties, and school districts in the area impacted by Hurricane Harvey. The survey findings indicate that local governments use a range of coping strategies to adapt their fiscal structure following disaster; of 137 local governments that responded to the survey, 66 percent used some number of coping strategies, with only 5 of 62 possible strategies not being used by an local governments. Findings show that these local governments have a preference for specific categories of coping strategies – namely seeking new revenue, adapting or adjusting policy, providing new services, and using collaborative or alterative provision strategies to provide services. The top coping strategies for local governments included applying for and receiving grants, purchasing new equipment, using fund balance reserves, and amending the budget. Open ended responses from the local governments signify that local governments

recognize the importance of having enough savings in fund balance and may take on the provision of new services following disaster.

The fifth chapter links the survey with secondary data from financial statements, raster map data on hazard impact, and census demographics to develop a causal model for what influences the decision to adapt. In chapter five, a set of negative binomial regressions are used to estimate the effects of prior fiscal condition, hazard impact, and environmental factors on the level of local government adaptation to disaster induced fiscal stress. The findings provide limited support for the hypotheses that local governments with lower prior fiscal condition and greater hazard exposure use more coping strategies. The findings show mixed results on whether institutional rules that restrict financial structures lead school districts to use more coping strategies than cities during the recovery process.

Finally, the dissertation concludes with a discussion of the contributions and limitations on results from both research questions and provides a roadmap for future research. This dissertation provides an analysis of how local governments adapt their following disaster, and also shows influences local governments decision to use more or less coping strategies. Following this study, future research can assess if the selection of different coping strategies leads to different outcomes.

CHAPTER 2

LITERATURE REVIEW

This chapter connects disparate literatures available from both public finance and emergency management. Within public finance, the concept of fiscal condition, or the ability of local governments to meet their financial and service obligations, is well established within the literature. The literature on fiscal condition often seeks to either forecast financial troubles for municipalities (with an eye for guiding state intervention), or to model how governments adjust to a new fiscal environment once they have experienced fiscal stress. However, the literature displays a bias in what qualifies as fiscal stress, with many studies focusing on how cities cope with recessions, new state-imposed mandates or constraints, or major changes to a tax base spurred by the loss of a major employer or out migration. Although disasters are implicitly included in fiscal stress frameworks because they may initiate these types of economic contexts studied, disasters themselves are not overtly studied or tested as stressors themselves.

Emergency management literature has also considered the financial impact of disaster. The literature makes clear that disasters can have severe and long-term financial impacts on individuals, communities, businesses and local governments. However, literature from the emergency management perspective often uses case studies, and this can make generalization difficult. The literature also often asks how disasters impact revenues or expenditures, but do not further ask how local governments adapt their fiscal structure in light of new information on risk, using disasters to improve their fiscal structure for improved long run solvency. While an emerging adaptive governance literature focuses on how a community of stakeholders may act to improve the fit between social and ecological systems, the focus is largely on the successful

realization of policy, rather than the fiscal choices that are connected to these policies. See Chaffin, Gosnell, and Cosens (2014) for a discussion of the state of this line of research.

This chapter provides an overview of fiscal condition, including how fiscal condition and fiscal stress are commonly defined and measured within public finance literature. Historical context shows that research on fiscal health has often been conducted in response to large economic events rather than post-disaster recovery. In the overview, the chapter also reviews previous studies that try to determine how local governments cope with fiscal stress, and what factors determine their selection, from a myriad of potential strategies local governments can take to reshape their fiscal structure.

Bridging the gap between public finance and emergency management literature, the chapter then provides an overview of disaster literature, including definitions and measurements of disasters, and the fiscal federalism-based process used to finance disaster recovery in the United States context. The chapter then reviews in detail the financial impact that disasters have on the revenue and expenditure of local governments.

Finally, the chapter ends with a discussion of the gap in the literature. Disasters are events that can have severe long-term fiscal consequences for the local governments that experience them. However, the financial stress from disasters is different from recessions or state-imposed mandates. It remains to be tested whether local governments recovering from disaster employ the same strategies as they would to cope with other types of fiscal stress. This question is vital, because we first need to understand how local governments currently respond to disaster before we can determine what strategies lead to faster recoveries and more resilient fiscal structures in the long term.

2.1 Overview of Fiscal Condition

Local governments provide essential services to their residents, and often have additional responsibility for the implementation of state and federal goals. Local governments must be responsive to changes in the fiscal environment, so that they can continue providing services during times when revenue collections are low, or service demands rise beyond levels possible to sustain with current revenue collections.

At the heart of the matter, the fiscal condition of a government, or labeled by some as the organization's fiscal health, refers to its "ability to meet financial and service obligations" (H. Levine, Scorsone, and Justice 2012, 11). However, while governments may have obligations to provide specific levels and types of services – determined by public preferences voiced through political processes – the available revenue used to provide these services may fluctuate, become more restricted, or even inaccessible. External factors are often out of the control of local governments, and shifts in the economic conditions, or other types of external shocks, require local governments to adapt.

As Jacob and Hendrick (2012, 12) note, "fiscal condition is the result of a process characterized by the strategic choices of local officials with respect to goals regarding different forms of solvency." Fiscal condition is the consequence of internal decisions, shaped by the advantages and limitations of the fiscal environment. Not only do decision makers need to consider current threats, but they must accurately assess future conditions, and balance current needs with how they impact future opportunities. Local choices focus on the types and levels of current revenues and services and future investments and liabilities (Jacob and Hendrick 2012). Put most simply, fiscal condition is a combination of capacities, constraints, and the net fiscal condition, defined as a balance of these capacities and constraints with other environmental

factors and future concerns (Hendrick 2011; H. Levine, Scorsone, and Justice 2012).

2.1.1 Capacities

Capacities refer to the revenues, assets, and other resources held and collected by the local government. There are two most general forms of revenue streams: intergovernmental revenues and own-source revenues.

Intergovernmental revenues are transfers from other levels of government, either the state or federal government. This money can either be general assistance or earmarked for a specific purpose, such as the implementation of federal policies. Intergovernmental revenues that are provided on a one-time basis are often tied to specific obligations, while reoccurring funding is often determined by a need-based formula (Jacob and Hendrick 2012). Intergovernmental revenue can be a substantial part of a local government's total revenue, especially following a disaster, where federal funding fuels recovery, including federal and state-backed flood insurance payouts (Settle 1985; Burby 2001; Hildreth, Miller, and Sewordor 2011). However, reliance of intergovernmental revenue is not without risk; these funds may cease; especially if the state itself is dealing with its own financial concerns.

Own-source revenues refer to the revenue generated from within the local government's jurisdiction (Jacob and Hendrick 2012). Collection can either be done by the local government, or facilitated by another government, that then distributes the money back to the local level at intervals, such as sales tax in Texas, which is collected by the state. It is not only the quantity of own-source revenues that factor into fiscal condition, but also the stability and diversification of the portfolio (Jacob and Hendrick 2012). While property tax incomes are often stable throughout economic cycles, income and sales tax are more revenue elastic and tend to dramatically decline during recessions. Local governments that rely more heavily on elastic revenue streams must

hold more resources in slack, often in a fund balance, to weather future economic recessions and other external shocks.

The financial capacity of a local government does not only refer to the money they collect, but also the revenue that they can access (Berne and Schramm 1986). Within a jurisdiction there is an economic base, or total economic resources of a community. From the economic base, only a portion is accessible to local governments, due to institutional constraints, such as tax and expenditure limits or other state statues that restrict local government financial management practices. For example, while income is an available form of economic base within Texas, state law prevents local governments from taxing this resource. Local governments may be further restrained through caps on tax rates; hence a local government's revenue capacity is often less than its revenue base. Actual revenue may also differ from revenue capacity, and this difference is called revenue reserves. Local governments that can draw from revenue reserves when they must adapt to environmental shifts are considered to be more resilient and generally are considered to have a better fiscal condition (Jacob and Hendrick 2012).

The ability to pull resources from the tax base can also be impacted by overlapping jurisdictions, which are also pulling resources from the same base. For example, a city, county, and school district may all collect taxes from the same residents, who can only pay so much in taxes. Neighboring and overlapping jurisdictions compete for the same tax base, and this may result in overuse, similar to a common pool resource. Literature suggests that historically, overlapping debt can degrade public support and willingness to pay (Justice and Scorsone 2012; Sbragia 1996). Furthermore, overlapping jurisdictions can lead to higher levels of debt interest payments (Greer 2015), and other measures of public sector size and tax burden, like total own-source revenue (Berry 2008; Jimenez 2015).

One vital element of fiscal capacity is that of fiscal slack, or the excess resources, beyond what is necessary to produce minimum service levels; fiscal slack can refer to both financial and other resources like excess staff (Hendrick 2006; Jacob and Hendrick 2012). Fiscal slack is often measured in terms of fund balance, or rainy-day funds, but informally it may also refer to budget flexibility and discretionary spending that can be reduced during economic downturns. Some resources within the fund balance may be earmarked for specific purpose, so unreserved fund balance best describes short-term financial condition (Jacob and Hendrick 2012). Changes to accounting reporting practices recommended by GASB 54 in 2009 allow for more accurate reporting of different kinds of slack, separating unassigned net assets from those that are restricted, committed, or assigned for specific use (Arapis 2015).

Slack resources not only can be spent down during times of financial difficulty, but also can act to smooth fluctuations in cash flows, when revenue collection does not align with cash expenditure requirements. While greater amounts of slack resources may be advantageous in times of fiscal stress, possessing too much slack is not necessarily viewed as positive by local governments, since there is an associated opportunity cost in not using those funds for other investments. Marlowe (2011) finds that governments often keep 5 percent of revenue in reserves, per guidelines from GFOA, regardless of their fiscal structure or considerations of financial risk. However, the study finds that so long as local governments hold minimal amounts in reserve, additional slack resources do little to improve credit ratings. In other words, baseline levels of slack signal to investors a sense of solvency, even though levels of fiscal risk may be substantially different.

Looking at the potential for slack resources to provide expenditure stabilization, Marlowe (2005) finds that unreserved general fund balance has a marginal counter-cyclical effect on

municipalities, essentially boosting expenditures during downturn years. This suggests that municipalities do draw from slack resources during times of need, to continue stable levels of service provision.

2.1.2 Constraints

Constraints refer to expenditures and liabilities, or obligations that the government has to other parties. Jacob and Hendrick (2012) suggest that there is a baseline set of services that are considered spending needs. These needs are levels of service that the government must provide to keep citizens safe and healthy. This baseline is partially a consequence of external environmental factors, like the age of the infrastructure, growing population, or the level of crime, all of which may determine capital outlay or department staffing levels. Beyond service needs are those services additionally demanded by the public through political behavior.

One element of fiscal condition is the ability of the government to adapt to changes in fiscal environment, and to manage their level of fiscal risk, or vulnerability to fiscal shocks. Expenditures differ in the extent to which they are fixed. Expenditures that cannot be put off, like personnel costs or debt payments that cannot be deferred, are considered fixed (Jacob and Hendrick 2012). Choices to defer maintenance or repairs on infrastructure or the use of long-term borrowing can create future obligations.

Some spending is mandated by other levels of government. The level of expenditure for local government is also influenced by institutional factors, such as the number of overlapping jurisdictions such as special districts, and the services they provide. Constraints often have a time element associated with them.

One area of study that has seen considerable attention is that of the management of pensions. This is especially in light of the aging population changing the structure and

demographics of the public workforce (Wolf and Amirkhanyan 2010). For example, Gehl, Willoughby, and Bell (2013) and Peng (2004) analyze case studies in Atlanta, West Virginia, New Jersey, and New York City to look at efforts in pension reforms, the relationship between pensions and the operating budget, and the long-term solvencies of local governments. St. Clair (2013) looks at how institutional factors that dictate the rules for withdrawals and deposits to budget stablization funds impact the level of contribution to pension funding.

Another area of focus is on the management of debt, especially during recessions or periods that require substantial cutback, and the impact that financial management can have on bond ratings. Verifying findings based on case studies such as Detroit, Gorina, Joffe, and Maher (2018) confirm that changes to levels of general fund balances, and measures of long-term obligations and local unemployment are associated with municipal defaults and bankruptcies. Looking at bond ratings, Jimenez (2011) highlights the need for personnel capacity, finding that for state government general obgligation bond ratings are influenced by the quality of management systems, but this impact is diminished when negative environmental impacts, like economic conditions or political uncertainties, arise.

The organizational structure and legal constraints of different types of government can also have an impact on fiscal condition. Local governments that are restricted to specific types of revenue, or are limited in terms of revenue or expenditures may be less able to adapt, or more slow to respond to changes in their environment. Looking at tax and expenditure limits (TELs) imposed on local governments by states, finds that TELs impact various aspects of fiscal condition, including revenue, expenditures, unreserved fund balances, debt service, general-obligation debt, and unfunded pension liabilities in surprising ways (Maher and Deller 2012, 421–22). For instance, local governments with more restrictions tend to have less own-source

revenues and general fund expenditures, but higher levels of unreserved fund balance and lower levels of debt service and general obligation debt. TELs do not always effectively cut revenues and expenditures, but instead push local governments to rely on other sources of revenue, including increased use of state aid (Skidmore 1999). TELs restrict a local government's ability to be flexible, and change their fiscal structure from past preferences to current preferences of voters, and may lead local governments to make poor financial management practices (Jimenez 2018). MacManus (1993) finds that cities, counties, and school districts use different coping mechanisms following a recession, largely due to their level of reliance on different revenue streams, and their general ability (or inability) to raise revenue.

2.1.3 Net Fiscal Condition

Net fiscal condition refers to measures of balance and levels of solvency. Fiscal balance is a conception of how well the local government has tailored their fiscal structure in light of external pressures and opportunities, with an eye towards future concerns (Clark and Ferguson 1983; Jacob and Hendrick 2012, 17). When a local government does not take advantage of the revenue streams available to them through institutional constraints placed on them by the state, they may be considered less adapted to their environment.

Groves, Godsey, and Nollenberger (2003) put forth four measures of solvency: long-run, service-level, budgetary and cash based solvency. Overall these measures serve as a proxy for fiscal condition, by determining how sustainable expenditures are to revenues. Long-run solvency refers to the long-run balance between revenue and spending. Service-level refers to the government's ability to provide an adequate level of services. Budgetary solvency refers to the government's ability to have enough revenue to meet expenditures for the current year. Finally, cash solvency refers to the government being able to generate the cash necessary to pay its bills

over the next 30 to 60 days.

Measures of net fiscal condition are often expressed as ratios, such as the revenue burden, a measure of revenue base to revenue capacity, or measures of long term solvency that compares aggregate spending needs relative to total revenue wealth (Jacob and Hendrick 2012). Measuring the solvency of physical assets may involve comparing debt to the value of the infrastructure minus appreciation. Measures of solvency can be somewhat elusive; service level solvency measures may compare concepts of slack to risk, but forecasting risk can be difficult, given future uncertainty (Jacob and Hendrick 2012). Localities have requirements to plan for a balanced budget, but comparing short-term revenues and expenditures can indicate budgetary solvency.

2.2 Fiscal Stress and Retrenchment

Not all local governments are equally adapted to their environment, or as flexible to future change. Literature as traditionally focused on retrenchment, or the reduction of costs within an organization in response to economic difficulty, often studying department and government efforts to reprioritize goals and trim down services during periods of economic decline. However, economic decline is only one way that local governments may experience fiscal stress.

According to Justice and Scorsone (2012, 45–46), fiscal stress refers to a government's "actual or potential failure to satisfy one or more of the solvency, sustainability, flexibility, and vulnerability conditions of fiscal health." In this conception of fiscal stress, solvency refers to the ability for a government to meets its financial and service commitments while maintaining solvency. Flexibility is how much a government can reshape its tax burden or debt. Finally, vulnerability refers to the level of dependency on funding resources outside its control that can

impact the ability to meet obligations.

Wolman and Davis (1980, 231) defines fiscal pressure as a situation that persists long enough to require a response in increasing revenues or cutting expenditures. Potential situations include a decrease in either the growth of the base or the level of intergovernmental funds. Others have defined a financial emergency as one where the government cannot continue to provide services because of a lack of cash or appropriation authority (Clark 1994; Clark and Ferguson 1983).

2.2.1 Historical Context

Much of the research on fiscal stress has been spurred by significant economic events. Justice and Scorsone (2012) suggest that there are periods in history that have motivated our literature and understanding of fiscal stress, and also lead to changes in politics, legal requirements, and public budgeting practices. In the 19th century, states imposed borrowing restrictions through state constitutional limits and additional requirements for electoral approval. These restrictions were brought about following state bond defaults following the depression in 1839 and southern states' defaulting on railroad bonds in the 1870s. During the Great Depression in the 1930s, growing service demands, budget deficits, heavy debt burdens, and a reliance on short-term debt left cities vulnerable.

During the late 1970s and start of the 1980s, economic recession, as well as the migration and land-development trends put fiscal stress on large central cities (Justice and Scorsone 2012). Taxpayer revolts during this time period resulted in tax and expenditure limitations (TELs) that restrict local government's ability to respond to their new economic environment. The academic studies from this era focused on explaining and predicting urban fiscal stress, and found that the loss of businesses, the increased demand of services, the politics of employee unions and budget

maximizing bureaucrats, and management issues were largely responsible. Literature directly following this era often focused on how local governments could best practice cutback management or retrenchment.

Most recently, during the 1990s to the present, the dot-com bubble and real estate bubble that culminated in the fiscal recession during 2007-2008 put fiscal strain on local governments that already faced budget deficits, experienced faster real estate growth prior to the crash, or were overly optimistic with economic development efforts (Justice and Scorsone 2012).

The literature available on fiscal stress have largely focused on these key incidents where large urban municipalities experienced stagnation, new legal restrictions, growing service demands, and population migration, and were not quick enough or truly able to react. Disasters may also require changes to fiscal structure due to changes in the fiscal environment and are rightly mentioned as potential catalysts for fiscal stress. However, studies that consider what aspects of fiscal structure lead to financial vulnerability to disaster, and how local governments respond following disaster are not prevalent. Literature from the emergency management field provides some case studies on individual municipalities' difficulties during disaster recovery, but this literature has not been fully utilized to further develop our understanding of fiscal stress more broadly.

2.2.2 Measuring Fiscal Stress

Measuring fiscal stress and the resulting poor fiscal condition is difficult, in part due to the complexity of factors that make up fiscal condition. Complex indices can provide a nuanced understanding of fiscal condition, but may rely on less accessible information. Furthermore, some literature obfuscates factors that may influence fiscal condition, like socioeconomic characteristics of the population that may stand as a proxy for service demand, and actual

measures of fiscal condition that constitute the ability for the local government to be able to meet its obligations. For a critique, see Wang, Dennis, and Tu (2007). Several different measures have been developed, either as a tool for local governments to self assess their condition, or as part of a forecasting tool, to alert states of potential dips in fiscal condition that may require state intervention.

One of the most established measures of fiscal condition comes from the International City/County Management Association's (ICMA) Financial Trend Monitoring system (FTMS), that tries to assess fiscal condition through measures focused on the 4 types of solvency (Groves, Godsey, and Nollenberger 2003). This system considers how five environmental factors (community needs and resources, external economic conditions, intergovernmental constraints, disasters and emergencies, and political culture) impact six financial factors (revenues, expenditures, operating position, debt structure, unfunded liabilities, and condition of capital plant). The fiscal condition of the financial factors are determined from a series of indicators.

It is worth noting that while risk to disaster is included as one of the indicators in the FTMS, the measure asks only local governments to determine if they have adequately prepared for disaster, by determining their level of risk, previous damage experience, use of a reserve fund, and how recently they have updated their preparedness plans (Groves, Godsey, and Nollenberger 2003, 144). Including potential for disaster as a component of overall fiscal condition obfuscates factors that impact fiscal condition and actual measures of fiscal condition, which should measure how well local governments have adapted their fiscal structure to their environment, factoring in this risk.

While the FTMS system is more comprehensive, Brown (1993) has developed a simpler system to be used as a tool of assessment for small cities. Cities can calculate 10 ratios from

standard financial documents that measure some aspect of operating position, debt structure, revenues and expenditure. These measures can then be compared with ratios of similarly sized cities obtained through the GFOA's financial indicator's database. A total score of fiscal condition can be established by adding points based on quartile rankings with the comparison group. Maher and Nollenberger (2009) have since recalculated the comparison group using data from 2003-2006; they suggest that new comparison groups are necessary given recent shifts in local government to more heavy reliance on more income elastic revenue sources.

Kloha, Weissert, and Kleine (2005) have similarly developed a 10 point system, but with somewhat different measures, including socio-economic factors and different meeasures of demand, and provides an absolute measure of fiscal condition, rather than providing a comparison to a group of similarly sized jurisdictions.

The FTMS system provides a general assessment of fiscal condition, in a way that allows a local government to monitor year to year, but does not assess fiscal condition in comparison to other groups. Many of the 10 point scale systems attempt to compare local governments to others within a similar area or size, but few if any are able to truly benchmark fiscal condition to a standard, as it is unclear exactly what constellation of fiscal factors is required for a full bill of health (Jacob and Hendrick 2012).

2.2.3 Fiscal Stress Coping Strategies

Once local governments experience a change to their environment that amounts to fiscal stress, they may pursue different strategies to adapt to their new fiscal environment. Because of the complexity involved in having a good fiscal condition, these solutions may vary widely.

Research from the cutback management literature of the 1970s and 1980s attempts to determine if there were predictable stages of retrenchment. Levine (1985) looks at police

departments, and finds that they pursue different strategies based on the length and severity of the event. During a short and low severity event, termed a fiscal crunch, departments defer maintenance and hire freezes, while a short but severe event may require layoffs or the cancellation of purchases. A long term but low severity fiscal event leads to downscaling, while a severe and long-term event necessitates a reorganization or priorities, increased outsourcing and use of volunteers.

Similarly, Wolman and Davis (1980) suggest that there is an order to the selection of strategies. First local governments buy time, and use saved resources, or delay filling positions or doing maintenance, before moving on to strategies that are less politically appealing. Next, Woman and Davis suggest that local governments make efforts try to improve revenue streams, first through intergovernmental funds, and then by changing tax rates or increasing fines and fees. Should these strategies fail to relieve the fiscal stress, the final (and least preferable) strategies involve the reduction of services, the termination of programs, or other expenditure cuts that run against the organizational mission of local governments: to provide services to their residents.

Running counter to the assertions of Wolman and Davis, Afonso (2013) finds that county governments reduce expenditures more often than they increase taxes. Examining cities, counties, and school districts, MacManus (1993) also finds expenditure reduction strategies more common than revenue raising strategies. Levine, Rubin, and Wolohojian (1981) suggest that rather than order all revenue raising strategies before expenditure-based strategies, the order revolves around conflict avoidance, with revenue and expenditure strategies viewed as less unfavorable being used before moving on to more antagonistic or extreme strategies.

Justice and Yang (2018) suggest that local governments that encounter fiscal stress do not

focus on just revenue or expenditure strategies, but use a coherent plan that may involve actions from multiple categories within the retrenchment models. Coping strategies may be a mix of short-term solutions and efforts to adapt fiscal structure to a new fiscal environment in the long run.

Several factors may determine what strategies are most politically feasible, or most agreeable to decision makers, and likely to be implemented. Comparing cities with different levels of citizen participation in the budget process, Jimenez (2014) finds that, relative to less participatory governments, more participatory cities selected strategies that included eliminating services and laying off workers, thus avoiding the increase of property taxes.

All coping mechanisms are not equally likely to improve fiscal condition. For example, while annexation may promise to increase the tax base and therefore improve fiscal condition, Smith and Afonso (2016) find that in practice annexation leads to decreased fiscal condition, especially for involuntary annexation practices. Jimenez (2017) finds that managerial networking with external stakeholders may restrict local governments strategy choices and leads to worse outcomes.

2.3 Connecting Fiscal Stress with Disasters

As shown, literature on fiscal condition often indicates that fiscal stress can develop following natural disasters, but often to not distinguish how this stress differs from other types of economic events. While research has asked broadly how local governments respond to fiscal stress, they haven't studied how local governments cope with post-disaster fiscal stress. Disasters cause different pressures on fiscal structure and may disrupt regular decision-making processes. The following section details relevant emergency management literature on the fiscal impacts of

disasters, and the strategic process that local governments likely follow when determining how to adjust their fiscal structure following a disaster.

2.4 Disasters

2.4.1 Defining Disasters

In the most typical set of definitions used by scholars, disasters refer to events that impact a community and overwhelm their capacity to respond (Kreps 1995; Couch and Kroll-Smith 1985; Kroll-Smith, Couch, and Couch 1991). For a disaster to occur there must be an interaction of a community with its environment that results in loss. Disaster risk is a combination of a social unit's potential for damage (i.e., their vulnerability), and their exposure to hazard (Wisner et al. 2004). A lower level of loss may not necessitate external assistance, but an event like Hurricane Katrina requires extraordinary resources from higher levels of government or other communities for impacted communities to recover. A tsunami hitting an empty beach constitutes a hazard, but without damage to humans, infrastructure, and institutions a hazard does not constitute a disaster.

Emergency management comprises the cycle of actions taken in response to risk. Traditionally, emergency management follows four stages: mitigation, preparedness, response and recovery. These phases of the cycle overlap; often recovery involves rebuilding in a new way, following lessons learned from the experience, either through improved building standards or changing land use patterns (Neal 1997).

Moving through the four phases sequentially, mitigation refers to the attempt to reduce the exposure to risk. This may involve building sea walls to protect ocean fronts from storm surge, a city plan being cognizant of floodplains and not developing in hazardous areas, raising homes to protect them from flooding, or removing vegetation from near the home to decrease the

risk of forest fires. The goal of mitigation is to reduce either hazard exposure and/or disaster losses.

Preparedness refers to the actions that lead up to a disaster, and this may involve emergency responder practice drills, getting water and food supplies for the home, setting up early warning systems for tornadoes, or sandbagging areas to protect from flooding, while mitigation seeks to decrease the likelihood of a disaster impacting the community. Preparedness is the action of getting ready for response.

Response includes the actions that occur directly around the time of the disaster, such as search and rescue efforts, or the immediate debris removal following the event. Response efforts may be short relative to other phases of disaster, but choices made during response often impact recovery. Response is saving lives and containing losses while the event is unfolding.

Finally, recovery is the longer process following an event, where the community returns to a sense of normalcy, where individuals either return to or establish new normal routines. Quarantelli (1999) notes that rolled into recovery are concepts of reconstruction, restoration, rehabilitation, and even restitution. Recovery involves the physical rebuilding of property and the return of members of the community to previous social patterns. Wisner and others (2004, 357) suggest that while the language often uses the pre-fix “re” suggesting a return to pre-existing condition, in reality some households and individuals who are most vulnerable do not recover, but sustain decreased home values, increased debt, and return to less favorable conditions. Others suggest that a concept of recovery should include the ability for one to not just bounce back to previous conditions, but to bounce forward towards levels of growth that would have been attained had the disaster not occurred (Manyena et al. 2011). A return to pre-disaster conditions recreates the same vulnerabilities to future disaster, while instead communities should aim to

improve conditions (Chang 2010; Mileti 1999; Godschalk 2003).

Local governments as organizations must also act strategically to shape their fiscal structure relative to their potential and experience of disaster risk. Local governments may mitigate the impact of a disaster event through a variety of means, including enacting land use controls to decrease the amount of property in areas susceptible to flood risk, and thus, protect property tax revenue. Additionally, local governments can diversify their revenue sources, so they can continue to provide services following a disaster, even if one revenue source is heavily impacted. Local governments can prepare for disaster financially by holding slack resources or rainy-day funds to remain cash solvent during times of increased expenditure demands during response. During disasters local governments may increase service provision, using overtime staffing for police, fire, and public works staff during rescue and debris removal. During the recovery phase, local governments may adapt their fiscal structure due to changes in population, public service preferences, and long-term changes to housing values, or other changes in revenue sources.

Not all communities with comparable levels of hazard exposure and disaster impacts will have the same experience of recovery. Some communities may have enough slack resources to provide additional services, quickly repair infrastructure, remove debris, and clear roads to facilitate a faster return to normal levels of economic activity. Conversely, other communities may already carry a heavy debt burden and/or simply lack the equipment, finances, or human capital necessary to facilitate a fast recovery. The pressure and release model suggests that individuals or communities who are more vulnerable to disaster are often those with limited access to power and resources, including access to loans, insurance, quality information about risk, or have a lack of political voice to make their plight known (Wisner et al. 2004).

Several studies have shown that some minority groups have a slower recovery. For example, Peacock and others find that minority households often did not have access to high quality insurance programs and lack access to the financial markets necessary to make timely home repairs following hurricanes (Dash and Peacock 1997; Peacock and Girard 1997). Other studies find that low-income neighborhoods are often situated in areas of highest risk, because these areas are most financially accessible; however not all neighborhoods see a return in home values at the same rate; minority majority neighborhoods often see a slow or incomplete recovery to pre-disaster levels, compared with other neighborhoods. (Peacock et al. 2014; Peacock, Dash, and Zhang 2007; Krueger, Winkler, and Schumann III 2019)

Some social and demographic features are found to be correlated with a lack of access to resources, making some individuals more at risk to disaster than others. According to Cutter (1996, 530), social vulnerability is the "susceptibility of social groups or society at large to potential losses (structural and nonstructural) from hazard events and disasters" and further is "an interaction of the hazards of place (risk and mitigation) with the social profile of communities" (Cutter 1993; 1996, 532).

Literature that focuses on the social aspects of disaster often focus on what factors make an individual vulnerable to disaster, or less able to recover (Fothergill and Peek 2004; Fothergill, Maestas, and Darlington 1999; Peek and Stough 2010). However, many different factors play into vulnerability, making comparisons difficult. Cutter and other scholars have developed indices that factor in a multitude of demographic factors that can contribute to vulnerability and mapped them, as a tool to compare the levels of vulnerability between regions (Cutter, Boruff, and Shirley 2003; Cutter and Emrich 2006; Borden et al. 2007; Cutter and Finch 2008; Emrich and Cutter 2011; Bergstrand et al. 2015). Several demographic characteristics contribute to

higher levels of social vulnerability on a near universal basis, but some of these factors or combinations of factors hold differing levels of relevance. Social Vulnerability indices with a multitude of factors provide a tool for comparing vulnerability across communities..

Economic characteristics, beyond demographic features can also determine the impact of disaster on a community. Chang and Rose (2012) provide an extensive literature review on business recovery following disasters, acknowledging that while business and local economies are generally resilient, some locally-oriented businesses are more susceptible to risk (Kroll et al. 1991; Dahlhamer and Tierney 1998; Alesch et al. 2001; Chang and Falit-Baiamonte 2002) Others find that pre-disaster trends of growth or decline are often exacerbated (Council 2006; Chang 2000; Dahlhamer and Tierney 1998; Alesch, Arendt, and Holly 2009; Chang 2010), especially hurting any businesses already stressed (Dahlhamer and Tierney 1998; Webb, Tierney, and Dahlhamer 2002; Alesch et al. 2001; Alesch, Arendt, and Holly 2009). Businesses not directly hit by disaster may still be impacted by neighborhood effects due to a loss of customers returning to the area (Webb, Tierney, and Dahlhamer 2000; Chang and Falit-Baiamonte 2002), and business failure may occur substantially after the disaster has occurred (Alesch et al. 2001; Webb, Tierney, and Dahlhamer 2002; Lam et al. 2009). Local governments may see drastic changes to their revenue and expenditure needs if the community is heavily dependent on a single sector, single major local employer, or those sectors that are more vulnerable to disasters (Heinz Center 2002).

2.4.2 Fiscal Impact of Disasters on Local Government

Disasters are often costly events. As an extreme example, using figures from 2015, in response to Hurricane Katrina FEMA spent $11.7 billion in federal share of public works projects, and $5.2 billion in assistance to individuals for Louisiana alone (FEMA 2015). This

federal assistance does not approach the total costs from the event; private insurance markets, local governments, and individual businesses and residents also bear the cost and effort to rebuild and recover. Local governments are often the first to respond to a disaster, and most pay a substantial amount during the recovery process. However, part of those payments may later be reimbursed by FEMA for designated areas. Local governments are often constrained in their ability to collect revenue and redirect funds towards recovery efforts and must work to reshape their budget to match new priorities.

Through the Stafford Act, the federal government only provides 75 percent of the funding for public assistance to rebuild public facilities, unless additional funds are approved through presidential action, or resources are sought through the Hazard Mitigation Grant Program (*The Stafford Act* 1988). The federal funding is not instantaneous, but is rather a refund of local government payments, which must have access to savings and even take on debt to start the initial recovery process. Funding from FEMA is often processed for years following the event, and often provided sporadically, rather than as a steady stream of income (Hildreth 2009). Furthermore, public assistance funds can only be used towards rebuilding previous structures as they were, not in funding improvements, leaving cities to find additional funds to learn from disasters, and make their recovery into a more resilient future.

Revenue streams often follow new patterns following disaster, making revenue forecasting difficult. Because cities are limited to having a balanced budget, the amount of saving that cities have in their rainy-day fund, their capacity, their level of debt, and the flexibility and resilience of their revenue streams and expenditure requirements all determine their road to fiscal recovery (Sylves 2007; Settle 1985). Local government's financial solvency throughout the recovery process is essential, as local government provide essential services to the

community, and often provide services during the recovery process to those most vulnerable residents.

Due to the aspect of federalism in the disaster recovery process, intergovernmental aid plays a large role in recovery. Local governments that experience disaster may see a sudden, if temporary increase in intergovernmental aid earmarked for specific rebuilding purposes but are limited to specific uses. However, disaster may also impact those most vulnerable in the community, and when disasters disrupt business and employment, may push these vulnerable members of the community, who previously were self-sustaining, to be eligible for non-disaster related welfare assistance programs (Miao, Hou, and Abrigo 2018).

Sales tax is often a substantial part of a local government's revenue, but due to its income elasticity can be volatile following disaster. Handley (2006) finds that in the months following Hurricane Katrina sales tax increased by 50 percent compared to the previous year; however, this is only part of the story. As Ismayilov and Andrew (2016) find, sales tax often has a steep increase within the first year following a disaster, but usually sees a decrease by year two, so this increase in sales tax is not sustained, and may even dip to below pre-disaster levels. This is likely because the surge in sales tax occurs when people spend money on repairs and there is an insurgance of contractors who come in for repairs, but after this initial economic activity, those who had to spend money on repairs cut back on personal expenditures, workers who came into the area for repairs move on to other projects, and some of the population decides not to return to the area, leading to the eventual slump in sales tax collections(Zhang, Lindell, and Prater 2009; Ismayilov and Andrew 2016). Others have found similar patterns in sales tax at a state level (Miao, Hou, and Abrigo 2018).

Property tax revenue is also impacted by disaster. Peacock and others find that home

values can be slow to return to pre-hurricane levels, and often minority and low income groups never return to previous home values (Peacock et al. 2014; Peacock, Dash, and Zhang 2007; Zhang and Peacock 2009). In their case study following Hurricane Floyd in North Carolina, Bin and Polasky (2004) also find that homes in floodplains have lower market values, and the gap between at-risk homes and those outside the floodplain increases post-disaster.

Disasters may also necessitate changes to expenditures, either because budgets need to be cut to match revenue, or because of new demands for services. Hildreth (2009) presents a case study of New Orleans following Hurricane Katrina, illustrating the range of fiscal difficulties local governments may deal with following disaster. In the wake of Hurricane Katrina, the city of New Orleans had to lay off 2,400 employees, (half of their workforce), to cut costs to match revenues and balance routine expenditures with the costs for emergency work, such as debris removal (Hildreth 2009). Changes in budgeting also reflected at least temporary changes in priority, as regular services like garbage pickup were reduced in frequency. Services funded through enterprise funds were largely based on user fees and suffered difficulty in managing funds as those service users were slow to return from evacuation. Anticipating a decline in assessed property values, the City of New Orleans increased the property tax rate to offset this issue; this was but one of the many strategies used to fulfill the city's debt payments.

Disasters not only impact revenues and expenditures, but they can also impact a local government's access to financial resources by impacting bond ratings. As Handley (2006) notes, Louisiana and Mississippi both experienced a downgrading in their bond ratings following Hurricane Katrina; however, Alabama, which had sustained less damage, did not see a change in its bond rating. Fowles, Liu, and Mamaril (2009) find that Hurricane Katrina directed the insurance market's attention to the risk of disasters beyond hurricanes, finding that municipal

bonds in California began to factor in levels of earthquake risk in determining interest costs, but only for those bonds issued following Hurricane Katrina.

2.4.3 Decision Making

In general, budget levels for different programs and policies within local government are the product of incrementalism, since local government officials adjust expenditures as they learn and as programs develop (Lindblom 1959). However, disasters often act as focusing events (Birkland 1997), and they can radically shift public perception of policy areas, or provide support for a policy that would be less palatable otherwise. If policies can only be implemented during a policy window, when a problem is clearly established, there is political support, and there is a policy based solution designed, (Kingdon 1984) disasters may provide a rare opportunity for local governments to make changes to their fiscal structure, if they are already aware and are developing policies to fix fiscal structure, relative to other types of risk.

Literature on coping strategies (Justice and Yang 2018; Nelson 2012) and disasters (Crow et al. 2018) suggest that local governments use a rational approach, and construct a coherent plan of coping strategies to learn and improve their fiscal condition following times of stress. Local governments are not the only ones to learn and adjust practices following disaster. Literature suggests that following disaster, bonds and debt markets may change pricing in areas susceptible to risk (Fowles, Liu, and Mamaril 2009; Hildreth, Miller, and Sewordor 2011).

2.5 Disasters vs. Recessions: Different Kinds of Fiscal Stress

Disasters do result in fiscal stress for local governments. However, literature on the coping methods used following fiscal stress for local governments have not considered the choices local governments make following disasters. Some case studies provide in depth discussions for the choices single local government faced during disaster. After Hurricane

Katrina, New Orleans faced extreme circumstances, and had to make substantial cuts to expenditures (Hildreth 2009). However, the experience of disaster is local; one hurricane event can impact cities differently, based on different levels of flooding and wind damage, as well as the vulnerability of the businesses and people to the disruption, and the strength of the built environment. For example, Ebdon, O'Neil, and Chen (2012) looked at a long lasting flooding event in Omaha, Nebraska, and found for the most part that mitigation efforts were successful, and the impact to local government revenues and expenditures were minor. Using a comparative approach to examine large number of disaster recovery experiences can determine the extent to which findings from these case studies are generalizable to all local governments following disaster, or whether they are anomalies confined only to most severe disaster events.

Using disasters to test available frameworks of fiscal stress can also help determine if these models are robust. The nature of fiscal stress in these instances is different. While recessions may see local governments draw down on fund balance, local governments following a presidentially declared disaster may see an increase in fund balance due to the distribution of federal aid (Krueger and Winkler 2018). Disasters can substantially change spending demands, first to provide services to survivors, but also to have the personnel who are able to manage the federal grant process, to serve public assistance to rebuild public structures. While some economic events may have fiscal impacts for a relatively short period (i.e., months to years), disaster literature suggests that degradation to the tax base can be long lasting (i.e., years to decades) following hurricanes and floods, where some property values never return to previous levels (Peacock et al. 2014; Krueger, Winkler, and Schumann III 2019). While sales tax is a key indicator of recession, in the months following a disaster, sales tax often temporarily spikes, as people hire contractors and purchase supplies to rebuild (Krueger and Winkler 2018). These

differences may lead to a different selection of coping mechansims following disaster, compared with recessions, or other kinds of economic fiscal stress events.

The perception of disasters among local government decision makers may also be different, leading to different choices in coping strategies. Disasters may be viewed as once in a lifetime events, compared to recessions that are anticipated to occur in cycles. Research is necessary to determine if local governments seek temporary coping strategies to rebuild and return to a previous norm, or if disasters alert communities and investors to risk they were not aware of, motivating permanent structural changes.

CHAPTER 3

THEORY

Local governments aim to sustainably provide services and meet their obligations, despite drastic changes to their environment. The literature on fiscal condition suggests that local governments act strategically to readapt their fiscal structure following periods of fiscal stress so that they can continue to provide services and meet obligations. Following fiscal stress from economic events like recessions, local governments may take efforts to increase and diversify revenue, cut expenditures, and improve efficiency in service delivery. Not only do local governments try to balance revenue and expenditures, but they also make their fiscal structure more resilient to the types of fiscal risk in their environment.

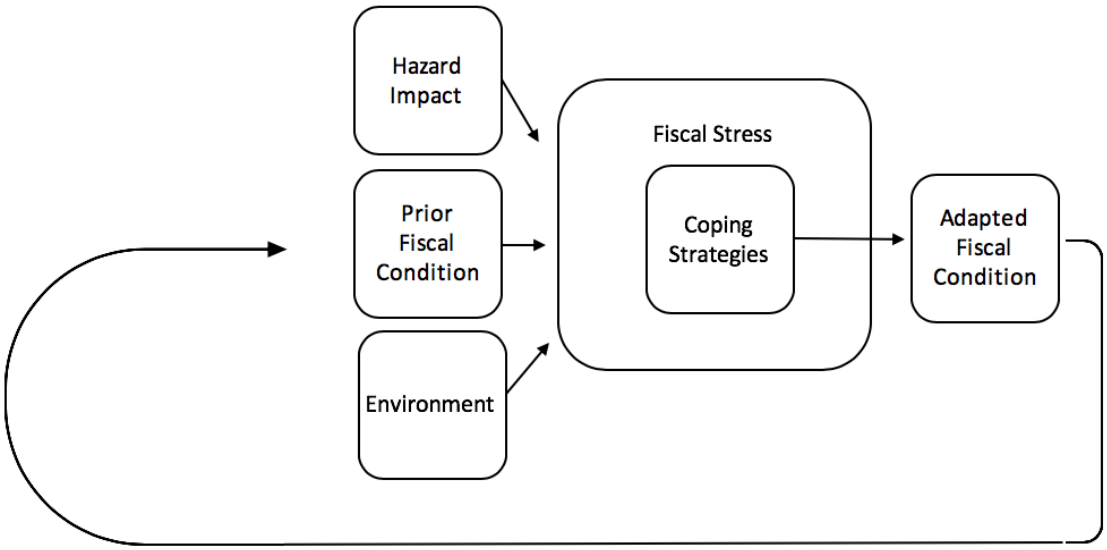
While the literature often makes mention of disasters as potential catalysts for fiscal stress, no study fully considers what factors influence local government's choices in selecting coping strategies following disasters, beyond some case studies on catastrophic events (see for example Hildreth (2009) for an extensive discussion on the finances of Hurricane Katrina) that are less generalizable. Research is necessary to determine if local governments use the same strategies following disasters as they take following recessions. Without empirical study, it is unclear whether the forces that drive adaptation following disasters result in the same selection of coping strategies, or if instead, local governments that experience disaster shift their fiscal structure in different ways from cities that experience economic fiscal shocks. The framework developed below describes the factors that can lead to fiscal stress and may impact the selection of coping strategies.

3.1 Framework of Fiscal Coping Strategies Following Disasters

The proposed framework combines literature on fiscal condition and disaster recovery to

provide a model of the components that influence local government's preference for and selection of coping mechanisms after disasters. This model is adapted from models of fiscal condition set out by Hendrick (2011), models for disaster risk from Wisner and others (2004), and a model of coping strategies based on literature studying retrenchment efforts following recessions, such as Wolman and Davis (1980). While other frameworks are in-depth descriptions of one of these concepts, they do not fully capture the fiscal decision-making process that local governments use following disaster, and they miss the key temporal aspect of decision making, where current choices are largely based on previous environmental factors and decisions. To evaluate the coping strategies used by local governments following disaster, the following framework models the different components that impact the selection of these coping mechanisms, as part of a process that determines future fiscal condition.

Figure 1: Framework of Local Government Fiscal Coping Strategies following Disasters



3.1.1 Prior Fiscal Condition

Fiscal condition is conceptualized as the level of ability that a local government has to meet their obligations - both payments and expenditures, but also in providing quality services to

the public (Jacob and Hendrick 2012). Good fiscal condition, or fiscal health, is when a local government can meet those obligations, both in the short-run and long term, given forecasted changes to service demands and revenue streams. Some governments may have a fiscal structure that is more vulnerable to fiscal shocks than others, due to characteristics of their fiscal choices and their environment.

There are several measures used to indicate the fiscal condition of a local government. Developing from Brown (1993), Maher and Nollenberger (2009) provide an updated list of 10 measures that consider aspects of revenues, expenditures, debt, operating position and unfunded liability, to get an overview of the fiscal condition of a local government, based on information readily available in annual financial reports.

Local governments that have good fiscal condition will have diversified revenue or pursue more reliance on revenue that is not susceptible to the types of risk exist in that local government's environment. They will also have a balance of revenues and expenditures, and enough in slack resources to overcome shortages from differences in time between revenue cycles and expenditures, or unexpected external conditions.

Prior fiscal condition impacts the selection of coping strategies for local governments experiencing fiscal stress. Local governments with poor prior fiscal stress may seek larger changes to fiscal structure to improve overall conditions; conversely, they may also not have the resources to be able to pursue some of the coping strategies they would prefer and may be pushed to seek less optimal resources. A local government that has already deferred payments and cut staffing because of an imbalance of revenues and expenditures may not have the capacity to seek grants following disaster or may not have enough slack resources to easily cut further expenditures during times of fiscal stress. Local governments with good fiscal condition prior to

fiscal stress may prefer not to modify their fiscal structure, because they are already well suited to their environment. This framework predicts that local governments with different levels of fiscal health in prior fiscal condition will then seek different types of coping strategies and may also seek more or less strategies overall.

3.1.2 Environment

Fiscal condition is the result of fiscal choices made by governments within the context of their environment. Environment refers to the economic, political, and institutional factors that impact fiscal choices on fiscal structure. A city may be restricted in how they adapt their fiscal structure because they have a small tax base or because there are pressures from the public that limit their ability to react in times of fiscal stress.

The economic environment refers to aspects of the community that determines the revenue base. Economic environment can directly impact fiscal condition – local governments that operate in a low-income community with low property values may try to use changes to property tax rates to improve revenue, but the improvement to fiscal condition will be small, compared to a similar change in tax rate for a wealthy community.

State statutes and actions that can restrict or provide opportunities to the local government are part of the institutional environment. State statutes may restrict what revenue sources are available to a local government; in Texas for example, cities have access to a limited amount of sales tax revenue, while school districts cannot collect sales tax revenue at all, and instead rely solely on property tax revenue, augmented with grants and donations. Because legal restriction differs for different types of governments, they operate within different environments, in terms of different institutional rules that they must follow.

The political environment refers to expectations and pressures placed on the government

from residents, businesses, other governments, and general stakeholders in the community. In a disaster context, this also refers to the demands placed on the government by residents who are more vulnerable, and more heavily exposed to the hazard. If a city has a population which is more at risk, they can expect more pressure from residents. In a fiscal condition context, voters may prefer to keep property taxes low, pressuring the local government to rely more heavily on other revenue streams, than it would otherwise. Especially in the wake of tax revolt movements like proposition 13 in California or TABOR in Colorado, local governments may pursue fiscal activities during times of fiscal stress that are more palatable to the public, and avoiding revenue increasing measures. Employees can also exert a level of pressure that may dissuade preferences for certain choices, like the reduction of fire crews (C. H. Levine, Rubin, and Wolohojian 1981). For a more specified model of fiscal condition and environmental factors see Hendrick (2011, 25).

Local governments determine what services to provide at what level, within constraints set by state statutes, and pursue a wide array of revenue streams. Within similar environments, a local government that does not draw enough revenue to meet expenditure demands has a worse fiscal condition, compared to one that achieves balance. Similarly, a local government that relies heavily on an income elastic revenue stream like sales tax but do not balance their reliance with a level of reserve funds may be more vulnerable to fiscal stress.

Within the environment that determines the communities' needs and the local government's potential fiscal capacity, governments make choices on how to adapt their environment in terms of revenue streams and expenditures. These fiscal choices, or coping strategies, refer to the actions taken, following a decision process, in response to environmental conditions. The decision process may involve the individual motivations of decision makers, and

the institutional rules and procedures used to select an action, and implement it (Justice and Yang 2018). A coherent combination of fiscal choices that are taken together make an organizational strategy (Justice and Yang 2018).

3.1.3 Hazard Impact

Within emergency management literature, a disaster only occurs when there is an interaction of a hazard and a community, resulting in losses that overwhelm local resources. Hazard exposure is the local experience of the physical event (Wisner et al. 2004). Neighboring local governments may have differing hazard, resulting in uneven levels of damage, which in turn necessitate different types of response and recovery efforts. For example, wind and water damage from a hurricane exhibit different requirements during recovery, as water damage can sit for weeks, degrading structures and growing mold and other health concerns not always present with wind damage. Both the type of hazard and the extent of damage determine the variety of post-disaster revenue streams available to state governments, local governments, and impacted residents themselves. (For example, flood insurance through NFIP, access to PA and/or IA, CDBG-DR funds, SBA loans, or regular homeowners' insurance). Local governments that experience greater hazard exposure, and therefore likely experience more damage, are expected to use more coping strategies to adapt their fiscal structure to a new fiscal environment, where there may be changing demands, changes to population, and changes to the availability to normal revenue streams.

3.1.4 Fiscal Stress

Viewing the local government as an organization, the experience of post-disaster fiscal stress is a combination of the hazard impacts, and the local government's prior fiscal condition, and factors of their environment. The framework proposed in this chapter treats fiscal condition

as the combination of strengths and weaknesses of the local government that determines its vulnerability to disaster. This conception of fiscal stress borrows from literature with emergency management, where disaster is defined as a combination of hazard and vulnerability. For an example of a model showing the relationship between hazard exposure and vulnerability, see the Pressure and Release Model (PAR) from Wisner and others (2004, 51).

The PAR model of risk to disaster has been used to describe individuals, families, and communities, but not governmental organizations in the way proposed here. The concept of individual vulnerability has been well developed in the literature; Cutter and others have developed a Social Vulnerability Index to aggregate individual characteristics often indicating higher vulnerability, so that it is possible to compare regions in terms of vulnerability and to better assess where within a geographic region vulnerability is concentrated (Cutter, Boruff, and Shirley 2003). Two families which face the same exposure to a hazard may have different experiences of disaster based on their social vulnerability; therefore, they may endure uneven impacts and face different choices during recovery, both of which ultimately impact their resilience in the long-term. Generally, families with more savings or better access to financial markets are less constrained in their choices during recovery.

Fiscal stress is the fiscal aspect of the disaster for a local government. Fiscal stress can be classified as a sudden severe change to revenue or expenditure needs, requiring the local government to react. For example, damage to residential and commercial property impacts revenue from property tax, and changes to the population size and increased activity during the rebuilding process impacts sales tax. Changes to expenditure needs are also prevalent, as local governments may have damaged facilities, may need to remove debris and facilitate community recovery, and may have a population who previously did not use job training or other assistance

programs increase their demand for public services when disasters impact their business or employment. Local governments whose combination of hazard and fiscal condition results in a worse fiscal stress, will likely be motivated to use more coping strategies to be able to meet their obligations.

3.1.5 Coping Strategies

In response to fiscal stress, local governments must use coping strategies to adapt to their new fiscal environment. Coping strategies differ slightly from the fiscal choices earlier in the model, in that fiscal choices are a series of continuous tweaks to a shifting environment. Coping strategies in contrast, are a response to sudden and severe events, and some of the strategies implemented may be recognized by decision makers as temporary, while other strategies will be long term adaptations to their environment, given new information on their level of risk. Coping strategies may be a mix of actions that represent incrementalism and also may involve some large changes in response to a shift in strategies, priorities, and environment.

A disaster, or severe fiscal stress, may provide a window of opportunity to establish policy that previously had been less politically feasible (Birkland 1997). Serving as a focusing event, disasters can bring policy areas related to the disaster to the forefront of public attention, increasing the pressure to pass policies to improve community safety. Policies on mitigation spending and saving for disasters may gain new public approval, compared to times between disasters when emergency management funding and slack resources may be devalued.

Previous frameworks of fiscal condition and the coping strategies used to respond to fiscal stress have largely been developed with a focus on retrenchment and cutback policies following recessions. Some literature has considered the change in fiscal condition due to a loss of a major employer, the response to state or federally mandated unfunded mandates, or new tax

and expenditure limitations. Some have failed to find significant patterns and suggest that local governments essentially pull from the grab bag of options when selecting coping methods, rather than using a rational strategy (Pammer 1990; Bartle 1996). However, most of the literature suggests that local governments do follow some kind of strategic approach.

In the work from Pfeffer and Salancik (1978) on research dependency theory, organizations respond to threatening environmental changes by repurposing or restructuring, using and developing slack resources to withstand fluctuations in the environment through buffering strategies, or controlling input or output exchange. Some suggest that during retrenchment, local governments follow decrementalism, involving small, mostly across-the-board cuts to match with priorities, and that changes to expenditures do not directly impact changes to revenue policy (Lewis 1984). Decrementalism models are often less explanatory than other models that suggest local governments will seek out alternative strategies before making expenditure and service cuts.

From the cutback literature of the 1970s-80s, one branch of literature suggests that there are predictable stages of retrenchment. Levine, Rubin, and Wolohojian (1981) argue that the severity and duration of a fiscal crisis determine what strategies organizations will use during retrenchment, pushing organizations from easier solutions to harder ones during worse situations. From this literature, Wolman and Davis (1980; 1983) suggests that there is a rank order of preferences for coping strategies to respond to a recession or economic crisis.

First, local governments attempt to buy time, and ride out fiscal stress, by delaying payments or using saved resources. Next, local governments will attempt to improve their revenue streams, first by seeking intergovernmental revenue, and then changing other aspects of revenue, such as by changing tax rates or increasing fines and fees. Once revenue improving

strategies have occurred, local governments will make efforts to try to make efforts to cut expenditures without changing service provision. This may involve improving productivity, using contracting out, or simply lowering wages. The final choice for local governments is to cut services and expenditures. Local governments may delay seeking strategies that involve cuts because it is contrary to their organizational mission of providing services.

Despite how appealing it is to determine a conclusive order of the types of coping strategies, research has found conflicting evidence on the ordering of revenue and expenditure-based strategies. MacManus (1993) finds a preference for expenditure cutting strategies, more than revenue based strategies, running counter to the model put forth by Wolman and Davis.

Levine, Rubin, and Wolohojian (1981) have suggested that there is a mix of both revenue and expenditure activities that will be considered less likely to come up against public criticism – both hiring freezes, shallow across the board cuts (expenditures) and efforts to increase the tax base through expanded definitions (revenue) will be pursued before more controversial changes to revenue collections and larger targeted expenditure cuts.

This literature suggests that policymakers may make their selections based on conflict avoidance – picking solutions that may be received with less criticism from the public and other stakeholders. As local governments run out of more preferable strategies or have constraints that do not allow them to implement these strategies, they will implement less favorable strategies. Local governments that experience a less severe event or have slack resources may be able to get through a disaster by pulling from reserve funds or delaying maintenance, without needing to adapt. Changing revenue levels may be politically unfavorable and will only be pursued if necessary. However, given the different political pressures, institutional arrangements, and policymaker preferences, it can be difficult to rank activities using this model.

Justice and Yang take the retrenchment model further and suggest that local governments pursue a coherent plan that draws from multiple categories within the retrenchment models. This strategic plan may involve taking complimentary actions, rather than focusing on one side of the equation, either revenue or expenditures, and may focus on not just selecting the least contentious options but balance political capital with longer term reward. They argue that because the large number of environmental factors impact individual government's strategic choices, retrenchment strategies may appear unique. Using an exploratory factor analysis, they find several actions correlate together, showing that local governments with similar fiscal conditions and environments may select from potential overarching strategies, rather than considering each strategy in isolation.

The model proposed here takes a similar approach, that local governments will consider aspects of their prior fiscal condition, their environment, and exposure to the hazard, and select an overall plan that draws from multiple types of coping strategies. The choice to use any one category of coping strategies will be determined by different levels of weight that these factors hold in the decision-making process.

This study considers 62 strategies from the following eight categories: cuts to expenditures, services cuts, increased services for new demands, changes to human resource management, revenue diversification and raising strategies, debt management, collaboration and contracting, and policies and processes. While other studies have not always included fiscal choices like increased expenditure to meet new demands, it is appropriate to determine if local governments that face fiscal stress following disasters actually tradeoff some expenditures with increases in other expenditures as a way to help residents recovery from disaster more quickly while maintaining a balanced budget. Please see Table 1 for survey questions related to each of

these eight categories of fiscal coping strategies.

Table 1: Coping Strategy Survey Items

Type	Survey Items	Type	Survey Items
Revenue Strategies	Fines	Service Level Strategies	Eliminated services
	Local option sales tax		EMS staffing
	Property tax abatements		Library hours
	Property tax deductions		Police patrolling hours
	Property tax rates		Reduced services
	Service charges or fees		Transferred service provision responsibility to another entity
	Applied for grants		Trash pick-up frequency
	Received donations	New Service Provision Strategies	Created new positions
	Received grants		Leased Purchased new property
	Used fund balance reserves		Planned new capital projects
	Used Interfund transfers		Provided new programs services
Expenditure Strategies	Canceled property lease		Purchased new equipment
	Canceled / Reduced capital expenditures	Debt Strategies	Issued long-term general obligation debt
	Canceled / Reduced equipment maintenance		Issued long-term revenue bonds
	Deferred capital expenditures		Issued other kinds of debt
	Deferred equipment maintenance		Issued short-term general obligation debt
	Sold equipment		Issued short-term revenue bonds
	Sold property		Refinanced debt
	Across-the-board spending cuts	Collaborative & Alternative Provision Strategies	Changed level of automation
	Targeted spending cuts		Collaboration with nonprofits
Human Resources Management Strategies	Cut positions		Collaboration with other governments
	Eliminated/ Reduced development training budget		Contracting out
	Eliminated/ Reduced travel budget		Use of volunteers
	Froze salaries	Policy and Process Strategies	Amended budget
	Furloughed staff/ Reduced hours worked		Annexation plan
	Laid off employees		Delayed budget
	Left vacant positions unfilled		Developed special revenue funds
	Reclassified positions		Fund balance policy
	Reduced salaries		Land use or zoning policy

Type	Survey Items	Type	Survey Items
	Revised association contracts to reduce pay benefits		Reclassified expenditures as capital spending
	Use of overtime		Strategic plan

3.1.6 Adapted Fiscal Condition

As local governments adjust their revenue extraction and expenditure levels to cope with disaster-induced fiscal stress, a *new normal* is eventually reached, where the local government has attained an adapted fiscal condition. Local governments that receive adequate intergovernmental revenue, have enough savings, and operate in a community quickly rebuilds are able to meet or exceed previous service levels. Local governments that make better choices to adapt to their environment, perhaps by establishing zoning and land use policy that limits exposure to future hazard, or diversifying their revenue policy to limit reliance on more elastic revenue sources may even improve their fiscal condition in the long run, allowing them to be more sustainable in providing services to residents in the future, and more resilient to disasters and other kinds of future fiscal crises.

Choices made during the recovery process may impact the available strategic choices down the road. For this reason, the model is cyclical. In the best-case scenario, some local governments may bounce back and view disasters as an opportunity to reshape policy. However, other local governments that are already in a worse fiscal condition may be limited in their available coping strategies and may find that each event of fiscal stress they experience results in a worse fiscal condition. The fiscal impact of disasters may interact with other fiscal stress; for instance, the coastal communities recovering from Hurricane Katrina in 2005 were likely still adapting to their fiscal environment when they experienced the Great Recession in 2008. Previous experiences with disaster recovery and the success of adaptation can impact the

available choices for new fiscal stress.

3.2 Hypotheses

The remainder of this dissertation aims to test the proposed framework with the following research questions:

R1: What coping strategies did local governments use after Hurricane Harvey?

R2: What factors influence local governments' level of adaptation?

Because there is little available data on the full range of fiscal coping strategies that local governments use following disaster, a chapter four is devoted to giving descriptive statistics on the range of choices used in the survey. It is not only important to determine what strategies were used, but how important the local government financial officers found these strategies to assist in the recovery process.

The variation in the level of adaptation and type of coping strategies used following Hurricane Harvey are hypothesized to be influenced by aspects of the prior fiscal condition and extent of hazard impact. Further, any model must account for environmental factors that may impact the choices available to local government. Table 2 shows predicted direction for variables influence on overall adaptation.

Table 2: Independent Variables Hypothesized Impact on Level of Adaptation

Concept	Variable	Hypothesis
Hazard Impact	Previous Disaster Declarations	+
	Individual Assistance	+
	Public Assistance Category C-G	+
	Perception - % Damaged Homes	+
	Perception - % Damaged Facilities	+
	Rainfall August 2017 (in)	+
	Average Flood Depth (ft)	+
Environment	% Unemployment	+
	Median Income	-
	% White	-

Concept	Variable	Hypothesis
	% Hispanic	+
Prior Fiscal Condition	Outstanding Debt per capita	+
	Total Fund Balance, General Fund, per capita	-
	Total Own Source Revenue, Governmental Funds per capita	-
	Intergovernmental Revenue per capita	+
	Capital Outlay per capita	+
	Dept Service per capita	+
	Assessed Value per capita†	-

Prior fiscal condition is hypothesized to be a main driver of the selection of coping strategies. Local governments that have a fiscal structure that is maladapted to their fiscal environment may be more motivated to take strategies that can improve their overall condition, especially when disasters as focusing events open a window of opportunity for otherwise unfavorable changes in revenue and expenditure policy to pass public scrutiny. Furthermore, local governments with bad fiscal condition may not have enough reserve resources to pay debts and meet obligations without taking more strategies to balance revenues and expenditures. This leads to the first hypothesis:

H1: Local governments with low prior fiscal condition will use more coping strategies.

Fiscal condition is multifaceted; some aspects of fiscal condition may result in more or less influence on the selection of different categories of coping strategies, but any aspect indicates a lower level of fiscal condition is predicted to result in a higher level of coping strategies.

Higher levels of own-source revenue per capita indicates good fiscal condition, and local governments with more own-source revenue per capita are predicted to use fewer coping strategies. Similarly, local governments that have more in reserves in their fund balance, or more assessed value per capita are in a strong fiscal condition and are predicted to use fewer coping strategies.

Debt, however, indicates poor fiscal condition. Those with higher levels of outstanding debt or debt service per capita are predicted to use more coping strategies. Local governments that rely on higher levels of intergovernmental revenue per capita may be receiving aid to help with communities with higher service demands, who may also be more vulnerable to disaster. Those with higher levels of intergovernmental revenue are predicted to use more coping strategies.

Finally, communities that exhibit a high level of capital outlay in the year before the storm are likely in a situation of more flexibility, where they may choose to switch priorities for capital projects, due to changes in the community's preferences following the disaster. Increased capital outlay per capita is predicted to have a positive relationship with the level of coping strategies selected.

Local governments likely select multiple strategies from various different categories; there is likely a mix of actions that cut expenditures and raise revenues. However, for each category of coping strategies collected in our survey, the model suggests that local governments implement more strategies per category (and therefore better adapt their fiscal structure) when they have a worse prior fiscal condition.

The second major component of the proposed framework is the extent of hazard impacts that local governments face. Local governments whose jurisdictions are more exposed, and thus experience higher levels of damage, likely see larger changes to their environment. This leads to the second hypothesis:

H2: Local governments with greater hazard impacts will use more coping strategies.

Environmental changes may include both increased demands that change expenditure needs and changes in the tax base, as assessed property values decline. Local governments that

experience greater hazard impacts are also hypothesized to seek out more coping strategies. Local governments that are in counties which receive public or individual assistance are predicted to select more coping strategies. Local governments that report higher levels of damage to homes or facilities within their jurisdiction are likewise predicted to use a larger number of coping strategies. Local governments that are in areas that have deeper flood conditions or more rainfall likely experienced more flooding, and therefore are predicted to use a higher number of coping strategies. Finally, local governments that have more experience with disaster declarations, and are therefore more exposed to hazard, are predicted to use more coping strategies.

Finally, environmental factors in terms of economics, politics, and institutional rules may also impact fiscal choices in that past and present and will need to be controlled for in the model. This leads to the third and fourth hypotheses:

> *H3: Local governments with a higher percentage of socially vulnerable populations will use more coping strategies.*
>
> *H4: Schools districts will pursue more coping strategies than cities.*

Local governments with populations that have the characteristics to make them more vulnerable to disasters will likely see an increased demand for services following disaster, and therefore will be more likely to pursue coping strategies, to sustain services, and even provide new services. Populations with low median income, high unemployment, and high percent of minority populations are predicted to use more coping strategies.

Institutional rules likely result in different types of local governments pursuing different strategies and requiring different levels of adaptation. Local governments that are more constrained are less likely to have a fiscal structure that is as well adapted to their environment, and will therefore pursue more coping strategies, because they are more vulnerable to fiscal

stress. School districts have less sources of revenue available to them and cannot collect sales tax. Furthermore, the rely heavily on property tax, which may see an impact following a hurricane event. These aspects of their institutional rules suggest that they are more restricted and may not be able to fully adjust their financial structure to best reduce financial impacts from the risk of a major disaster.

In summary, this dissertation proposes to document the strategies that local governments actually take following disaster, to adapt their fiscal structure to a new environment, and to continue to meet obligations despite changes to revenue streams and expenditure demands. The framework suggests that local governments select strategies and determine how to adapt their fiscal structure based on aspects of their prior fiscal condition, experience of disaster, and the fiscal stress that results because of the unique local experience of the combination of disaster and fiscal condition. Local governments are expected to undertake more fiscal strategies overall and from a wider variety of categories of if their pre-disaster fiscal condition is poor, or if they have endured heavier impacts from a disaster. This is because local governments act strategically and will attempt to fix their fiscal structure to improve fiscal condition in the long-term, accounting for the new understanding of risk they gain from the experience of fiscal stress. Local governments will also find limitations or opportunities to adapt their fiscal structure because of pressures from their economic, political, and institutional environment.

CHAPTER 4

DESCRIPTIVE ANALYSIS OF ADAPTATION AFTER DISASTER

4.1 Introduction

In order to assess how local governments cope following disaster, an original survey was developed and sent to local governments that were federally declared for Hurricane Harvey. The purpose of the survey was to build from previous literature on the fiscal condition of local governments following economic events, to better understand fiscal stress in a disaster context. The following chapter discusses the development of the survey and then provides a qualitative description of the responses and self-reported lessons learned from the local governments surveyed. Because little work has been done to show the range of coping strategies that local governments use following disaster, this chapter provides new insight on the ways that local governments adapt to the fiscal and physical stress of disasters during the recovery process.

First, the chapter describes the development of the questions and overall design of the survey, including the tweaks made following the results of the pilot study. The chapter then details the survey sample, distribution process, and response rate, before discussing the validity, reliability, and limitations of the survey. The findings from this survey provide new insight into the range of coping strategies and lessons which local governments have learned recovering from the disaster.

4.2 Survey Methodology and Collection

4.2.1 Survey Distribution

The survey was sent to financial officers, whose responses represent their local government. Even though the questions are answered by individuals, the unit of analysis is the local government, because questions are about actions taken by the local government.

The survey is web-based and is designed and conducted through Qualtrics. Survey administration followed the steps from Dillman (2000), to increase response rate. First, an introductory email was sent, inviting participation, and indicating that the actual survey would be sent in a few days. Next, an email with the actual survey link was sent by email, using Qualtrics personalized links. The emails and survey included information on the purpose of the survey and IRB approved informed consent. The next contact included thank-you emails to respondents, and reminders to the remaining members of the sample, a few weeks after the original survey email. After an additional few weeks, a second reminder was sent to nonresponses. Finally, phone calls were made to those that had not yet responded, one week after the last email. Thank-you emails were then sent to all completed surveys.

The entire process was conducted in between June 2019 and January 2020, almost 2 years after Hurricane Harvey's landfall. The timing of survey deployment provides local governments some time to initiate changes to fiscal condition, but still be close enough to the event for respondents to remember whether motivations behind changes to fiscal structure were at least partially motivated by the disaster. While some adaptations may take longer to implement, this study timeline provides insight into the preferences of cities during the first two years of the recovery phase. For those who completed the survey, the median time they kept the survey window open was 9 minutes, 17 seconds, and likely indicates less concern for respondent fatigue. It is also likely that actual active participation duration was even less, as a few respondents kept the window open for days.

4.2.2 Survey Design

The survey questions largely focus on what fiscal actions the local government has taken since August 2017 when Hurricane Harvey hit that were due, at least in part, to the hurricane,

and whether those actions were perceived to be an important part of the recovery process.

The survey first asked general questions about the respondent, such as job title, local government type and name, years of experience, and educational attainment. The next sections of the survey asked if the local government had taken any coping strategies in response to Hurricane Harvey, and also asked respondents to rate the level of importance to recovery each of these options are to their recovery. No single measure can fully assess the level of adaptation, and the use of multiple indicators of coping strategies allowed for a more nuanced understanding of how local governments react to fiscal stress. The survey responses are aggregated into a measure of total adaptation in the following chapter.

For some questions there was also an option to answer if there was an increase or decrease in the use of that coping strategy. For example, if there was an increase or decrease in property tax rates or abatements. Because disasters may require increased service provision during sheltering and response, and may require new expenditures during the rebuilding process, disasters could result in both cuts and increases in expenditures, which the survey intended to capture.

The questions on coping strategies were designed to provide an exhaustive list of possible coping strategies that local governments might use to respond financially following disasters. In total, 62 potential coping strategies were organized roughly into eight sections on strategies focused on: revenue (11 questions); expenditures (9 questions); service levels (7); debt (6 questions); human resources management (11 questions); collaborative and alternative provisions (5 questions); policies and processes (8 questions); and serving new demands (5 questions). To see the full list of the coping strategies organized by category, please see Table 1.

Each section has an option to select “none of the above,” and an open-ended question

near the end of the survey also asks if there are other coping strategies their organization has used to respond to Hurricane Harvey; however, this open ended section did not yield responses that required being code into additional indicators, and so only the 62 coping strategies originally asked are used for further analysis.

The sections on revenue and expenditures were randomized, so that any respondent fatigue would not show a bias between these question heavy sections, however the question order within a section and the remaining section orders were not randomized, due to comments received during the pilot study.

The list of possible coping strategies that respondents choose from are determined through consideration of all aspects of fiscal condition described in the chapter from Jacob and Hendrick (2012), and then compared with actions described in other studies on coping strategies to fiscal stress (Wolman and Davis 1980; Justice and Yang 2018; MacManus 1993; C. Levine, Rubin, and Wolohojian 1982; C. Levine 1978; 1985). The final selection of possible coping strategies completely encompasses questions from these other survey designs and theory descriptions, which improves the reliability of the design, by allowing the findings to be compared with other studies. For example, a subset of individual indicators from these categories can also be rearranged to fit the Wolman and Davis model of strategies: buying time, increasing intergovernmental revenue, own-source revenue increases, expenditure reduction & efficiency improvement, cutting spending & services. While somewhat differently worded, the questions asked by Justice and Yang (2018, 121) related to local government responses to address fiscal crisis are also included in this study.

However, this study also considers other types of adaptation like providing new services, or adapting debt structure, that are not considered in traditional models of retrenchment, so

indicators have been regrouped. Unlike traditional models of retrenchment which assume only expenditure cuts, here it is assumed that disasters may also result in new demands for services, and possibly new sources of intergovernmental revenue (Miao, Hou, and Abrigo 2018). For some indicators where applicable, the direction of the change may also be indicated in the survey (i.e., increased or decreased service hours).

Following the questions about coping strategies, questions were asked to estimate the perceived level of damage that the jurisdiction for the local government experienced. Based on the type of local government, survey participants received tailored questions on the level of damage to home and facilities, and also how they feel their jurisdiction compared to other local governments of the same type. For school districts, survey participants were also asked if the school had to close, for how long, and if students did not return to the district. All local governments were also asked if they experienced a change in their bond ratings.

The survey ended with open-ended questions that asked what policies and processes they wish had been in place prior to the storm, what the local government learned in responding to Hurricane Harvey, and if they think that the steps taken have been sufficient. A copy of the survey instrument is available in Appendix G, as well as table showing the coping strategies survey items organized by category in Table 1.

4.2.3 Sample

The sample for this study includes all cities, counties, and school districts that intersected with the counties that received some category of presidential disaster declaration during Hurricane Harvey. The two types of assistance available through major disaster declarations are PA and IA and are declared by county, although these are not the only funding streams. All areas included in the sample were at least partially within declared counties for some type of federal

public assistance grants, but varied both in their disaster experience, and categories within public assistance grants for which they qualified. Those local governments that did not have physical damage within their jurisdiction may have still had financial impacts during sheltering efforts or due to mutual aid relationships, and for that reason, if a local government was in an area that received any federal declaration, they were included in the survey.

Counties were selected based on FEMA's list of designated areas for disaster DR-4332, corresponding to Hurricane Harvey in Texas, for a total of 53 counties. Using Census Tiger shapefiles, school districts that overlapped with the disaster designated area were included in the sample, for a total of 341 school districts, including 339 unified school districts, and 1 area with both a primary and secondary school district spatially overlapping. For cities, all census places from the 2018 Tiger shapefile that were either incorporated cities, villages or towns that overlapped with the designated area were included in the sample, for a total of 402 cities. Census designated places, and unincorporated communities, were excluded. In sum, there are 797 local governments which were included in the initial sample area.

By including cities, counties, and school districts, local governments exhibiting a variety of institutional constraints on fiscal condition are included in the survey. By selecting all areas that had any level of disaster declaration, there is also variation in hazard impacts, extent of damage, previous fiscal condition, population, and fiscal capacity across those surveyed. The range in these parameters increases the potential for generalization to other local governments impacted by large areal extent, high consequence hazard events.

To select who to survey, each local government's website was reviewed, and the most optimal contact person was selected. For larger cities, the head of the finance department was selected, then if there was no clear finance director or finance officer, a city manager was

selected, or if no city manager, a city secretary, which was often the only listed employee for very small cities. Similarly, for school districts, the survey was sent to the district superintendent, who was likely to have the best full picture of the local government's financial decisions. For counties, at first treasurers were contacted, and then auditors were contacted.

For local governments that did not have a website or emails listed, a phone number was used to get an appropriate email address. A few local governments did not have email, website, or phone listed online, or had an email which bounced back and also the individual could not be contacted via phone for a correct address. In all these cases, the local governments were also removed from the study, resulting in 24 cities removed and 2 school districts removed. This resulted in a total of 770 local governments which were contacted with the survey, for a contact rate for the sample area of 96.61 percent. Figure 2 is a map of the local governments which received the survey, and in Figure 3 is a map of those which were excluded from the receiving the survey, due to a lack of access.

Figure 2: Map of Local Governments Surveyed

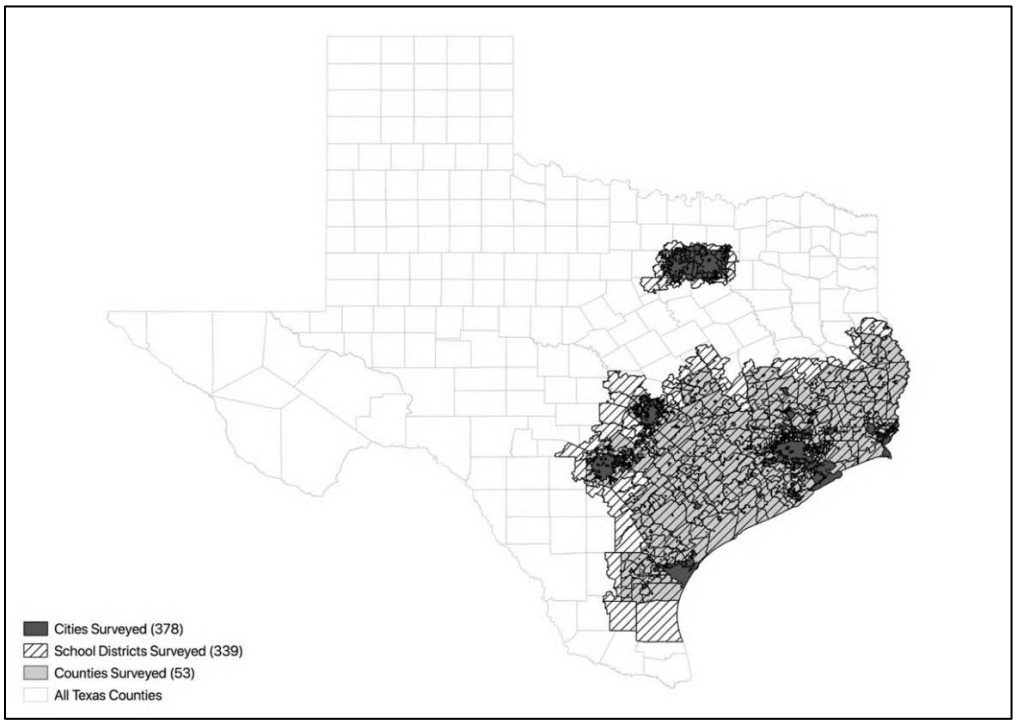
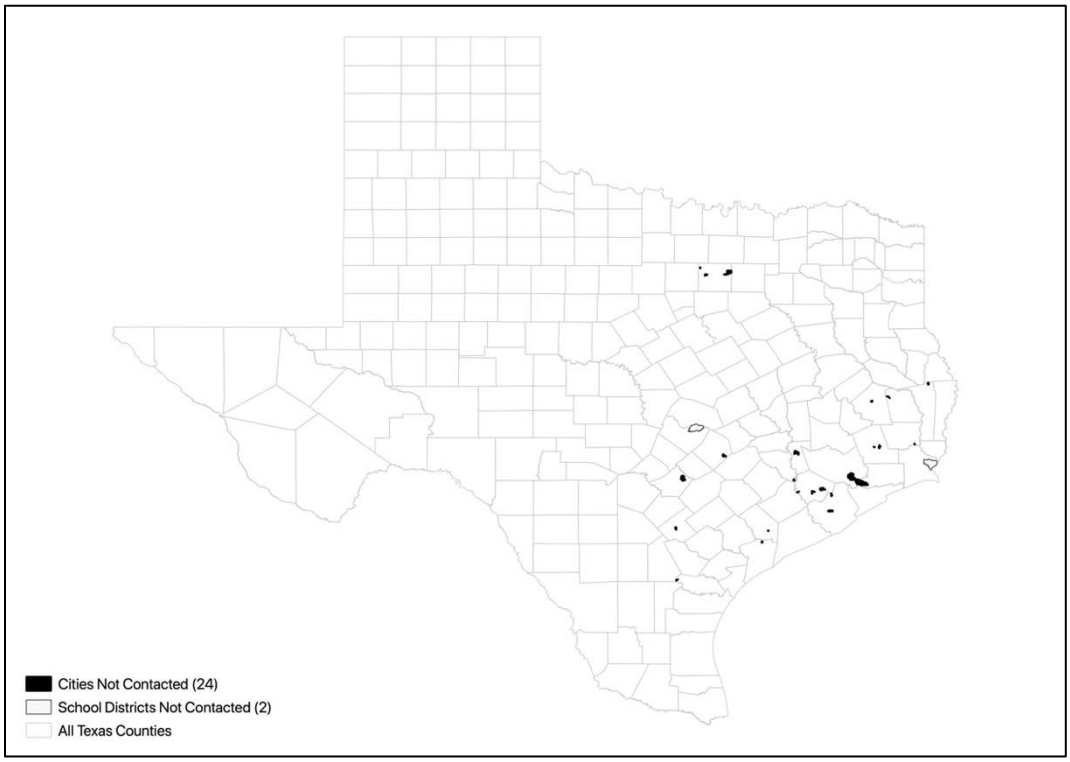


Figure 3: Map of Local Governments Not Contacted within Declaration Area



4.2.4 Pilot Study

A pilot study was conducted to determine if the survey structure and questions were understandable for the target audience. Four local government financial officers from northern Texas were asked to review the survey, and then participate in an open-ended phone discussion of their thoughts on the survey. These participants were a principal budget analyst, finance manager, assistant city manager, senior budget analyst – all from cities – and budget and policy analyst from a county. No financial officers from school districts were included in the pilot.

The feedback we received suggested that it would be necessary to send the survey to high level financial officers or city managers, who would have an overview of many aspects of the local government's changes. All terms in the survey were easily understood by those in the pilot study, and they felt it would be understandable for our target audience. Those who reviewed the survey found that any random ordering of the questions within a section or a random ordering of

a section felt strange, as they liked to compare similar items together, and order sections with revenue or expenditures first, and then the rest of the categories of coping strategies following these. This feedback impacted the final study's design, recognizing that the ease of completing the study had to be balanced against efforts to reduce bias from responder fatigue as they went through the survey. The questions related to disaster experience was reworded to ask specifically about the percent of homes or buildings that were damaged. The participants of the pilot study did not think it was necessary to reduce the survey length, finding it would only take 10 minutes to complete, because any responder would likely only have to select a small number of options and otherwise use the "none of the above" option for any category of coping strategies.

4.2.5 Survey Response Rate

The overall minimum response rate was 17.79 percent. This calculation treats refusals and partial responses as nonresponses. Table 3 provides a break-down of response rates by type of local government. Despite response rate being relatively high for counties, the small number of responses require a purely qualitative analysis of county data; only cities and school districts are included in the following chapter's statistical model. The calculated response rate for local governments with over 5,000 in population shows a similar response rate, indicating no bias in increased response for larger cities, which have the ability to become home rule cities, rather than general law cities, in the state of Texas.

Table 3: Response Rates

	Completed	Surveyed	Response Rate	Completed (5,000+ pop.)	Surveyed (5,000+ pop.)	Response Rate (5,000+ pop.)
City	76	378	20.11%	34	165	20.61%
School District	49	339	14.45%	32	238	13.45%
County	12	53	22.64%	12	53	22.64%
Total	137	770	17.79%	78	456	17.11%

Those who responded to the survey were primarily upper management positions, with high levels of experience in government. For a more complete picture of the demographics of the respondents, please see Tables 4 through 6.

Table 4: Respondent Tenure in Government

Years in Government	Min	Max	Mean
City	0	42	14.72
School District	0	45	23.9
County	4	35	19

Table 5: Respondent Job Titles

Primary Respondent Job Titles		Count
City	Director of Finance	22
	City Secretary	16
	City Administrator	9
	City Manager	4
	Assistant City Administrator	3
	Other	20
	NA's	2
School District	Superintendent	32
	Assistant Superintendent	5
	Chief Financial Officer	3
	Deputy Superintendent	2
	Executive Director	2
	Other	4
	NA's	1
County	Auditor	11
	Emergency Management Coordinator	1

Table 6: Respondent Educational Attainment

Educational Attainment	City	School District	County
Some High School			
High School Diploma	14		1
Associate Degree	8		1
Bachelor's Degree	22	3	8
Master's Degree	25	32	1
Doctorate Degree		11	
MD			

Educational Attainment	City	School District	County
JD		1	
Other	5	1	
NA's	2		1

4.3 Assessing Survey Design

4.3.1 Representativeness

A number of those who refused to complete the survey reported feeling that the survey was not relevant to them, as they did not have substantial damage; however overall refusals were geographically well spread across the area, including coastal areas in counties with individual assistance declarations, indicating no clear geographic bias for those who refused the survey. The following three maps in Figures 4 through 6 show the type of responses we received, by type of local government. These maps clearly indicate that completed surveys represent a wide geographic area and are not bias to one area of the survey sample area. Similarly, nonresponses and refusals do not indicate a geographic bias.

Figure 4: Map of City Responses

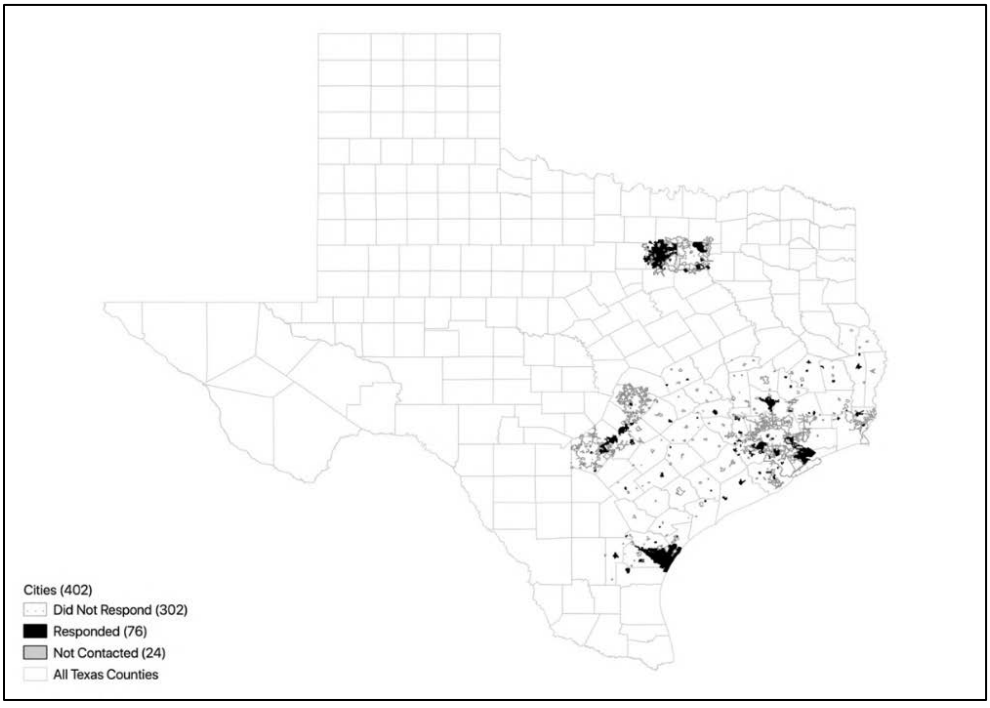


Figure 5: Map of School District Responses

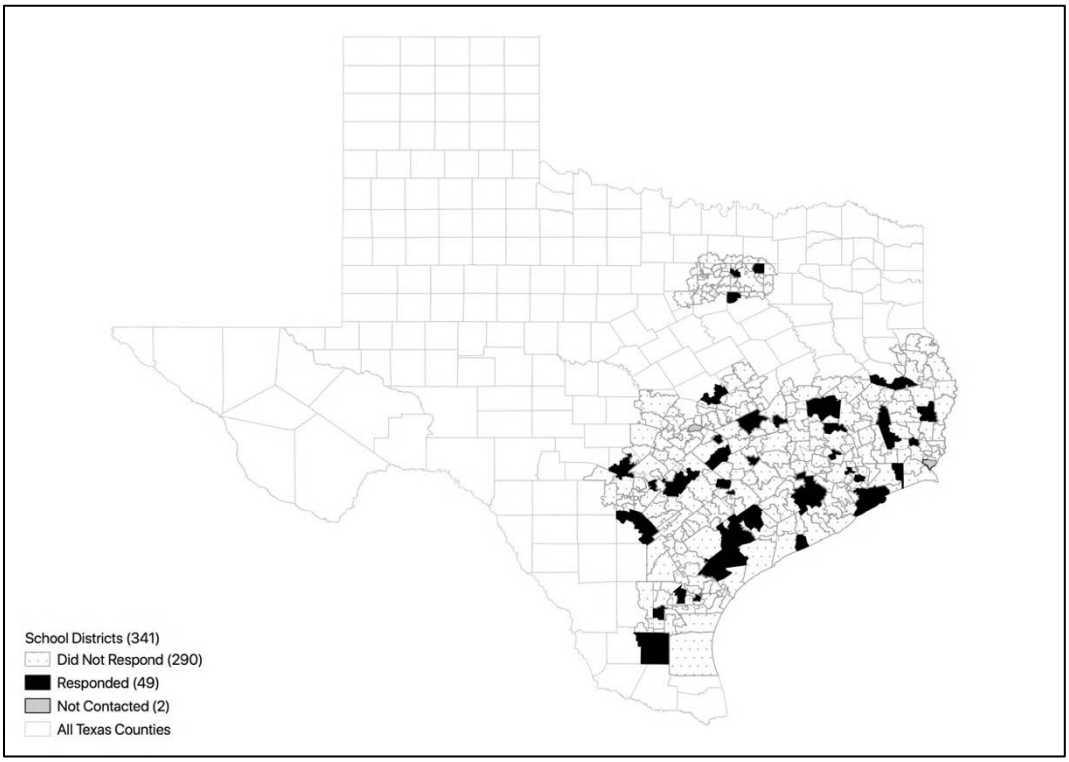


Figure 6: Map of County Responses

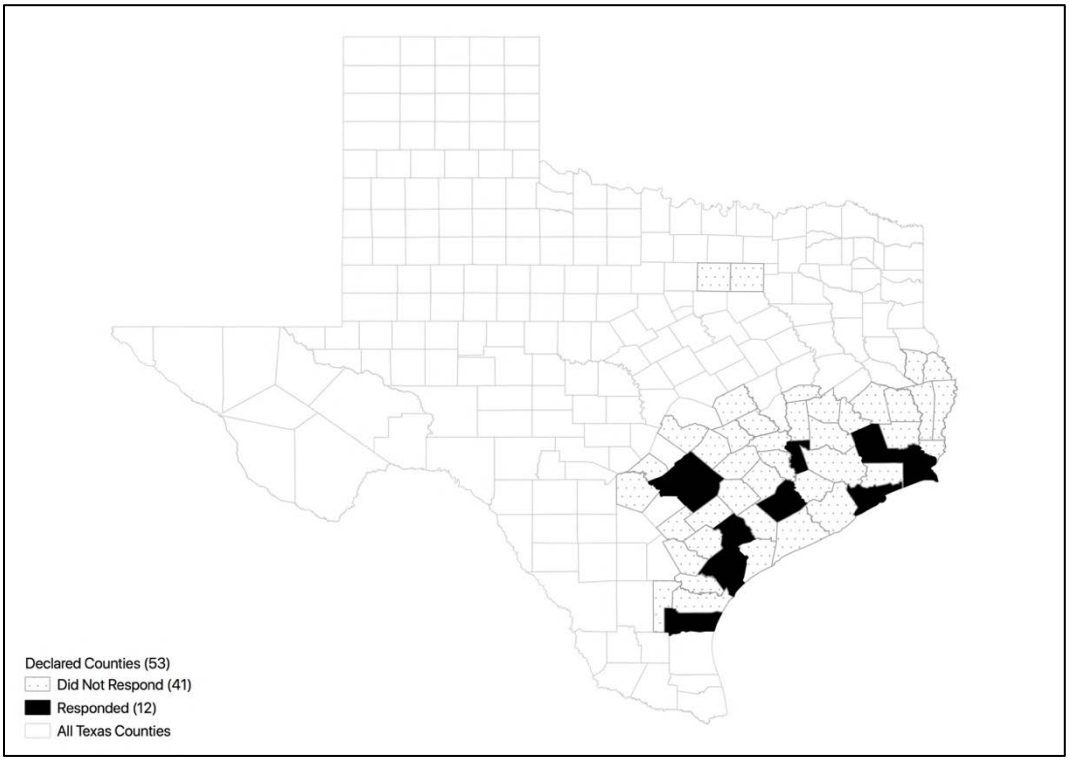


Table 7: Comparison of Means on Select Demographics

	Responded Mean	Surveyed Mean	t	p-value
Overall				
Total Population	38800	60768	-1.82	0.07
Percent White	0.8091	0.7997	0.79	0.43
Percent Hispanic of Latino	0.319	0.2984	1.05	0.3
Median Home Value	$162,273	$158,711	0.21	0.84
Prior Declarations	21.44	21.46	-0.06	0.95
IA Assistance	0.6642	0.6013	1.42	0.16
City				
Total Population	32374	33507	-0.08	0.94
Percent White	0.8066	0.7908	0.92	0.36
Percent Hispanic of Latino	0.2969	0.2938	0.12	0.91
Median Home Value	$196,221	$185,127	0.36	0.72
Prior Declarations	22.24	22.38	-0.29	0.77
IA Assistance	0.6184	0.6111	0.12	0.91
School District				
Total Population	35882	53322	-1.59	0.12
Percent White	0.8243	0.8117	0.69	0.49
Percent Hispanic of Latino	0.3369	0.3023	1.05	0.3
Median Home Value	$119,967	$134,928	-1.74	0.08
Prior Declarations	20.53	20.65	-0.17	0.86
IA Assistance	0.6735	0.5634	1.51	0.14
County				
Total Population	91412	301789	-0.94	0.35
Percent White	0.7633	0.786	-0.73	0.47
Percent Hispanic of Latino	0.385	0.3064	1.41	0.16
Median Home Value	$120,017	$122,134	-0.17	0.87
Prior Declarations	20.08	20.08	0.01	1.00
IA Assistance	0.9167	0.7736	1.11	0.27

To assess the representativeness of responses, a comparison was made between respondents and all those surveyed. Table 7 shows there is no statistically significant difference between those who responded to the survey and the overall area surveyed, in terms of total population (2016), race (percent white, 2016), ethnicity (percent Hispanic/Latino, 2016) median home value (2016), number of prior FEMA declarations for the county that jurisdiction is in (From 1953 until Hurricane Harvey, August 2017), or whether the county had an Individual

Assistance declaration during Hurricane Harvey. On all six measures, both for overall survey responses, and broken up by type of local government, there are no significant differences between the sample mean for those who responded, compared to the population mean of the survey area. The table above shows the value of the Welch's t-test, but Student's t-tests were also run, and found insignificant. Tables with more complete comparisons of the descriptive statistics can be found in the Appendices C, D, and E.

Histograms of the overall variance in frequency for each measure was also considered, and it was determined that there were no significant differences. The survey responses are likely a good representation of the survey area, and is highly generalizable for the study area, without a clear bias.

4.3.2 Validity and Reliability Limitations

Several efforts were made to improve the validity of the survey. The survey was sent out two years after the hurricane hit, leaving enough time for financial impacts to be fully felt, but still close enough to the event that respondents could remember their response, and local governments had individuals who were still with the organization who could answer the questions. However, this time frame does overlap with other incidents: Tropical Storm Imelda made landfall on the Texas coast during the survey collection period, and likely made respondents more interested in the survey, but also may have changed their focus and perception of questions, as they were in the middle of a new disaster response. Surveys were collected both before and after Tropical Storm Imelda. Responses were collected over a longer time period, and some local governments answered when they were experiencing different parts of the budget cycle. Some may have already finalized the next year's budget and incorporated more coping strategies, compared to local governments who were earlier in their strategic planning and

budgeting process for the upcoming fiscal year.

Section of questions to revenue and expenditure focused strategies were randomly ordered, with either revenue or expenditure appearing first in the survey. The purpose of this was to combat respondent fatigue on longer question sets and avoid a bias towards one of these categories of coping strategies. While more randomization could have been done, both within a section of questions and between sections, this was purposefully not done, after receiving feedback from the pilot study, who found a clear structure to the study easier to understand. There is a possibility that respondents were less careful with responses as the survey with each following section and gave fewer coping strategies than were actually used, but this downward bias should be consistent across respondents.

The questions cover and expand upon previous research on retrenchment, making the survey hold more external validity. The survey allowed respondents to specify additional coping strategies that could be coded into coping strategy categories; however this part of the survey was not much used, indicating we had a near complete list of coping strategies. The pilot study indicated that the survey was easily understood, and question should be understood similarly between respondents. Sadly, only one person per local government was questioned, but this is because often there are limited number of individuals qualified to answer that type of question, especially in cities where there is only one paid employee. However, the benefit to the design of this study is that it allows for a survey of all cities within the geographic area, and not just those with a larger population, and therefore provides more generalizable findings on the experience of local governments as a whole, for the region.

Finally, the small response rate is a limitation of the study, especially as the small number of county responses require that we exclude them from the statistical analysis. However, as

previously shown, the sample is geographically dispersed, there is no clear pattern to those who refused to respond to the study, and the local governments are similar to the larger population for the geographic study area on several key known factors on disaster experience, size, race, ethnicity and wealth.

4.4 Descriptive Analysis

4.4.1 Overall

For 137 local governments that answered the survey, the average number of coping strategies used (from the list of 62 possible strategies) was 4.64 (SD=6.06). When dropping the 47 local governments which did not use any coping strategies at all, the average number of coping strategies for local governments who adapted to some extent was 7.06 (SD=6.23, N=90). This indicates that local governments which experience a disaster do change multiple aspects of their fiscal structure to cope with new pressures.

Local governments overall had 66 percent reporting some level of adaptation and selected at least one coping strategy from a list of 62 possible options. Only 5 of the 62 coping strategies were not utilized by any local governments that responded to the survey. These strategies were: selling property; issuing short-term general obligation debt; issuing short-term revenue bonds; furloughing staff; reducing hours worked; or laying off employees. Interestingly, the literature gives examples of some of these strategies being used during Hurricane Katrina, such as New Orleans laying off employees to reduce costs (Hildreth 2009).

Six coping strategies were in the top ten used strategies for all three types of local governments. These are applying for grants, receiving grants, collaborating with other governments, purchasing new equipment, changing the strategic plan, and amending the budget. The top strategies used overall by local governments are listed in Table 8.

Table 8: Top Coping Strategies for Local Governments to Adapt to Hurricane Harvey

Top Coping Strategies Overall	# of Local Governments
Applying for grants	73
Receiving grants	59
Purchasing new equipment	32
Using fund balance reserves	32
Amending budget	31
Collaborating with other governments	29
Receiving donations	28
Modifying strategic plan	25
Planning new capital projects	25
Increasing overtime use	23
Contracting out	21

These popular strategies indicate a preference towards revenue increasing strategies, rebuilding the community through new purchases and new capital projects, and modifying short- and long-term plans. While during traditional retrenchment local governments may cut down on services, after disasters local governments step up and provide services for their community, and can seek out less traditional revenue streams, like donations, to do so.

The top two strategies for all three types of local governments was applying for grants, and then receiving grants. However, while 90 percent of counties both report applying for and receiving grants, cities report 81 percent applying for grants, and only 52 percent receiving grants. While seven of the ten county respondents that did use coping strategies reported purchasing new equipment in response to Hurricane Harvey, only 38 percent of school districts and 27 percent of cities reported new purchases. The variation in the selection of coping strategies between these local governments suggests a nuanced interplay between institutional rules that dictate what coping strategies are possible, but also are related to the responsibilities which they take on during the recovery process. County's high percent of grants received and decision to make new purchases to respond to the event may have to do with their expected

duties during the response and recovery process of disaster.

Table 9 shows the number of local governments that used at least one coping strategy within any category, from local governments that showed some level of adaptation. The percentages show the proportion of cities that used that type of coping strategy, out of those that reported any adaptation at all. This shows that revenue strategies were most popular across the board, with 88 percent of local governments that did adapt using at least one revenue-based strategy, possibly in combination with other strategies. The top four strategies show a preference for changing aspects of revenue, policy, and plans, taking on new services and capital projects, and using alternative methods of service delivery, through collaboration and contracting out, as frequent mechanisms of coping with the fiscal and physical impact of disaster. For a count or percent of local governments using specific coping strategies within a category, please see Appendix A and B.

Table 9: Categories of Coping Strategies, by Type of Local Government

Strategy Type (Ordered by Overall popularity)	City		County		School District		Overall	
Revenue Strategies	41	85%	10	100%	28	88%	79	88%
Policy Adaptation Strategies	23	48%	6	60%	22	69%	51	57%
New Service Provision Strategies	24	50%	7	70%	16	50%	47	52%
Collaborative & Alternative Provision Strategies	23	48%	5	50%	17	53%	45	50%
Human Resources Management Strategies	17	35%	4	40%	12	38%	33	37%
Expenditure Strategies	10	21%	2	20%	13	41%	25	28%
Service Level Strategies	6	13%	2	20%	10	31%	18	20%
Debt Strategies	3	6%	1	10%	2	6%	6	7%
Overall Adaptation (Total)	48	100%	10	100%	32	100%	90	100%

Within the category of revenue strategies, the most popular methods of coping strategies for local governments overall were applying for and receiving grants, using fund balance

reserves, and receiving donations. The use of fund balance reserves is clearly an important aspect of the recovery process, as FEMA grants and aid may take a long time to process, and is only a reimbursement, requiring local governments to have resources upfront to get through the first stages of recovery (Hildreth 2009). One city official noted in the open-ended discussion that they learned the necessity of keeping enough cash to cover operating expenses for 3 months. They further revealed that hurricane season aligns with the end of the fiscal year, when cities may have already gone through much of the ad valorem tax revenue collected earlier in the year. The city stated that "Depending on sales taxes during the months following a disaster is almost a disaster in itself." A different city echoed the sentiment, saying "Fund balance reserves are extremely important in the aftermath of a storm. Without them you cannot make it through the initial expenses and continue to fund your current expenses without having to make cuts." One county noted that they learned from seeing the coastal counties' experience of Hurricane Ike and had developed a fund balance policy requiring to keep at least 3 months of the budget in savings, and their 7 months' worth of fund balance at the time of Hurricane Harvey allowed them to "dodge a financial bullet in the effects of Harvey." School districts also noted the significance of proper levels of reserves in their response to a question asking about lessons learned, with one district indicating that they should secure 3 to 5 months of reserves in the future. (A complete list of responses to the open-ended questions of the survey is in Appendix F.)

Within the category of policy adaptation strategies, by far the most popular strategy was amending the budget. Because hurricane season falls during the key transition period of the budget cycle, many local governments were in the process of finalizing the next year's budget. Hurricane Harvey hit in the end of August, and budgets for cities are usually finalized by the end of September to be approved before the start of the fiscal year starting in October. Not only is

cash on hand possibly lower during the hurricane season, but also, many of the decisions about the financial priorities for the upcoming year are made during this time. Some local governments also reported making changes to fund balance policy, developing special revenue funds, or reclassifying expenditures as capital spending. These strategies likely allow local governments to better access funds, learn from the experience about necessary savings levels, and track resources related to disaster recovery.

Within the category of new service provision, the most popular coping strategies were purchasing new equipment and planning new capital projects. Some local governments also reported creating new positions, providing new programs or services, and leasing or purchasing new property. Several school districts discussed grants for mental health and wellness. One school district was able to increase counseling services and provide mental health services for the year. Another mentioned that mental health counseling was not previously accessible for their rural community, but they were able to provide counseling to students and teachers who experienced damage to their homes. Schools also were able to provide other new programs through grants or donations: one school district was able to provide free meals, provide students with backpacks and school supplies, and assist employees with home repairs and lost items, like mattresses. This highlights the difference between traditional retrenchment contexts, where services are cut due to economic stress. During disasters, local governments may need to balance their own need to recover as an organization with new demands from their residents or constituents.

Within the category of collaborative and alternative provision-based strategies, the most popular coping strategies were collaborating with other governments, contracting out, using volunteers, and collaborating with nonprofits. This mirrors expected patterns in the literature for

extreme fiscal stress; Levine (1985) reports in his study of police departments experiencing retrenchment that organizations that experience long-term and high-severity fiscal stress likely seek innovative solutions, and find alternative methods to provide services, such as using a volunteer neighborhood watch, in lieu of as frequent patrolling. Making partnership with other local governments to provide new recovery related services is not without some risk; one city mentioned that one of their lessons learned was to partner with the school district for sheltering residents, finding their partnership with the county less successful than hoped.

4.4.2 Cities

For the 76 cities that answered the survey, the average number of coping strategies selected was 3.71 (SD=5.15). When only considering cities that used at least 1 type of coping strategy, the average number of coping strategies was 5.88 (SD=5.42, N=48). 72 percent of cities adapted to the disaster in some way, using at least one coping strategy. The city with the most overall adaptation used 24 strategies. Cities reported using a wide array of coping strategies, overall using 48 out of the 62 possible strategies in the survey. Cities used eight coping strategies not used by the other two types of local governments: they changed annexation plans; changed fines; reduced salaries; changed land use or zoning policies; changed local option sales tax; canceled property leases; issued long-term general obligation debt; and issued other kinds of debt. These strategies again show institutional rules which dictate how local governments are able to respond. Cities are responsible for most of local land use policy and have the power to update zoning or land use requirements and are the only type of local government which has the ability to annex land or change their geographic boundaries. Cities likely respond to new flooding events by changing land use policy to avoid residential building in areas of repeated loss, or areas now marked as flood zones due to new information. Cities may also be concerned

with declining property tax revenue or residents not returning following a large hurricane event and may seek to use annexation power to broaden their tax base.

4.4.3 Counties

For the 12 counties that answered the survey, the average number of coping strategies used (from the list of 62 possible strategies) was 6.33 (SD=5.03). When dropping counties which did not use any coping strategies, the average number of coping strategies for local governments that adapted to some extent was 7.60 (SD=4.50, N=10) 83 percent of counties had some level of adaptation and selected at least one coping strategy from a list of 62 possible options.

The county with the most overall adaptation used 13 coping strategies, which lower than the maximum amount of coping strategies exhibited by high adapters for school districts and cities. Counties reported using 28 out of the 62 possible strategies in the survey, which is also a lower amount of variation in types of strategies used, compared to the two other types of local governments surveyed. Surprisingly, the only strategy used by counties that was not used by the other two local governments was the change in library hours.

4.4.4 School Districts

For the 49 school districts that answered the survey, 5.65 (SD=7.32) coping strategies were used per organization, on average. When dropping local governments which did not use any coping strategies at all, the average number of coping strategies for local governments that adapted to some extent was 8.66 (SD=7.49, N=32). School districts had 65 percent show some level of adaptation and selected at least one coping strategy from a list of 62 possible options. The local government with the most overall adaptation was a school district, which used 31 out of the 62 listed coping strategies, or half of the entire list of possible coping strategies in the

survey. School Districts reported using 48 out of the 62 possible strategies in the survey, tied with cities for the variation in strategies used by one type of local government.

School Districts used six strategies which were not used at all by cities or counties. These were: reducing services; eliminating services; selling equipment; revising association contracts to reduce pay / benefits; changing the level of automation; and delaying the budget. Furthermore, 53 percent of school districts that did some type of adaptation reported adapting the budget, compared to only 30 percent of counties and 23 percent of school districts. School districts also reported 28 percent of those that used at least 1 coping strategy using targeting spending cuts as a response to Hurricane Harvey, compared with 4 percent of cities, and 0 percent of counties.

4.4.5 Comparing City to School District Response

Hypothesis four from the theory section in chapter three suggests that school districts will have to seek more coping strategies during the recovery process, because they are subject to more institutional restrictions in terms of the types of revenue that they can collect. While cities can collect sales tax and other fees, school districts rely more heavily on property tax, which may be heavily impacted by flooding that occurs during hurricanes. This means that school districts are not as flexible in designing their fiscal structure to fit their specific exposure to risk before the event. As predicted, school districts on average use a higher number of coping strategies, 5.65 (SD=7.32), compared to cities 3.71 (SD=5.15), and a one-sided Student's t-test is significant at $p<.05$, indicating the difference in means is significant. A two-sided variance test indicates that a student's t-test is appropriate, because the difference in variance is insignificant.

4.5 Conclusion

The descriptive analysis of the results of the survey show that local governments react to large-scale disasters by using a wide variety of coping strategies. The top choices in strategies

indicate that local governments step up to provide for their communities during the recovery process, and do not prefer strategies that cut back on services or make expenditure cuts -although some local governments still do make cuts following disasters. The top choices reveal a preference for seeking new revenues, using capital spending for new projects or new equipment, and readjusting policy in light of the new environment. These strategies are in line with Wolman and Davis (1980), who find a preference for seeking intergovernmental revenue, and increasing other revenue, before cutting services.

As predicted, school districts are more restricted in their allowed forms of fiscal structure, and therefore may not be as well adapted to the risks they face. They may have their tax base in an area that is likely to experience damage to properties from hurricanes, but still must rely on property tax and intergovernmental revenue to run their business. As such, when disaster hits they must take on more coping strategies per organization, in order to recovery from the disaster. Interestingly, cities and school districts both used 48 out of the 62 types of coping strategies, indicating that while school districts might be restricted from using some types of coping strategies, they still use a wide range of strategies to get the job done.

This chapter has illustrated *how* local governments act to cope with the fiscal stress of disasters. The following chapter provides a statistical model to estimate what influences their level of adaptation, essentially exploring why they do what they do.

CHAPTER 5

CAUSAL MODEL OF THE LEVEL OF ADAPTATION

This chapter presents a causal model of the factors that influence the number of coping strategies a local government uses to adapt during the recovery process following disasters. The model elucidates what cities and school districts considered when adapting their overall fiscal structure following Hurricane Harvey, by determining which aspects of their prior fiscal condition, environmental factors, and experience of the hazard influenced their selection of coping strategies.

This question, couched within the literature on fiscal condition, contributes to the wider literature of disaster finance by helping determine what drives local government's decision-making processes to adapt their local government and fiscal structure following disasters, and can help clarify how that may differ from the pressures that drive adaptation during other types of fiscal stress, like economic recessions. This study helps develop a more nuanced understanding of local government's strategic decision making, and adaptation to fiscal structure in times of fiscal stress. Determining what variations of coping strategies local governments use following disasters is the first step in determining what coping strategies lead to faster recoveries and more resilient outcomes and generate best practices for adaptive governance in disasters.

The chapter is organized as follows. First, the chapter discusses the dependent and independent variables selected for the models. This discussion includes information on the source, collection process, measurement, and descriptive statistics for each the variable. In the following methods section the rational for the model selection process is given.

Interpretation for three groups of negative binomial regressions are provided in the findings section; one set of models for the overall adaptation, another set for city adaptation, and

also one set for school district adaptation. While counties were included in the survey, there was not enough response to include them in a statistical model, however, school districts and cities differ in their revenue and expenditure streams and institutional rules enough to provide an interesting comparison. The chapter ends with a discussion of the findings and concluding remarks.

5.1 Dependent Variable: Measuring Overall Adaptation

The dependent variable measures overall adaptation by taking a count of how many coping strategies the respondent selected out of the list of 62 options in the survey. This measure indicates how much the local government changed aspects of their fiscal structure and policies in order to respond to Hurricane Harvey. For the 125 local governments that took the survey, on average they took 4.47 strategies (SD=6.14), with a range from 0 to 31 strategies. Table 10 provides descriptive statistics for the dependent and independent variables in the model.

5.2 Independent Variables

Congruent with the theory in chapter three, the model in this chapter includes measures of three main concepts drive a local government's level of adaptation. A full list of independent variables, with their year of collection, type of measure, and unit of analysis, is available in Table 11, and a table on the hypothesized direction of influence for each variable from the discussion in Table 2.

5.2.1 Hazard Impacts

From Wisner and others (2004, 49), hazard refers to the natural events that impact places with varying intensity and severity. Impact may differ due to interaction with other physical characteristics or timing. To get at measures of the impact of the hazard impact on communities for Hurricane Harvey, this study considers seven measures.

Table 10: Descriptive Statistics of Independent and Dependent Variables in Model

Variable	n	mean	sd	median	min	max	se
Hazard							
Previous Disaster Declarations	125	21.57	4.25	22.00	13.00	31.00	0.38
Individual Assistance	125	0.64	0.48	1.00	0.00	1.00	0.04
Public Assistance Category C-G	125	0.70	0.46	1.00	0.00	1.00	0.04
Perception - % Damaged Homes	125	13.91	22.27	1.00	0.00	92.00	1.99
Perception - % Damaged Facilities	125	11.14	22.98	1.00	0.00	100.00	2.05
Rainfall (in)	125	20.91	14.23	19.99	1.76	60.34	1.27
Average Flood Depth (ft)	125	5.50	7.40	3.24	0.00	39.43	0.66
Environment							
% Unemployment	125	0.06	0.03	0.06	0.00	0.18	0.00
Median Income	125	61854.66	33488.66	52453.00	24913.00	250000.00	2995.32
% White	125	0.81	0.13	0.84	0.40	1.00	0.01
% Hispanic	125	0.31	0.21	0.30	0.00	0.94	0.02
Fiscal Condition							
Outstanding Debt per capita	124	2633.49	2957.03	1855.35	0.00	15208.44	265.55
Total Fund Balance, General Fund, per capita	103	554.61	436.95	456.89	-69.16	2259.65	43.05
Total Own Source Revenue, Governmental Funds per capita	103	1183.93	844.91	967.91	91.64	4909.46	83.25
IGR per capita	103	607.53	777.03	151.50	0.00	3881.53	76.56
Capital Outlay per capita	103	343.23	652.35	168.85	0.00	4535.13	64.28
Dept Service per capita	103	238.62	293.35	155.02	0.00	2200.68	28.90
Assessed Value per capita †	124	91217.27	119276.10	59501.91	0.00	907208.41	10711.31
Dependent Variable							
Overall Adaptation	125	4.47	6.14	2	0	31	0.55

Table 11: Independent Variables: Measurement Description

Concept	Variable	Source	Year	Unit of Analysis	Measure
Hazard	Previous Disaster Declarations	FEMA	1953 - 2017	County	Interval
	Individual Assistance	FEMA	2017	County level; 1=declaration; 0=otherwise	Dichotomous
	Public Assistance Category C-G	FEMA	2017	County level; 1=declaration; 0=otherwise	Dichotomous
	Perception - % Damaged Homes	Survey	2017	Organization	Ordinal
	Perception - % Damaged Facilities	Survey	2017	Organization	Ordinal
	Rainfall (in)	NWS AHPS	2017	Organization	Interval
	Average Flood Depth (ft)	FEMA & TACC /Corral	2017	Organization	Interval
Environment	% Unemployment	Census	2016	Organization	Interval
	Median Income	Census	2016	Organization	Interval
	% White	Census	2016	Organization	Interval
	% Hispanic	Census	2016	Organization	Interval
Prior Fiscal Condition	Outstanding Debt per capita	Texas BRB	FY15-16	Organization	Interval
	Total Fund Balance, General Fund, per capita	CAFRs	FY15-16	Organization	Interval
	Total Own Source Revenue, Governmental Funds per capita	CAFRs	FY15-16	Organization	Interval
	Intergovernmental per capita	CAFRs	FY15-16	Organization	Interval
	Capital Outlay per capita	CAFRs	FY15-16	Organization	Interval
	Dept Service per capita	CAFRs	FY15-16	Organization	Interval
	Assessed Value per capita	Texas BRB	FY15-16	Organization	Interval

All measures of hazard impact, except the number of previous disaster declarations, are predicted to have a positive impact on the selection of strategies, since greater levels of impact likely result in more fiscal stress, and in turn require more adaptation. In communities with previous disaster declarations, it is expected that local governments use more coping strategies because they are in an area of high risk, may have already used some coping strategies to respond to previous disasters, and now must seek out harder or less preferable coping strategies to respond.

5.2.1.1 Previous Disaster Declarations

Previous disaster experience may influence how a local government adapts to a new event. Local governments which have already been through several similar events may have already adapted their fiscal structure to be less vulnerable to the fiscal stress of disasters. For example, they may have learned how much they must hold in reserve, in order to cover initial recovery costs before federal aid reimbursements are provided. Conversely, local governments that had to use less optimal coping strategies during previous events and are not fully recovered may be more vulnerable to future disaster events. These local governments may also have more resources invested towards adapting to risk (i.e. have employed grant writers specifically geared towards seeking out mitigation grants, or planners who focus on changing land use policies), and therefore exhibit more strategies. In the theory section the model predicted the later; that a higher amount of prior disaster experience leads to more coping strategies selected. For each local government in the study, a count of all previous disaster declarations before Hurricane Harvey is used as a measure of previous disaster experience.

The data was tallied from a FEMA dataset on all federally declared disaster declarations from 1953 until the present. This dataset includes events managed by previous iterations of the

emergency management arm of the federal government, before the creation of FEMA in 1979. Declarations are organized into three types, major disaster declarations, emergency disaster declarations, and fire management declarations. These designations mean that the event was severe enough to warrant federal assistance. In the count for the model, all declaration types were included. Because disasters are federally declared at a county level, a dominant county was determined for each local government, and that county's count was used for the local government. The county with the largest proportion of the area in a local government's jurisdictional boundaries was selected as the dominant county. This means that for a city in three counties, the county which is the largest proportion of the city's geographic area was selected as the dominant county. There are clear limitations to this measure; a city may have a high count of disaster declarations in our study, but it may be that all those previous disasters occurred elsewhere in the county. However, this is the best available measure of experience with federally declared disasters, which at least somewhat indicates their past experience in navigating the federal reimbursement process.

For the 125 local governments included in the model, the minimum number of prior declarations was 13, and the maximum was 31. On average, local governments in the study experienced 21.57 declarations (SD 4.25). For a full table of descriptive statistics per variable, see Table 10.

5.2.1.2 Individual Assistance Designation

Counties that are designated for individual assistance are those that have a sufficient amount of damage to homes that the area qualifies for federal grants for individual recovery. Individual assistance is only a piece of recovery finance for individuals; often assistance comes in the form of low interest rate federal loans or insurance payments through the National Flood

Insurance Program (NFIP). The maximum amount of aid disaster survivors can receive through individual assistance program is $33,300 for Hurricane Harvey (FEMA 2018b), but the average grant was $7,000 (FEMA 2018a).

In this study a dichotomous variable of individual assistance is included. This measure is a proxy for the level of physical damage which impacted residential areas for the dominant county of any jurisdiction. While public assistance refers to the amount that local governments need to recover their own facilities, individual assistance designations indicate the level to which the tax base is impacted, and also how much the local government may need to support the community through increased service provision. The individual assistance designation is predicted to have a positive effect on the level of coping strategies selected. For local governments in the study, 64 percent received a designation for individual assistance. Please see the (FEMA 2017) for a map of the spatial extent of both individual and public assistance designations.

5.2.1.3 Public Assistance Designation, Category C-G

For counties that are declared for the disaster, they are designated for different types of disaster aid. These designations include qualifications for individual assistance and public assistance, with categories within public assistance for types of emergency work and permanent work. While emergency work may include finances for communities that supported evacuation efforts through sheltering, some areas that received emergency work designations did not have physical damages for the storm. Permanent work refers to the recovery process for damages to public infrastructure and facilities.

For the sample in this study there was no variation between categories of permanent work, either the county received all categories C through G, or were not eligible for any of them.

Because we selected our sample area by those that were declared for the disaster, there was no variation in emergency work. However, there was variation in whether counties received permanent work.

Table 12: Categories of Public Assistance

Emergency Work	Category A: Debris removal
	Category B: Emergency protective measures
Permanent Work	Category C: Roads and bridges
	Category D: Water control facilities
	Category E: Public buildings and contents
	Category F: Public utilities
	Category G: Parks, recreational, and other facilities

In this study a dichotomous variable of permanent work is included. This measure is a proxy for the level of physical damage which occurred to public facilities, compared to residential damage, or the level of impact with an area that did not result in damages, (i.e., flooding to an undeveloped area.) Because designations are at a county level, the value of this variable is determined for the dominant county per each local government, which is the largest proportion of the jurisdiction. The Public Assistance Designation, Category C-G, is predicted to have a positive effect on the level of coping strategies selected. For local governments in the study, 70 percent received a designation for permanent work. Please see Figure 7 to see a map of areas declared for public and individual assistance.

5.2.1.4 Perception of the Percent of Damaged Homes and Damaged Facilities

The survey developed for this dissertation included questions related to the level of damage to homes and facilities. While FEMA declarations are not an indication of the level of damage, and the unit of analysis is the county, survey respondents were asked “In your estimation, what was the impact of Hurricane Harvey on your [jurisdiction]?” with a slider bar allowing them to indicate the percent of homes and facilities that were damaged. While these are

imperfect measures because they rely on the perception of the respondent, they provide an indication of the level of homes and public facilities that were damaged specifically within each jurisdiction, and not the overall county, which may include a much broader area. For the 125 local governments in the model, they reported an average of 13.91 percent of homes (SD=22.27) damaged within their jurisdiction, with a minimum of 0 percent and a maximum of 92 percent of homes damaged. They reported an average of 11.14 percent of facilities (SD=22.98) damaged within their jurisdiction, with a minimum of 0 percent and a maximum of 100 percent of facilities damaged. The reported amount of damage to homes and facilities is predicted to have a positive effect on the level of coping strategies selected.

5.2.1.5 Rainfall (Inches)

Hurricane Harvey was noted for being a slow-moving storm that produced heavy rainfall, suggesting that flooding was more widespread, and not just of riverine flooding from water being channelized from the bay and storm surge hitting the coast. To measure the impact of the hazard, rainfall was included in the model. Measures of the hazard exposure and impact derived from raster map data are seldom used in the public finance literature, and so measures of rainfall and flood depth are novel inclusions to this study.

Rainfall average were calculated per local government, using raster data from the national weather service's Advanced Hydrologic Prediction Service and census shapefiles for jurisdictional boundaries. For each jurisdiction, the average pixel value for band 1, indicating the observed cumulative rainfall for August 2017 was determined, using zonal statistics. Because the raster has a resolution of 4763 meters, some cities were smaller than a pixel, and initially not calculated. For these communities, the value of the pixel overlapping with the centroid of the jurisdiction was used for the average value.

For the 125 local governments included in the study, the average rainfall in inches was 20.91 (SD = 14.23), with a minimum of 1.76 inches for the month of August, and a maximum of 60.34 inches. Rainfall is predicted to have a positive effect on the level of coping strategies selected.

5.2.1.6 Average Flood Depth (ft)

FEMA published a flood inundation map (CUAHSI 2017), providing flood depths based on gauged high-water marks, as well as LiDAR and IFSAR data (Qin, Khakzad, and Zhu 2020). This raster data is available at a 3-meter resolution. Average flood depths were calculated per local government, using FEMA's raster and census shapefiles for jurisdictional boundaries. Average depths were preferred over maximum values, because gauge values may be erroneously high. The variable generated from this data indicates if the local government's jurisdiction is in an area that experienced riverine flooding due to the hurricane, and for areas that experienced flooding, how deep the flooding was. The average value of the mean flood depth for local governments in the study was 5.50 ft (SD=7.40), with a minimum of 0 ft and a maximum value of 39.43ft. The average flood depth is predicted to have a positive effect on the level of coping strategies selected

5.2.2 Prior Fiscal Condition

Fiscal condition is the ability of an organization to meet obligations. Many factors play a role in determining fiscal condition. Maher and Nollenberger (2009) provide a list of 10 ratios of fiscal condition, adapted from Brown (1993), which largely indicate that the key financial indicators focus on ratios of revenue, expenditure, operating position, debt, and unfunded liability. This study includes similar measures, but uses per capita values, rather than ratios, and excludes measures of unfunded liability.

Financial data is collected from two sources: Comprehensive Annual Financial Audit Reports (CAFRs) for each local government, and a dataset from the Texas Bond Review Board (BRB). The data is collected for Fiscal year ending in 2016, which is the closest full fiscal year before Hurricane Harvey related expenses are included in the finances. CAFR data was not available for 22 cities for fiscal year 2015-2016 and was not included in the study. For a table of data sources please see Table 11 and for descriptive statistics on these variables please see Table 10.

Local governments that have a worse fiscal condition are anticipated to be more motivated to adapt their fiscal environment, and so most indicators associated with good fiscal condition are hypothesized to be negatively associated with the use of coping strategies.

5.2.2.1 Total Own Source Revenue, Governmental Funds per Capita

One measure of revenue used in the study is total own-source revenue (within governmental funds), per capita. This measures the amount of revenue collected in taxes and fees for primary government functions, relative to the population. This is calculated by subtracting intergovernmental revenue from total revenue for governmental funds, and then dividing by the total population. This measure indicates how much the local government relies on their own revenue streams, and also if they have enough revenue collected to provide support services for the size of the population. Higher levels of own source revenue per capita indicates the local government has enough revenue per capita and is less likely to use the disaster as a focusing event to change fiscal structure. The average amount of own-source revenue was $1,184 per capita (SD=$845), with a range from $93 to $4,909 per capita.

5.2.2.2 Intergovernmental Revenue per Capita

Intergovernmental revenue refers to the amount of revenue collected that is from another

unit of government. When combined with total own-source revenue, the result in total revenue. This measure indicates the level of dependence on other units of government. More intergovernmental aid may mean more individuals requiring government services, who are more vulnerable, and therefore need more in assistance during disasters. For this reason this measure is hypothesized to have a positive relationship with the level of adaptation. The average amount of intergovernmental revenue was $608 per capita (SD=$777), with a range from $0 to $43,881 per capita.

5.2.2.3 Total Fund Balance in General Fund per Capita

Total fund balance refers to the amount of reserves in the general fund. Those that have more in savings are predicted to require fewer coping strategies are necessary to weather the storm. The average total fund balance per capita was $555 (SD=$437), with a range from $-70 to $2260 per capita.

5.2.2.4 Assessed Value per Capita

Assessed value refers to the value of the property tax base. Communities with homes that are highly valued are more likely to return to pre-hurricane levels, and generally recover at a faster rate. This expected trajectory of recovery leads the author to predict that local governments with higher assessed value per capita will require fewer coping strategies. Assessed value is included in Maher and Nollenberger (2009) and Brown (1993) as part of a ratio of long-term debt , but here it is included as a stand-alone variable.

5.2.2.5 Outstanding Debt per Capita

Outstanding debt is measured as the tax-supported debt outstanding as of August 31st, 2016, from the Texas Bond Review Board. This measure indicates how much of a debt burden

exists, and indicates a larger obligation, and overall lower fiscal condition. This includes both principal and interest amounts. For this study it is predicted that higher levels of debt overall indicate lower fiscal condition, and therefore predicts that local governments with high levels of outstanding debt will have a higher number of coping strategies selected.

5.2.2.6 Dept Service per Capita

Similar to outstanding debt, which measures long-term debt, debt service refers to the amount of resources which must be put towards paying off debt in any given year. Higher levels of debt overall indicate less fiscal health and therefore this model predicts more coping strategies will be used.

5.2.2.7 Capital Outlay per capita

Capital outlay refers expenditures for capital projects. Local governments that have spent a lot in capital outlay may still be in the process of building public facilities and infrastructure. This may mean that the disaster disrupts the building process, and opens new opportunities for how to build, or changes in community demographics as some do not return to damaged homes may lead to new service demands. This predicts that communities with higher levels of capital outlay before the event will likely use more coping strategies following the disaster. This is less an indication of fiscal condition but is instead a measure of how flexible the local government may be in determining future plans. On average local governments in the study spent $343.23 per capita on capital outlay (SD=652.35) with a range from $0 to $4535.

5.2.3 Environment

There are several environmental factors that shape decisions of fiscal structure that the study includes as control variables. From Hendrick (2011), measures of environment include

political, institutional, and economic aspects of the environment that indicate service demands, organizational restrictions, and the size of the economic base that can impact financial decisions for the local government. These environmental factors can influence the potential amount of revenues that can be collected following changes in fiscal structure.

In this model measures of race (percent white), ethnicity (Percent Hispanic), unemployment (percent), and median income are used as control variables. These values are taken from the American Community Survey for 2016. These measures are also included in the social vulnerability model (Cutter, Boruff, and Shirley 2003), indicating that populations with low income, high unemployment, and high percent of minority populations are more at risk, and may require additional services to recover from the hurricane, and therefore increase service demands following the disaster.

Institutional rules may shape policy on fiscal structure by putting in place limitations to certain types of local governments. School districts are limited in revenue streams, primarily rely on property tax, and cannot collect sales tax revenue. Cities are less restricted, but they still may follow different procedures and have different organizational missions, leading to a different selection of coping strategies following disasters. Separate models are presented for cities and school districts, to account for institutional differences, and a dummy variable for type of organization is included in the overall model.

For jurisdictions in the model, the average level of unemployment was 6 percent (SD =3 percent) with a range of 0 percent to 18 percent, and the average median income was $61,855 (SD = $33,489) with a range of $24,913 to $250,000. The average percent of the population that was white was 81 percent (SD =13 percent) with a range of 40 percent to 100 percent, and the average percent of the population that was Hispanic was 31 percent (SD=21 percent) with a

range of 0 percent to 94 percent.

For the control variables, high percent unemployment, low percent white, high percent Hispanic, and high median income are predicted to result in increased adaptation.

5.3 Method of Analysis

5.3.1 Negative Binomial Regression

The effects of prior fiscal condition, hazard impact, and environmental factors on the level of local government adaptation to disaster induced fiscal stress is estimated using negative binomial regression. Because the dependent variable is count data, a Poisson or negative binomial regression was more appropriate than a linear ordinary least squares regression, which may produce biased regression coefficients (King 1998). The negative binomial model is preferred over the Poisson model when the data is over dispersed, as is the case in the models presented here. A Poisson model using over dispersed data may produce overly small estimated standard errors (Cameron and Trivedi 1986), and the negative binomial is preferred because it has an additional parameter to account for having the variance exceed the mean (Fox 2015; Agresti 2018).

This method of analysis using negative binomial regression mirrors that of other public administration literature with similar data forms. LeRoux, Brandenburger, and Pandey (2010) use a negative binomial regression to estimate the effects of social networks on interlocal service cooperation, where the dependent variable is a count of the number of interlocal agreements reported in their survey. Similarly, Carr and LeRoux (2005) use a negative binomial regression for estimating the effects of fiscal capacity and administrative structure on the frequency of cooperation for fire and police services, which is also count data.

5.3.2 Variables Excluded from the Model

While measures of total expenditures, total revenues, and median home values were collected, these measures showed high multicollinearity and were excluded from the model. Total expenditures are balanced with total revenues, and total revenues is the combination of own-source revenues and intergovernmental revenues, which are included in the model. Because school districts rely heavily on property tax for their own source revenue, compared with cities that also heavily rely on sales tax, assessed values were also excluded from the model for school districts. These three measures were the only variables found to have a Variance Inflation Factor (VIF) score greater than 10 and were dropped from the model. A VIF score of 10 is customarily considered the threshold, and the decision to drop these variables is in line with other public administration studies using a binomial regression analysis, see for example Amirkhanyan, Kim, and Lambright (2008). Final VIF scores for the three models are listed below.

Table 13: VIF Values for the Final Model

Independent Variable	Overall VIF	City VIF	School District VIF
Previous Disaster Declarations (1953-August 2017)	1.69	2.04	2.27
Federal Declaration, Individual Assistance	5.89	5.93	8.24
Federal Declaration, Public Assistance Category C-G	4.98	5.65	5.29
Perception - % Damaged Homes	2.69	2.56	3.98
Perception - % Damaged Facilities	2.52	2.31	4.20
Rainfall, inches (August 2017)	3.90	4.62	4.82
Average Flood Depth (ft)	2.49	2.96	3.45
% Unemployment	1.79	2.18	2.86
Median Income	3.44	5.62	1.72
% White	1.25	1.31	1.58
% Hispanic	2.24	2.61	2.58
Outstanding Debt per capita	3.63	5.34	5.22
Total Fund Balance, General Fund, per capita	1.97	2.84	2.09
Total Own Source Revenue, Governmental Funds per capita	5.42	6.52	3.59
Intergovernmental Revenue per capita	3.17	1.95	1.73

Independent Variable	Overall VIF	City VIF	School District VIF
Capital Outlay per capita	3.17	5.82	3.21
Dept Service per capita	2.34	5.37	2.48
Assessed Value per capita †	4.41	5.50	
Type of Organization	3.57		

† Assessed Value excluded from School Model due to high VIF score, from highly correlating with own source revenue.

5.4 Findings

Results of the negative binomial regressions are included in Tables 14-16. These tables include incident rate ratios (IRR), standard errors, z-values, and significance for three groups of models; the overall model, city model, and school district model. Partial models are provided, as are log likelihood, LN Alpha, McFadden's Pseudo R^2, and LR Chi-Squared for each model. Estimates have been transformed into incident rate ratios for ease of interpretation.

5.4.1 Hazard Impact

Seven measures were included to measure how hazard impact influenced the number of coping strategies selected. They were all predicted to have a positive coefficient. In the full overall model, only receiving a public assistance designation (Categories C-G), and the survey respondent's perception of the number of facilities were significant, and they were both in the anticipated positive direction. From the five remaining hazard impact variables, three were insignificant, but in the anticipated direction. The measure of Flood Depth and Rainfall had an insignificant impact on the full models but trended towards having a negative impact. This may be due to having a lack of sophistication in the measurement – perhaps a measure of percent of area flooded, or number of homes within a flood zone would be more appropriate but were unobtainable for the geographic size of the surveyed area.

Table 14: Overall Binomial Regressions for Local Government Adaptation to Fiscal Stress

	Hazard Impact			Hazard Impact + Fiscal Health			Full Model		
	IRR	Std. Error	z	IRR	Std. Error	z	IRR	Std. Error	z
Hazard Impact									
Previous Disaster Declarations	1.06	0.02	2.45*	1.07	0.02	2.77*	1.05	0.03	1.86
Individual Assistance	1.64	0.46	1.09	2.09	0.49	1.52	2.09	0.47	1.56
Public Assistance Category C-G	3.41	0.44	2.80*	2.68	0.45	2.17*	3.38	0.47	2.57*
Perception - % Damaged Homes	1.01	0.01	2.18*	1.01	0.01	1.68	1.01	0.01	1.75
Perception - % Damaged Facilities	1.01	0.01	2.21*	1.01	0.00	2.67*	1.01	0.01	2.29*
Rainfall August 2017 (in)	0.99	0.01	-0.96	1.00	0.01	-0.52	0.99	0.01	-0.51
Average Flood Depth (ft)	0.98	0.02	-1.03	0.98	0.02	-1.37	0.99	0.02	-0.65
Fiscal Health									
Total Fund Balance, per capita				1.00	0.00	-2.54*	1.00	0.00	-3.20*
Total Own Source Rev. per capita				1.00	0.00	2.04*	1.00	0.00	3.02*
Intergovernmental Revenue per capita				1.00	0.00	2.00*	1.00	0.00	1.90
Outstanding Debt per capita				1.00	0.00	-0.84	1.00	0.00	-0.82
Dept Service per capita				1.00	0.00	-0.58	1.00	0.00	-0.83
Capital Outlay per capita				1.00	0.00	0.54	1.00	0.00	0.73
Assessed Value per capita				1.00	0.00	-2.13*	1.00	0.00	-3.15*
Environment									
% Unemployment							402.22	4.06	1.48
Median Income							1.00	0.00	2.59*
% White							0.59	0.76	-0.69
% Hispanic							1.38	0.68	0.48
Type (City=0, School District=1)							0.88	0.34	-0.38
(Intercept)	0.25	0.54	-2.58*	0.22	0.56	-2.69*	0.12	0.90	-2.32*
Log-Likelihood	-231.43			-225.69			-221.15		
LN Alpha	0.61			0.48			0.43		
McFadden's Pseudo R^2	0.13			0.15			0.17		
LR Chi-Squared	68.71			80.20			89.28		

* = Significance of $p<0.05$; n = 102

Table 15: City Binomial Regressions for Local Government Adaptation to Fiscal Stress

	Hazard Impact			Hazard Impact + Fiscal Health			Full Model		
	IRR	Std. Error	z	IRR	Std. Error	z	IRR	Std. Error	z
Hazard Impact									
Previous Disaster Declarations	1.01	0.04	0.33	1.06	0.04	1.29	1.04	0.05	0.91
Individual Assistance	1.66	0.61	0.84	1.44	0.61	0.60	1.44	0.63	0.58
Public Assistance Category C-G	2.28	0.60	1.37	1.87	0.59	1.06	2.76	0.63	1.61
Perception - % Damaged Homes	1.01	0.01	0.90	1.02	0.01	1.76	1.02	0.01	1.93
Perception - % Damaged Facilities	1.01	0.01	1.60	1.01	0.01	1.04	1.01	0.01	1.06
Rainfall August 2017 (in)	1.00	0.01	-0.33	1.00	0.01	0.28	0.99	0.02	-0.34
Average Flood Depth (ft)	0.98	0.03	-0.63	1.00	0.03	-0.08	1.00	0.04	0.00
Fiscal Health									
Total Fund Balance, per capita				1.00	0.00	-2.48*	1.00	0.00	-3.04*
Total Own Source Revenue, Governmental Funds per capita				1.00	0.00	2.09*	1.00	0.00	2.57*
Intergovernmental Revenue per capita				1.00	0.00	0.15	1.00	0.00	-0.26
Outstanding Debt per capita				1.00	0.00	0.53	1.00	0.00	0.67
Dept Service per capita				1.00	0.00	-0.59	1.00	0.00	-1.01
Capital Outlay per capita				1.00	0.00	-0.10	1.00	0.00	0.38
Assessed Value per capita				1.00	0.00	-2.14*	1.00	0.00	-2.88*
Environment									
% Unemployment							166.17	6.67	0.77
Median Income							1.00	0.00	1.76
% White							0.95	1.05	-0.05
% Hispanic							0.60	1.03	-0.50
(Intercept)		0.84	-0.07	0.31	0.97	-1.21	0.20	1.19	-1.37
Log-Likelihood		-119.84			-115.62			-113.30	
LN Alpha		0.64			0.46			0.39	
McFadden's Pseudo R^2		0.09			0.13			0.14	
LR Chi-Squared		25.08			33.52			38.17	

* = Significance of $p<0.05$ n=53

Table 16: School District Overall Binomial Regressions for Local Government Adaptation to Fiscal Stress

	Hazard Impact			Hazard Impact + Fiscal Health			Full Model		
	IRR	Std. Error	z	IRR	Std. Error	z	IRR	Std. Error	z
Hazard Impact									
Previous Disaster Declarations	1.08	0.03	2.16*	1.08	0.03	2.29*	1.03	0.04	0.85
Individual Assistance	1.64	0.64	0.77	4.34	0.77	1.92	4.88	0.72	2.19*
Public Assistance Category C-G	28.95	1.11	3.03*	19.13	1.16	2.54*	17.76	1.18	2.44*
Perception - % Damaged Homes	1.01	0.01	1.28	1.00	0.01	0.45	1.00	0.01	0.48
Perception - % Damaged Facilities	1.01	0.01	1.92	1.02	0.01	2.42*	1.01	0.01	1.27
Rainfall August 2017 (in)	0.99	0.01	-0.57	0.99	0.01	-0.67	1.00	0.02	0.06
Average Flood Depth (ft)	0.97	0.02	-1.15	0.96	0.02	-1.85	0.98	0.03	-0.55
Fiscal Health									
Total Fund Balance, per capita					0.00	-1.47		0.00	-2.15*
Total Own Source Revenue, Governmental Funds per capita					0.00	-0.31		0.00	-0.12
Intergovernmental Revenue per capita					0.00	2.62*		0.00	1.33
Outstanding Debt per capita					0.00	0.01		0.00	0.08
Dept Service per capita					0.00	-0.52		0.00	-0.48
Capital Outlay per capita					0.00	0.62		0.00	0.19
Environment									
% Unemployment								7.52	1.34
Median Income								0.00	0.48
% White								1.54	0.07
% Hispanic								1.00	1.66
(Intercept)		1.17	-3.18*		1.23	-3.38*		1.99	-2.44*
Log-Likelihood	-105.39			-101.12			-98.21		
LN Alpha	0.44			0.33			0.24		
McFadden's Pseudo R^2	0.20			0.24			0.26		
LR Chi-Squared	68.23			62.42			53.88		

* = Significance of $p<0.05$; n=49. † Assessed Value excluded from School Model due to high VIF score, due to highly correlating with own source revenue.

No hazard impact variables were significant in the city model. All variables were in the anticipated direction except for rainfall. For school districts, both individual assistance and public assistance (C-G) designations were significant, and in the anticipated positive direction. All variables were in the positive direction as anticipated, except the measure on flood depth, however this variable was insignificant in the model.

5.4.2 Environment

Four measures were included to control for environment factors that can contribute to the level of expected services from the local government, as well as the expected difficulty for the local government to use some strategies over others. Only median income was significant in the overall model, and no environment measures were significant in city or school district models. Median income was anticipated to have a negative relationship with the number of coping strategies selected, but the overall model shows a positive relationship. The author had reasoned that higher median income communities would need less government support to recover from the storm, however, it may be the case the high-income communities actually expect more services overall from their local government, and so they would receive expect more coping strategies to be used during recovery.

Unemployment, while not significant, was trending towards a positive relationship with the number of coping strategies used, as expected. For the variable measuring the percent of the jurisdiction that was white, the relationship was not significant, but negative for cities and positive for school districts. The reverse was true for the percent Hispanic, where the relationship was negative for cities and positive for school districts.

5.4.3 Prior Fiscal Condition

Seven variables were included in the overall and city models to measure prior fiscal

condition, with the measure of assessed value excluded from the school district model. Total fund balance was significant in the negative direction for all the full overall model, full city model, and full school district model, as expected. Total own source revenue was anticipated to have a negative effect, but was significantly positive in the overall model, and for cities, but was insignificant and negative for school districts.

Total intergovernmental revenue was significant for the overall model with a positive influence on coping strategies, which was unexpected. However, while insignificant in the full city and full school district model, the relationship is negative as expected for cities, and positive for school districts. This may be due to differences in the types of intergovernmental revenue being received; school districts largely rely on intergovernmental aid, while cities may receive aid based on the needs for specifically underserved populations. A more in-depth analysis of the makeup of total intergovernmental aid would be necessary to determine the relationship.

The models included two measures of debt; total outstanding debt per capita, and debt service per capita. Neither of these variables were significant in any of the full models. Debt service, while insignificant, had a negative relationship with the number of coping strategies in all three models, which was reverse of the predicted relationship – that local governments using more debt would use more strategies to try to improve their fiscal condition. It may be instead that taking on debt requires agreement to certain behaviors which limit the ability to cope with disasters. Looking more in depth into the characteristics of the debt may reveal why these variables are both insignificant, and in the unanticipated direction.

Capital outlay was insignificant in all three models but had a positive relationship with the number of coping strategies selected, as anticipated. Finally, assessed values were significant in the overall model and the city model, and as anticipated, and a negative relationship with the

number of coping strategies selected.

5.5 Discussion

The findings indicate that for any significant hazard variables, the more exposure to hazard, the higher the number of coping strategies used. This gives support to the hypothesis that local governments which are more impacted by the hazard use more coping strategies in response. While it is surprising that the measures of physical attributes of the hazard – rainfall and flood depth – are not significant, and trend reverse of the expected direction. However, this is likely a limitation of the measure. Hazards can have very different impacts on the community in terms of the severity and physical range of damage, the length of time that residents are evacuated or otherwise impacted, what industries and sectors of economy are most impacted, changes in population due to migration or failure to return, and changes in public perception about the safety of the area. just measuring flood depth or rainfall do not adequately determine whether the hazard impacted residential or commercial areas, or if public infrastructure was damaged, let alone the length of time before the flooding receded, and the community was able to return. However, the designation for public or individual assistance is at least in theory determined based on the level of damage to structures and infrastructure.

Environment variables included in the model were largely inconsequential, with only median income having a positive effect on the overall model, suggesting that local governments serving more wealthy communities may provide more services or adapt more in other ways following disaster. The measures on the percent of the jurisdiction that was white, or Hispanic were aimed at determining the relative number of minorities that are usually considered more socially vulnerable. However, for some local governments where the community is a minority majority, it may not actually be the case that these groups are more vulnerable, and a more

complex definition of vulnerability would be necessary to fully assess how environment factors impacted the decision to use coping strategies.

For fiscal condition, the story is a little more complicated. Those local governments that had enough in savings, as shown by a high total fund balance, used less coping strategies, giving partial support for the hypotheses that local governments with poor fiscal condition are more likely to adapt their structure in response to the disaster, and those that are already well suited for their environment will do less to change their overall structure. In the overall model and the city model, higher total assessed values for the property tax base result in fewer coping strategies being used. This also lends support to the idea that local governments with a strong tax base and a good fiscal condition are less likely to adapt following the disaster.

However, the level of total revenue, from both own source revenue and intergovernmental revenue was positively associated with the level of coping strategies, indicating that communities that receive more revenue per capita actually adapt more following disaster, which suggests that healthy organizations may adapt more. This may be true for several reasons; it may be that these communities have more resources and knowledgeable staff to be able to adapt, while those that already face poor fiscal health cannot afford the resources necessary to pursue changes to policies or provide new services.

Debt, which plays a key role in the fiscal condition literature for being an indicator of poor fiscal health, is not significant in the model, suggesting that debt is not a key factor which determines how much a local government adapts following the disaster.

There is also an interesting distinction between the two types of local governments. School district's response and level of adaptation seems to be predicated on their access to federal assistance and the level of their fund balance reserves, likely because their own-source

revenue is impacted by the disaster, and they rely more heavily on intergovernmental revenue. Without receiving a federal designation which allows them to receive intergovernmental aid, or have reserve funds at the ready, they may not be able to provide additional services, or make other changes to their fiscal structure to adapt.

In comparison, cities are not significantly influenced by aspects of hazard impact or environment, and instead make their decision on the amount of savings they have in the fund balance and their level of own source revenue per capita. If they have enough resources, they may adapt regardless of the actual characteristics of the physical hazard.

Looking at the different aspects of fiscal condition, it appears that local governments that have enough in savings and a large property tax base may choose not to adapt much if they find their fiscal structure adequately fits their environment – including their level of risk to disasters. However, they may use more coping strategies, if they have high levels of revenue per capita, and their community seeks more adaptation in response to the event. This suggests that if local governments want to act strategically to improve their fiscal structure relative to their risk, and those that are already in good fiscal condition are the ones that adapt, then those which are not in good fiscal condition and do not adapt may be left in worse condition. This provides an opportunity for future study, in the years following this survey. Are the organizations which chose to adapt during the time of this survey quicker to recover financially, and are they better equipped for future disasters? Are the local governments with good fiscal condition getting healthier, while the local governments already in poor fiscal condition not able to adapt to disasters? Only time will tell.

5.6 Conclusion

This chapter introduced a series of negative binomial regressions to estimate the impact

of fiscal health, hazard impact, and environment on a local government's selection of coping mechanisms. The models show mixed results; while some variables measuring hazard impact show a positive impact on the number of coping strategies selected, no hazard impact variables were significant in the model of city adaptation, compared to the overall model and school district model. In terms of fiscal health, fund balance plays a clear role in adaptation, where local governments with higher levels of reserves in their fund balance choose fewer coping strategies. Cities also are influenced by the level of total assessed value in their property tax base, and the amount of revenue they have per capita, while these do not impact school districts' decision to adapt.

These findings suggest that local governments do consider their ability to adapt and the need, based on hazard impact, when deciding how much to adapt. The findings indicate that cities and school districts differ in what they consider before selecting coping strategies, and this likely has to do with differences in institutional rules that govern their fiscal structure, as well as their expected roles during the recovery process.

However, findings also implicate that healthy local governments may choose to adapt, while local governments with poor fiscal condition are less flexible and use less adaptation is worth future study, as it indicates that the gap between local governments with strong and weak fiscal health may grow as this region is cyclically hit by hurricanes.

The next chapter concludes the dissertation's exploration of local government's selection of coping strategies following disasters. The conclusion focuses on the two research questions presented in the introduction, namely how do local governments adapt to the fiscal and physical stress of disasters, and what influences their level of adaptation.

CHAPTER 6

CONCLUSION

Local governments face unique challenges following exposure to major disasters. As shown by the communities in southern Texas who experienced the flooding and deluge of rain from Hurricane Harvey, local governments must support their community through the provision of new services – they commit resources towards organizing evacuations, participating in search and rescues, and sheltering survivors. They must clear debris and increase garbage collection to facilitate the recovery process and jumpstart the economic activity as residents return to damaged homes and businesses. All these actions fall beyond the realm of usual activity, and may require additional expenditures, beyond what the local government had initially budgeted for the year.

But local governments must themselves also recover. Just as a business or individual may need to pay for damages, the local governments are responsible for rebuilding their own public facilities and infrastructure following the event. They also face a potential decline in their revenue streams; some literature suggests that hazard impacts on a community can have long term impacts on sales and property tax revenue (Ismayilov and Andrew 2016; Bin and Polasky 2004; Krueger, Winkler, and Schumann III 2019; Peacock et al. 2014; Dash and Peacock 1997). The question that emerges, is how are local governments able to balance increased service demands with declining revenue? How can they adapt their fiscal structure to be able to support their communities' recovery efforts, but also maintain the solvency to be able to pay their regular obligations, and stay in proper financial condition?

The literature on fiscal stress has traditionally focused on retrenchment – how can a government cut back on expenditures during periods of economic decline. The literature has found mixed results on ways that local governments cope, suggesting that once easier strategies

are completed, local governments either focus their efforts on increasing revenue streams (Wolman and Davis 1980) or making expenditure cuts (Afonso 2013; MacManus 1993), or developing a more complex strategy to balance short and long term needs (Justice and Yang 2018).

But this literature largely assumes that services are cut during more extreme incidents of fiscal stress, unless innovative solutions allow local governments to cut costs through alternative service methods (C. Levine 1985). Research focused on how local governments adapt to fiscal stress from economic events understate how some incidents of fiscal stress actually necessitate additional expenditures. This dissertation aimed to fill the gap in the literature on fiscal stress of disasters, by focusing on two research questions:

R1: What coping strategies did local governments use after Hurricane Harvey?

R2: What factors influence local governments' level of adaptation?

The remainder of this chapter focuses on the findings which provide insight on these two topics, and hopefully adds depths and nuance to our understanding of local government adaptation to fiscal stress, before concluding with a discussion of topics that are ripe for future research.

6.1 How Do Local Governments Adapt to Hurricane Harvey?

To determine how local governments adapt, a survey was sent to financial officers of cities, counties, and school districts that were in an area that experienced fiscal or physical impacts from Hurricane Harvey. The results show that local governments adapt in a diverse set of ways. The survey included 62 possible coping strategies which these local governments might use during the recovery process, ranging between diverse options like using across-the-board cuts, selling equipment, or freezing salaries, to options like leasing new property, making

changes to land use or annexation plans, providing new programs and services, or planning new capital projects. Between the 137 organizations that answered the survey 66 percent reported using some level of adaptation, and for those that did adapt, they used an average of 7.06 different coping strategies. Only 5 out of the 62 possible coping strategies were not used by any organization, showing there is a vast range of ways that local governments seek to adapt to their environment and level of risk.

The most popular types of coping strategies included applying for and receiving grants, purchasing new equipment, using fund balance reserves, and amending the budget. These popular strategies were top choices for all three types of government, and indicate a preference towards revenue increasing strategies, rebuilding the community through new purchases and new capital projects, and modifying short- and long-term plans. These actions show that at least the experience of Hurricane Harvey did not fit with traditional conceptions of fiscal stress and retrenchment – in some cases local governments actually sought out new revenues to provide additional services, rather than make cuts.

A comparison of cities to school districts in a one-sided t-test indicated that there was a significant difference in the mean number of coping strategies used. This gives modest support to the hypothesis that school districts do use a significantly larger number of coping strategies to cope; however the dummy variable for organization type was not significant in the overall negative binomial model. More research is necessary, but these findings imply that school districts may not initially have a fiscal structure that is well adapted to their level of risk to disruption from disasters. School districts are more restricted in terms of their revenue streams, and heavily rely on property tax revenue, and flooding from hurricanes can have long-term

impacts on the housing market and assessed values, inevitably influencing school district revenues.

6.2 What Influences the Level of Adaptation to Hurricane Harvey?

Following a descriptive analysis of the range of coping strategies that local governments adopt following Hurricane Harvey, a series of negative binomial regression models were developed to estimate the effects of prior fiscal condition, hazard impact, and environmental factors on the level of local government adaptation to disaster induced fiscal stress. The author predicted that local governments having a fiscal structure less adapted to their environment and level of risk would act strategically and take on more coping strategies during the recovery of Hurricane Harvey. The results indicate that overall local governments do take into account some aspects of hazard exposure when selecting their level of adaptation; specifically a local government's location in an designated for public assistance grants, and a perception of a higher number of damaged facilities had a positive effect on the number of strategies used.

The level of total fund balance in the general fund prior to the disaster and the amount of assessed value per capita is negatively associated with increased adaptation, indicating that those with the savings do not need to do more to adapt their fiscal structure during the recovery phase. However, the amount of own source revenue, and intergovernmental revenue, and have a positive impact on the number of strategies used.

When looking separately at school districts and cities, there are differences in which variables are significant predictors of the level of coping strategies selected following Hurricane Harvey. School districts select more coping strategies when they are in an area declared for individual and public federal grant assistance. Cities, in comparison, select more coping strategies when they have more in own source revenue per capita, and have higher assessed value

per capita. This difference is likely due to the restrictions placed on their revenue streams; school districts rely on intergovernmental aid and look to federal grant accessibility when determining their level of coping strategies, while cities look at their own tax base.

6.3 Lessons Learned and Concluding Thoughts

From open ended responses in the survey, a few clear lessons emerge. While unsurprising, the results from the survey echo the importance of having reserves in the fund balance, with many local governments suggesting at least three months of budget in savings. Having enough in reserve allows the organization to continue regular payments and take action on initial response and recovery efforts before reimbursement funds are dispersed.

Second, the timing of the institutional rules of budget cycle and revenue collection cycle in our social system may be at odds with the rhythm of the ecological system. Local governments are in the midst of finalizing their budgets in the months before October 1st, when the new budget cycle starts. The Atlantic hurricane season generally peaks from August to October, indicating that these communities are most at risk during this final phase of the budget season. This is not necessarily the best timing; 31 local governments that responded to the survey reported amending the budget, but only one local government reported having to delay the budget. This may be due to legal constraints on budget adoption, but also suggests that local governments are able to use part of the budget process to plan their fiscal adaptation to hurricane events.

However, while it is unclear if the budget cycle is misaligned with the hurricane season, it is clear that revenue collection cycles may lead to low cash flow levels during this time of uncertainty. One city indicated that much of the ad valorem tax revenue is collected earlier in the year, and “Depending on sales taxes during the months following a disaster is almost a disaster

in itself." This suggests that a better academic understanding of the relationship between annual cash flow practices and recovery from hazard exposure may be worth further pursuit.

The findings from this study lend themselves to future research. While the survey results indicate that local governments react to disaster using a variety of strategies, what is still unknown is the impact that differing strategies may have on long term outcomes. Questions remain on which strategies can lead to better financial outcomes, or more resilient communities. What are the best practices that local governments can take, to recover following disaster? If the federal government puts more pressure on local governments take on more responsibility for the response and recovery from disasters, how may those local governments manage their recovery from disasters without as much reliance on federal assistance? Furthermore, are some of these strategies not purely reactive, but also proactive? Some local governments mentioned learning to save enough in their fund balance from prior hurricane events; is it the case that some communities which did not have a terrible experience of the disaster still took proactive strategies to reduce their exposure to risk? More research is necessary to determine what aspects of the financial structure of local governments lead to faster, more sustainable financial recovery, and if these types of financial structures are the same or different from the best financial strategies when not exposed to a natural disaster. Finally, the findings in this dissertation can be expanded upon, to see if other types of disasters result in a similar selection of strategies.

This dissertation sought out to answer two primary questions: how local governments adapt to the fiscal stress of disasters, and what influences overall level of adaptation. Future research building on these findings can look to answer what determines the preference of some coping strategies over others, and how the selection of different strategies lead to different outcomes. The framework in chapter three puts forth that the relationship between local

government finance and their experience of risk is cyclical; the choices they make can lead them towards improved or worsened fiscal condition. This research shows that local governments do adapt to their environment and make choices based off their experience of exposure. What still remains to be answered is if they make the right choices; and which choices facilitate faster recovery for both the organization itself, and for the community at large.

APPENDIX A

COUNTS OF COPING STRATEGIES BY TYPE OF LOCAL GOVERNMENT

Measure	Strategy	City	County	School District	Total
Revenue	Fines	2	0	0	2
	Local option sales tax	1	0	0	1
	Property tax abatements	1	0	1	2
	Property tax deductions	1	0	1	2
	Property tax rates	4	1	7	12
	Service charges or fees	5	0	2	7
	Applied for grants	39	9	25	73
	Received donations	8	6	14	28
	Received grants	25	9	25	59
	Used fund balance reserves	14	4	14	32
	Used Interfund transfers	8	1	4	13
Service Level	Eliminated services	0	0	2	2
	EMS staffing	3	0	1	4
	Library hours	0	1	0	1
	Police patrolling hours	4	1	5	10
	Reduced services	0	0	3	3
	Transferred service provision responsibility to another entity	1	0	1	2
	Trash pick-up frequency	1	1	1	3
Expenditure	Canceled property lease	1	0	0	1
	Canceled / Reduced capital expenditures	1	1	6	8
	Canceled / Reduced equipment maintenance	1	0	6	7
	Deferred capital expenditures	5	1	10	16
	Deferred equipment maintenance	1	0	6	7
	Sold equipment	0	0	1	1
	Sold property	0	0	0	0
	Across-the-board spending cuts	6	1	8	15
	Targeted spending cuts	2	0	9	11
Debt	Issued long-term general obligation debt	1	0	0	1
	Issued long-term revenue bonds	2	0	1	3
	Issued other kinds of debt	1	0	0	1
	Issued short-term general obligation debt	0	0	0	0
	Issued short-term revenue bonds	0	0	0	0
	Refinanced debt	0	1	2	3

Measure	Strategy	City	County	School District	Total
Human Resources Management	Cut positions	2	0	4	6
	Eliminated/ Reduced development training budget	2	0	4	6
	Eliminated/ Reduced travel budget	2	0	4	6
	Froze salaries	1	0	1	2
	Furloughed staff reduced hours worked	0	0	0	0
	Laid off employees	0	0	0	0
	Left vacant positions unfilled	4	1	6	11
	Reclassified positions	0	2	6	8
	Reduced salaries	2	0	0	2
	Revised association contracts to reduce pay benefits	0	0	1	1
	Use of overtime	14	2	7	23
Collaborative & Alternative Provision	Changed level of automation	0	0	1	1
	Collaboration with nonprofits	7	2	6	15
	Collaboration with other governments	16	3	10	29
	Contracting out	13	2	6	21
	Use of volunteers	8	4	3	15
Policy and Process	Amended budget	11	3	17	31
	Annexation plan	3	0	0	3
	Delayed budget	0	0	1	1
	Developed special revenue funds	5	0	3	8
	Fund balance policy	3	0	3	6
	Land use or zoning policy	2	0	0	2
	Reclassified expenditures as capital spending	2	2	2	6
	Strategic plan	12	4	9	25
New Service Provision	Created new positions	2	1	4	7
	Leased Purchased new property	4	1	1	6
	Planned new capital projects	15	4	6	25
	Provided new programs services	1	1	5	7
	Purchased new equipment	13	7	12	32
Total		**282**	**76**	**277**	635

APPENDIX B

PERCENT OF COPING STRATEGIES USED BY ADAPTING LOCAL GOVERNMENTS

Measure	Strategy	City	County	School District	Total
Revenue	Fines	4%	0%	0%	2%
	Local option sales tax	2%	0%	0%	1%
	Property tax abatements	2%	0%	3%	2%
	Property tax deductions	2%	0%	3%	2%
	Property tax rates	8%	10%	22%	13%
	Service charges or fees	10%	0%	6%	8%
	Applied for grants	81%	90%	78%	81%
	Received donations	17%	60%	44%	31%
	Received grants	52%	90%	78%	66%
	Used fund balance reserves	29%	40%	44%	36%
	Used Interfund transfers	17%	10%	13%	14%
Service Level	Eliminated services	0%	0%	6%	2%
	EMS staffing	6%	0%	3%	4%
	Library hours	0%	10%	0%	1%
	Police patrolling hours	8%	10%	16%	11%
	Reduced services	0%	0%	9%	3%
	Transferred service provision responsibility to another entity	2%	0%	3%	2%
	Trash pick-up frequency	2%	10%	3%	3%
Expenditure	Canceled property lease	2%	0%	0%	1%
	Canceled / Reduced capital expenditures	2%	10%	19%	9%
	Canceled / Reduced equipment maintenance	2%	0%	19%	8%
	Deferred capital expenditures	10%	10%	31%	18%
	Deferred equipment maintenance	2%	0%	19%	8%
	Sold equipment	0%	0%	3%	1%
	Sold property	0%	0%	0%	0%
	Across-the-board spending cuts	13%	10%	25%	17%
	Targeted spending cuts	4%	0%	28%	12%
Debt	Issued long-term general obligation debt	2%	0%	0%	1%
	Issued long-term revenue bonds	4%	0%	3%	3%
	Issued other kinds of debt	2%	0%	0%	1%
	Issued short-term general obligation debt	0%	0%	0%	0%
	Issued short-term revenue bonds	0%	0%	0%	0%
	Refinanced debt	0%	10%	6%	3%

Measure	Strategy	City	County	School District	Total
Human Resources Management	Cut positions	4.17%	0.00%	12.50%	6.67%
	Eliminated/ Reduced development training budget	4.17%	0.00%	12.50%	6.67%
	Eliminated/ Reduced travel budget	4.17%	0.00%	12.50%	6.67%
	Froze salaries	2.08%	0.00%	3.13%	2.22%
	Furloughed staff reduced hours worked	0.00%	0.00%	0.00%	0.00%
	Laid off employees	0.00%	0.00%	0.00%	0.00%
	Left vacant positions unfilled	8.33%	10.00%	18.75%	12.22%
	Reclassified positions	0.00%	20.00%	18.75%	8.89%
	Reduced salaries	4.17%	0.00%	0.00%	2.22%
	Revised association contracts to reduce pay benefits	0.00%	0.00%	3.13%	1.11%
	Use of overtime	29.17%	20.00%	21.88%	25.56%
Collaborative & Alternative Provision	Changed level of automation	0.00%	0.00%	3.13%	1.11%
	Collaboration with nonprofits	14.58%	20.00%	18.75%	16.67%
	Collaboration with other governments	33.33%	30.00%	31.25%	32.22%
	Contracting out	27.08%	20.00%	18.75%	23.33%
	Use of volunteers	16.67%	40.00%	9.38%	16.67%
Policy and Process	Amended budget	22.92%	30.00%	53.13%	34.44%
	Annexation plan	6.25%	0.00%	0.00%	3.33%
	Delayed budget	0.00%	0.00%	3.13%	1.11%
	Developed special revenue funds	10.42%	0.00%	9.38%	8.89%
	Fund balance policy	6.25%	0.00%	9.38%	6.67%
	Land use or zoning policy	4.17%	0.00%	0.00%	2.22%
	Reclassified expenditures as capital spending	4.17%	20.00%	6.25%	6.67%
	Strategic plan	25.00%	40.00%	28.13%	27.78%
New Service Provision	Created new positions	4.17%	10.00%	12.50%	7.78%
	Leased Purchased new property	8.33%	10.00%	3.13%	6.67%
	Planned new capital projects	31.25%	40.00%	18.75%	27.78%
	Provided new programs services	2.08%	10.00%	15.63%	7.78%
	Purchased new equipment	27.08%	70.00%	37.50%	35.56%

APPENDIX C

COMPARISON OF OVERALL RESPONDED TO SURVEYED LOCAL GOVERNMENTS

Overall	Descriptive Statistics							Welch Two Sample t-test		
	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NAs	t	df	p-value
Total Population, 2016										
Responded	82	2244	7923	38800	39848	815930				
Surveyed	38	2233	7862	60768	28174	4434257	2	-1.82	594.58	0.07
Percent White, 2016										
Responded	0.4	0.75	0.84	0.8091	0.9	1				
Surveyed	0.06	0.73	0.83	0.7997	0.91	1	2	0.79	207.2	0.43
Percent Hispanic or Latino, 2016										
Responded	0	0.1601	0.31	0.319	0.45	0.94				
Surveyed	0	0.126	0.25	0.2984	0.4196	0.95	2	1.05	192.43	0.30
Median Home Value, 2016										
Responded	$45,600	$85,400	$121,900	$162,273	$157,200	$1,624,200				
Surveyed	$26,600	$86,000	$118,000	$158,711	$163,350	$1,624,200	7	0.21	174.91	0.84
Prior Declarations (1953-July 2017)										
Responded	13	20	22	21.44	23	31				
Surveyed	10	18	22	21.46	24	31		-0.06	204.22	0.95
Hurricane Harvey Individual Assistance Declaration										
Responded	0	0	1	0.6642	1	1				
Surveyed	0	0	1	0.6013	1	1		1.42	191.4	0.16

APPENDIX D

COMPARISON OF RESPONDED CITIES TO SURVEYED CITIES

Cities	Descriptive Statistics							Welch Two Sample t-test		
	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NAs	t	df	p-value
Total Population, 2016										
Responded	82	1450	3828	32374	21297	815930				
Surveyed	38	1362	3752	33507	13212	2240582	2	-0.08	65.9	0.94
Percent White, 2016										
Responded	0.4	0.7275	0.84	0.8066	0.9	1				
Surveyed	0.06	0.72	0.82	0.7908	0.91	1	2	0.92	122.61	0.36
Percent Hispanic or Latino, 2016										
Responded	0	0.103	0.2793	0.2969	0.4175	0.8601				
Surveyed	0	0.1177	0.2356	0.2938	0.4152	0.9441	2	0.12	110.61	0.91
Median Home Value, 2016										
Responded	$45,600	$85,375	$126,000	$196,221	$179,425	$1,624,200				
Surveyed	$26,600	$84,200	$121,600	$185,127	$178,550	$1,624,200	3	0.36	99.59	0.72
Prior Declarations (1953-July 2017)										
Responded	13	21	22	22.24	23	31				
Surveyed	11	20	22	22.38	25	31		-0.29	119.33	0.77
Hurricane Harvey Individual Assistance Declaration										
Responded	0	0	1	0.6184	1	1				
Surveyed	0	0	1	0.6111	1	1		0.12	107.21	0.91

APPENDIX E

COMPARISON OF RESPONDED SCHOOL DISTRICTS TO SURVEYED DISTRICTS

School Districts	Descriptive Statistics							Welch Two Sample t-test		
	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NAs	t	df	p-value
Total Population, 2016										
Responded	889	3188	8905	35882	43146	289121				
Surveyed	168	3935	10684	53322	38348	1428146		-1.59	134.17	0.12
Percent White, 2016										
Responded	0.44	0.76	0.84	0.8243	0.9	0.99				
Surveyed	0.23	0.74	0.84	0.8117	0.92	1		0.69	68.23	0.49
Percent Hispanic or Latino, 2016										
Responded	0.02	0.18	0.31	0.3369	0.46	0.94				
Surveyed	0	0.13	0.26	0.3023	0.43	0.95		1.05	63.49	0.30
Median Home Value, 2016										
Responded	$57,000	$85,700	$118,900	$119,967	$138,000	$343,600				
Surveyed	$41,400	$87,350	$114,800	$134,928	$153,050	$1,148,400	4	-1.74	103.4	0.08
Prior Declarations (1953-July 2017)										
Responded	13	17	20	20.53	23	31				
Surveyed	10	16.5	21	20.65	23	31		-0.17	65.08	0.86
Hurricane Harvey Individual Assistance Declaration										
Responded	0	0	1	0.6735	1	1				
Surveyed	0	0	1	0.5634	1	1		1.51	64.23	0.14

APPENDIX F

SURVEY RESPONSES TO OPEN ENDED QUESTIONS

Note: Answers have been redacted to provide more protection to respondents and have been edited for spelling and typos.

Are there other coping strategies which your organization has used to respond to Hurricane Harvey?

City Responses

- We had to keep reminding ourselves that this was a marathon not a sprint.
- Not significantly impacted by Hurricane Harvey.
- We repaired a culvert on *[ROAD]* Road which was damaged at an expense of $62,708.36. That money was paid to *[COUNTY]* Precinct #1 Commissioner for the repairs. The repairs at the sewer plant cost $4,040.00 and was repaired by a local contractor. Both projects were turned in to FEMA and a portion of the costs were reimbursed.
- A very small portion of our city experienced flooding; therefore, only about 2% of housing and businesses were affected. However, our sewer treatment plant and police training center were completely flooded, since they are located near the San Jacinto River. The berms surround each were crested and we lost both facilities, resulting in about $12 million total damage. Our insurance carrier, TML covered the damages, while FEMA has funded the majority of the costs related to mitigating future flooding.
- No - Our City only sent firefighters down to the affected area to help with rescue efforts.
- Yes. We have dedicated a 1.00 fee per household to go to a Recovery Fund, for future catastrophic purposes. The intention that this will be there for cleanup and help in other ways for our citizens to get back up and running, and to minimize the hit to the City should this occur.
- Learn from experience (previous Hurricanes) and have a strong EMC
- Getting a really good and experienced Public Assistance representative with FEMA during the recovery. After getting 2 bad and inexperienced FEMA representatives we had enough. The 3rd individual worked hard to get our city back to normal with reasonably quick reimbursement on our 75% match. For a city with a total budget of just over $500,000 it was important to have the cash flow so we could continue recovery work from the 2015 flooding that decimated our streets (infrastructure)
- Drainage issues became more of a priority. We are experiencing growth and with the developments sprouting up all around the city, our planning staff is forced to ask about drainage and find solutions before all the rain happens this time.

- We were largely unaffected by Hurricane Harvey. The only impacts felt to the City were that we offered aid through a limited number of personnel sent from our police and fire departments over three separate deployments.

- Important that information gets from a County level to a City level quickly and accurately.

- No. We are not in the area affected by the Hurricane

- Other than support via mutual aid and state assistance teams, our City did not have a response to Hurricane Harvey.

- The City of *[CITY]* was not directly impacted by Hurricane Harvey except the one of our contractors, based in the Houston area, was delayed in completing a project due to the hurricane.

- We paid more attention to the disaster recovery plan. It became apparent not all members of the Emergency Management Team were ready for a live drill and additional drills needed to be done.

- No. We were not affected by Hurricane Harvey other than minor wind damage (downed tree branches, etc.) and minor flooding which typically occurs during any major rain event.

- Working with developers and neighboring cities to mitigate flood plains. Creating future capital projects to mitigate disasters.

- All essential personnel, which included public safety, administration, finance, and public works, were all on site 24/7 for the duration of the event. Accommodations and supplies had been previously planned and provided. The city was able to continue to function and provide services to the citizens beyond basic public safety and rescue.

- We have increased investment in drainage improvements that are necessary as a result of Harvey- significant improvements upstream and downstream to mitigate potential structural flooding, along with interlocal agreements with Levee Improvement Districts on pumping capacity.

- Positive attitude and a willingness to take on duties that the staff was not trained for.

- We have an excellent Emergency Mgmt. department and continue to strengthen that. We coped well with Hurricane Harvey by being quick to adapt to new situations. We had a strong fund balance and that certainly helped us weather the large outpouring of money at the time of the disaster and in the weeks and months following before we could get reimbursement from FEMA, etc.

- We went to emergency PO system and shut the regular one down.

- Not sure it is a coping strategy, but we hired a consultant to assist us with FEMA claims and pursuing grants and that was very helpful.

- Being a rural municipality with limited resources, working with FEMA and TDEM is our route to recovery. We must find a way to make the community resilient in order to withstand another disaster. Training & grants will be the best strategies we will be able to use in response to DR-4332 repairs and resiliency.

County Responses

- *[COUNTY]]* County was Ground Zero for Hurricane Harvey. A Long-Term Recovery Team has been brought in to assist in the recovery projects and locating funding to cover the costs of recovery.

- Our County is approximately 40,000 population on an outdated census and has experienced like disasters therefore was able to deal with Hurricane Harvey relevant to the previous disasters.

- *[COUNTY]* County was very lucky and suffered very little damage as a whole due to Hurricane Harvey. Most wind damage to homes was covered by regular homeowners' insurance.

- Patience, in engorgement most things move slowly due to paperwork and regulations, after a storm, additional layers of government are added which increases the time to recover from the event.

- No. One day at a time.

- We have implemented a total strategic review of our preparedness plans, to incorporate lessons learned and improvement objectives.

School District Responses

- No. Other than working as fast as we could to get students back into the classroom, the students handled the disaster rather well.

- Better communications with our county emergency management services/agency.

- Utilization of county resources and volunteer services

- We had a bunch of rain and street flooding causing us to close school for one day. We were not impacted by Hurricane Harvey like many other districts were.

- *[CITY]* Tx is a shelter community for hurricanes in the Gulf Coast region which included Harvey. We have a great relationship with *[COUNTY]* County Emergency Management and assist each other in meeting the needs of local community members and others in the Gulf Coast area.

- We have offered counseling on all campuses.

- Counseling was offered to our students and teachers who experienced damage to their homes. Donated funds to the district were used to help individual families and staff with the recovery efforts of their lost possessions.

- Our staff continued to receive normal compensation for the time off from school.

- *[SCHOOL DISTRICT]* ISD sustained no damage within our boundaries due to us not having any bridges, rivers or major drainage systems that limited our in-district mobility much. Too many staff live outside the district and many parents work outside the ISD. We also could not receive fuel, food or other usable supplies thus could not function but did not have any loss.

- We have increased counseling services and, through a grant, have been able to provide mental health services for the 19-20 school year. Since the storm, we have provided free breakfast and lunch to all students in the district. Through donations, we have been able to provide students with backpacks and school supplies and have been able to assist employees with home repairs and items lost in the storm such as mattresses.

- No due to low impact

- We utilized the services of a local nonprofit organization to assist with the financial and emotional needs of our community members who were directly impacted by the hurricane.

- There is no way to cope. You let the storm pass and you build it back and help those who have lost everything!

- Response planning

- We had to demolish 2 auxiliary buildings. We have relocated those services to "higher ground."

- Grants for mental health and wellness

Are there policies or processes that you wish had been in place before Hurricane Harvey?

<u>City Responses</u>

- No. Whether it be Harvey, or any disaster, the City tries to be proactive by initiating our EOC, if necessary; maintaining contact with our County Judge, and the Governor's office.

- Wish we had procured the services for PA assistant from a third party before the storm. This would have assisted in getting the FEMA projects started sooner.

- Consulting Services for small cities to handle massive amounts of paperwork (procurement)

- Not significantly impacted by Hurricane Harvey.

- No. The appropriate policies related to response, overtime pay, recording expenditures for FEMA and insurance reimbursement were in place.

- Training in completing forms required for TDEM. Designate one person per department for labor and equipment tracking. Agreement with the school for shelter of our citizens. Agreement was with the County and that did not work out well.

- More clear-cut emergency pay policy.

- Disaster overtime policy

- For other jurisdictions (such as DD7) yes. The City of *[CITY]* was adequate

- As a small city of about 2000 people, we have to rely on our partnership with our county government. It is interesting that HUD provides grant resources through the Texas Dept. of Agriculture and the Texas General Land Office, and it takes years for the grant funds to make their way to local governments who are the ones who took the blow. In the process of getting to the local governments the state develops all kinds of networking to assist the local governments and takes a pretty large chunk of the funding for administrative purposes. Local policies and procedures don't mean a hill of beans when dealing with the political hierarchy.

- The process of being able to help the residents faster.

- It's hard to make a process or policy to deal with something like Harvey, because it was a rarity on the scale of damage. You can't really plan for that sort of disaster. We probably adjusted some policies because now we have seen "what could really be the worst possible scenario".

- Know better how to cope with FEMA and TDEM

- No, existing policies and processes were successfully utilized during the response to Hurricane Harvey.

- No. Our polices and processes were sufficient.

- There were, as always, after the fact modifications to the emergency response master plan (ERP) as well as departmental ERPs.

- Better documentation of maintenance of facilities and vehicles and contracts that are in place. Clearer documentation of insurance claims through TML as their denial letters caused us many problems with FEMA review.

- Everything relied on the county responding to the catastrophe on behalf of the cities, when in fact the county provided no assistance. We relied on staff to accomplish everything that needed to be accomplished.

- We wish we had updated our purchasing policy prior to Harvey but it is updated now to meet Federal regulations. We wish we had understood FHWA's map of roads better and wouldn't have wasted time trying to get FEMA to repair damaged roads that were the responsibility of TXDOT and not FEMA

- There are many policies and processes that needed to be in place before DR-4332. I believe that is why the recovery time has been over 2 years. I do believe government is working on policies and processes for events of this magnitude.

County Responses

- It would have been helpful to have the Federal Procurement Policies in place prior to the storm.

- *[COUNTY]* County implemented an Overtime policy in preparation for future disasters. This County should consider adopting a strategic plan so it can incorporate the major processes and/or procedures with any future unforeseeable disasters. This assists the county maintaining consistency in its practices, policies and/or planning with capital programs, etc.

- Funding for the planning and preparation (engineering cost) for mitigation projects is always needed. Most mitigation projects are in response to the past event. With Hurricane Harvey, drainage and elevation of structures is the top priority for all upcoming projects.

- County Judge did not discuss with employees what they could do during a disaster. We only had one day by the time he decided to declare an emergency, to board up, pack, and evacuate. Those who stayed, needed emergency supplies, etc. For the ones who left, it took weeks to get electricity and water back on.

- We have an active Emergency Management team and with so many other floods we had encountered in the past, had policies in place that worked very well.

- Yes - we needed a better plan for debris monitoring and removal. We had no contracts in place, so recovery was delayed. We have since entered into these contracts.

School District Responses

- Definitely. We needed to have reviewed what needed to happen so everything would be set in dealing with disasters.

- Maybe communications equipment that could have bypassed the reliance on cell tower communications immediately following Harvey.

- Shelter, transportation, and communication policies or processes
- Knowing who to call first. Understanding Restoration versus construction
- governmental partnerships needed to be established
- Living in a hurricane prone area, we already had plans in place.
- Emergency procurement was a new area for us. It would have been beneficial to know in advance who to call for our needs. When you are cut off from the world with no phone service or access to internet, you must try to navigate through the many individuals and companies that show up wanting to provide services and that is quite difficult when juggling so many different responsibilities, organizations, donations, etc.
- No - we have emergency operations in place
- The purchasing/procurement policies related to competitive bidding can become a bit tricky after a disaster. We often run into a snag with FEMA related to whether an emergency purchase of goods or services will be a reimbursable expenditure if it was not competitively sourced. However, during an emergency there is little to no time to do any competitive sourcing. Clarifying these rules would be very helpful to our recovery efforts during a disaster.
- No, a hurricane is not something you can fight. You have to survive the storm and get back to work rebuilding/repairing buildings and get the kids back to school.
- Plan for shelter assistance during and after storm.
- A better immediate response plan to ensure financial recovery.
- Yes. I wish we had put the equivalent of the amount of our deductible away after Hurricane Ike. We would have earned enough from that investment to cover our deductible during Harvey and that would have allowed us not to engage FEMA to recover our deductible had the board decided to go that route. Without involving FEMA, we would have been able to complete all rebuild projects within 4- 6 months. Currently we have not completed all projects. That said, our FEMA experience has been very positive other than the fact that those wheels just moves slowly.
- Mental health counseling for our rural area had been non-existent before Harvey.

What were the biggest lessons in fiscal management that you learned during the response to Hurricane Harvey?

<u>City Responses</u>

- We sent a couple of firemen to assist with the response and we were not reimbursed

100% for the expenses related to the assistance provided by *[CITY]* but it was not an issue.

- NA - no significant recorded damages.
- The obvious one being that a city must have at least 3 months of reserves on hand to get back on its feet and keep the services going. Without this it is increasingly difficult to continue to provide services and start the recovery phase of rebuilding. Also FEMA is not going to save you. The process with FEMA is long and with a lot of red tape.
- Hire out admin of all FEMA projects
- Not significantly impacted by Hurricane Harvey.
- Being a city that was not directly impacted by this event, but sent resources to help, we learned the importance of making sure to work with other agencies to ensure the proper resources where sent. We made sure that all agencies agreed to how reimbursement was going to work before deployment.
- Better communication with certain agencies (i.e., the river authority) are crucial.
- Communication and preparing are key.
- The importance of a solid contingency/emergency reserve fund policy.
- Luckily, the City of *[CITY]* was not impacted has badly as other cities in the region. Insurance and FEMA covered 95% of the cost of Hurricane Harvey.
- Hurricane Harvey did not impact fiscal management in *[CITY]*
- Clarified emergency pay policy and expanding purchasing policies to account for Federal grant requirements (e.g., Buy Board vendors may or may not qualify under Federal guidelines).
- Have a "burn rate" tracking system set up in advance to capture expenses
- None specific to Harvey. I have learned through other experiences dealing with FEMA that it is critical to immediately establish a strategy to segregate all costs related to incident management. This includes both fixed costs as well as incident-specific costs.
- Good record keeping is a must for quick and accurate reimbursements
- To make sure there is enough cash in the bank to carry operating expenses for at least 3 months. Hurricane season happens right when most city governments are reaching the end of their fiscal year, so they are already low on funds after receiving most of their ad-valorem tax revenue early in the calendar year. Depending on sales taxes during the months following a disaster is almost a disaster in itself.

- Our City was not impacted by Harvey at all. The storm made landfall about 70 miles to the Northeast.

- A couple of key points were keeping thorough and complete records and backing up the data. With FEMA recovery especially, but it reminds you to keep the books and backups in everyday functions as well. City Hall flooded and some records may have been damaged or lost. Having the files scanned as back-up (or vice-versa) is something that every entity needs to practice.

- We were not affected enough to change anything about fiscal management.

- Document everything.

- Learned how to better cope with FEMA and TDEM

- Our disaster documentation tool is too simplistic to meet the needs for full and proper documentation of a disaster response and recovery effort. However, even though we have been working on improving the tools, a better solution has not been found.

- Being prepared.

- Have a larger reserve fund

- Creation and use of forms to identify people and equipment deployed is vital up front, even if the damage is minimal, for emergency relief funds and grants.

- During the response, it became even more evident that conservative fiscal management and practices are necessary to ensure that there are enough funds in reserve should an event like this affect our city in the same manner that it did others.

- Anything can happen at an unexpected time. Reserves are key to have in order to keep the quality of life, strength, and productivity high in a city despite a natural disaster. Also, having a disaster plan for when tough financial times happen will make it easier to adapt.

- Nature will always present something unexpected and unplanned for. Emergency response is a planned activity. It is a team activity. It requires constant, unfettered communications. Intimate knowledge of community and citizens. Educated personnel and knowledge of equipment availability and usage.

- Be ready to float the full cost of the response for over two years while you wait on FEMA to go through all of their review processes before you see any reimbursements.

- We used many volunteers who were trained in various levels of rebuilding to work along-side city staff to alleviate the financial stress. For example, in one day we had cleared all main streets in and out of the city. We then had folks clearing trees from properties so residents could get in their homes, we suspended some requirements for electrical restoration to eliminate permit requirements for simple repairs that could be done by staff

or volunteers and checked by electricians.

- Fund balance reserves are extremely important in the aftermath of a storm. Without them you cannot make it through the initial expenses and continue to fund your current expenses without having to make cuts. We learned to leverage assistance offered by other entities like the Texas Workforce Commission. We utilized temporary workers for months that were invaluable to getting back on our feet.

- After disaster, need to be prepared for loss of income due to no services available: loss of accounts (damaged homes- people moved).

County Responses

- Procurement Procedures

- The biggest lessons in fiscal management was communicating within the County and outside of the County between FEMA and/or TDEM to make sure that Caldwell County was following up in accordance to federal and/or state law. The major challenge was learning the new portal and changing from one FEMA representative to another. It was critical that our team within the County was consistent and communicating effectively.

- Have reserves available for uninsured items that will possibly be flooded. Provide guidance to employees on securing County equipment from potential damage.

- Hope you have someone in charge who knows how to make wise decisions. Do not depend on other people for advice or believe the stories of rebuilding it better. Know how much it will cost, and where the money will come from before starting a project. You will not have enough to replace or repair everything, but you do the best you can with what you have. As a small rural county, I have always been conservative on budgets. Oil makes or breaks taxes every year. Legislative mandates are hardships for small counties.

- Be prepared.

- We have a fund balance policy where it is required to keep at least 3 months of the following fiscal year budget. At the time of Harvey, we had about 7 months of fund balance. Our county was very aware of what happened to coastal counties during Ike and has been diligent in guarding fund balance reserves. We dodged a financial bullet in the effects of Harvey.

- Fortunately management had a strong fund balance on reserve in order to pay for the recovery process and then get reimbursed by FEMA.

School District Responses

- We were lucky that we had our insurance company on board immediately after the storm. If we would not have been in contact, we would have been delayed in startup as other districts were.

- Getting personnel back after the hurricane passed to get kids back to some form of "normalcy."
- The district must secure funds (at least 3 to 5 months of operating expenses) to utilize in the case of a natural disaster.
- It takes a while for insurance and billing to get on the same page, so you need reserves to pay for things. Reserves are very important.
- FEMA protocol
- My predecessor was not prepared and put the district in financial crisis.
- Back up access to data
- The process of coordinating FEMA and insurance is a lengthy process. We still have two projects that are pending close out due to the amount of paperwork involved in securing funds for certain types of repairs.
- In future events such as Hurricane Harvey the district will have our CFO and his staff more directly involved in maintaining accurate records of expenditure of funds and use of resources such as personnel and equipment.
- Our damage was minor, so recovery efforts were minimal.
- Have a plan in place for funds being offered to the district.
- We had to learn quickly how to record expenditures in a way that anything related to the hurricane could be pulled from the general ledger quickly. We are still unable to use either of our gymnasiums, so additional costs for travel to neighboring districts has been huge...as well as increased fees for student meals, administrators and officials because every game is an "away game" for volleyball and basketball seasons. We have learned to prioritize repairs to meet the insurance cash flow and tackle the buildings that are needed the most by the students, such as repairing the center of the high school before repairing the band hall, auditorium, science wings, administration, etc.
- Other school districts in the area who also did not have damage received funds related to Harvey because they over-projected their property values and benefitted from that.
- Entities must be prudent with spending at all times so there are adequate reserve funds available to respond to a disaster.
- I've been doing this my entire career. I knew what to do.
- Make sure insurance policies adequately cover potential loss.

- An Insurance/FEMA plan for classifying costs, archiving costs, targeting remediation strategies is critical.

- We were not greatly affected by Harvey.

- Good insurance is worth it.

- Proper planning with our fund balance in case of emergencies. Although we didn't have to use any, we would have been in good shape if needed.

- 1. Everything takes longer--rebuilding and reroofing prices have been exceptionally high and it's hard to find good, responsible companies who will bid. With so many areas of devastation, we are all waiting. 2. I did not expect the generosity of strangers who donated water, food, clothing, books, school supplies, and gift cards for our recovery. I am grateful for those who took their time to think of others.

Do you think the steps taken are sufficient? What still needs to be done to recover from Hurricane Harvey?

<u>City Responses</u>

- We are in the *[CITY]* metro area and we did not experience any damage from Hurricane Harvey. Our Fire Dept. did send a couple of firemen to assist with the response and we were reimbursed for most of our expenses through STRAC.

- Looking back things could have been done differently. Projects should have started sooner and with better oversight. We are still trying to get the water tower rebuilt, finishing up the Civic Center, working on some lift stations, and the SCADA for the water system.

- Not significantly impacted by Hurricane Harvey.

- Everything was completed.

- I think that resources need to be available not only to the metropolitan areas, but also the rural population. Resources were redeployed from the Victoria area to Houston.

- We are currently rebuilding the Police/FBI training facility. The wastewater treatment plant has been rebuilt.

- Our City was not affected by Hurricane Harvey.

- The one travesty that has been overlooked is the problems that small cities has receiving funding via grant from both State and Federal Governments. Although I do not discount the effects Harvey had on larger cities, it is disheartening to discover that a large portion of appropriated funds for more rural counties and cities was mandated by the State of Texas to be allocated to Houston. Again, I do not discount the disaster Harvey left in

Houston, but smaller cities could have used the grant money to recover as well. Also, I learned that much of the grant money allocated to the smaller cities and less populated counties was mandated to be used for buying homes in flood zones. There was a very small percentage of the funds used to buy homes. The state government knew this beforehand yet still went forward with the mandate. The allocation could still be used for infrastructure as the second part of the total allocation mandates (meaning part of the funds were to be used for buying destroyed houses in flood zones and the smaller portion of funds to be used to repair infrastructure, i.e. roads, sewer systems, and water systems.

- We still have drainage issues that need to be addressed.

- *[CITY]* is a very rural area and the main problem in our area has to do with drainage. Due to home building in subdivisions that are springing up and cutting property, it has clearly impacted drainage. We are working with *[COUNTY]* County because we have an interlocal agreement with them to do any road work within the incorporated city of *[CITY]*.

- The City is looking at future drainage projects, which includes recent land purchases and will eventually result in the buyout of several homes.

- We are working on creating a better plan for pre-disaster. We are fortunate to live in a community that is so willing to step up in the time of need, but we need more structure and procedure to follow to prepare for a long period of recovery.

- State of Texas needs to better define rules and procedures, forms, etc.

- Yes, for our agency, given the minimal impact.

- Less misinformation on social media from outside groups/individuals.

- Mitigation. Large, regional projects are fine (as it what is planned for the $4 Billion that the GLO is working with for mitigation projects). But it leaves the local folks who need assistance with dam structure modifications or something similar in the lurch. Guess who the finger will get pointed at when the dam fails and takes out a bridge that was part of the regional project in the area.

- Yes, Nothing.

- It's a work in progress. Even after the events of Harvey, there are still citizens who do not want to participate in drainage improvements on their land. You can try to mitigate the issues that come along when a disaster like this happens (so yes, I think sufficient steps are taken) but you have to balance what is sufficient versus what you can do without citizens feeling like their rights are being suppressed.

- We are continuing to work diligently on repairing roads damaged during Harvey.

- Finish capital projects

- At this time, the steps taken in our city seem to be sufficient. However, we will continue to review our emergency management plan and fiscal policies in an effort to remain ready to face future events.

- We were very fortunate, but we need to always be vigilante and prepared.

- we are still waiting on funding of grants and buyouts from 2016, let alone Harvey. We need a better, more streamlined process. the current procedure is redundant and frustrating.

- Though our City was in the heart of the event, we suffered minimal damage with only a handful of homes taking water. All personnel performed admirably and effectively with no loss of life. Reimbursed claims from FEMA were less than $1,000,000. The City undertook three drainage projects at considerable expense to improve areas that had the poorest drainage. Those projects were tested with the passing of Imelda and proved themselves. There was no water damage to private property that time. The runoff cleared quickly. We will always be scrutinizing infrastructure for weaknesses.

- Understanding of drainage improvements and how levee improvement districts operate vs city operations.

- We are on our last 3 major projects that will be complete by December. We could have used additional assistance from our county or state, but we did not let bureaucratic inefficiency hamper our progress to get our city back up and running, even if some approaches weren't in the norm, we accomplished much for a small community. Our City Council worked alongside volunteers and staff every day for over two weeks which helped keep moral up.

- Money needs to flow from the Federal and State government much faster. There needs to be a more streamlined process for both cost reimbursement and for grants to get into our hands to start doing the work necessary. We are required to have pre-disaster contracts but apparently the State and Federal governments are not, and they start over creating programs when those programs should already be designed and ready to roll out to help governmental entities and citizens recover quickly. We should not have to wait over 2 years to get funding for infrastructure and housing repairs

- We are still working on water to our WWTP. Our water well was destroyed during the storm.

- Major projects through FEMA have not been started at this time. Paperwork has just been finalized and some procurement and biddings have started. The governmental process for "regular" business slows down the recovery process. This is a timely process that extends the recovery time by at least 6 months or longer.

<u>County Responses</u>

- Aransas County has taken steps to repair all damages from the storm. A few projects have

not been completed yet. Aransas County is also working on resiliency projects to protect life and property during the next storm.

- All steps have been met and we are completing one final project with Hurricane Harvey. Our County hired a County Grants Administrator to assist the Internal Auditor with managing grants due to the excess volume of work in the County Auditor's office. The Grants Administrator facilitates over fifteen grants, not just this one FEMA grant.

- The County did respond quicker and better in TS Imelda, so the steps implemented did work to minimize the loss to County assets.

- No. Without funds there is only so much we can do. FEMA sent bodies on the ground for over one and a half years, who only wasted our time and

- theirs. FEMA is still working on projects not submitted as yet. We have just started working on a couple of projects this year replacing buildings. We have 67 projects with FEMA, or will have if they finish, plus all the other damaged buildings that did not qualify for FEMA. There was nothing our county owned that was not damaged or destroyed. So, everything still needs to be done!

- Yes, steps taken have been sufficient.

- We still have a museum to rebuild that was located in the flood zone and unfortunately, we did not have flood insurance which resulted in FEMA reducing the amount they could reimburse. After we rebuild, we plan on obtaining flood insurance.

School District Responses

- We are a small rural community. Trying to get companies out in the area to work on our facilities is not always easy. Slowly, we are able to repair damages on the buildings.

- The Coastal Bend area didn't receive the amount of rain that other parts of Texas did, but this area received the brunt of storm surge and wind. I believe things are on the mend in the Coastal Bend.

- Small, rural school districts need additional funds to make preparations for natural disasters. The funds would be utilized for transportation and shelter.

- Yes. Our community as almost totally recovered, with the exception of a few homes.

- Many homes in need of repair. Some of the school roofing still needing repair.

- Our district continues to provide transportation and other services to a few students who became homeless due to Harvey.

- We feel that our recovery efforts are complete.

- Our school district buildings did not receive much damage, so our school district has recovered from Hurricane Harvey.

- More than two years later, we are still knee deep in repair projects. We have made great strides since the days immediately following the storm, but there is still much to do. Every building in our district was damaged in some way and repairs take much planning, time, and money. We are still without an auditorium, administration building, gymnasium, and science labs. Our tennis courts and football stadium are in need of repairs as well. The Texas Education Agency has done tremendous work and has provided us the means to continue with repairs to our facilities that would have otherwise been impossible.

- Yes. Nothing

- Our school district had minimal damage to our facilities, and we are fully recovered.

- We lost three buildings as a result, two elementaries and a middle school. With a successful bond election in 2018, we are now building 4 new campuses.

- Continue to access conditions for roofs and HVAC equipment.

- A streamlined accounting of remediation costs and classification plan.

- We have about 2 months of construction left before all projects will be completed.

- 1. Working with the FEMA employees has been a major disappointment. They have a form they call the DDD--which means something to them. I call it Discuss, Delay, Deny. We have not received timely responses to questions, and they have held us up more than a year when we needed to demolish a dangerous building damaged by Harvey. 2. Homes in our community were hard hit and some people have not had the funds to repair or rebuild. We have lost student enrollment in our rural school because there is no place for families to live.

APPENDIX G

SURVEY INSTRUMENT

Local Government Fiscal Stress & Financial Coping Strategies Following Disaster
Informed Consent for Studies with Adults

TITLE OF RESEARCH STUDY: Local Government Fiscal Stress & Financial Coping Strategies Following Disaster

RESEARCH TEAM: Julie Winkler, University of North Texas (UNT) Department of Public Administration, juliewinkler@my.unt.edu. This work is being done as part of a dissertation under the supervision of Dr. Skip Krueger, University of North Texas (UNT) Department of Public Administration, skip.krueger@unt.edu, 940-565-4870.

You are being asked to participate in a research study. Taking part in this study is voluntary. The investigators will explain the study to you and will any answer any questions you might have. It is your choice whether or not you take part in this study. If you agree to participate and then choose to withdraw from the study, that is your right, and your decision will not be held against you.

You are being asked to take part in a research study about how local governments are able to adapt their fiscal structure following disaster. Specifically, this survey will ask what actions local governments implemented during the recovery process following Hurricane Harvey.

Your participation in this research study involves complete an online survey about your organization's actions taken in response to Hurricane Harvey. This survey should take about 20 minutes. We are conducting this research to better determine how local governments make efforts to stay financially solvent during the recovery process following disaster. More details will be provided in the next section.

You might want to participate in this study if you wish to share your organization's experiences and challenges in providing services and meeting demands following Hurricane Harvey. However, you might not want to participate in this study if you do not have the time to fill out the survey.
You may choose to participate in this research study if you are knowledgeable about your organization's actions taken in the last few years following Hurricane Harvey, such as changing staffing, fees or tax rates.

The reasonable foreseeable risks or discomforts to you if you choose to take part is the time or effort required in answering questions related to your community's experience of Hurricane Harvey, which you can compare to the possible benefit of helping inform research and recommendations on how local governments and public organizations can stay financially solvent during times of fiscal stress.
You will not receive compensation for participation. Instead of being in this research study, your choices may include informing us of other members of your organization who are more or equally appropriate to answer the survey in your place.

DETAILED INFORMATION ABOUT THIS RESEARCH STUDY: The following is more detailed information about this study, in addition to the information listed above.

PURPOSE OF THE STUDY: The purpose of this study is to determine how local governments are able to adapt their revenues, expenditures, and other aspects of their organization to meet changes in demands following disasters. We are interested in determining if local governments are likely to implement specific financial strategies during the recovery phase of natural disasters, and if these preferences are similar to how local governments react to other types of fiscal stress.

TIME COMMITMENT: The online survey should take approximately 20 minutes to complete. We may contact you following your participation in the survey to clarify your responses, or to ask your participation in follow up studies on your organization's future recovery from Hurricane Harvey, but you may decline to future requests.

STUDY PROCEDURES: Your participation in this research study involves filling out an online survey about your organization's actions taken in response to Hurricane Harvey. This survey should take about 20 minutes. We may contact you following your participation in the survey to clarify your responses, or to ask your participation in follow up studies on your organization's future recovery from Hurricane Harvey, but you may decline to future requests, but at any point you may choose to remove yourself from the study, or further participation. In any publication or analysis of the results of the survey, your responses will be referred to by your organization, and no reference will be made to you as an individual. Questions will largely involve actions taken by your organization which are public in nature, such as changing your fee structure, or cutting staffing levels. Some questions will ask you about your personal perception of the level of damage in your area from Hurricane Harvey, and about what you think you've learned from the experience. If you feel that someone else in the organization is more appropriate to survey, please let us know.

POSSIBLE BENEFITS: Participation in this study may provide valuable information on how local governments choose to navigate the financial hurdles during the recovery process following natural disasters. This research may inform on recommendations on how to best serve local governments and provide a better understanding of the recovery process following disasters.

POSSIBLE RISKS/DISCOMFORTS: This research study is not expected to pose any additional risks beyond what you would normally experience in your regular everyday life. However, if you do experience any discomfort, please inform the research team.

COMPENSATION: There is no compensation for participating in this study.

CONFIDENTIALITY: Efforts will be made by the research team to keep your personal information private, including research study information, and disclosure will be limited to people who have a need to review this information. All paper and electronic data collected from this study will be stored in a secure location in the Qualtrics account, password protected, and only accessible by main researchers listed in this study. Research records will be labeled with a number and the master key linking names with numbers will be maintained in a separate and secure location. Survey responses will be referred to by the organization you represent, so please be advised that although the researchers will take these steps to maintain confidentiality of the data, the nature of having limited potential respondents per organization prevents the researchers

from guaranteeing confidentiality.

The results of this study may be published and/or presented without naming you as a participant. The data collected about you for this study may be used for future research studies that are not described in this consent form. If that occurs, an IRB would first evaluate the use of any information that is identifiable to you, and confidentiality protection would be maintained.

While absolute confidentiality cannot be guaranteed, the research team will make every effort to protect the confidentiality of your records, as described here and to the extent permitted by law. In addition to the research team, the following entities may have access to your records, but only on a need-to-know basis: the U.S. Department of Health and Human Services, the FDA (federal regulating agencies), and the reviewing IRB.

CONTACT INFORMATION FOR QUESTIONS ABOUT THE STUDY: If you have any questions about the study you may contact Julie Winkler at juliewinkler@my.unt.edu or (505) 204 – 8752, or Dr. Skip Krueger, at skip.krueger@unt.edu or 940-565-4870. Any questions you have regarding your rights as a research subject, or complaints about the research may be directed to the Office of Research Integrity and Compliance at 940-565-4643, or by email at untirb@unt.edu.

I have read the consent information and agree to take part in the research:

O I consent, begin the study

O I do not consent, I do not wish to participate

What is your job title:

_____

Your organization is:

O City

O County

O School District

What is the name of the city, county, or school district which you represent?

_____

How many years have you worked in government?

_____

Highest level of education completed:

- O Some High School
- O High school Diploma
- O Associate Degree
- O Bachelor's Degree
- O Master's Degree
- O Doctorate Degree
- O MD
- O JD
- O Other _____

Do you have an MPA / MPP degree?

- O Yes
- O No

Have you changed any of the following at least in part due to Hurricane Harvey?

	Indicate any that changed:	Increase or decrease:		Importance to recovery: (Select one)		
	Yes	Increase	Decrease	Low	Mid	High
Property tax rates	☐	☐	☐	☐	☐	☐
Property tax abatements	☐	☐	☐	☐	☐	☐
Property tax deductions	☐	☐	☐	☐	☐	☐
Service charges or fees	☐	☐	☐	☐	☐	☐
Fines	☐	☐	☐	☐	☐	☐
Local option sales tax	☐	☐	☐	☐	☐	☐
None of the above	☐	☐	☐	☐	☐	☐

Have you done any of the following at least in part due to Hurricane Harvey?

	Indicate implemented activities:	Importance to recovery: (Select one)		
	Yes	Low	Mid	High
Applied for grants	☐	☐	☐	☐
Received grants	☐	☐	☐	☐
Received donations	☐	☐	☐	☐
Used fund balance reserves	☐	☐	☐	☐
Used Interfund transfers	☐	☐	☐	☐
Developed special revenue funds	☐	☐	☐	☐
Reclassified expenditures as capital spending	☐	☐	☐	☐
None of the above	☐	☐	☐	☐

Have you changed any of the following at least in part due to Hurricane Harvey?

	Indicate any that changed:	Increase or decrease:		Importance to recovery: (Select one)		
	Yes	Increase	Decrease	Low	Mid	High
Police patrolling hours	☐	☐	☐	☐	☐	☐
Library hours	☐	☐	☐	☐	☐	☐
EMS staffing	☐	☐	☐	☐	☐	☐
Trash pickup frequency	☐	☐	☐	☐	☐	☐
None of the above	☐	☐	☐	☐	☐	☐

Have you done any of the following at least in part due to Hurricane Harvey?

	Indicate implemented activities:	Importance to recovery: (Select one)		
	Yes	Low	Mid	High
Deferred capital expenditures	☐	☐	☐	☐
Canceled/reduced capital expenditures	☐	☐	☐	☐
Deferred equipment maintenance	☐	☐	☐	☐
Canceled/reduced equipment maintenance	☐	☐	☐	☐
Sold equipment	☐	☐	☐	☐
Canceled property lease	☐	☐	☐	☐
Sold property	☐	☐	☐	☐
None of the above	☐	☐	☐	☐

Have you done any of the following at least in part due to Hurricane Harvey?

	Indicate implemented activities:	Importance to recovery: (Select one)		
	Yes	Low	Mid	High
Across-the-board spending cuts	☐	☐	☐	☐
Targeted spending cuts	☐	☐	☐	☐
Reduced services	☐	☐	☐	☐
Eliminated services	☐	☐	☐	☐
Amended budget	☐	☐	☐	☐
Delayed budget	☐	☐	☐	☐
Changed level of automation	☐	☐	☐	☐
Transferred service provision responsibility to another entity	☐	☐	☐	☐
None of the above	☐	☐	☐	☐

Have you done any of the following at least in part due to Hurricane Harvey?

	Indicate implemented activities:	Importance to recovery: (Select one)		
	Yes	Low	Mid	High
Issued short-term general obligation debt	☐	☐	☐	☐
Issued short-term revenue bonds	☐	☐	☐	☐
Issued long-term general obligation debt	☐	☐	☐	☐
Issued long-term revenue bonds	☐	☐	☐	☐
Issued other kinds of debt	☐	☐	☐	☐
Refinanced debt	☐	☐	☐	☐
None of the above	☐	☐	☐	☐

Did at least one of your bond ratings change since Hurricane Harvey?

- ○ No
- ○ Yes - it went down
- ○ Yes - it went up
- ○ I do not know

Have you done any of the following at least in part due to Hurricane Harvey?

	Indicate implemented activities:	Importance to recovery: (Select one)		
	Yes	Low	Mid	High
Left vacant positions unfilled	☐	☐	☐	☐
Froze salaries	☐	☐	☐	☐
Reduced salaries	☐	☐	☐	☐
Laid off employees	☐	☐	☐	☐
Furloughed staff/reduced hours worked	☐	☐	☐	☐
Cut positions	☐	☐	☐	☐
Reclassified positions	☐	☐	☐	☐
Eliminated/reduced travel budget	☐	☐	☐	☐
Eliminated/reduced development/training budget	☐	☐	☐	☐
Revised association contracts to reduce pay/benefits	☐	☐	☐	☐

None of the above	☐	☐	☐	☐

Have you changed the level of any of the following at least in part due to Hurricane Harvey?

	Indicate any that changed:	Increase or decrease:		Importance to recovery: (Select one)		
	Yes	Up	Down	Low	Mid	High
Contracting out	☐	☐	☐	☐	☐	☐
Collaboration with other governments	☐	☐	☐	☐	☐	☐
Collaboration with nonprofits	☐	☐	☐	☐	☐	☐
Use of volunteers	☐	☐	☐	☐	☐	☐
Use of overtime	☐	☐	☐	☐	☐	☐
None of the above	☐	☐	☐	☐	☐	☐

Have you updated any of the following at least in part due to Hurricane Harvey?

	Indicate any that changed:	Importance to recovery: (Select one)		
	Yes	Low	Mid	High
Strategic plan	☐	☐	☐	☐
Fund balance policy	☐	☐	☐	☐
Land use or zoning policy	☐	☐	☐	☐
Annexation plan	☐	☐	☐	☐
None of the above	☐	☐	☐	☐

Have you done any of the following at least in part due to Hurricane Harvey?

	Indicate implemented activities:	Importance to recovery: (Select one)		
	Yes	Low	Mid	High
Purchased new equipment	☐	☐	☐	☐
Created new positions	☐	☐	☐	☐
Planned new capital projects	☐	☐	☐	☐
Leased/purchased new property	☐	☐	☐	☐
Provided new programs/services	☐	☐	☐	☐
None of the above	☐	☐	☐	☐

In your estimation, what was the impact of Hurricane Harvey on your city?

	0 10 20 30 40 50 60 70 80 90 100
% Houses damaged	
% City government facilities damaged	

In your estimation, relative to other cities, how bad was your jurisdiction's experience of the disaster?

	Much better	Moderately better	Slightly better	About the same	Slightly worse	Moderately worse	Much worse
Disaster experience	O	O	O	O	O	O	O

In your estimation, what was the impact of Hurricane Harvey on your county?

	0 10 20 30 40 50 60 70 80 90 100
% Houses damaged	
% County government facilities damaged	

In your estimation, relative to other counties, how bad was your jurisdiction's experience of the disaster?

	Much better	Moderately better	Slightly better	About the same	Slightly worse	Moderately worse	Much worse
Disaster experience	O	O	O	O	O	O	O

In your estimation, what was the impact of Hurricane Harvey on your school district?

	0 10 20 30 40 50 60 70 80 90 100
% Houses damaged	
% School facilities damaged	
% Students did not return to district	

In your estimation, relative to other school districts, how bad was your jurisdiction's experience of the disaster?

	Much better	Moderately better	Slightly better	About the same	Slightly worse	Moderately worse	Much worse
Disaster experience	O	O	O	O	O	O	O

Did schools close due to Hurricane Harvey?

O No

O Yes - How long: _____

Are there other coping strategies which your organization has used to respond to Hurricane Harvey?

_____

_____

_____

_____

_____

Are there policies or processes that you wish had been in place before Hurricane Harvey?

_____

_____

_____

_____

_____

What were the biggest lessons in fiscal management that you learned during the response to Hurricane Harvey?

_____

_____

_____

_____

_____

Do you think the steps taken are sufficient? What still needs to be done to recover from Hurricane Harvey?

_____

_____

_____

_____

_____

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