RELOCATION CONSIDERATIONS OF GULF COAST RESIDENTS FOLLOWING THE 2017 HURRICANE SEASON FOR HAZARD RISK REDUCTION

A Thesis

by

ABBEY ELIZABETH HOTARD

Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF MARINE RESOURCES MANAGEMENT

Chair of Committee,	Ashley D. Ross
Committee Members,	David Retchless
	Meri Davlasheridze
	Wesley Highfield
Head of Department,	Kyeong Park

August 2019

Major Subject: Marine Resources Management

ABSTRACT

The United States experienced a series of record-breaking climate and weather-related disasters in 2017. While this may have been a record-breaking year, it is not expected to be an anomaly. Climatologists warn that disasters will become more costly in the U.S. as a result of global climate change and coastal development. A recent study suggests that many of low-lying coastal communities along the Gulf of Mexico may need to relocate by 2100 to avoid chronic flooding events exacerbated by sea level rise. Since rapid unmanaged outmigration of coastal residents caused by a disaster may have negative consequences for efforts of sustainability and community resilience, it is important for us to understand current relocation attitudes and potential buy-in for migration policy interventions. This study uses online survey measurements of both relocation and home buyout consideration to see if and under what circumstances Gulf Coast residents consider hazard relocation and if these circumstances vary between different strategies. The regression results presented highlight a number of individual and environmental factors contributing to relocation considerations of Gulf Coast residents following the 2017 hurricane season. However, there are variations in the influence of these factors between relocation and buyout consideration suggesting that compensation offered with buyouts influences relocation decision making. Findings from this analysis provide a new benchmark and direction for future studies assessing migration potential and buy-in within Gulf Coast communities under changing environmental conditions.

ACKNOWLEDGEMENTS

I would like to thank my committee chair, Dr. Ross, and my committee members, Dr. Retchless, Dr. Davlasheridze, and Dr. Highfield for their guidance and support throughout the course of this research.

Thanks also to my friends and the department faculty and staff for their incredible support in navigating the past two years at Texas A&M University at Galveston.

CONTRIBUTORS AND FUNDING SOURCES

Contributors

This work was supervised by a thesis committee consisting of Professor Ross (chair), Professor Davlasheridze, and Professor Retchless of the Department of Marine Sciences and Professor Highfield of the Department of Landscape Architecture and Urban Planning.

The data analyzed for this thesis was provided by Dr. Ross and Dr. Retchless. All other work conducted for the thesis was completed by the student independently.

Funding Sources

Graduate study was supported by the 2-Year Competitive Graduate Student Fellowship from Texas A&M University at Galveston. This work was made possible in part by funding from Texas A&M University at Galveston Comprehensive Research Funds, which supported collection of the survey data used in the analysis.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1. Problem statement

Development within coastal zones is rapidly outpacing development in non-coastal areas. Economic growth has caused migration towards the coasts and increased population density closer to coastal hazards such as flooding and storm damage (Neumann et al., 2015). Simultaneously, many coastal zones are expected to experience sea level rise ranging from 0.3 meters to 2.0 meters by 2100 (IPCC, 2014). This sea level rise will cause more frequent coastal and inland flooding and increase the severity of storm surges (Wobus et al., 2017), thereby heightening the exposure of millions of Americans to coastal hazards. Hauer et al. (2016) estimated that 13.1 million people in the United States could be vulnerable to a 1.8-meter increase in sea level rise by 2100 based on current population and sea level rise trends. They further estimate that 70% of the 13.1 million are concentrated in the Southeastern United States. These predictions suggest that many low-lying coastal communities will be forced to migrate to less risk prone areas within the next eighty years.

Hazard driven migration occurs on both the aggregated, community-wide planning level, and on the individual, household level. Communities with high exposure to hazards may opt for buy out programs or formal resettlement using money from federal or state governments. While migration ultimately reduces human exposure to growing coastal hazards, it can reduce local social capital and economic resources in the short- and long-term future (Marino, 2012; Binder et al., 2019). Carefully facilitating migration through resettlement or home buyout programs, however, requires significant political will, and community buy-in, and financial resources. Knowing if and under what circumstances individuals consider relocating (i.e. unmanaged migration, formal resettlement, or home buyouts) can help community planners make more

proactive decisions for hazard mitigation interventions to foster resilience to growing coastal hazards. Throughout this study, *relocation* is used to refer to the movement of a single individual or household while *migration* is used to refer to aggregate movement of individuals or households from one area to another.

1.2. Overview of study

1.2.1. The U.S. Gulf Coast

Economic growth has caused increased population density closer to coastal hazards such as flooding and storm damage (Neumann et al., 2015). This is particularly prevalent along the Gulf Coast. Nearly 20 percent of the U.S. population lives within the five Gulf Coast states—Texas, Louisiana, Mississippi, Alabama, and Florida (National Academies of Sciences, 2018). Furthermore, about 51 percent of total U.S. petroleum refining capacity and 50 percent of total U.S. natural gas processing plant capacity is located along the Gulf Coast (EIA, 2017). In response to increased risk, many Gulf Coast communities have modified their environment to accommodate population and economic growth (McPhee, 1989; National Academies of Sciences, 2018). Due to the extensive development, environmental modification, and climate change, the Gulf Coast experiences extensive patterns of destructive coastal flooding and storm damage as most recently exhibited by the 2017 hurricane season (FEMA, 2018).

1.2.2. The 2017 Hurricane Season

The 2017 Atlantic Hurricane season was one of the most active on record with a total of 17 named storms which contributed to the 16 billion-dollar weather events in the United States. The cumulative cost of just the hurricane events in the US was approximately $306.2 billion (NOAA, n.d.a). The 2017 hurricane season was the first year since 1893 in which 10 consecutive named storms strengthened into hurricanes (Lim et al, 2018). Global sea surface temperatures

were ~0.96℃ higher than the 1901-2017 average with ~0.42℃ attributed to a linear upward trend associated with global warming and ~0.54℃ attributed to leading modes of climate variability, primarily the positive phase of the Atlantic Meridional Mode (AMM) (Lim et al., 2018). While traditional leading modes of climate variability are currently the predominant drivers of storm activity, recent studies of the 2017 hurricane season suggest that the role of global warming may increase over time (Lim et al., 2018; Emanuel, 2017).

The Gulf Coast was hit with three named tropical storms, three hurricanes, and several other severe weather events (NOAA n.d.b). The three hurricanes—Harvey, Nate and Irma—triggered major disaster declarations with at least one declaration in each of the Gulf Coast states over the course of the season (FEMA, 2018). Hurricane Harvey caused approximately $125 billion in damages across the United States (NOAA, n.d.a) and triggered major disaster declarations in Texas and Louisiana (FEMA, 2018); Irma caused approximately $50 billion in damages and triggered six major disaster declarations in Florida, Georgia, South Carolina, Puerto Rico, and the Virgin Islands; and Hurricane Nate caused approximately $2.5 billion in damages and triggered major disaster warnings in Alabama and Mississippi. While the 2017 hurricane season was one of the most destructive on record, it may be a signal of intensifying coastal hazards (Villarini and Vecchi, 2013).

1.2.3. Contribution of this work

Although there has been some work done to understand human migration in response to climate change (e.g. Hunter, 2005; McLeman, 2018), there is still a lack of consensus on the relative importance of driving factors for migration decisions across different regions, peoples, and types of environmental change (National Academies of Sciences, 2018). While several studies have taken a theoretical approach to climate migration (Black et al., 2011; Gemenne and

Blocher, 2016; McLeman, 2018), much of the empirical research previously done on migration relies on small case studies centered on developing nations (Bardsley and Hugo, 2010; Bott, 2016; Stojanov et al., 2017) or on isolated disaster events (DeWaard et al., 2016; Bukvic et al., 2015) to develop broad theories about human migration in response to climatic hazards. Therefore, there has been relatively little focus on the drivers of hazard migration in developed coastal systems such as the U.S. Gulf Coast (National Academies of Sciences, 2018). Recent analysis by Hauer (2017) suggests that sea level rise will cause a major outmigration of Gulf Coast communities by 2100. However, increased storm impact could create a tipping point causing more rapid migration out of coastal areas before 2100 (National Academies of Sciences, 2018). This research seeks to capitalize on the broad impact of the unprecedented 2017 hurricane season to provide a new benchmark and direction for future work on coastal hazard migration across the entire U.S. Gulf Coast.

1.3. Research question and objectives

This research attempts to gain insight into the factors contributing to individual relocation for hazard mitigation across the Gulf of Mexico following exposure to a severe hurricane season. Questions to be addressed include: 1) Are there certain demographic characteristics that increase the likelihood of relocation? 2) Does greater disaster experience correlate with more relocation consideration? 3) Are there community or environmental conditions that contribute to relocation considerations? This analysis will explore individual's consideration of relocation, and then, more specifically, an individual's consideration of participation in a home buyout program. This approach allows for assessment of how the driving factors of relocation consideration might change when considering a more specific relocation strategy.

2. LITERATURE REVIEW, CONCEPTUAL MODEL, & HYPOTHESES

2.1. Literature review

2.1.1. Growing coastal hazards

The U.S. Gulf Coast has always been governed by dynamic physical processes. However, over the next several decades, Gulf Coast will respond to a number of shifting environmental stresses, such as accelerated relative sea level rise, continued subsidence and erosion, increasing impact of storms, and warming temperatures (National Academies of Sciences, 2018). These stresses will pose new challenges to coastal communities, requiring proactive and innovative hazard mitigation strategies.

2.1.2. Hazard mitigation

Without careful hazard mitigation, coastal communities will continue to become more vulnerable to flooding and storm damage. Coastal hazard risk mitigation seeks to limit vulnerability to coastal hazards to prevent loss of life and disruption of livelihood (FEMA, 2015). However, implementing hazard mitigation requires a clear understanding of coastal hazards and community vulnerability. Hazard refers to any agent or means that has the potential to cause loss (Tierney, 2014, p. 12). It is important to note that hazards are present even in the absence of human populations and therefore cannot be directly managed. Hazards become disasters when a community is vulnerable to its impacts.

Disaster vulnerability is a function of a community's exposure, sensitivity, and adaptive capacity (Integrate, 2017). Exposure refers to the density of people and property within reach of a hazard and the presence or absence of mitigation structures. Sensitivity refers to the degree something or someone can be harmed by a hazard. This can be affected by factors such as age or

socioeconomic status. And adaptive capacity refers to the ability of communities to learn from their previous experiences and implement change to reduce risk of damage from hazards. Thus, it is clear that increased disaster exposure in the U.S. emerged alongside dense development in hazard prone regions.

While coastal risk management should be tailored to the specific hazards and needs of different communities, climate change is limiting mitigation options for particularly low-lying regions. Without radical adaptation, sea level rise and the associated increased storm impact will cause migration of millions of Americans over the next several decades (Hauer et al., 2016). It is important to note that coastal migration does not need to be a haphazard household response to coastal hazards. Policy interventions such as targeted home buyouts or formal resettlement may prove successful risk mitigation strategies for particularly vulnerable communities, but they are not without significant financial and social costs (Burby, 2006; Phillips, 2015; Binder et al., 2019). Consequently, policy makers must consider the both the community impact and buy-in for such interventions.

2.1.3. Options for Hazard Migration

2.1.3.1. Unmanaged Retreat

Individual unmanaged migration out of a hazard prone area typically occurs either immediately after a devastating disaster or following chronic more gradual stressors such as sea level rise or coastal erosion (Dalbom et al., 2014; McLeman and Hunter, 2011; Bukvic et al., 2016; Davlasheridze and Fan, 2017; Smith et al., 2006; Boustan et al., 2012; Hornbeck, 2012). The stress individuals experience stems from both the physical exposure of natural hazards and

the financial costs of responding, recovering, and adapting to these hazards. [1] Once a household reaches their threshold of resilience, that household will relocate. This may be abrupt following displacement from severe damage from a disaster such as Hurricane Katrina (Fussell, 2015) or may be a well-developed decision based on months of planning and research (McLeman, 2018).

Either process of unmanaged retreat has potentially significant consequences for communities. Abrupt retreat frequently creates numerous abandoned properties with significant storm damage—most notably in New Orleans after Hurricane Katrina (Dalbom et al., 2014; Vigdor, 2008). In cases where these properties were cleared, the empty lots often filled with invasive and nuisance plant species to be cleared using public resources with a smaller tax base. Individually planned retreat may allow for new residents to purchase a high-risk property. If the new residents have the means to implement hazard mitigation strategies, this may not be a problem. However, if not, these properties may be repeatedly damaged creating a burden for both the residents and the public resources used to rebuild. Therefore, entirely unmanaged retreat is not an ideal policy for high risk coastal communities.

2.1.3.2. Resettlement

Resettlement involves government intervention of organized and concentrated efforts to move an entire community (Dalbomet et al., 2014). While these efforts attempt to keep social ties and community identity, they still require individual buy-in to move to a new location. For example, the Biloxi - Chitimacha - Choctaw Native American community on the drowning island of Isle de Jean Charles, Louisiana was awarded a significant grant for resettlement from the United States Department of Housing and Urban Development. Yet, many tribal members

[1] Some scholars have cited the interesting role of FEMA's National Flood Insurance Program. Increasing insurance premiums to better reflect risk (and reduce the debt of the program) may in fact increase migration due to the financial burden of the premiums for some populations (Dalbom, Hemmerling, and Lewis, 2014).

have protested the move. In the face of chronic land loss and flooding, these individuals would rather stay in their existing homes than resettle on higher ground (Davenport and Robertson, 2016). This sentiment is common among many coastal, low lying communities and potentially reflects conservative American values of property rights and individualism (Simms, 2017; Dalbom et al., 2014).

However, social ties and personal values are only small hurdles to facilitating resettlement when compared to cost. Formally resettling the estimated 13.1 billion individuals at risk to sea level rise is estimated to cost over $14 trillion, based on the cost of resettling communities in coastal Alaskan villages (Hauser et al., 2016). This also assumes that there will be enough desirable land to support large resettlements in preferred locations. Due to the high financial and social costs, individual home buyouts are the more popular proactive hazard migration policy option.

2.1.3.3. Home Buyout

Home buyout programs involve targeted property acquisition to reduce exposure to hazards, particularly flooding. This is often done using hazard mitigation grants from FEMA (FEMA, 2015). Hazard mitigation funds may be used to purchase frequently flooded properties and convert them into green space. This then reduces population density in the flood zone while decreasing the severity of flooding to the surrounding area. Home buyout programs are thus designed to protect the government from future losses by providing incentives to relocate to safer areas (Burby, 2006; Phillips, 2015; David and Mayer, 1984).

Despite their extensive use following Hurricanes Sandy and Harvey (HCFCD, n.d.), there is still relatively little research on the demographics of communities targeted for buyout programs (Robinson et al., 2018). And there is even less research on the permanent resettlement

of individuals following buyout participation to ensure they remain outside of high-risk flood zones (Binder et al., 2019). The lack of instrumental policy learning between different buyout programs makes it difficult for local and state officials to make comparisons and assess efficacy of different program models (Binder and Greer, 2016; Greer and Binder, 2017). Insight into household level decision making regarding hazard related relocation could be valuable information for gauging potential buyout participation to then develop a more comprehensive home buyout strategy for hazard risk reduction.

2.1.4. Drivers of Relocation

Past empirical research of hazard related migration has previously been limited to isolated case studies or events. Lessons from these cases, however, should be used to guide research of migration considerations along the Gulf Coast. These studies indicate that the presence coastal hazards alone does not drive individual relocation considerations. In fact, complex socioeconomics, community conditions, and individual beliefs and perceptions also contribute resettlement into less risk prone areas (McLeman, 2018; Gibbons and Nicholls, 2005). For example, Gibbons and Nicholls (2005) argue that abandonment of a drowning island in Chesapeake Bay was caused by more complex social and economic conditions on the island rather than sea level rise alone. After conducting interviews and reviewing town records, the authors determined that complete island abandonment occurred before the island would have been made uninhabitable by sea level rise. While increased sea level on some neighborhoods directly contributed to abandonment, other neighborhoods followed due to loss of community services such as religious services and school networks. Similarly, Bukvic et al. (2015) show that the influence of socioeconomic and demographic characteristics on household relocation is present even immediately following a disaster. While perceived risk of sudden onset events has

historically had large influence on household mitigation behaviors (Bubeck et al., 2012; McLeman, 2018), the decision to permanently relocate is most likely driven by the combination of personal and external factors. Therefore, it is clear that relocation considerations stem from interactions of an individual's demographics, resources, experiences and beliefs with his or her surrounding community and environment.

2.2. Conceptual model

The personal and external factors influencing relocation decisions can be conceptualized within a social ecological model. Social ecological models are often used in public health literature to describe the interactions between personal, interpersonal, and environmental factors (Centers for Disease Control and Prevention, 2019) impacting a specific outcome. Here, the drivers of relocation consideration can be grouped into individual, community, and environmental factors illustrated in Figure 1. Individual characteristics include factors such as

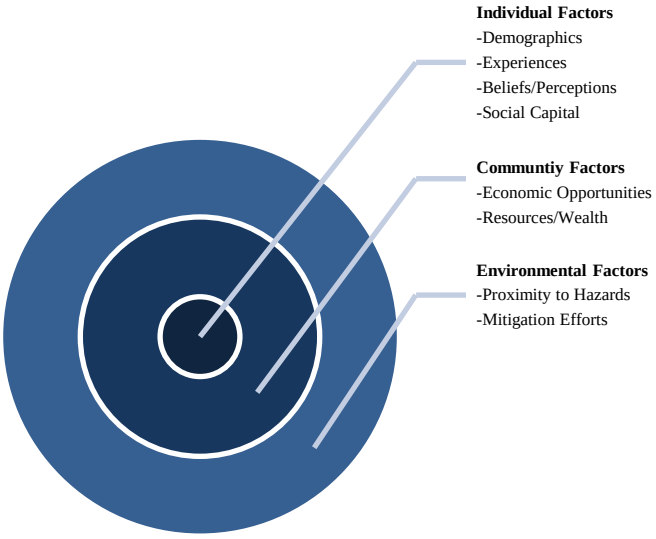

Figure 1: Conceptual Model.
Note: This figure illustrates the proposed social ecological model for conceptualizing factors influencing relocation considerations of coastal residents.

demographics, disaster experience, and personal beliefs or perceptions, and social capital. These factors address acute variations between individuals in their demographics, beliefs, and experiences. Community factors can include factors such as economic opportunities, public resources, and policy implementation at a neighborhood or county scale. And environmental factors measure natural conditions such as exposure to environmental hazards. This conceptual model is a useful tool for exploring to what extent individual preferences (i.e. relocation consideration) are influenced by different levels within the ecological system.

2.3 Hypotheses

Hypotheses about potential drivers of relocation have been developed by synthesizing theories from migration, coastal hazard risk mitigation, and case studies of coastal relocation. Here, potential drivers are organized into individual, community and environmental factors.

2.3.1. Individual Factors

2.3.1.1. Demographics

In an analysis of climate related relocation and migration, McLeman and Hunter (2010) argue that certain demographic groups are more likely to be displaced and permanently relocate following exposure to climate related hazards such as major hurricanes and sea level rise (McLeman and Hunter, 2010). In particular, household resources, or assets, have had a large influence on the migration consideration and ability of individuals. McLeman and Hunter synthesized research following Hurricane Katrina in New Orleans showing that homeownership and household income were positively correlated with returning to the city after the storm. These findings are also supported by Bubeck et al. (2012) and Davlasheridze and Fan (2017) which finds that households with higher income are more likely to invest in risk mitigation measures

for their properties (rather than abandon them) to reduce impact from disasters. Accordingly I expect:

H1a: Home ownership will decrease the probability of considering relocation for hazard risk reduction.

Education has been linked to greater understanding and perception of personal risk to hazards (Botzen et al., 2012). Using a wide range of case study locations and hazards, McLeman and Hunter (2010) similarly found that higher levels of education are positively correlated with migration to areas with more favorable climates and away from perceived hazards. This finding is consistent with analysis of relocation consideration following Hurricane Sandy (Bukvic, et al., 2015). However, recent Analysis by Song and Peng (2017) found that individuals with college degrees or less are more reluctant to relocate from Panama Beach, Florida to avoid inundation from sea level rise. The authors suggest that this finding may be caused by higher personal resources or trust in public flood mitigation infrastructure—something they did not address within their model. Therefore, consistent with earlier work, I propose:

H1b: Higher educational achievement will increase the probability of considering relocation for hazard risk reduction.

Age has been shown to have a negative effect on proactive relocation in response to climatic hazards. McLeman and Hunter (2010) note that younger individuals, particularly those who are also married and have children, tend to be more likely to migrate after experiencing climatic hazards. This is supported by findings after Hurricane Katrina and Hurricane Sandy (e.g. Fussell et al., 2010; Groen and Polivka, 2010). For example, Fussell et al. (2010) found that one only half of pre-Katrina residents under the age of 40 returned to the city after the storm, compared to two-thirds of those who over the age of 40. In a study five months after Hurricane

Sandy, Bukvic et al. (2015) found that younger individuals impacted by Hurricane Sandy were generally more stressed about disaster recovery and more likely to consider relocating elsewhere. Therefore, I propose:

H1c: Age will decrease the probability of considering relocation for hazard risk reduction.

Disaster and hazard risk mitigation literature have consistently highlighted race as an important factor contributing to disparities in disaster impact and recovery. Minority groups exposed to hazards often incur more intense damages due to historic social inequalities (Fussell et al., 2010; Tierney, 2014). Findings from Hurricane Katrina and suggest that minority groups are also less likely to return following the event if displaced (Stringfield, 2010). McLeman and Hunter, 2010). Consistent with these findings, I propose:

H1d: Being of a minority race will increase the probability of considering relocation for hazard risk reduction.

Unlike other demographic characteristics, gender has been shown to have mixed results between disaster recovery and relocation decisions. While research has shown that women tend to have higher environmental risk perceptions (e.g. Bubeck et al., 2012; Tierney, 2014), this does not necessarily translate into significant mitigating behavior or relocation consideration in flood prone areas (Bubeck et al., 2012; Bukvic et al., 2016). In fact, some findings from post-disaster recovery following Hurricane Katrina note a higher percentage of single mothers in New Orleans (Stringfield, 2010). Therefore, I propose:

H1e: Being female will decrease the probability of considering relocation for hazard risk reduction.

2.3.1.2. Disaster Experience

Disaster damages, particularly from sudden onset events are highly associated with risk perceptions and mitigative behaviors (Bubeck 2012). Particularly devastating disaster damages are more likely to motivate (or sometimes force) relocation. Fussell et al. (2010) found that housing damage was negatively associated with returning to New Orleans after Hurricane Katrina as residents permanently relocated elsewhere. Similarly, Bukvic et al. (2015) found that long-term displacement, housing damage, and personal costs of recovery significantly increased relocation considerations of New Jersey residents impacted by Hurricane Sandy. Considering the scope of the 2017 hurricane season across the Gulf Coast, I propose:

H2: Disaster impact from the 2017 hurricane season will increase the probability of considering relocation for hazard risk reduction.

2.3.1.3. Risk Perceptions and Vulnerability Assessments

Literature regarding perceptions of coastal hazards suggests that risk perception of hazards tends to increase risk mitigation behaviors (Baan and Klijn, 2004; Bubeck et al., 2012; Bukvic et al., 2015). An individual with higher risk perception is more likely to take actions to protect his or her assets from anticipated hazardous phenomena such as flooding or tornadoes. However, the effect of risk perceptions on individual mitigation behaviors may be weakened by the so called "coping appraisals" or vulnerability assessments (Bubeck et al., 2012). Coping appraisals are composed of an individual's opinions of response efficacy, self-efficacy, and response cost. Response efficacy refers to the degree an action will actually reduce risk, self-efficacy refers to the ability of the individual actually carry out the mitigation action or behavior, and response cost refers to the cost of mitigation implementation. This research implies that individual considerations of mitigation behaviors (e.g. relocation) are influenced by individual

appraisals of personal beliefs and resources in context of a perceived risk of hazards. To account for both general risk perception and personal assessments of vulnerability, I expect:

H3a: Individuals with a higher general risk perception will be more likely to consider relocation for hazard risk reduction.

H3b: Individuals with a higher vulnerability assessment will be more likely to consider relocation for hazard risk reduction.

2.3.1.4. Political Ideology

Environmental risk perceptions and subsequent mitigation behaviors is also highly influenced by political ideologies (McCright and Dunlap, 2011; Myers et al., 2016; Botzen et al., 2016). While climate scientists have predicted alarming rates of sea level rise, these predictions are not immediately reflected in risk perceptions. The lack of consensus on what hazards are or will be influenced by climate change has varying effects on individual understandings and appraisals of environmental risk. McCright and Dunlap (2011) note that liberals and Democrats are more likely believe scientific consensus and express concerns about climate change than conservatives and Republicans. This suggests that an individual's political ideology, or party affiliation, may influence perceptions long term habitability of his or her current environment. Consequently, I propose:

H4: Conservative ideology will decrease the probability of considering relocation for hazard risk reduction.

2.3.1.5. Social Capital

Social capital refers to the information and resources available to people through their connections to others (Aldrich, 2012). These connections are often measured in the dimensions of bonding, bridging, and linking. Bonding social capital refers to the resources and support

shared between individuals and their friends, family, and neighbors. Bonding social capital is usually strongest among people who share similar beliefs and experiences thus creating a strong sense of belonging. Bridging social capital refers to the resources and support shared between individuals and different social networks or organizations spanning different ethnic, racial, or religious differences. And finally, linking social capital refers the resources and support shared between individuals and formal institutions or authority.

Past research has shown mixed results for the effect of social capital on migration (Aldrich, 2012). For example, Simms (2017) found that strong cultural ties and sense of place, a proxy for bonding social capital, made individuals less inclined to leave their community, especially following a disaster event. However, individuals with strong social and professional networks extending out of the immediate community, proxies for bridging and linking social capital, are more likely to relocate following increased hazard exposure (McLeman and Hunter, 2010). The effect of social capital on coastal migration is likely linked to the locations of an individual's social network. For example, if an individual maintains connections outside of his or her immediate community, he or she might be more inclined to move away if local resources have been compromised. Conversely, if an individual is highly dependent on local friends and neighbors for resources and information, the social cost of relocating is much higher (Aldrich, 2012). With an understanding that different forms of social capital have diverging effects on relocation decisions, I propose:

H5: Social capital in terms of external networks will increase the probability of considering relocation for hazard risk reduction.

2.3.2. Community Factors

Perceived loss of services or economic opportunity affects individual perceptions of

community resilience (Aldrich, 2012; McLeman and Hunter, 2010). Aldrich (2012) noted that many individuals initially displaced by Hurricane Katrina decided not to return to New Orleans because of perceived loss of economic opportunities. Many families believed that small business could not (or would not) pay to rebuild in the city. Small businesses are particularly vulnerable to disasters and may impede long term recovery (Davlasheridze and Geylani, 2017). Song and Peng (2017) also found that local opportunities and resources impact relocation considerations. Specifically, they found that 81% of their survey respondents noted the difficulty of finding a new job in making the decision not to relocate to avoid sea level rise in Panama Beach, Florida. To address both community resources and economic opportunity, I propose:

H6a: Higher median income of a community will decrease the probability of considering relocation for hazard risk reduction.

H6b: Higher average work commute time for community members will increase the probability of considering relocation for hazard risk reduction.[2]

2.3.3. Environmental Factors

Environmental factors have been used to model individual risk perceptions and mitigation preferences (Brody et al., 2017; Botzen et al., 2009; Bubeck et al., 2012). The proximity to perceived hazards likely affect individual knowledge and perceptions of community safety. Individuals living closer to coasts or major bodies of water are more likely to experience flooding over time. Individuals living further from waterways are less likely to perceive vulnerability to these hazards because they have less flood experience. However, individual appraisals of risk and mitigation behaviors may also be influenced by the presence of public risk mitigation efforts. Past studies have shown that those living in risk prone areas protected by

[2] Work commute was chosen as proxy for economic opportunity. The assumption here is that longer average work commutes indicate fewer local job opportunities.

levees are less likely to perceive that their properties may be damaged because the government has taken the necessary actions to mitigate that risk (Grothmann and Reusswig, 2006; Ludy and Kondolf, 2012; Boustan et al., 2016). The presence of and proximity to physical representations of mitigation efforts (i.e. levees, floodgates, etc.) impacts individual perceptions of community safety and resilience. To address both physical proximity to coastal hazards and the presence of mitigation, I propose:

H7a: Individuals living closer to the coast will be more likely to consider relocation for hazard risk reduction.

H7b: Individuals living within areas protected by a levee will be less likely to consider relocation.

3. RESEARCH METHODS & DATA

The primary data source for this study was obtained from an online survey administered by Qualtrics and launched by faculty members of Texas A&M University in Galveston, Texas (IRB2017-0916M). The survey was in the field between December 11, 2017 and January 11, 2018, nearly two weeks following the end of the unprecedented 2017 hurricane season. The survey is a representative sample of 73 counties designated as NOAA Coastal Zone Management Program Counties from the states of Alabama, Florida, Louisiana, Mississippi, and Texas. Nearly every county in the sample experienced at least one weather related disaster declaration in 2017 (FEMA, 2018). A map of the surveyed counties and storm tracks for three major hurricanes is provided in Figure 2. The survey sample was drawn to fulfill quotas for age, race/ethnicity, gender and state population size based on population data from the U.S. Census Bureau. A survey weight was calculated to adjust the survey sample for population parameters using an iterative proportional fitting method (Bergmann 2011). While this reduces sampling bias associated with quota-based, non-probability surveys, it does not eliminate the bias inherent to opt-in panels such as the one used for this study (Battaglia 2008).

This study focuses on two measures of migration attitudes: 1) relocation consideration and 2) home buyout consideration. “Relocation consideration” assesses if an individual has ever considered moving away to avoid impacts from natural hazards while “home buyout consideration” assesses if an individual would consider relocating if offered compensation. The same set of hypotheses are applied to both measures. Relocation consideration is measured as responses to the survey question: “Have you ever considered moving to another place where the threat of natural disasters is smaller?” Home buyout consideration is measured as responses to

the survey question: “Have you ever considered (or would you consider) a home buyout program because your house is located in a place where flooding frequently occurs?” Responses of “yes” are coded 1 and of “no” are coded 0.

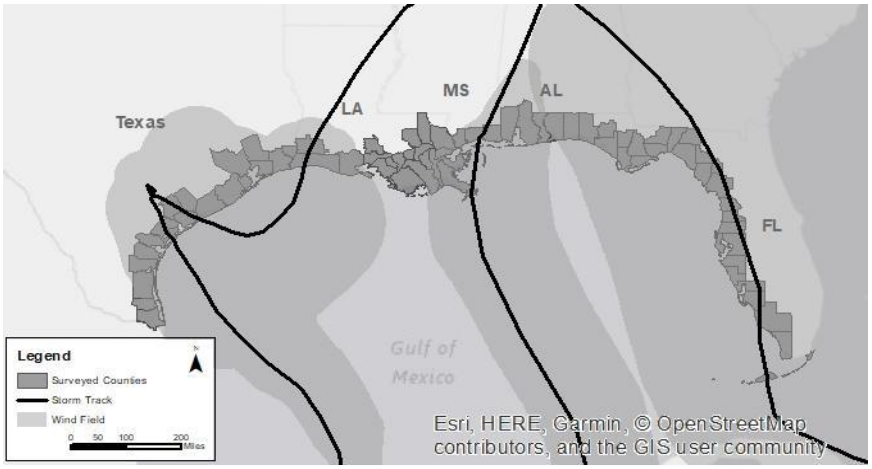

Figure 2: Study Area.
Note: This map designed by the author highlights surveyed counties and storm tracks and wind fields from three major hurricanes making landfall in 2017 (ESRI, 2018; NOAA, n.d.b). From left to right, the storms are Hurricane Harvey, Hurricane Nate, and Hurricane Irma.

Consistent with past studies, the following individual factor independent variables are included in the model: gender, race, home ownership, age, education, risk perceptions, vulnerability assessment, disaster experience, political ideology, and social capital. To account for external factors noted in past studies, the following independent variables for community and environmental factors were generated and included in the model: median income, average commute time[3], distance to the coast[4], and community area within a leveed area. Community and

[3] Median income and average work commute were obtained from the U.S. Census Bureau American Community Survey 2016 5-Year estimates for all zip codes falling within the study area.
[4] Distance to the coast is measured as the distance between the centroid of a reported zip code (calculated using ESRI’s ArcGIS) to the nearest point on the U.S. Gulf Coastline.

environmental factors were collected and generated on a zip code scale because it is the smallest reported geographic unit reported by survey respondents.[5] Table 1 provides the measures adopted for each independent variable. For more details on data sources and hypothesized direction with dependent variables, see Appendix A; pairwise correlations are provided in Appendix B. Details on the construction of the factor scores for social capital, risk perception, and vulnerability assessment are provided in Appendix C.

Table 1: Independent Variable Measurement & Coding

Variable	Measure	Coding
INDIVIDUAL FACTORS		
Home Ownership	Do you own or rent your home?	1 = Own 0 = Rent
Education	What is the highest level of degree you have earned?	1 = High school 2 = Some college 3 = Associate's degree 4 = Bachelor's and post-graduate degree
Age	Please select your age range.	1 = 18-24 years 2 = 25-44 years 3 = 45-64 years 4 = 65 years and older
Minority Race	Which of the following do you most closely identify with?	0 = White 1 = Latino, African American, or Other
Female	What is your gender?	0 = Male 1 = Female
Disaster Experience	What impact did the hurricane this year have on your home and personal property?	0 = No threat of a hurricane in 2017 1 = No damage 101 = extreme devastation

[5] Literature suggests that individuals choosing to relocate would prefer lower risk residences within their current cities or counties (Song and Peng, 2017; Lu et al., 2018). The variation of zip code wealth (median income), proximity to economic resources (average work commute), and proximity to environmental hazards (distance to the coast and the proportion of leveed area) provides the best available external factors that might be used by individuals considering relocating for risk reduction.

Table 1 Continued

Variable	Measure	Coding
INDIVIDUAL FACTORS		
Risk Perception	Indicate your agreement with each the following statements on scale in which 1=strongly disagree and 5=strongly agree: 1) I'm worried about the danger of a storm surge on the Gulf Coast. 2) A storm surge can have fatal consequences for the coastal area and its inhabitants. 3) Living on the Gulf Coast is a threat to my safety. 4) I greatly expect a storm surge to cause floods in coastal areas. 5) When I think of floods, I feel concerned.	Factor score where higher values indicate greater risk perception (i.e. the community would experience greater damage due to one of these events)
Vulnerability Assessment	How much harm do you think would come to you personally (to your family, property, job, etc.) if the following were to happen? Assume each hazard is of moderate intensity. 1) Hurricane wind 2) Flooding from rainfall 3) Flooding from river overflow 4) Tornado	Factor Score where higher values indicate higher vulnerability assessment (i.e. more damage would occur to self and property)
Political Ideology	Here is a 7-point scale on which the political views that people might hold are arranged from extremely liberal to extremely conservative. Where would you place yourself on this scale?	1 = Liberal 2 = Moderate 3 = Conservative
Social Capital	How many times in the past 12 months have you...? 1) Worked on a community project; 2) Attended a public meeting about town or school affairs; 3) Attended a political meeting or rally 4)Attended any club or organizational meeting 5)Been in the home of someone you consider to be a community leader or had one in your home	Factor score where a higher score indicates higher social capital
COMMUNITY FACTORS		
Median Income	Median income of respective zip code	Natural log of median income
Work Commute	Average work commute from a respective zip code	Average work commute of those in the labor force within respective zip code
ENVIRONMENTAL FACTORS		
Distance to the Coast	Proximity to the Gulf Coastline	Distance from zip code centroid to nearest coastline
Within Leveed Area	Proportion of respective zip code falling within a leveed area	Percent area of respective zip code falling within USACE defined leveed areas

4. STATISTICAL METHODS

Due to the dichotomous coding of the dependent variables, logit regression models are estimated. A separate regression is estimated for each dependent variable using the same set of independent variables with a weight applied to survey responses to correct bias in the sample. A total of 2,842 responses are included in the analyses. The regression equation for the full social ecological model used for final analyses is provided below where P is the probability of responding "yes" to either of the dependent variables and β_i is the regression coefficient for each independent variable. Regression coefficients describe the relationship between a predictor variable and the response.

$$\begin{aligned} Ln\left(\frac{P}{1-P}\right) = {} & \beta_0 + \beta_1(Age) + \beta_2(Education) + \beta_3(Gender) + \beta_4(Race) \\ & + \beta_5(Conservative\ Political\ Ideology) + \beta_6(Home\ Ownership) \\ & + \beta_7(Disaster\ Experience) + \beta_8(Risk\ Perception) \\ & + \beta_9(Vulnerability\ Assessment) + \beta_{10}(Social\ Capital) \\ & + \beta_{11}(Median\ Income) + \beta_{12}(Average\ Commute\ Time) \\ & + \beta_{13}(Distance\ to\ the\ Coast) + \beta_{14}(Within\ Leveed\ Area) \end{aligned}$$

5. RESULTS

According to weighted cross-tabulations of the survey data, about 35% of survey respondents said that they have considered moving to another place where the threat of natural disasters is smaller and about 31% said that have or would consider participating in a home buyout program.[6] A selection of descriptive statistics of these respondents (i.e., education level, age, minority group membership, political ideology) is provided in Appendix E. Given that approximately 1-in-3 individuals surveyed would relocate, how do different individual, community and environmental factors affect an individual's willingness to relocate? Do these factors change for specific relocation strategies?

To explore these questions, two regression models – one for individual relocation and another for buyout – were estimated to test the association of a series of individual, community, and environmental characteristics.[7] Regression results, presented in Table 2, show that a number of individual and environmental factors – but not community factors – have a significant effect on relocation and buyout consideration. However, there are variations in the influence of these factors between the models for relocation and buyout consideration. Table 3 provides a summary of all results in terms of the hypotheses. Given that logistic coefficients are difficult to interpret directly, the findings are explored in terms of marginal effects for relocation consideration first then those affecting buyout consideration. The marginal effects presented hold all other variables at their mean value and use regression coefficients to estimate predicted probability.

[6] Interestingly, of the respondents that said that they have considered relocating, only 52% said that they would consider a buyout program suggesting that respondents may not be associating the two survey questions with the same process or act of moving away to a place where risk from natural disasters is lower.

[7] A separate model for buyout consideration was estimated by restricting the sample to only respondents who own their homes. This model is presented in Appendix F. Due to the similarity between these models, the full sample model is used to explore marginal effects and discuss results.

Table 2: Logit Regression Coefficients for Full Social-Ecological Model

	Relocation	**Buyout**
Home Owner	-0.457***	0.207**
	(0.100)	(0.101)
Education: Some College	0.011	0.043
	(0.118)	(0.120)
Education: Associate's Degree	0.184	0.118
	(0.139)	(0.139)
Education: Bachelor's or Post-Graduate Degree	0.286*	-0.061
	(0.155)	(0.154)
Age: 25-44 Years	-0.202	-0.078
	(0.139)	(0.142)
Age: 45-64 Years	-0.561***	-0.198
	(0.158)	(0.161)
Age: 65+ Years	-0.750***	-0.434**
	(0.179)	(0.182)
Minority	0.088	0.172
	(0.104)	(0.107)
Female	-0.071	-0.321***
	(0.102)	(0.103)
2017 Disaster Experience	0.005***	0.005***
	(0.002)	(0.002)
Risk Perception	0.187***	0.146***
	(0.049)	(0.049)
Vulnerability Assessment	0.271***	0.150***
	(0.053)	(0.052)
Political Ideology: Moderate	-0.348***	-0.258**
	(0.110)	(0.110)
Political Ideology: Conservative	-0.306***	-0.075
	(0.115)	(0.116)
Social Capital	0.383***	0.410***
	(0.049)	(0.048)
Average Work Commute	-0.006	0.011
	(0.010)	(0.010)
Median Income	-0.107	0.064
	(0.139)	(0.138)
Distance to Coast	-0.004	0.005**
	(0.003)	(0.002)
Within Leveed Area	0.635***	-0.052
	(0.179)	(0.191)
Constant	1.311	-1.868
	(1.477)	(1.463)
N	2842	2842

Note: Ordered logit analysis estimated. Coefficients reported with standard errors in parentheses. Statistical significance noted as: *** p<0.01, ** p<0.05, and * p<0.10.

Table 3: Results of Hypotheses

	Hypothesis	Relocation	Buyout
Individual	1a. Home ownership (-)	-***	+**
	1b. Education (+)	+ *	+/-
	1c. Age (-)	-***	-**
	1d. Minority race (+)	+	+
	1e. Female (-)	-	-**
	2. Disaster experience (+)	+***	+***
	3a. Risk perception (+)	+***	+**
	3b. Vulnerability assessment (+)	+***	+**
	4. Conservative political ideology (-)	-**	-
	5. Social capital (+)	+***	+***
Community	6a. Median income (-)	-	+
	6b. Work commute (+)	-	+
Environmental	7a. Distance to the coast (-)	-	+**
	7b. Within leveed area (-)	+***	-

Note: Expected direction of the independent variable relationship with the dependent variable indicated in parentheses following the description of the hypothesis. The direction of the relationship indicated by the regression results is shown in the columns under "Relocation" and "Buyout" for each regression analysis, accordingly. Positive relationships are denoted with "+" and negative relationships with "–". Statistical significance noted as: *** $p<0.01$, ** $p<0.05$, and * $p<0.10$.

5.1 Relocation Consideration

5.1.1. Individual Factors

Individual factors play a key role in relocation consideration of Gulf Coast residents. Regression results show that home ownership, age, and conservative ideology decrease relocation consideration, while education, disaster experience risk perception, vulnerability assessment, and social capital increase relocation consideration. These results are in line with the hypotheses presented. Gender and race did not have a significant effect on relocation consideration. Beginning with demographic characteristics, home ownership decreases relocation consideration by 9.02% ($p<0.01$) from a likelihood of 40.15% among homeowners to 31.12% among renters. Conversely, education increases relocation consideration. Individuals with only a

high school education have a 32.63% likelihood of considering relocation; this increases to 38.21% for those with at least a bachelor's degree. Relocation consideration decreases with age, but this is statistically significant only for those aged 18-24 years and those that are at least 45 years old. Individuals between the ages of 18 and 24 years have a 42.30% likelihood of considering relocation; this decreases to 30.88% for those 45-64 years and to 27.43% for those over the age of 65 years.

Impact from the unprecedented 2017 hurricane season has a positive effect on relocation consideration as expected. Interestingly, the average reported disaster impact from the 2017 season of survey respondents who have considered relocating is 35 on a scale of 0 (no impact) to 101 (extreme devastation). The average reported impact of all respondents was 27 with nearly 85% of respondents reporting at least some impact. The marginal effects of disaster experience are provided in Figure 3. Individuals that experienced extreme devastation from the 2017 have a 41.87% likelihood of considering relocation while those that were not impacted have only a 31.59% likelihood of the same.

As expected, risk perception and vulnerability assessment both have a significant positive effect on relocation consideration. An individual with the minimum risk perception (i.e. low general concern for natural phenomena) has 24.03% likelihood of considering relocation, while an individual with average risk perception has a 34.20% likelihood and a person with the maximum risk perception has a 39.00% likelihood of the same. An individual with minimum vulnerability assessment (i.e. low concern for personal impact or damage from natural phenomena) has a 22.42% of considering relocation, while someone with average vulnerability assessment has a 33.88% likelihood and an individual with the maximum vulnerability assessment has a 42.52% likelihood of the same.

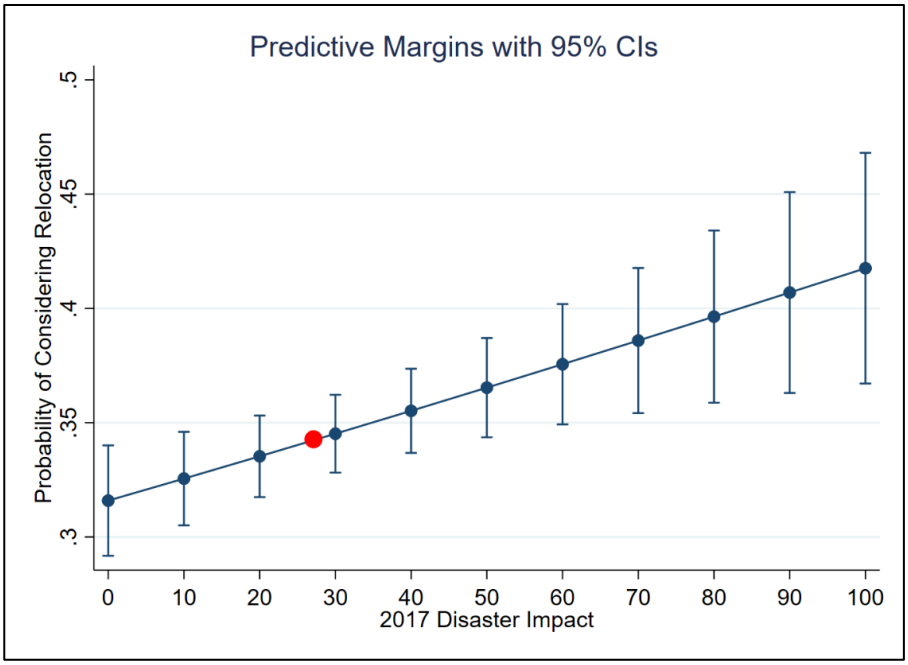

Figure 3: Effect of Disaster Impact on Relocation Consideration.
Note: This figure illustrates the marginal effects of self-reported disaster impact on relocation consideration. Average disaster experience of all survey respondents was 27 on a scale of 0 to 101 and is indicated by a red marker.

Having a conservative political ideology has a significant negative effect on relocation consideration when compared to a liberal political ideology. An individual with liberal ideology has a 39.05% likelihood of considering relocation. This decreases to 32.17% for moderates and 32.97% for conservatives. While there is statistically significant difference between conservatives and liberals, pairwise comparisons of marginal effects indicate there is no significant difference between moderates and conservatives. Conservatives are 6.07% less likely consider relocating than liberals ($p<0.01$).

Social capital, measured in terms of community involvement, has a significant positive effect on relocation consideration. The marginal results for social capital are displayed in Figure 4. An individual with the lowest level of social capital has a 27.90% likelihood of considering

relocation. This increases to a 34.09% likelihood of relocation for someone with average level of social capital and to 65.57% for the highest level of social capital.

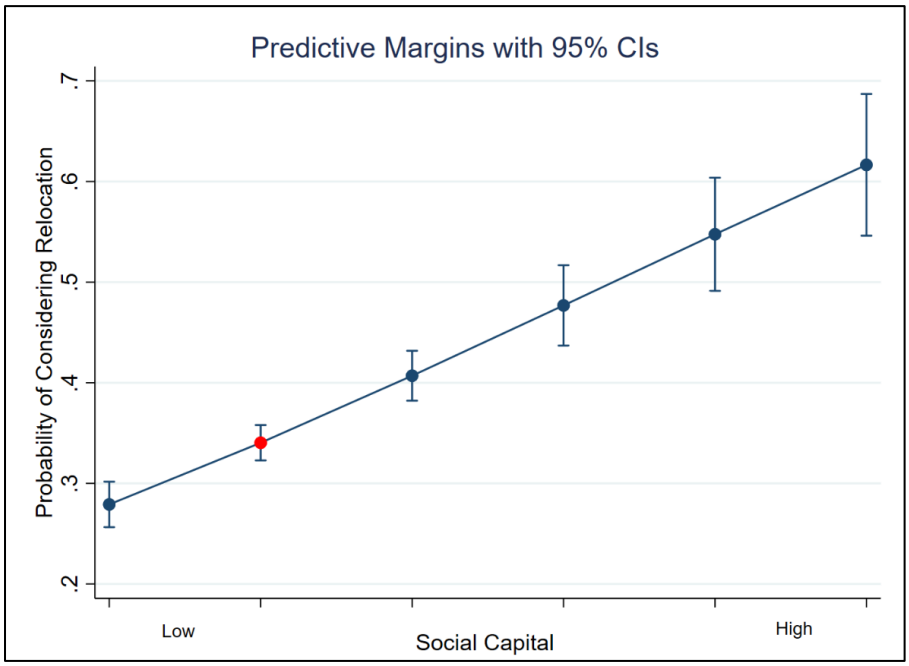

Figure 4: Effect of Social Capital on Relocation Consideration.
Note: This figure illustrates the marginal effects of social capital on relocation consideration. The average social capital factor score of all survey respondents is indicated by a red marker.

5.1.2. Community Factors

Neither of the tested community factors had a significant effect on relocation consideration when accounting for individual and environmental factors. Both median income and average work commute achieved statistical significance in an independent model of community factors presented in Appendix D. In the model with only community factors as independent variables, higher median income of an individual's zip code has a negative relationship with relocation consideration, as expected. Unexpectedly, higher average work commute also has negative relationship with relocation.

5.1.3. Environmental Factors

In consideration of environmental factors, the proportion of a respondent's zip code falling within a leveed area had a significant positive effect on relocation consideration. This is contrary to the hypothesized direction of the relationship. Descriptive statistics indicate that nearly 20% of all respondents live within a zip code that is at least partially within a U.S. Army Corps of Engineers designated levee area. Marginal effects based on the regression estimates show that individuals living in zip codes that are entirely within a leveed area have a 46.22% likelihood of considering relocation; this decreases to 39.56% for an individual within a zip code that has half its total area within a leveed area and to 33.24% for someone within a zip code entirely outside of a leveed area. Proximity to the coast did not have a significant effect on relocation consideration in the full model (see Table 2) or the environmental model (see Appendix D).

5.2 Home Buyout Consideration

5.2.1. *Individual Factors*

Regression results show that home ownership, age, gender, disaster experience, risk perception, vulnerability assessment, and social capital have significant effects on considering participation in a home buyout program. Most of these are in the hypothesized direction. Race and education do not have a significant effect. Beginning with demographic characteristics, unlike the results of relocation consideration, home ownership increases the likelihood of considering buyout participation. Similar to results for relocation, age decreases the likelihood of considering buyout participation. However, this is only statistically significant for those 65 year or older. An individual aged 65 years or older has a 26.28% likelihood of considering buyout participation; this increases to 34.64% for an individual aged 18-24 years. Unlike results for

relocation, pairwise comparisons of marginal effects show that females, in comparison to males, are 6.22% less likely to consider participating in a home buyout program ($p<0.01$).

Impact from the 2017 hurricane season has a significant positive effect on buyout consideration as expected. The marginal effects of disaster experience are provided in Figure 5. Individuals that experienced extreme devastation have a 39.35% likelihood of considering buyout participation while those that were not impacted have only a 28.19% likelihood of the same. The average reported disaster impact from the 2017 season of survey respondents who have or would consider participating in a home buyout program is also 35 on a scale of 0 (no impact) to 101 (extreme devastation).

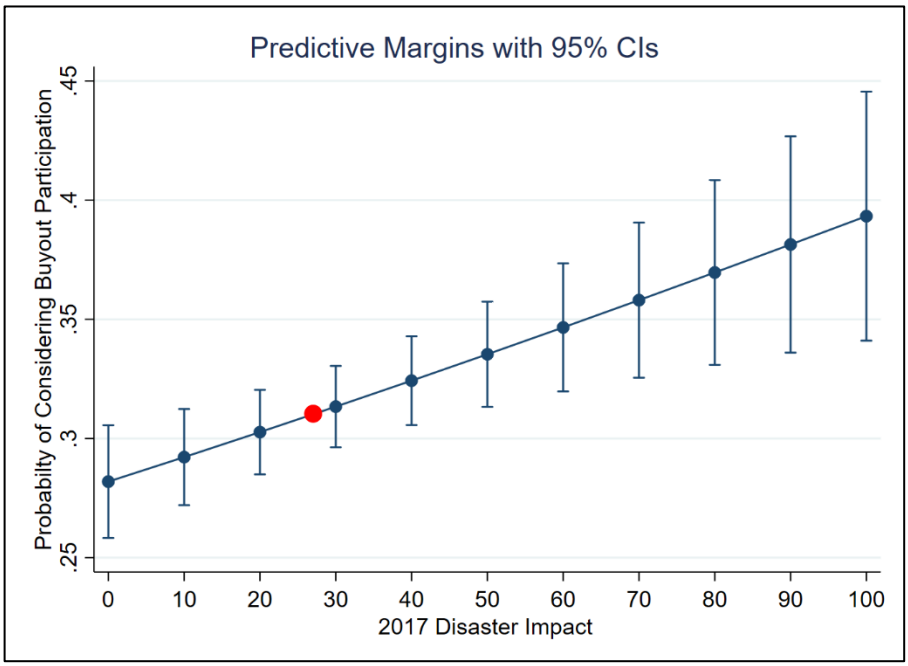

Figure 5: Effect of Disaster Impact on Home Buyout Consideration.
Note: This figure illustrates the marginal effects of self-reported disaster impact on considering participation in a home buyout program. Average disaster experience of all survey respondents was 27 on a scale of 0 to 101 and is indicated by a red marker.

Risk perception and vulnerability assessment have a significant positive effect on considering buyout participation, as expected. Someone with the minimum risk perception has a 23.16% likelihood of considering buyout participation; this increases to 31.07% for an individual with an average risk perception and to 34.80% for someone who has the highest measured risk perception. Vulnerability assessments have a similar pattern in which an individual with the lowest personal concern for disaster impact has a 24.52% likelihood of considering buyout participation; this increases to 31.00% for someone with an average assessment and to 35.64% for an individual with the highest vulnerability assessment.

While having a conservative ideology does not significantly decrease the likelihood of considering buyout participation, having a moderate ideology does. A liberal individual has a 33.60% likelihood of considering buyout participation while someone who is politically moderate has a 28.61% likelihood of the same. Pairwise comparisons of the marginal effects show that the probability of conservatives considering buyout participation (32.10%) is not statistically distinct from that of liberals or moderates.

Social capital, measured in terms of community involvement, significantly increases buyout consideration, as expected. Someone with the lowest measured social capital has a 24.17% likelihood of considering participating in a buyout program; this increases to 30.68% for an individual with average social capital and to 66.11% for an individual with the highest amount of social capital.

5.2.2. Community Factors

Neither of the tested community factors had a significant effect on buyout consideration when accounting for individual and environmental factors. Similarly, neither factor achieved

statistical significance in the separate model of community factors for buyout consideration presented in Appendix D.

5.2.3. Environmental Factors

Individuals living further from the coast have a higher probability of considering participation in a buyout program. Descriptive statistics show that the average straight-line distance from a reported zip code to the nearest coastline was nearly 13.5 miles (about 22 km); the maximum distance was about 50 miles (about 80km). As shown in Figure 6, those living in zip codes less than one mile from the coastline have a 29.01% likelihood of considering buyout participation. However, this increases to 31.14% for those living about 13.5 miles from the coastline and to 37.40% for those living about 50 miles from the coastline. Unlike the results for relocation consideration, an individual's zip code falling within a leveed area did not have a significant effect on considering buyout participation in the full model or in the separate environmental model (see Appendix D).

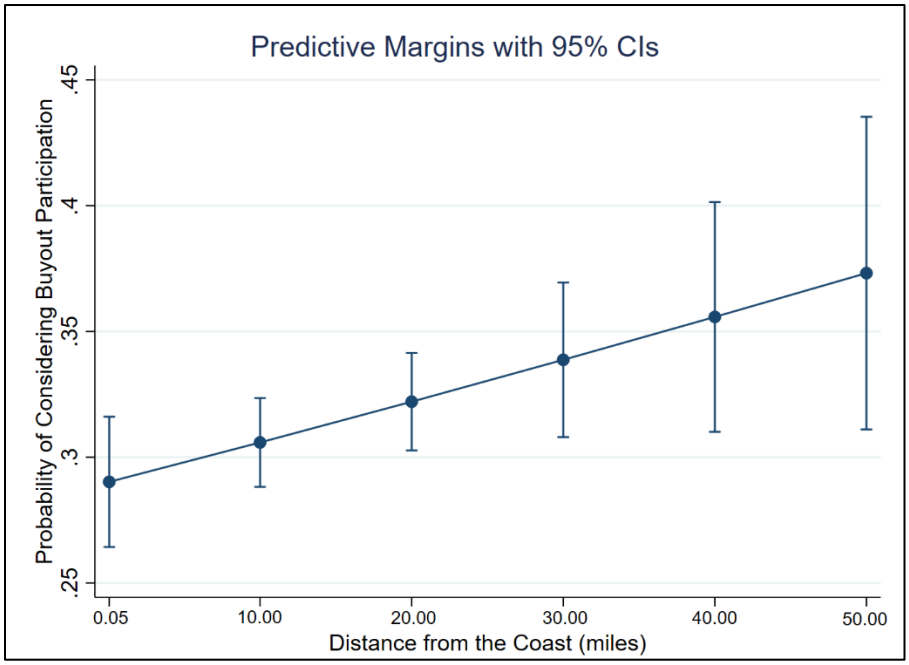

Figure 6: Effect of Distance to the Coast on Home Buyout Consideration.
Note: This figure illustrates the marginal effects of distance from the nearest coastline on considering participation in a home buyout program.

6. DISCUSSION

The regression results presented in this study highlight a number of individual and environmental factors contributing to relocation considerations of Gulf Coast residents following the 2017 hurricane season. The community factors presented did not have a significant effect on relocation considerations. There are differences between the factors influencing consideration of independent relocation and those influencing consideration of a home buyout program. This is likely explained by the risk and cost of independently moving to a new home versus receiving an incentive through some amount of compensation in a home buyout program. The results of this study can be used to better understand the factors affecting community buy-in for hazard migration policy interventions in Gulf Coast communities.

6.1. Individual Factors

Individuals who own their homes are less likely to consider moving away without compensation than those who rent their homes. This is consistent with literature stating that individuals with greater financial resources and assets are more likely to invest in mitigative adaptations than migrate (e.g. McLeman and Hunter, 2010). This effect is flipped for considerations of buyout participation. However, this is expected since renters primarily cannot qualify for home buyout programs and offered compensation may be preferred to expensive adaptation strategies such as elevating a home.

Greater educational achievement increased relocation consideration as expected. Individuals with higher education tend to make better assessments of their personal risk and often have more financial resources for mitigative actions such as relocation (Bubeck et.al., 2012). Interestingly, this effect is not present for buyout consideration. Although this result is

insignificant, education has a positive effect on buyout consideration between those with only a high school education and those with some college or an associate's degree, but those with a bachelor's degree or other post graduate degree are less likely to consider participating in a home buyout program than those with a high school degree. This may be explained by higher expected earnings of college graduates than those with only a high school degree (Abel and Dietz, 2014). Those with greater financial resources may be less motivated by compensation to relocate because they have greater ability to implement mitigative adaptations on their properties.

Demographic traits of age, race, and gender were largely consistent with the proposed hypotheses and between relocation and buyout considerations. Age decreases the likelihood of relocation likely due to greater sense of place, social establishment, and the physical burdens of moving to a new location. Being of a minority race increases relocation and buyout consideration, however, this result is not significant in either the full social ecological model nor the separate individual model. Females are less likely to consider relocation, but this effect is only significant for buyout consideration.

Disaster experience, risk perceptions, and vulnerability assessments increased both relocation and buyout consideration as expected. This is consistent with research finding that experience of high impact, low probability events greatly increases awareness of environmental risks and concern for future events (Bergquist et al., 2019). It is unclear from these results how long this effect may last. It is interesting to note, however, that the marginal effects of risk perceptions and vulnerability assessments are lower for buyout consideration compared to relocation consideration. This may indicate that the influence of risk perceptions and vulnerability assessments are not as important when compensation is offered.

Political ideology effects relocation considerations as expected. Conservatives are less likely to consider relocating for hazard risk reduction than liberals. Conservative political ideology may dampen relocation considerations through belief in climate change – and hence, the reluctance to accept the need to relocation – and/or a greater importance of private property rights that are not easily relinquished by relocation. However, relocation with compensation (i.e. home buyout) makes this effect insignificant. This is a particularly interesting finding for garnering community support for potential relocation policies.

Social capital in terms of external networks increases relocation and buyout consideration as expected. The measures used to construct the factor score of social capital in this model focuses on indicators of community involvement (see measures in Appendix A for details on survey items used and Appendix C for factor loadings). These activities are more characteristic of bridging and linking social capital, which often indicates the presence of broad social networks (Aldrich, 2012). These broad networks likely indicate more social relationships (or social skills) that produce greater resources outside of someone's immediate neighborhood or community reducing the social cost of moving to a new location.

6.2. Community Factors

Although insignificant in both models, median income has a positive relationship with relocation and a negative relationship with buyout consideration. Since median income is a measure of community wealth, this may be related to higher home ownership in areas with higher median income. Average work commute has conflicting effects although this is also insignificant. Higher work commutes correlate with lower relocation consideration but higher buyout consideration. This may be reflecting residential preferences for suburbs rather than access to economic opportunity when there is no other form of compensation for moving.

Furthermore, the insignificance of both community measures may be explained by preferences for relocation within the same community. Song and Peng (2017) found that many individuals considering relocation would prefer relocating within their current city or neighborhood. Thus, it may be difficult to rely on variations between communities at a zip code scale as community predictors for relocation.

6.3. Environmental Factors

Proximity of coastal hazards has an interesting effect on relocation and buyout consideration. Distance to the coast has a significant positive relationship with buyout consideration but not relocation consideration. Individuals living closer to the coast are less likely to consider participating in a buyout program than those living further away. This may be due to the perception of coastal proximity as an environmental amenity, rather than a hazard. Zhang et al. (2010) review the effect of natural and technological hazards on property values. They note that some environmental features, such as proximity to water or the beach, increase property values, however, perceptions of risk in that area mediate this effect. At such a broad scale, the results presented here may be picking up on the effect of proximity as an environmental amenity rather than perceived risk following exposure to major hurricanes.

An individual's zip code falling within a leveed area has a significant positive effect on relocation consideration but not buyout consideration. Leveed areas are defined by the U.S. Army Corps of Engineers (USACE) as areas from which water has been excluded by a levee (USACE, n.d.). This definition seems to indicate that these areas have been engineered in some way to reduce flooding. When compared to FEMA's National Hazard Flood Layer, however, these areas have mixed levels of flood risk. In other words, "leveed areas" may be composed of patches of Zone A (1-percent annual chance of flood), Zone B (0.2-percent-annual-chance of

flood), and Zone X (areas of minimal flood hazard) (FEMA, 2019). However, review of the 2011 National Land Cover Database provided by the U.S. Geological Survey shows that these areas are composed of 30% cultivated crops, 34% wetlands, 9% pastureland, and 9% low intensity development (USGS, 2014).[8] While, it is not immediately apparent why living in a zip code that partially falls within leveed area would increase individual relocation considerations, especially when considering that this effect is insignificant (and reversed) for buyout consideration, it may be influenced by the closer proximity to primarily flat and inundated land cover. Future analysis may be needed to assess other environmental and risk conditions of "leveed areas" defined by USACE to better understand how this affects relocation attitudes of coastal residents.

[8] Land cover analysis was conducted by extracting land cover classifications of the zip code areas falling within leveed areas. These classifications were aggregated to assess percent land cover type. These areas are composed of 29.5% cultivated crops, 34.2% wetlands, 9.3% pastureland, 9.1% developed low intensity, 5.0% developed open space, and less than 5% of all other land cover types.

7. LIMITATIONS

Although this study provides insight into significant driving factors of relocation consideration along the Gulf Coast, it is important to note the limitations of the findings from this study. Most importantly, these results cannot necessarily be used to predict relocation behaviors. Respondents replied to questions asking about their considerations of moving away or participating in a home buyout question, not if they intend to move or participate. Relocation—unmanaged or compensated through a home buyout—still requires significant household resources to re-establish elsewhere. Furthermore, this model does not directly measure household financial resources which has been shown to have a significant effect on relocation decisions following a major disaster (Bukvic et al., 2015).

The model constructed is also limited by the data available. For example, while social capital can be measured in a number of ways (Aldrich, 2012), this study relied on measurements primarily capturing community involvement characteristic of bridging and linking social capital. Bonding social capital, built through relationships with friends and neighbors, is left entirely unmeasured. Some scholars have found that relocation decisions are also dependent on the relocation behaviors of someone's friends and neighbors (McLeman, 2018; Gibbons and Nicholls, 2005). Once there is significant migration out of a specific neighborhood, those left will be more likely to follow. Similarly, Simms (2017) highlights the importance of sense of place in reducing relocation considerations. Future studies should incorporate effects of bonding social capital with particular attention to sense of place.

This model also does not measure potential "pull" factors on individual considerations such as specific employment opportunities or family in another location. These are resources that

would likely have an impact on relocation considerations and implementation (McLeman, 2018). Future studies of hazard migration should consider addressing pull factors or economic and social characteristics of target communities (i.e. communities to which an individual migrates). Despite these limitations, this study offers a unique insight into factors influencing relocation considerations across the entire Gulf Coast that should be used to guide future analyses at a local scale to inform policy development.

8. CONCLUSIONS

Gulf Coast communities are highly vulnerable to increasing coastal hazards potentially causing an outmigration of millions of residents over the next eighty years. Without policy interventions, unmanaged migration may undermine other efforts to foster sustainability and community resilience. Facilitating migration through resettlement or home buyout programs requires significant political will and buy-in. Knowing if and under what circumstances coastal residents consider relocation (i.e. unmanaged migration, formal resettlement, or home buyouts) can help communities make more proactive decisions for hazard mitigation interventions to foster resilience to growing coastal hazards.

This study took a regional approach to assessing relocation attitudes of Gulf Coast residents following exposure to severe weather events. This study uses two measures of relocation attitudes: 1) individual relocation consideration and 2) home buyout consideration. The objective of this analysis is to see if and under what circumstances an individual considers hazard relocation and if these circumstances vary between different migration strategies. The results indicate that a number of individual and environmental factors influence relocation attitudes and that these factors vary between relocation strategies. Relocation considerations are highly dependent on access to resources and personal assessments of risk. The differences between individual relocation and buyout motivations, however, suggest that offered compensation may influence individual decision-making processes for hazard migration. Findings from this analysis provide a new benchmark and direction for future studies assessing migration potential and buy-in within Gulf Coast communities under changing environmental conditions.

REFERENCES

Abel, J. R., and Deitz, R. (2014). Do the Benefits of College Still Outweigh the Costs? *Current Issues in Economics and Finance*, 20(3).

Aldrich, D. P. (2012). *Building Resilience: Social Capital in Post-Disaster Recovery*. Chicago, IL: The University of Chicago Press.

Baker, C. K., Binder, S. B., Greer, A., Weir, P., and Gates, K. (2018). Integrating Community Concerns and Recommendations into Home Buyout and Relocation Policy. *Risk, Hazards & Crisis in Public Policy*, 9(4), 455–479. https://doi.org/10.1002/rhc3.12144

Bardsley, D. K., and Hugo, G. J. (2010). Migration and climate change: examining thresholds of change to guide effective adaptation decision-making. *Population and Environment*, 32(2–3), 238–262. https://doi.org/10.1007https://www.mrlc.gov/data/nlcd-2011-land-cover-conus/s11111-010-0126-9

Battaglia, M. P. (2011). Nonprobability Sampling. *Encyclopedia of Survey Research Methods*. 2008. SAGE Publications.

Bergmann, Michael. (2011). IPFWEIGHT: Stata module to create adjustment weights for surveys.

Bergquist, M., Nilsson, A., and Schultz, P. W. (2019). Experiencing a Severe Weather Event Increases Concern About Climate Change. *Frontiers in Psychology*, 10. https://doi.org/10.3389/fpsyg.2019.00220

Binder, S. B., Barile, J. P., Baker, C. K., and Kulp, B. (2019). Home buyouts and household recovery: neighborhood differences three years after Hurricane Sandy. *Environmental Hazards*, 18(2), 127–145. https://doi.org/10.1080/17477891.2018.1511404

Binder, S. B., and Greer, A. (2016). The Devil Is in the Details: Linking Home Buyout Policy, Practice, and Experience After Hurricane Sandy. *Politics and Governance*, 4(4), 97. https://doi.org/10.17645/pag.v4i4.738

Black, R., Adger, W. N., Arnell, N. W., Dercon, S., Geddes, A., and Thomas, D. (2011). The effect of environmental change on human migration. *Global Environmental Change*, 21, S3–S11. https://doi.org/10.1016/j.gloenvcha.2011.10.001

Bott, L.M. (2016). Linking Migration and Adaptation to Climate Change: How Stakeholder Perceptions Influence Adaptation Processes in Pakistan. *Internationales Asienforum*, 47(3-4): 179-201.

Botzen, W. J. W., Aerts, J. C. J. H., and Bergh, J. C. J. M. van den. (2009). Dependence of flood risk perceptions on socioeconomic and objective risk factors. *Water Resources Research*, 45(10). https://doi.org/10.1029/2009WR007743

Botzen, W. J. W., Aerts, J. C. J. H., and van den Bergh, J. C. J. M. (2009). Willingness of homeowners to mitigate climate risk through insurance. *Ecological Economics*, 68(8–9), 2265–2277. https://doi.org/10.1016/j.ecolecon.2009.02.019

Botzen, W. J. W., Michel-Kerjan, E., Kunreuther, H., de Moel, H., and Aerts, J. C. J. H. (2016). Political affiliation affects adaptation to climate risks: Evidence from New York City. *Climatic Change*, 138(1–2), 353–360. https://doi.org/10.1007/s10584-016-1735-9

Boustan, L. P., Kahn, M. E., and Rhode, P. W. (2012). Moving to Higher Ground: Migration Response to Natural Disasters in the Early Twentieth Century. American Economic Review, 102(3), 238–244. https://doi.org/10.1257/aer.102.3.238

Burby, R. (2006). Hurricane Katrina and the paradoxes of government disaster policy: Bringing about wise governmental decisions for hazardous areas. *The Annals of the American*

Academy of Political and Social Science, 604, 171–191. doi:10.1177/0002716205284676

Brody, S. D., Lee, Y., and Highfield, W. E. (2017). Household adjustment to flood risk: a survey of coastal residents in Texas and Florida, United States. *Disasters*, 41(3), 566–586. https://doi.org/10.1111/disa.12216*138*(1–2), 353–360. https://doi.org/10.1007/s10584-016-1735-9

Bubeck, P., Botzen, W. J. W., and Aerts, J. C. J. H. (2012). A Review of Risk Perceptions and Other Factors that Influence Flood Mitigation Behavior: Review of Flood Risk Perceptions. *Risk Analysis, 32*(9), 1481–1495. https://doi.org/10.1111/j.1539-6924.2011.01783.x

Centers for Disease Control and Prevention. (2019). *The Social-Ecological Model: A Framework for Prevention*. Retrieved March 25, 2019, from https://www.cdc.gov/violenceprevention/publichealthissue/social-ecologicalmodel.html

Dalbom, C., S. Hemmerling, and J. Lewis. (2014). Community Resettlement Prospects in Southeast Louisiana: A Multidisciplinary Exploration of Legal Cultural and Demographic Aspects of Moving Individuals and Communities. *An Issue Paper of the Tulane Institute on Water Resources Law and Policy*, New Orleans, Louisiana: Tulane University.

Davenport, C. and Robertson, C. (2016, May 3). "Resettling the First American 'Climate Refugees.'" *The New York Times.* Retrieved from www.nytimes.com/2016/05/03/us/resettling-the-first-american-climate-refugees.html

Davlasheridze, M., and Fan, Q. (2017). Household Adjustments to Hurricane Katrina. *The Review of Regional Studies*, 47, 92-112.

Davlasheridze, M., and Geylani, P. C. (2017). Small Business vulnerability to floods and the

effects of disaster loans. Small Business Economics, 49(4), 865–888. https://doi.org/10.1007/s11187-017-9859-5

DeWaard, J., Curtis, K. J., and Fussell, E. (2016). Population recovery in New Orleans after Hurricane Katrina: exploring the potential role of stage migration in migration systems. *Population and Environment*, 37(4), 449–463. https://doi.org/10.1007/s11111-015-0250-7

EIA. (2017). *Gulf of Mexico fact sheet*. Retrieved from https://www.eia.gov/special/gulf_of_mexico

ESRI. (2018). Light Gray Canvas Basemap. Retrieved from ArcGIS.com

Elliott, J. R., and Pais, J. (2006). Race, class, and Hurricane Katrina: Social differences in human responses to disaster. *Social Science Research*, *35*(2), 295–321. https://doi.org/10.1016/j.ssresearch.2006.02.003

FEMA. (2015). *Hazard Mitigation Assistance Guidance*. Retrieved from https://www.fema.gov/media-library-data/1424983165449-38f5dfc69c0bd4ea8a161e8bb7b79553/HMA_Guidance_022715_508.pdf

FEMA. (2018). *Disaster Declarations by Year*. Retrieved December 8, 2018, from https://www.fema.gov/disasters/year/2017?field_dv2_declaration_type_value=DR

FEMA. (2019). *National Flood Hazard Layer*. Retrieved from https://www.fema.gov/national-flood-hazard-layer-nfhl

Fussell, E. (2015). The Long Term Recovery of New Orleans' Population after Hurricane Katrina. *The American Behavioral Scientist*, 59(10), 1231–1245. https://doi.org/10.1177/0002764215591181

Fussell, E., Sastry, N., and VanLandingham, M. (2010). Race, socioeconomic status, and return

migration to New Orleans after Hurricane Katrina. *Population and Environment*, 31(1–3), 20–42. https://doi.org/10.1007/s11111-009-0092-2

Gemenne, F., and Blocher, J. (2017). How can migration serve adaptation to climate change? Challenges to fleshing out a policy ideal. *The Geographical Journal*, *183*(4), 336–347. https://doi.org/10.1111/geoj.12205

Gibbons, S. J., and Nicholls, R. J. (2006). Island abandonment and sea level rise: An historical analog from the Chesapeake Bay, USA. *Global Environmental Change*, 16: 40-47.

Greer, A., and Brokopp Binder, S. (2017). A Historical Assessment of Home Buyout Policy: Are We Learning or Just Failing? *Housing Policy Debate*, 27(3), 372–392. https://doi.org/10.1080/10511482.2016.1245209

Groen, J. A., and Polivka, A. E. (2010). Going home after Hurricane Katrina: Determinants of return migration and changes in affected areas. Demography, 47(4), 821–844. https://doi.org/10.1007/BF03214587

Grothmann, T., and Reusswig, F. (2006). People at Risk of Flooding: Why Some Residents Take Precautionary Action While Others Do Not. *Natural Hazards*, 38(1–2), 101–120. https://doi.org/10.1007/s11069-005-8604-6

Hauer, M. E., Evans, J. M., and Mishra, D. R. (2016). Millions projected to be at risk from sea-level rise in the continental United States. *Nature Climate Change*, 6(7), 691–695. https://doi.org/10.1038/nclimate2961

Hauer, M. E. (2017). Migration induced by sea-level rise could reshape the US population landscape. *Nature Climate Change*, 7(5), 321–325. https://doi.org/10.1038/nclimate3271

HCFCD. (n.d.). *Home Buyout Program*. Retrieved from https://www.hcfcd.org/hurricane-harvey/home-buyout-program/

Hunter, L. M. (2005). Migration and Environmental Hazards. *Population and Environment*, *26*(4), 273–302. https://doi.org/10.1007/s11111-005-3343-x

InTeGrate. (2017) *Module 10: Understanding and assessing coastal vulnerabilities*. Retrieved from https://serc.carleton.edu/integrate/teaching_materials/coastlines/student_materials/1443

Lim, Y.-K., Schubert, S. D., Kovach, R., Molod, A. M., and Pawson, S. (2018). The Roles of Climate Change and Climate Variability in the 2017 Atlantic Hurricane Season. *Scientific Reports*, 8(1). https://doi.org/10.1038/s41598-018-34343-5

Ludy, J., and Kondolf, G. M. (2012). Flood risk perception in lands "protected" by 100-year levees. *Natural Hazards*, 61(2), 829–842. https://doi.org/10.1007/s11069-011-0072-6

Marino, E. (2012). The long history of environmental migration: Assessing vulnerability construction and obstacles to successful relocation in Shishmaref, Alaska. *Global Environmental Change*, 22(2), 374–381. https://doi.org/10.1016/j.gloenvcha.2011.09.016

McLeman, R. (2018). Thresholds in climate migration. *Population and Environment*, *39*(4), 319–338. https://doi.org/10.1007/s11111-017-0290-2

McLeman, R. A., and Hunter, L. M. (2010). Migration in the context of vulnerability and adaptation to climate change: insights from analogues: Migration and adaptation to climate change. *Wiley Interdisciplinary Reviews: Climate Change*, *1*(3), 450–461. https://doi.org/10.1002/wcc.51.

McCright, A. M., and Dunlap, R. E. (2011). The Politicization of Climate Change and Polarization in the American Public's Views of Global Warming, 2001-2010. *Sociological Quarterly*, 52(2): 155.

National Academies of Sciences, Engineering, and Medicine. (2018). *Understanding the Long-*

Term Evolution of the Coupled Natural-Human Coastal System: The Future of the U.S. Gulf Coast. Washington, DC: The National Academies Press. doi: https://doi.org/10.17226/25108

Neumann, B., Vafeidis, A. T., Zimmermann, J., and Nicholls, R. J. (2015). Future coastal population growth and exposure to sea-level rise and coastal flooding--a global assessment. *Plos One*, *10*(3), e0118571. doi:10.1371/journal.pone.0118571

NOAA. (n.d.a). *Hurricane Costs.* Retrieved December 21, 2018, from https://coast.noaa.gov/states/fast-facts/hurricane-costs.html

NOAA. (n.d.b). *2017 Atlantic Hurricane Season*. Retrieved July 19, 2018, from https://www.nhc.noaa.gov/data/tcr/index.php?season=2017&basin=atl

Phillips, B. (2015). *Disaster recovery* (2nd ed.). Boca Raton, FL: CRC Press.

Robinson, C. S., Davidson, R. A., Trainor, J. E., Kruse, J. L., & Nozick, L. K. (2018). Homeowner acceptance of voluntary property acquisition offers. *International Journal of Disaster Risk Reduction*, 31, 234–242. https://doi.org/10.1016/j.ijdrr.2018.05.002

Simms, J. R. Z. (2017). "Why Would I Live Anyplace Else?": Resilience, Sense of Place, and Possibilities of Migration in Coastal Louisiana. *Journal of Coastal Research*, 33(2), 408-420.

Smith, V. K., Carbone, J. C., Pope, J. C., Hallstrom, D. G., and Darden, M. E. (2006). Adjusting to natural disasters. Journal of Risk and Uncertainty, 33(1–2), 37–54. https://doi.org/10.1007/s11166-006-0170-0

Stringfield, J. D. (2010). Higher ground: an exploratory analysis of characteristics affecting returning populations after Hurricane Katrina. *Population and Environment*, *31*(1–3), 43–63. https://doi.org/10.1007/s11111-009-0095-z

Stojanov, R., Duží, B., Kelman, I., Němec, D., and Procházka, D. (2017). Local perceptions of climate change impacts and migration patterns in Malé, Maldives. *The Geographical Journal*, 183(4), 370–385. https://doi.org/10.1111/geoj.12177

Tierney, K. (2014). *The Social Roots of Risk: producing disasters, promoting resilience*. Stanford, CA: Stanford University Press.

USGS. (2014). *NLCD 2011 Land Cover (2011 Edition, amended 2014)*. Retrieved from https://www.mrlc.gov/data/nlcd-2011-land-cover-conus

USACE. (n.d.). *The National Levee Database*. Retrieved from https://levees.sec.usace.army.mil/#/

Vigdor, J. (2008). The Economic Aftermath of Hurricane Katrina. Journal of Economic Perspectives, 22(4), 135–154. https://doi.org/10.1257/jep.22.4.135F

Villarini, G., and Vecchi, G. A. (2013). Projected Increases in North Atlantic Tropical Cyclone Intensity from CMIP5 Models. *Journal of Climate*, 26(10), 3231–3240. https://doi.org/10.1175/JCLI-D-12-00441.1

Walsh, F. (2016). Family resilience: a developmental systems framework. *European Journal of Developmental Psychology*, 13(3), 313–324. https://doi.org/10.1080/17405629.2016.1154035

Wobus, C. Gutmann, E., Jones, R., Rissing, M. Mizukami, N., Lorie, M., Mahoney, H., Wood, A. W., Mills, D., and Martinich, J. (2017). Climate change impacts on flood risk and asset damages within mapped 100-year floodplain of the contiguous United States. *Natural Hazards Earth Systems Science*, 17: 2199-2211.

Zhang, Y., K. Lindell, and S. N. Hwang. (2010). "Hazard proximity or risk perception? Evaluating effects of natural and technological hazards on housing values." *Environment*

and Behavior 42(5): 597-624.

APPENDIX A: VARIABLE MEASUREMENTS AND DATA SOURCES

Variable	Measure	Coding	Hypothesis	Data Source
DEPENDENT VARIABLES				
Relocation	Have you ever considered moving to another place where the threat of natural disasters is smaller?	1 = yes 0 = no	n/a	2017 Gulf Coast Survey
Buy-Out	Have you ever considered (or would you consider) a home buyout program because your house is located in a place where flooding frequently occurs?	1 = yes 0 = no	n/a	2017 Gulf Coast Survey
INDIVIDUAL FACTORS				
Home Ownership	Do you own or rent your home?	1 = Own 0 = Rent	-	2017 Gulf Coast Survey
Education	What is the highest level of degree you have earned?	1 = High school 2 = Some college 3 = Associate's degree 4 = Bachelor's degree, master's degree, doctorate degree, medical degree, or law degree	+	2017 Gulf Coast Survey
Age	Please select your age range.	1 = 18-24 years 2 = 25-44 years 3 = 45-64 years 4 = 65 years and older	-	2017 Gulf Coast Survey
Minority Race	Which of the following do you most closely identify with?	0 = White 1 = Latino or Hispanic, African American, or Other race/ethnicity	+	2017 Gulf Coast Survey
Female	What is your gender?	0 = Male 1 = Female	-	2017 Gulf Coast Survey
Disaster Experience	What impact did the hurricane this year have on your home and personal property?	0 = No threat of a hurricane in 2017 Scale of 1 (none) to 101 (extreme devastation)	+	2017 Gulf Coast Survey
Risk Perception	Indicate your agreement with each the following statements on scale in which 1=strongly disagree and 5=strongly agree: 1) I'm worried about the danger of a storm surge on the Gulf Coast. 2) A storm surge can have fatal consequences for the coastal area and its inhabitants. 3) Living on the Gulf Coast is a threat to my safety. 4) I greatly expect a storm surge to cause floods in coastal areas. 5) When I think of floods, I feel concerned.	Factor score where higher values indicate greater risk perception (i.e. the community would experience greater damage due to one of these events)	+	2017 Gulf Coast Survey
Vulnerability Assessment	How much harm do you think would come to you personally (to your family, property, job, etc.) if the following were to happen? Assume each hazard is of moderate intensity. 1) Hurricane wind 2) Flooding from rainfall 3) Flooding from river overflow 4) Tornado	Factor Score where higher values indicate higher vulnerability assessment (i.e. more damage would occur to self and property)	+	2017 Gulf Coast Survey

APPENDIX A Continued

Variable	Measure	Coding	Hypothesis	Data Source
DEPENDENT VARIABLES				
Political Ideology	Here is a 7-point scale on which the political views that people might hold are arranged from extremely liberal to extremely conservative. Where would you place yourself on this scale?	1 = Liberal 2 = Moderate 3 = Conservative	-	2017 Gulf Coast Survey
Social Capital	How many times in the past 12 months have you...? 1) Worked on a community project; 2) Attended a public meeting about town or school affairs; 3) Attended a political meeting or rally 4)Attended any club or organizational meeting 5)Been in the home of someone you consider to be a community leader or had one in your home	Factor score where a higher score indicates higher social capital	+	2017 Gulf Coast Survey
COMMUNITY FACTORS				
Median Income	Median income of respective zip code	Natural log of median income	-	US Census Bureau American Community Survey 2016 5-Year Estimates
Work Commute	Average work commute from a respective zip code	Average work commute of those in the labor force within respective zip code	+	US Census Bureau American Community Survey 2016 5-Year Estimates
ENVIRONMENTAL FACTORS				
Distance to the Coast	Proximity to the coast	Distance from zip code centroid to nearest coastline	-	NOAA Medium Resolution Shoreline and US Census Bureau County Boundaries
Within Leveed Area	Proportion of respective zip code falling within a leveed area	Percent area of respective zip code falling within USACE defined leveed areas (i.e. area from which water is excluded by a levee)	-	USACE National Levee Database Leveed Areas

APPENDIX B: VARIABLE CORRELATION MATRIX

	Reloc.	Buyout	Ed.	Age	Female	Minor.	Home Own	Social Capital	2017 Dis. Exp.	Risk Percep.	Vuln. Assess.	Pol. Ideol.	Work Comm.	Med. Income	Dist. Coast	Levee Area
Relocation	1.0000															
Buyout	0.3276*	1.0000														
Education	0.0433*	0.0600*	1.0000													
Age	-0.2069*	-0.1085*	0.1963*	1.0000												
Female	0.0494*	-0.0459*	-0.2370*	-0.3291*	1.0000											
Minority	0.1102*	0.0467*	-0.1644*	-0.4448*	0.3705*	1.0000										
Home Owner	-0.1092*	0.0517*	0.2543*	0.2862*	-0.2153*	-0.2649*	1.0000									
Social Capital	0.2512*	0.2582*	0.2272*	-0.1783*	-0.0615*	-0.2649*	0.1220*	1.0000								
2017 Disaster Experience	0.2013*	0.1794*	-0.0348	-0.2504*	0.0773*	0.1801*	-0.0887*	0.3364*	1.0000							
Risk Perception	0.1428*	0.1010*	0.0583*	-0.0282	0.0583*	-0.0364	0.0289	0.0771*	0.0954*	1.0000						
Vulnerability Assessment	0.2300*	0.1500*	-0.0461*	-0.2496*	0.1671*	0.1429*	-0.0737*	0.2020*	0.3169*	0.3283*	1.0000					
Political Ideology	-0.1333*	-0.0556*	-0.0253	0.1985*	-0.1064*	-0.1761*	0.1100*	-0.0923*	-0.0970*	-0.1212*	-0.1560*	1.0000				
Average Work Commute	-0.0636*	0.0342	-0.0128	0.0142	-0.0005	-0.0215	0.0998*	-0.0408*	-0.0106	-0.0277	-0.0315	0.0392*	1.0000			
Median Income	-0.0713*	0.0150	0.2004*	0.1376*	-0.1159*	-0.1735*	0.1689*	-0.0053	-0.0443*	-0.0095	-0.0716*	0.0968*	0.2707*	1.0000		
Distance to Coast	-0.0006	0.0796*	0.0047	-0.1169*	-0.0207	0.0748*	0.0095	0.0283	0.0245	0.0228	0.0524*	0.0129	0.3627*	0.1470*	1.0000	
Within Leveed Area	0.0878*	0.0064	0.0170	-0.0347*	-0.0376*	0.0128	-0.0124	0.0228	-0.0911*	0.0586*	0.0905*	-0.0270	-0.2035*	-0.1207*	0.0922*	1.0000

APPENDIX C: FACTOR SCORE CONSTRUCTION

Principal component factor analysis was used to create a factor scores for social capital, risk perception, and vulnerability assessment. Tables C1, C2, and C3 report the factor loadings and Cronbach's alpha for each variable created. All of the Cronbach alphas indicate sufficient to high reliability of their respective factor scores.

Table C1. Social Capital

Scale Items	Factor Loading
Worked on a community project	0.8007
Attended a public meeting about town or school affairs	0.8311
Attended a political meeting or rally	0.8180
Attended any club or organizational meeting	0.7425
Been in the home of someone you consider to be a community leader or had one in your home	0.7570
Percentage of Variance	62.51
Eigenvalue	3.12534
Cronbach's alpha	0.8437

Table C2. Risk Perception

Scale Items	Factor Loading
I'm worried about the danger of a storm surge on the Gulf Coast.	0.8480
A storm surge can have fatal consequences for coastal areas.	0.7561
Living on the Gulf Coast is a threat to my safety.	0.7242
I greatly expect a storm surge to cause floods in coastal areas.	0.8070
When I think of floods, I feel concerned.	0.8065
Percentage of Variance	62.34
Eigenvalue	3.1169
Cronbach's alpha	0.8475

Table C3. Vulnerability Assessment

Scale Items	Factor Loading
Hurricane wind	0.25476
Flooding from rainfall	0.28564
Flooding from river overflow	0.30483
Tornado	0.20462
Percentage of Variance	54.65
Eigenvalue	2.73266
Cronbach's alpha	0.7868

APPENDIX D: SEPARATE MODELS OF INDIVIDUAL, COMMUNITY, & ENVIRONMENTAL FACTORS

	Individual		Community		Environmental	
	Relocation	**Buyout**	**Relocation**	**Buyout**	**Relocation**	**Buyout**
Education: Some College	-0.002	0.043				
	(0.118)	(0.119)				
Education: Associate's Degree	0.168	0.117				
	(0.136)	(0.137)				
Education: Bachelor's or Post-Graduate Degree	0.276*	-0.042				
	(0.152)	(0.151)				
Age: 25-44 Years	-0.205	-0.093				
	(0.138)	(0.140)				
Age: 45-64 Years	-0.559***	-0.227				
	(0.156)	(0.159)				
Age: 65+ Years	-0.751***	-0.497***				
	(0.176)	(0.180)				
Female	-0.086	-0.343***				
	(0.101)	(0.102)				
Minority	0.090	0.167				
	(0.102)	(0.106)				
Home Owner	-0.483***	0.232**				
	(0.099)	(0.100)				
Social Capital	0.392***	0.405***				
	(0.049)	(0.047)				
2017 Disaster Experience	0.004**	0.006***				
	(0.002)	(0.002)				
Risk Perception	0.196***	0.142***				
	(0.050)	(0.048)				
Vulnerability Assessment	0.286***	0.152***				
	(0.052)	(0.052)				
Political Ideology: Moderate	-0.360***	-0.252**				
	(0.109)	(0.110)				
Political Ideology: Conservative	-0.318***	-0.056				
	(0.114)	(0.115)				
Average Work Commute			-0.021**	0.015		
			(0.009)	(0.009)		
Median Income			-0.364***	0.043		
			(0.126)	(0.125)		
Proximity to Coast					-0.001	0.009***
					(0.002)	(0.002)
Within Leveed Area					0.734***	-0.004
					(0.160)	(0.169)
Constant	0.048	-0.762***	3.835***	-1.637	-0.689***	-0.973***
	(0.193)	(0.199)	(1.322)	(1.317)	(0.061)	(0.064)
N	2,850	2,850	2,842	2,842	2,850	2,850

Notes: Ordered logit analysis estimated. Coefficients reported with standard errors in parentheses. Statistical significance noted as: *** p<0.01, ** p<0.05, and * p<0.1

APPENDIX E: DEMOGRAPHICS OF SURVEY RESPONDENTS WHO CONSIDERED RELOCATION OR HOME BUYOUT PROGRAMS

Respondents Who Considered Relocation		Respondents Who Considered Participating in a Home Buyout	
High School Education	22.08%	High School Education	20.15%
Some College	23.82%	Some College	35.71%
Associate's Degree	23.30%	Associate's Degree	25.71%
Bachelor's or Other Post-Graduate Degree	18.87%	Bachelor's or Other Post-Graduate Degree	18.42%
18-24 Years Old	17.29%	18-24 Years Old	14.70%
25-44 Years Old	44.00%	25-44 Years Old	40.24%
45-64 Years Old	27.80%	45-64 Years Old	31.54%
65+ Years Old	10.91%	65+ Years Old	13.52%
Minority	51.99%	Minority	47.87%
Female	54.89%	Female	48.09%
Liberal Ideology	35.52%	Liberal Ideology	32.55%
Moderate Ideology	36.18%	Moderate Ideology	34.15%
Conservative Ideology	28.30%	Conservative Ideology	33.30%

APPENDIX F: LOGIT REGRESSION COEFFICIENTS FOR BUYOUT CONSIDERATION OF HOMEOWNERS

Education: Some College	0.042
	(0.167)
Education: Associate's Degree	0.199
	(0.177)
Education: Bachelor's or Post-Graduate Degree	0.087
	(0.190)
Age: 25-44 Years	-0.155
	(0.205)
Age: 45-64 Years	-0.131
	(0.220)
Age: 65+ Years	-0.465**
	(0.236)
Minority	0.070
	(0.132)
Female	-0.280**
	(0.126)
2017 Disaster Experience	0.005**
	(0.002)
Risk Perception	0.181***
	(0.064)
Vulnerability Assessment	0.158**
	(0.052)
Political Ideology: Moderate	-0.104
	(0.139)
Political Ideology: Conservative	-0.045
	(0.141)
Social Capital	0.400***
	(0.048)
Average Work Commute	0.019
	(0.013)
Median Income	-0.050
	(0.170)
Distance to Coast	0.003
	(0.003)
Within Leveed Area	0.012
	(0.237)
Constant	-0.677
	(1.796)
N	1,861

Note: Ordered logit analysis estimated. Coefficients reported with standard errors in parentheses. Statistical significance noted as: *** p<0.01, ** p<0.05, and * p<0.10.