Assessing the Impact of Industry Resilience as a Function of Community Resilience:

The Case of Natural Disasters

Dissertation

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

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Abstract

This dissertation examines the impact of natural disasters and five types of community resources or capital stocks (social, economic, physical, human, and natural capital), on three measures of hospitality industry survival (the impact on restaurant and hotel units; number of jobs; and annual payroll) at the county level of analysis using population level data from the U.S. Census Bureau. The investigation and explanation of the effects of natural disasters on restaurants and hotels in the hospitality industry form the core purpose of the research. The secondary purpose is to understand the impact of community resources on industry resilience.

Research in this area has been limited and produced confounding results. Researchers in the hospitality industry embrace different approaches to recovery and resilience hospitality when analyzing the effects of natural disasters. There is an understandably heightened concern for the safety and protection of guests during extreme hazard events, so that recovery and resilience almost always refers to the evacuation of guests to safe shelters and the preservation of life. This research however is interested in the effects of natural disasters on the survival of businesses that comprise the hospitality industry sector, restaurants and hotels, in the North Central region of the United States.
This question has not been posed or answered before with population level data for the hospitality industry. This research also purports that businesses do not exist in isolation but, rather, in relationship with the communities in which they reside, so that what happens to the community also impacts businesses in the community. As such, the second research question investigates aspects of the community that may impact hospitality industry resilience.

This research takes on the empirical challenge of merging multiple public use data sets. The data used for the analysis of industry resilience were counties in the North Central region of the U.S. from 1998 to 2000 (n=983). The major obstacle to this and similar analyses has been lack of complete data. This obstacle was overcome by merging data sets using Federal Information Processing system (FIPS) codes. Datasets included the Census County Business Patterns (CBP) which provided industry data; the Northeast Regional Center for Rural Development provided social capital data; the Cooperative Regional Research Project NC 1030, partially supported by the U.S.D.A., provided human, economic, physical and natural capital data; and the University of South Carolina’s SHELDUS dataset provided disaster data. The analysis may increase our understanding of why some hospitality and tourism firms recover from natural disasters and others do not, referenced as firm resilience in the current research.

The primary dependent variable is the change in the number of establishments; the change in the number of jobs; and the change in the annual payroll of hospitality and tourism establishments at the county level in the 11 states of the North Central region of the U.S. Our predictor variables are county-level measures of social, human, physical,
economic, and natural capital as developed by Mayunga, 2007. We conduct SPSS and regression analysis to understand the role of community resilience on hospitality and tourism industry resilience. The model that best predicts outcomes on the hospitality industry indicates that community capitals are significant indicator variables for industry resilience in the North Central region of the U.S. Indirect effects of natural disasters explain a greater proportion of the change in hospitality industry resilience than do direct effects.

KW: survival; resilience; disasters; capital stocks; hospitality industry
Dedication

This dissertation is dedicated to my mother and in memory of my father whose embrace of an imaginative life; service to God through their dedication to humanity; steadfast commitment to education; love of reading; appreciation of nature; and modeling of the sublime pleasure received from great food, have taught me, Jeffery, and Cassie about all there is to fundamentally know.

My father, by example, taught me that persistence and determination alone are omnipotent and that imagination is more important than knowledge. He continues to encourage the best in us all.

And it is my mother, without whose support of me, Jeffery, and Cassie, I simply would not have had the life I have. I thank her; she is the blinking beacon of the lighthouse on the dark shore. My joy would be incomplete without my best friends and children, Jeffery and Cassie, and my husband, Moustapha. How lucky am I, to have the three people that thrill me so, under my own roof?
Acknowledgments

This research would not have been possible without the advice of my co-advisors Dr. Kathryn Stafford and Dr. Jay Kandampully, and Dr. Michael Tews.

The space allotted to me here, is insufficient for my appreciation of Kay Stafford. Under her tutelage, I have learned how to really interpret research findings and the eloquence of a simple, straightforward statistical procedure. However, I have also learned so much about how to think; how to write; and what to do when you do not know what to do (keep going). I consider myself fortunate to be among those students to have been selflessly mentored by her. Her commitment to graduate students is nothing short of miraculous. I hope to be in her midst for a long time to come, and that I repay the gift she has given by making her glad she invested in me in the ways that she did.

My road would have been more laborious and dreary were it not for Jay Kandampully’s constant support and belief in my ability to make it this far. His perennial refrain of ‘start writing’ made me believe that I could start writing and end up with one page of meaningful text, then maybe two, until at the end I was thankfully done. More importantly, the transparent moments when he shared his great triumphs, challenges, and values have left an indelible impression on my spirit. Jay believed in me and was
committed to throwing me from the nest so I could fly. In the end, it was as critical as the models of which he is so fond of drawing on the white board, insisting that this work ultimately answer the ‘so what’ question.

I thank Michael for his brevity during calamity, a balm in a sometimes turbulent sea. I appreciate the counsel he offered that kept me on top of what I should be doing next. This document has benefited greatly from his advice (and warnings), his finely-honed editing skills, and his reassurance that this is manageable. I thank him for sharing his technical wizardry on formatting slides, presentations, posters, and tables; it is beyond compare! I am not only left with a well-trained eye for clear, concise writing, communication but a model for exemplary classroom administration and teaching. Moreover, I appreciate his candor and friendship.

A very warm thank you must be extended to Dr. Catherine Montalto; absent her thorough and expert navigation through multiple lines of communication with The Graduate School, I am most certain I might still be waiting in the wings for official documentation that my candidacy exam results really do exist. There must exist a very special place in heaven for those detailed-oriented souls that rescue the detail-challenged in this life.
Vita

Academic Experience

1974 .................... Muskegon Heights High School
1979 .................... B.S., Packaging Engineering, Michigan State University
1989 .................... MBA, University of Miami (FL)
1979-1988 ............... The Burger King Corporation (Miami, FL)
1988-2003 ............... The Burger King Corporation (Franchisee)
1994-1999 ............... Franklin University, MBA Faculty
1999-2000 ............... Zero Base Advertising
2000-2005 ............... The Global Growth Group
2005-2009 ............... Graduate Teaching Associate, Consumer Sciences
                         The Ohio State University

Publications


consumers’ brand selection process and identification of brand attributes in a service

Fields of Study

Major Field: Human Ecology
Area of Focus: Hospitality Management
Minor Area: Strategy & Entrepreneurship
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Assessing the Impact of Industry Resilience as a Function of Community Resilience:

The Case of Natural Disasters
Chapter 1: Introduction

Businesses are essential and beneficial for society and they play an increasingly important socio-economic role in community life, due to the interdependencies between businesses and their environment in the form of taxes, customers, suppliers, and job creation. Businesses provide goods and services that consumers cannot grow, raise, manufacture, or do, and the financial returns these providers of goods and services yield enable communities to continue. Because of organizations, consumers are able to concentrate their time and efforts on those activities central to the ways in which they choose to live, maximizing their utilities.

The businesses of interest in this study are restaurants and hotels in the hospitality industry. The US hospitality industry is a critical source of domestic and international activity. The restaurant industry alone accounts for 14 million jobs and produces a $1.5 trillion impact on the U.S. economy. For every dollar spent in a restaurant, more than two dollars are generated in supporting industries. This industry is larger than the U.S. agricultural industry, the U.S. airline industry and the U.S. motion picture industry combined (QSR Magazine, 5/18/ 2009). Given its importance to the economy, the
sustainability and resilience to environmental threats to the industry is relevant to the
genral public as well as owners and employees.

Survival is a particular challenge for businesses in the hospitality industry
(Kusluvan, 2003), with estimates of failure ranging anywhere from twenty to ninety
percent in the first year of operation (Parsa, Self, Njite, & King, 2005; Sidney, 2005).
Threats to the hospitality industry are many, among them, natural disasters. The risk of
exposure to a natural disaster poses an inimitable threat to the restaurant and hotel sectors
of the hospitality industry (Chandler, 2004; Enz and Canina, 2002; Hystead and Keller,
2008; Zhang, Lindell, & Prater, 2009).

This research will use the capital approach to community resilience to explain
hospitality industry resilience after natural disasters. The purpose of the research is to
explain the effects of community capital and natural disaster characteristics on post-
disaster, hospitality industry resilience.

*Hospitality Industry Resilience*

In this study, industry resilience is the ability of the hospitality industry to return
after disasters to pre-disaster levels of functioning or better. Resilience in this study is
represented as a change-in-state between two periods of time. This definition of
resilience is a hospitality specific variation of the concept of social system resilience in
which resilience is the ability of a social system to respond and recover from realized
threats (Cutter, Barnes, Berry, Burton, Evans, Tate, & Webb, 2008). The term resilience is
frequently used interchangeably with the notion of ‘bouncing back’ and dates back to the
field of ecology and Holling’s (1973) seminal article “Resilience and Stability of the
Ecological Systems.” Different levels of biological and social systems may possess varying degrees of resilience that vary over time (McEntire et al. 2002). Consequently, Mayunga (2007) noted that researchers and practitioners who focus on a variety of aspects of multiple types of systems have been unable to reach consensus on a common definition for resilience (See Table 2) for alternative definitions of the resilience concept).

Rose (2004) suggests that resilience operates at three levels and is of two types. Resilience levels include: 1) the microeconomic level of individual behavior of households, firms, and businesses; 2) at the sector level, such as the economic sector, referenced as the mesoeconomic level; and 3) at the macroeconomic level which comprises all individual units and markets. The two types of resilience include 1) inherent resilience, distinguished as the ability to recover from a severe shock under normal circumstances and 2) adaptive resilience, defined as the ability to recover in crisis situations “due to ingenuity or extra effort”, such as increasing input substitutions (Rose, 2004, p 308). Industry resilience is at the meso economic level and encompasses both inherent and adaptive resilience.

**Natural Disasters**

Although disasters have been conceptualized and defined by a variety of scholarly traditions (see Table 2), in this study disaster simply refers to the hazard itself (flood, tornados, and winter storms). The hazard as disaster scholarship was largely defined by the contributions of Burton and Kates (1964) in which disasters were viewed as extreme events and part of the normal environmental process. According to Cutter (2005) the hazard as disaster approach includes the examination of disasters’ social impact.
Table 1: Definitions of Resiliency

<table>
<thead>
<tr>
<th>Author</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holling (1973)</td>
<td>Ecological resilience is the amount of disturbance that an ecosystem can withstand without changing self-organized processes and structures.</td>
</tr>
<tr>
<td>Holling et al., (1995)</td>
<td>Resilience is a buffer capacity or ability of a system to absorb perturbation, or the magnitude of the disturbance that can be absorbed before a system changes its structure by changing the variables and processes that control behavior.</td>
</tr>
<tr>
<td>Miletti, 1999</td>
<td>Local resiliency with regard to disasters means that a locale is able to withstand an extreme natural event without suffering devastating losses, damage, diminished productivity, or quality of life without a large amount of assistance from outside the community. Distinguished by the notion of self-reliance of communities.</td>
</tr>
<tr>
<td>Gunderson (2000)</td>
<td>In ecological systems, resilience lies in the requisite variety of functional groups and the accumulated capital that provide sources for recovery. Resilience within a system is generated by destroying and renewing systems at smaller, faster scales. People change the resilience of a system.</td>
</tr>
<tr>
<td>Perrings (2001)</td>
<td>Resilience is the ability or capacity of a system to absorb or cushion against damage or loss, conceptually similar to the notion of “sustainability as conservation of opportunity.”</td>
</tr>
<tr>
<td>McEntire et al. 2002</td>
<td>Resilience at different levels of analyses possess varying degrees sustainability</td>
</tr>
<tr>
<td>Klein, Nicholls and Thomalla, 2003</td>
<td>Resilience is derived from the Latin word <em>resilio</em>, meaning, “to jump back” and is measured as both outcome and process.</td>
</tr>
<tr>
<td>Bruneau et al. (2003)</td>
<td>Earthquake resilience is the ability of social units to mitigate, contain current and future hazards and to undergo recovery in ways that minimize social disruption.</td>
</tr>
<tr>
<td>Pelling (2003)</td>
<td>Resilience is the ability of an actor to cope with or adapt to hazard stress.</td>
</tr>
<tr>
<td>The Hyogo Framework for Action 2005–2015 (UNISDR)</td>
<td>The capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase this capacity for learning from past disasters for better future protection and to improve risk reduction measures.</td>
</tr>
<tr>
<td>Manyena (2006)</td>
<td>Disaster resilience could be viewed as the intrinsic capacity of a system, community or society predisposed to a shock or stress to adapt and survive by changing its non-essential attributes and rebuilding itself. While traditionally defined as an outcome, has become more process-oriented.</td>
</tr>
<tr>
<td>Sustainable Livelihoods Framework (2007)</td>
<td>Resilience is the capacity of a social-ecological system to absorb disturbance and reorganize while undergoing change so as to retain essentially the same function, structure, identity and feedbacks</td>
</tr>
<tr>
<td>Cutter, Barnes, Berry, Burton, Evans, Tate, &amp; Webb (2008)</td>
<td>Resilience is the ability of a social system to respond and recover from disasters and includes those inherent conditions that allow the system to absorb impacts and cope with an event, as well as post-event, adaptive processes that facilitate the ability of the social system to re-organize, change, and learn in response to a threat</td>
</tr>
<tr>
<td>Source</td>
<td>Definition</td>
</tr>
<tr>
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</tr>
<tr>
<td>Carr, 1932; Erikson</td>
<td>Hazard events that are threatening and disruptive to the ongoing social order</td>
</tr>
<tr>
<td>Fritz, 1961b</td>
<td>Essential functions of society [are] prevented</td>
</tr>
<tr>
<td>Selbst, 1978 in Booth, 1993</td>
<td>Crisis: Any action or failure to act that interferes with an organization’s ongoing functions, survival, or that has a detrimental effect as perceived by the majority.</td>
</tr>
<tr>
<td>Kreps &amp; Drabek, 1996</td>
<td>(Hazards that are) episodic and non-routine in nature</td>
</tr>
<tr>
<td>Kreps, 1998</td>
<td>Disasters create social disruption and physical damage; uses stages of disaster to plan and mitigate against; forewarning; magnitude of impact; score and duration of impact,</td>
</tr>
<tr>
<td>Faulkner, 2000, p 136</td>
<td>“Situations where an enterprise or collection of enterprises is confronted with sudden unpredictable changes over which it has little control.”</td>
</tr>
<tr>
<td>Pelling, Ozerdem, &amp; Barakat, 2002; Quarantelni, 2004; Rodriguez, 2006</td>
<td>Urgent and sudden event catalyst such as in floods, earthquakes, and tsunamis.</td>
</tr>
<tr>
<td>United States Disaster Center</td>
<td>The probability of a combination of a threat that attacks a particular vulnerability, with some consequence.</td>
</tr>
<tr>
<td>Hyogo Framework For Action (2007)</td>
<td>Disaster risk arises when hazards interact with physical, social, economic, and environmental vulnerabilities.</td>
</tr>
<tr>
<td>The Disaster Assessment Portal, 2008</td>
<td>“The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions.”</td>
</tr>
</tbody>
</table>
Rationale for the Study

The exposure of restaurants and hotels in the hospitality industry to the risk of natural disasters poses a substantial threat. Part of these businesses’ competitive advantage is attractive geographic settings that may be increasingly vulnerable to natural disasters. Faulkner (2001, p 136) highlights these threats by saying that “the attractiveness of high-risk … destinations…expose(s) tourists to greater levels of risk”. Recently, global warming scientists predict an increase in the number and intensity of natural hazards such as hurricanes, tornadoes, and floods, the most common of all natural disasters (United Nations, 2005). Natural disasters and climate change are expected to significantly exacerbate resource scarcities within the next twenty years (U.S. National Intelligence Council, November, 2008).

Natural disasters are relatively frequent and their consequences make them good examples to use to analyze industry resilience in the face of environmental threats. In any given year, approximately 90% of US counties experience natural disasters, and these disasters can disrupt business operations. A National Federation of Independent Business study found that at least 30% of businesses had closed for at least 24 hours in the previous three years because of a natural disaster (Dennis, 2004). While disasters were widespread, extreme natural disasters, defined as resulting in closure of at least a week or more and damage of greater than $100,000, were highly concentrated. Thirty presidential declarations is the annual average for all U.S. disaster types, 25 of which are major disasters (Sylves, 1996). The economic cost of natural disasters in the United States has
averaged as much as $1 billion a week since 1989 and is expected to rise, according to Mileti (1999a).

Little is known about the consequences of natural disasters for businesses, and even less is known in the hospitality industry. The business disaster studies that have been conducted are either set in urban disaster locations or conducted on small convenience samples after a single disaster. Disaster recovery has been difficult to explain, due in part to reliance on cross sectional data and the inability to obtain data on closed businesses post-disaster. In addition, the empirical analyses of disasters in the hospitality industry have not been informed by theoretical frameworks.

While the concept of resilience has been introduced in the disaster literature, it has not been introduced in hospitality literature, and neither has it been measured directly. Hospitality literature has been concerned with the more limited construct of recovery. Only indirect indicators of recovery, such as actions taken or decisions made, have been used in studies of the hospitality industry. Some of the indicators have been presence of recovery plans; lessons learned from prior disasters; the media’s role in assisting and or impeding recovery; the impact of disasters on travel plans; and balancing the investment in disaster planning with current financial survival.

Unlike previous disaster research in hospitality, this research purports that businesses do not exist in isolation. Rather, hospitality businesses are viewed as open systems that exchange resources with the communities in which they are located. This research investigates aspects of the community that may impact hospitality industry resilience. This question has not been posed or answered before for the hospitality industry.
Faulkner (2000) laments the lack of research on disaster phenomena and its impact on the tourism industry. He asserts that, “One of the reasons so little progress has been made in the advancing of our understanding of tourism disasters is the limited development of the theoretical and conceptual frameworks required to underpin the analysis of the phenomena” (Faulkner, 2001, p. 136). This research aims to fill this gap by extending the capitals approach to understand the phenomena of hospitality industry resilience to natural disasters.

Purpose of the Study

This dissertation examines the impact of natural disasters and five types of community resources or capital stocks (social, economic, physical, human, and natural capital), on three measures of hospitality industry resilience (change in number of restaurant and hotel establishments; change in number of jobs; and change in annual payroll) aggregated at the county level using data from the U.S. Census Bureau. The estimation of the effects of community capital on restaurants and hotels in the hospitality industry forms the core purpose of the research. The secondary purpose is to understand the impact of natural disasters on industry resilience.

Significance of the Study

This research contributes to the existing literature in several ways. It presents an empirical analysis of the hospitality industry based on a new paradigm of industry resilience that distinguishes between inputs and outcomes that have previously been confounded. It creates the first longitudinal dataset on the hospitality industry and
natural disasters in the North Central region of the United States, extending the nascent quantitative research on business resilience. It derives the first estimates of the effects of community capital stocks on the hospitality industry. Obtaining significant effects for community capital stocks will advance mathematical modeling of the socioeconomic effects of disasters, in general, as well as for the hospitality industry.

**Objectives of the Study**

1. To assess the effects of natural disasters on resilience of the hospitality industry (restaurants and hotels) at the county level.

2. To estimate the effects of community capital on industry resilience after natural disasters.

**Plan of the Study**

The plan of this study proceeds as follows. Chapter Two describes the relevant literature and theoretical frameworks that build the conceptual model and hypotheses for this research. The overarching theoretical construct used in the current research is borrowed from General Systems Theory (GST), which suggests a productive symbiosis or capital exchange between the firm and the community (Boulding, 1956). The beginning section presents conceptual disaster management and planning frameworks suggested in the hospitality industry. Next, disaster approaches used in the general disaster literature are considered, including the disaster-specific capital frameworks of Cutter (2003); expanded by Mayunga (2007) and the Sustainable Livelihoods Framework (DFID, 2005). The empirical literature on resilience is discussed, highlighting the varying outcomes by
which resilience is measured (resilience as an outcome and resilience as a process). Lastly, indicators of business and community resilience are presented; several of which are suggested as possible indicators of hospitality industry resilience. The chapter concludes with a proposed model of industry resilience. Chapter Three describes the data and sources of the data followed by the selection criteria. The creation of the dataset is described. Descriptive statistics of the counties used in the analysis are provided as well as an overview of the analytical procedure. Descriptive statistics for the dependent and independent variables are presented. The chapter concludes with the empirical specification of the theoretical model. Chapter Four reports the results of the estimation of the model equations. It concludes with a discussion of the predictive effectiveness of the proposed model. Chapter Five discusses the results and implications of the research, study limitations, and suggested areas for future investigation.
CHAPTER 2: REVIEW OF LITERATURE

Introduction

This chapter reviews and extracts relevant information from the theoretical and empirical literature on the resiliency of the hospitality industry, particularly post disaster resiliency. The chapter begins with a review of theoretical frameworks used to address this topic in the hospitality field and in other fields of scholarship. The second section presents findings on business resilience and recovery. The next section reviews antecedents of resilience and recovery identified previously, including community effects on resilience. The chapter concludes with a proposed model of industry resilience.

Frameworks

Because of the limited empirical research in hospitality on the effects of natural disasters, several authors have proposed disaster management frameworks (Faulkner, 2000; Hystad & Keller, 2008; Scott and Laws, 2006) and a crisis management framework (Ritchie, 2003). These approaches recognize the possibility of a natural disaster, the potential for negative consequences, and the need to prepare for and mitigate undesirable consequences. The primary concern, understandably, in hospitality disaster frameworks is evacuation and preservation of life, buildings, and equipment.
Faulkner’s (2001) tourism disaster framework identifies six phases in the disaster process to consider in disaster planning: 1) preparation; 2) prodromal, when it becomes apparent the crisis is inevitable; 3) the acute stage during the event; 4) short term needs handled immediately following the event; 5) long-term recovery, including infrastructure repair and environmental rehabilitation; and 6) re-establishment as a tourist destination in its original or modified state. Resilience would be phase six in Faulkner’s framework. Faulkner’s (2001) approach is normative, calling for high levels of interdependencies between non-tourist businesses, counties, and tourist businesses. He suggests that tourism disaster management planning processes and outcomes should include an assessment of risk; prioritization of needs; the establishment of protocols; an audit of community capabilities including a disaster management command center; monitoring and media activities; warning systems; flexible and adaptive capacities to meet the specific event with the most appropriate concepts; and an education and review format that directly involves managers in the development and implementation of the disaster plan and its implementation.

Ritchie (2004), addressing the lack of apparent “interest and research” (p 669) in tourism disaster planning and management, advances a strategic and holistic approach for the tourism industry in its efforts to manage and respond to disasters. Defining crises from Faulkner’s (2001) perspective as “…a situation ‘where the root cause of an event is …self-inflicted through…..inept management structures…or a failure to adapt to change’ “(p 670), Ritchie suggests approaching understanding disasters and crises through a cause and effect lens, by means of chaos and complexity theories. These theories illustrate the
interrelationships between human and natural systems, where small changes (perturbations) can dramatically impact the system and the study of these changes and their types is mandatory to understand system effects. The strategic management of these systems, he suggests, moves the field from the dominant reactive paradigm to a proactive, systems approach.

Ritchie’s model for strategic systems management includes scanning and planning; implementation; and evaluation and feedback, with appropriate activation of managerial tasks in each phase. Drawing parallels between the lifecycle of a disaster and his framework, he visualizes the pre-event stage of a crisis accompanying his prevention and planning tasks; the actual stage of crisis (immediately before or after) accompanies his call for implementation. As implementation efforts are sustained, the disasters’ severity should be lessened; the long term recovery stage of a crisis allows for Ritchie’s final tasks of evaluation and feedback that inform future prevention and planning strategies. Ritchie calls for interdisciplinary approaches and an industry move from prescriptive models that include checklists of how to respond to crises and disasters, or what he describes as reactive models, toward descriptive models, testing theories that investigate why crises were managed in the manner reported.

Hystad and Keller (2008) call for a cooperative communications strategy between all stakeholders in the disaster planning, management, and recovery phases of a disaster. For Hystad and Keller (2008) the need for clear accountability and responsibility is critical. Hospitality businesses are diverse; to assume a bottom-up flow of communication (where individual hospitality businesses take the initiative for planning
and managing) may not bring about the desired level of results. Tourism organizations and local emergency management businesses, in their view, have a pivotal role to play in assisting the flow of information among and between hospitality businesses, and in assuming the advocacy role for individual businesses in disaster situations.

Scott and Laws (2006) approach the understanding of disasters through systems effects and social network analysis. Specifically designed for tourism businesses, they suggest systems of tourism firms and their social networks possess properties that are created from the interaction of all their requisite, component parts. Disasters place stress on the network and its relationships and disasters create ripple effects in the network. Scott and Laws (2006) allow for both positive and negative disaster outcomes. Their framework is distinguished by its reliance on open boundaries, network exchanges, and a focus on information flows.

These frameworks do have the potential to advance research on disaster preparedness and management in hospitality, but their usefulness is limited for the purpose of this study. Where the above frameworks are necessary for heightened awareness of the effects of a disaster and the pre-meditated steps required to ensure the safety of people, equipment, and buildings, they are insufficient as business continuity frameworks. Table 3 provides a summary of hospitality disaster frameworks.
Table 3: Hospitality Disaster Frameworks

<table>
<thead>
<tr>
<th>Author</th>
<th>Focus &amp; Context</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faulkner (2001)</td>
<td>Disaster Planning: Advances new theoretical framework of crises/disaster research in tourism</td>
<td>Identifies response to disaster situation: shock, denial, acknowledgment, adaptation. Introduces chaos theory in disasters as a creative process, causing innovation. Suggests a framework for disaster that matches the stage of the disaster with its most appropriate response.</td>
</tr>
<tr>
<td>Scott &amp; Laws (2005)</td>
<td>Disaster Planning: Presents systems theory (social systems) as viable framework in tourism</td>
<td>Systems theory view: tourism firms are system and social networks whose properties derive from interaction of all components of firms so that disasters can have positive outcomes as well. An example: crises can lead to increased networking, cooperation, and collaboration among firms. Comments on similarity to chaos theory.</td>
</tr>
<tr>
<td>Hystad &amp; Keller (2008)</td>
<td>Disaster Planning: Presents new framework for disaster planning resulting from Kelowna, BC forest fires in 2003</td>
<td>Recommend a top-down collaborative approach, identifying responsibilities and interaction of key stakeholders at critical stages (pre-disaster; disaster; post-disaster).</td>
</tr>
</tbody>
</table>
While a large body of research in sociology, agricultural economics, and psychology credits capital stocks with community and individual resilience to catastrophic events, scant attention has been paid by scholars in hospitality and tourism research. Dahlhamer (1998) concluded that recovery of a firm depended mainly on how the community was affected rather than on its own physical damage. The importance of customer loss also has been noted (Dennis, 2004). Danes, Lee, Amarapurkar, Stafford and Haynes (2009) found disaster assistance had a positive effect on businesses owned by women, but not men.

Literature on community resilience and family resilience may help inform hospitality research. Research on family and individual resilience has been used to inform other empirical studies in the disaster literature (Danes, Stafford, & Haynes, 2007). Webb, Tierney, and Dahlhamer’s (2002) study on business’ experiences with the Loma Prieta earthquake and Hurricane Andrew used research based on household disaster recovery studies. In addition, the capitals approach to community resilience proposed by Mayunga (2007) has been extended to specifically include disasters, increasing its utility as a research model in disaster studies. Assessing community resilience is a complex process because of the dynamic interactions of people, community, and the environment. Several conceptual frameworks have been proposed to facilitate analysis of this concept (e.g., Brown & Kulig, 1996-1997; Tobin, 1999; Adger, 2000; Buckle, 2006; Foster, 2006; and Tierney, 2006). Generally, most of these frameworks focus on similar factors that could reduce vulnerability and increase community resilience following threats such as natural disasters. Such factors include
economic resources, assets and skills, information and knowledge, support and networks, access to services, and shared community values. These frameworks share a concept the author describes as “community capital”. However, the limitation of most of these frameworks is that they tend to focus on one or a few dimensions of community capital. The next section discusses the proposed framework to assess community disaster resilience.

Community Resiliency Frameworks

Community resiliency frameworks portray communities as possessing attributes that mitigate their vulnerabilities to the consequences of natural hazard events (Cutter, Boruff & Shirley, 2003; Mayunga, 2007; Haynes, Muske, Fitzgerald, & Fong, 2008.). The assumption behind these community resiliency models is what is good for the community is good for all the components of the community, including businesses. Community resiliency has been conceptualized from two fundamentally different perspectives or frameworks. Cutter (Cutter, Barnes, Berry, Burton, Tate & Webb, 2008; Cutter et al., 2003) and colleagues have proposed place-based models that focus on interactions between components of the community. Another group of scholars has proposed focusing on community capital instead of interactions. In the Sustainable Livelihood Framework (United Kingdom, 1999) and Mayunga’s (2007) capital-based approach to community disaster resiliency an increase in capital stocks results in increases in resiliency. These models include human, social, economic, physical, and natural capital.
Another type of resiliency model proposes that social and economic, hereafter socioeconomic, resiliency is the ability of human institutions to adapt to change (Horne & Haynes, 1999, p. 1). Borrowing from the ecological literature, they suggest that systems with higher diversity are more resilient than systems with lower diversity, as they are less affected by change. High resiliency is defined as those systems that adapt quickly as indicated by measures of socioeconomic well-being. According to this view, communities, individuals, and families that possess high levels of diversity provide resilient factors that make it more likely to survive the consequences of natural hazard events.

The Sustainable Livelihoods Framework (DFID, 2005) is an approach devised by the International Strategy for Disaster Reduction (ISDR) to mitigate poverty after a crisis (including natural disasters). It is not disaster-specific but includes disasters as crises and suggests community assets or capitals play a role in augmenting the livelihoods of the poor in lesser-developed countries. This framework is used in assessing the effectiveness of existing efforts to reduce poverty, and includes the capital asset mix in building community resilience, suggesting that different businesses with different access to livelihood “assets” (capitals) are affected by their diversity of assets; their amount of assets; and the balance between assets. Assets identified in the model include natural assets; social assets; financial assets; human assets; and physical assets.

This model was tailored by Mayunga’s (2007)specifically for disasters. His community disaster resiliency framework includes five major forms of capital: social,
economic, physical, human, and natural. Mayunga notes the alignment of capital with the concept of sustainability, frequently used in the literature on disaster.

Zhang, Lindell, and Prater’s (2009) proposed a systems model of disaster impacts on community businesses. Their model attempts to address factors that determine the magnitude of a disaster’s impact and recovery length for a local business. The implications of the model are designed to aid public policy research and agendas. In their conceptual model, Zhang, Lindell, and Prater, (2009) identified four sources of business vulnerability: capital, labor, supplier, and customer vulnerability and they proposed direct, indirect, and differential impacts of disaster effects based on these four dimensions.

In Zhang, Lindell, and Prater’s, (2009) model, capital vulnerability similar to traditional economic measures, is comprised of fixed assets, inventories, and cash. The first two of the dimensions, fixed assets, and inventories are highly vulnerable due to opportunities of direct physical damage and low mobility. Labor vulnerability is defined by a disaster’s capacity to disrupt labor stocks and inputs by employee availability due to personal disaster impacts; the degree of skill required of the employee; and the ease of employee replacement. Small businesses are particularly vulnerable to disruption of supplies because of suppliers’ own effects of disasters, creating a multiplier effect of direct and indirect losses. Finally, the potential for alternative employee housing, product and service substitutes, and shifting consumer demands expose small community businesses to customer vulnerability.
None of the existing frameworks is sufficient for the purpose of the current study. Hospitality frameworks address disaster management rather than resilience. Resilience models do not specifically address business. Business models address vulnerability rather than resilience and individual firms rather than industries.

**Resilience and Recovery**

Before proposing a framework tailored to hospitality industry resilience, the literature on business resilience and recovery is reviewed. Resilience, the ability to ‘jump back’ (Klein, Nicholls, and Thomalla, 2003), is one possible outcome of natural disasters. Presently, there are no studies on hospitality industry resilience to natural disasters. However, many studies in the literature focus on what has been described as recovery. Unlike resilience, recovery can be measured at one point in time and has been operationalized in a variety of ways. Recovery in this literature has been operationalized as resource inputs, management processes, and outcomes or impacts. For example, Enz and Taylor (2002) operationalized recovery by ascertaining the presence of resource inputs thought to result in recovery, the presence of hotel safety and security measures. Law (2006) and Min (2007) examined recovery by surveying customer attitude toward and demand for hospitality facilities in areas that experienced previous dramatic disasters. Cioccio & Michael (2007) analyzed disaster management planning; Enz and Canina (2002), Chandler (2004), Hystad and Keller (2008) estimated economic impact.

**Recovery as input**

Studies of tourists’ demand and travel intentions following a disaster have found that travelers are risk averse. Law (2006) found that travelers, in the aftermath of a
natural or man-made disaster, would prefer to visit tourist destinations with low risks and suggested that tourism industries fare best by quickly recovering after crises. Min (2007) found that Japanese tourists tended toward uncertainty avoidance more than American travelers in the aftermath of Taiwan’s September 21st earthquake of 1999.

Recovery as process

The hospitality literature as well as the more general business literature suggests that future disaster mitigation planning is seldom a result of natural disasters (Flynn, 2007; Tierney, 2006). Restaurant and hotel industry recommendations for disaster preparations are understandably dominated by evacuation procedures. Lynott (2006) cautions restaurants to make evacuation plans their first priority when creating disaster preparation and recovery plans. This is explained, in part, by the higher priority placed on life preservation versus business continuity (Drabek, 2000); the financial burden of preparedness and mitigation; and not knowing just what measures are most productive (Zhang et al. 2009). Preparedness and mitigation strategies may reduce long term loss, but they are costly, time-consuming, and disruptive. Consequently, they diminish short-term profitability. In the academic literature, business continuity planning for restaurants and hotels has yet to be analyzed; it has only been described.

As Cioccio and Michael (2007) suggest, hospitality businesses seem to cope with natural disasters rather than manage them. Hystad and Keller’s recent (2008) follow-up case study of disaster management practices from an earlier study found that 62% of the impacted businesses were still without a disaster management plan and 72% of the businesses had no post-disaster recovery plan. Cioccio and Michael (2007) found
owners of small businesses damaged by forest fires in Northeast Victoria, Australia, relied on commercial insurance as the primary approach to risk management.

Recovery as outcome

Studies of economic impact have focused exclusively on the hotel sector of the hospitality industry. Enz and Canina (2002) analyzed U.S. hotel performance the year following the World Trade Center attacks to understand its effects on that sector of the hospitality industry. Using a national database, Enz and Canina analyzed year-to-year changes in revenue per available room (RevPAR) from 1990 through the second quarter of 2002. RevPAR was then compared by region, state, population centers, and key cities. Large metropolitan areas were the most volatile, with the regions exhibiting the highest average RevPARs suffering the greatest declines. These regions’ RevPAR losses ranged from 9.27 to 10.3%, while less populous states such as Oklahoma, Wyoming, and North Dakota, outperformed year 2000 numbers in 2001. Enz and Canina’s findings may have reflected travel restrictions issued after the attacks and the higher dependence of non-local guests in major metropolitan areas. Enz and Canina (2002) did not refer to resiliency in their article, but their analysis of revenue trends before and after the terrorist attack would have enabled them to measure resiliency.

Chandler (2004) estimated the economic impact of hurricanes and resultant flooding on North Carolina’s lodging industry (n=64), finding physical damages and lost room revenue estimates in the months of September and October (1999) were approximately $125 million. The size of the sample limited generalizability.
Webb, Tierney, and Dahlhamer (2002) examined how businesses fared several years after their communities experienced two disasters: the California Loma Prieta earthquake in Santa Cruz county (N=858) and Hurricane Andrew (N=1,005) in South Dade county (Florida). Using mail surveys, they compared long-term recovery outcomes for businesses in both cities. Long-term business recovery outcomes were measured eight years after the Santa Cruz county earthquake and six years after Hurricane Andrew Dade County. Recovery was measured as an index of the following self-report measures: the number of employees at the business, the number of customers or clients served, and business profits; whether the business was currently worse off, about the same, or better off than it was just prior to the disaster event.

Addressing Fink’s (1986) widely cited observation that crises and disasters may produce both positive and negative outcomes, Okumus, Altinay, and Arasli (2005) found one positive and significant short-term outcome; that foreign (non-Turkey) tourist demand increased. This finding did not hold true for long term impacts, in which there were no positive effects. Okumus et al’s (2005) research revealed many long-term negative impacts including the loss of key staff; the delay of new domestic and foreign investments; and largely due to marketing recovery efforts, the perception that Northern Cyprus was seen as a cheap tourist destination.

Alesch and Holly (1997) operationalized recovery as the business is doing as well as before; the business has adapted to the changed business environment, even if not as profitable as before; the business is surviving, even if not viable; and the owner has maintained his/her financial resources even if the original business is no longer an
ongoing concern. Their analysis of small business responses to the Northridge earthquake identified primary and secondary disaster effects. Primary effects included direct, measurable losses (such as the loss of a house or a crop) while secondary effects included indirect losses incurred (such as a business disruption). Significant tertiary effects in the form of losses or negative impacts due to macro economy shifts in response to the disaster were observed as well.

Antecedents of Resilience and Recovery

Alesch & Holly (1977) found that businesses in sub-optimal financial condition and those that were smaller prior to the disaster were more likely to permanently cease operations. These businesses might have experienced disaster as the final catalyst propelling them toward failure. Even those businesses that suffered little primary damage were vulnerable to closure, due to surrounding community shocks and other tertiary effects. Alesch et al. (2001) suggested that businesses recover, but in varying degrees.

Resilience and its correlates for businesses of all types has been understudied; the focus of most research concentrates on other levels of analyses, such as families, households and government agencies (Tierney, 2006). The nascent literature suggests that in both the short and long term, most firms return to pre-level disaster levels of performance (Tierney, 1997; Webb, Tierney, & Dahlhamer, 2000). Research questions generally seek to understand disaster planning practices; losses incurred; direct and indirect effects and recovery mechanisms (Chang & Falit-Baiamonte, 2002; Rose, 2002).

Okumus, Altinay, and Arasli (2005) investigated the effects of Turkey’s 2001 economic crisis on Northern Cyprus’ tourism industry. This region of the world has been
involved in frequent conflict resulting in political uncertainty, which probably exacerbates other types of crises. Okumus et al. (2005) found that neither size nor market sector affected whether hotel managers prepared crisis management plans.

Lack of capital, size, and resignation to the inevitability of “negative impacts from such a large event” were volunteered as reasons for not developing and implementing a post-disaster recovery plan (Hystad & Keller, 2008). Recovery plans were non-existent due to a stated lack of resources, limited time availability, an unwillingness to focus on a disaster that may never happen, and the development of a disaster culture. Disaster cultures, a form of discounting future disaster effects, may develop because of the “community’s continued co-existence with a probable hazard” (Cioccio & Michael, 2007, p 6).

Hystad and Keller (2008) found firm size was a significant predictor of the effects from a disaster. The smaller the firm, the more devastating was the outcome. Cioccio and Michael (2007) found that for hospitality businesses in Australia, survival and recovery length were a function of market diversification; recovery from disaster varied by sector. The food and beverage sector recovered in an average of three months; hotels averaged five months; and the entertainment sector averaged ten months.

Survival is a minimum requirement for resilience. Predictors of hospitality industry survival without disasters, inherent resilience, are similar to predictors of their survival after disasters, adaptive resilience. According to Parsa, Self, Njite, and King, (2005) size, age, density, and institutional affiliation, location, and owner characteristics predict hospitality survival. Published research on businesses and natural disasters
suggests that many of the same variables that correlate with firm survival such as organization age and size (Hannan & Freeman, 1989) also predict firm recovery from natural disasters. Hjalager’s (2000) study of restaurants in Denmark suggested size explained more variance in restaurant survival than any other variable, while owner factors insufficiently contributed to variance explained. Variables that contribute to hospitality firm survival after a natural disaster include the size of the firm, with larger firms enjoying lower vulnerability and higher survival rates (Hystad & Keller, 2008) and the degree of market diversification, where markets with higher levels of diversification led to an increased likelihood of recovery (Cioccio & Michael, 2007).

Factors influencing business recovery include size (bigger is better); pre-financial condition (disasters exaggerate existing trends), neighborhood effects (infrastructure, supply-chain issues, business interruption, and customer impacts), industry market sector (retail vs. manufacturing businesses), and owner characteristics and decisions such as the strategic choice of leasing vs. owning (Dahlhamer and D’Souza, 1997; Tierney & Dahlhamer, 1998; Tierney & Nigg, 1995).

Chang and Falit-Biaamonte’s (2002) conducted structured in-person interviews with the owners or managers of 62 of the hardest hit buildings from the 2001 Nisqually earthquake to understand how physical damage, mitigation and preparedness, business size, occupancy tenure, and Chang and Falit-Biaamonte’s (2002), their findings indicated a weak relationship between physical damage and loss as well as preparedness and mitigation and loss. Rather, business sector, size, and neighborhood effects were more closely associated with recovery. Neighborhood effects contributed to business losses
more than physical damage, preparedness, and mitigation. More than twice as many owner/manager respondents cited neighborhood-related problems as more important to recovery than business-specific needs.

Webb, Tierney, and Dahlhamer (2002) found the strongest predictor of long-term recovery was owner perception of the community in their research on the Santa Cruz earthquake and Hurricane Andrew in Dade County (Florida). Recovery was measured as an index of the following self-report measures: the number of employees at the business, the number of customers or clients served, and business profits; whether the business was currently worse off, about the same, or better off than it was just prior to the disaster event.

The model for South Dade County businesses produced six statistically significant predictors of resilience beyond owner perceptions: 2) the economic sector variable (wholesale and retail firms are less likely to have recovered in the long-term); 3) a negative coefficient for business age (that older businesses were less likely to have recovered six years after the hurricane than their younger counterparts); 4) primary market (markets served that are mainly regional, national, or international in scope are more likely to recover; 5) firms forced to close for longer periods of time following the hurricane or earthquake were less likely to recover in the long-term; and 6) pre-financial condition (businesses in better financial condition just prior to the hurricane or earthquake are less likely to have recovered in the long-term). Both disaster preparedness and experience, and external sources of aid were insignificant predictors of recovery in both counties.
While business size has been found to be a consistent predictor of recovery (liability of smallness; Dahlhamer, 1989), research on small businesses does not always find business size as the most significant recovery variable. Danes, Stafford, and Haynes (2008) found type of business was the most important contributor to survival. Being a family business in an economically vulnerable, rural community was the second strongest predictor of survival. Danes et al. (2008) also found evidence for a positive effect on recovery through owner perception (see Webb, Tierney, & Dahlhamer, 2002). Businesses in the arts, entertainment, and recreation sector were least likely to survive or experience growth. Table 2 presents additional dimensions of business and community resiliency from the effects of a natural disaster.

Alesch, Holly, Mittler, and Nagy’s (2001) investigation of small businesses and not-for-profits identified five variables that account for long-term survival from a natural disaster for these types of firms. Business characteristics explaining recovery included the ability to procure substitute goods or services while the business was disrupted; pre-disaster health; industry effects; and pre and post-financial resources available for rebuilding or relocating. Additionally the disaster’s impact on the business’ customers and owner characteristics, such as the owner’s adaptability to the changed business environment were predictors of recovery. See Table below for dimensions of resiliency.
Table 4: Dimensions of Resiliency

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<tbody>
<tr>
<td><strong>Personal wealth</strong></td>
<td>Per capita income; HH earnings; median house values/rents</td>
<td>Median income;</td>
<td>Lifestyle Diversity</td>
<td>Economic capital; Human capital; Physical capital</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>Median age; over 65/under 5</td>
<td>Median age (SV)*</td>
<td>Beale code (rural area) &amp; urban influence</td>
<td>Lifestyle Diversity</td>
<td>Physical capital</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Built environment (density)</strong></td>
<td># manuf./commercial establishments</td>
<td></td>
<td></td>
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<tr>
<td><strong>Single-sector economy</strong></td>
<td>% employed in oil, agriculture, fishing (extractive industries)</td>
<td></td>
<td>% earnings in mining, agricultural services, farming, farming dependency</td>
<td>Economic Diversity: diversity of employment</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Housing &amp; Stock tenancy</strong></td>
<td>% mobile homes; renters; urban living; median value; median rent;</td>
<td></td>
<td></td>
<td>Physical capital</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td>% AA; Asian</td>
<td></td>
<td>% minorities; % whites</td>
<td>Lifestyle Diversity</td>
<td>Human capital</td>
<td>NA</td>
</tr>
</tbody>
</table>

Continued on next page
Table 4: Dimensions of Resiliency, con’t

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Occupation</th>
<th>Infrastructure</th>
<th>Social capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Hispanic; Native American</td>
<td>% service occupations;</td>
<td>% employed in transport, communications, public utilities</td>
<td>% community hospitals, nursing homes,</td>
</tr>
<tr>
<td>Farming dependency %; % earnings in farming/agriculture; % dependence on mining</td>
<td>Haynes, Muske, Fitzgerald, &amp; Fong (2008)</td>
<td>NA</td>
<td># hospital beds</td>
</tr>
<tr>
<td></td>
<td>NA</td>
<td>NA</td>
<td>Physical capital</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Presence/absence mitigation activity (biz with pipe replacement/biz as usual); CGE simulation model of supply &amp; demand given input supply disruptions</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>NA</td>
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</tr>
</tbody>
</table>

Lifestyle Diversity Economic Diversity: diversity of employment Human capital Human capital NA
NA

NA

NA

Physical capital

NA

Presence/absence mitigation activity (biz with pipe replacement/biz as usual); CGE simulation model of supply & demand given input supply disruptions

NA

Quantity/ quality of social cooperation; % non-profits; religious firms

Continued on next page
Table 4: Dimensions of Resiliency

<table>
<thead>
<tr>
<th>Economic capital</th>
<th>Per capita income; # physicians; % unemployed; % poverty; earnings; Poverty rate; median income; unemployment rate; non federal physicians &amp; # hospital beds</th>
<th>Poverty rate; median income; unemployment rate; non federal physicians &amp; # hospital beds</th>
<th>Economic Diversity (diversity of employment)</th>
<th>HH income; property values; credit; employment;</th>
<th>CGE simulation model of supply &amp; demand given input supply disruptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical capital</td>
<td>Median value homes; % land in farms; housing units; housing permits; mobile homes; # commercial establishments/sq. mile</td>
<td>NA</td>
<td>NA</td>
<td>Quality housing units; biz/industry; lifelines &amp; critical infrastructure</td>
<td>CGE Simulation model estimates of business interruption &amp; adaptive resilience responses</td>
</tr>
<tr>
<td>Human capital</td>
<td>Birthrate; net international migration;% females;% females in labor force; %female-headed HH; % SS recipients; education attainment</td>
<td>Population growth rate; Net migration &amp; education (SV)*</td>
<td>Population density (total pop/# sq miles)</td>
<td>Educational attain; health; pop. Density; race/ethnicity</td>
<td>Behavioral parameters (business managers)</td>
</tr>
<tr>
<td>Natural capital</td>
<td>NA</td>
<td>Natural Amenities Ranking</td>
<td>NA</td>
<td>Wetland; forests; Nat’l/local parks</td>
<td>NA</td>
</tr>
</tbody>
</table>
A Proposed Model of Industry Resilience

The frameworks of Cutter (2003); Landau (2007); Mayunga (2007); and Tierney (2006) have laid the foundation for hospitality industry resilience based on community capital stocks. The argument here is that community capital is positively associated with a resilient hospitality industry. The more resources a community possesses the more resilient will be its industries after disasters. The same factors that allow communities to be resilient are transferred to the businesses residing in these communities.

Natural capital

Natural capital is the stock of natural ecological systems that have future capacity to produce valuable goods and services. Natural capital includes natural resources that sustain life and communities such as water, minerals and oil (Smith et al., 2001). Mayunga suggests natural capital can be measured through wetlands, forests, and national and local parks amongst other resources. In 2006, the U.S Census reported that county population gains were highest in areas that offered natural amenities, proximity to metro jobs, or both and that counties that primarily rely on recreation and tourism experienced higher than average growth. Higher levels of natural capital in a community are expected to increase disaster resiliency of hotels and restaurants.

Human capital

Human capital is that feature of human beings that allows them to work productively with other forms of capital to sustain economic production (Smith et al., 2001), perhaps most commonly measured as the level of education attainment of a population. “Human capital is probably one of the most important determinants of
resilience among other forms of capital” (Mayunga, p 8). Higher levels of human capital in a community are expected to increase disaster resiliency of hotels and restaurants.

Social Capital

Social capital refers to social cohesion and personal involvement with the community; social networks that make possible collective action; and trust (Green & Haines, 2002). Social capital is suggested as a producer of “civic engagement” and a broad societal measure of communal health (Putnam, 1995) that facilitates cooperation and communication and coordination. Mayunga (2007) suggests that community networks facilitate group problem solving, noting that those communities able to work toward a common goal are better equipped to cope with the effects of a disaster.

There are two types of groups affiliated with social capital. The P-group offers no financial incentive to join and involve social interaction that promotes trust and cooperation (Putnam, 1993). Social capital indexes have measured the contribution of Putnam-type groups (P-groups) and Olson-type groups (O-groups). The O-groups have as an objective the transfer of income and wealth. P-groups are more likely to be found in rural communities and O-groups are more likely to exist in urban areas (Rupasingha, 2006). O-groups are said to depress social capital in communities. It is hypothesized that hotels and restaurants in communities that possess more P-groups are more disaster resilient.

Economic capital

Economic capital is important as it is hypothesized to increase the capacity of groups at all levels to absorb disaster shocks (Mayunga, 2007). This capital is resources
people accumulate via their livelihoods. It includes items such as savings, income, and investments. Economic capital increases resilience because it can be deployed to assist industries in disaster preparation and mitigation activities. The greater business disaster literature as well as the hospitality literature speaks to economic capital’s properties of accelerating or buffering the effects of a disaster. It is hypothesized that hotels and restaurants in counties with higher economic capital are more disaster resilient.

Physical capital

Physical capital refers to the built environment of buildings, roads, and bridges, and utilities. Mayunga (2007) suggests physical capital is second only to human capital in its ability to assist the community in coping with disasters due to the necessity of a functioning community after a natural disaster, particularly critical infrastructure. Hotels and restaurants will be more resilient in communities with more physical capital.

Proposed Hypotheses


$H_1$: community capital stocks will have a positive significant effect on the change in the number of restaurant establishments in the North Central Region of the U.S. from 1998 through 2000.

$H_2$: community capital stocks will have a positive significant effect on the change in the number of jobs in restaurant establishments in the North Central Region of the U.S. from 1998 through 2000.

$H_3$: Community capital stocks will have a significant positive impact on the change in annual payroll in restaurant establishments in the North Central Region of the U.S. from 1998 through 2000.
$H_4$: Community capital stocks will have a significant positive impact on the change in the number of hotel establishments in the North Central Region of the U.S. from 1998 through 2000.

$H_5$: Community capital stocks will have a significant positive effect on the change in jobs in hotel establishments in the North Central Region of the U.S. from 1998 through 2000.

$H_6$: Community capital stocks will have a positive impact on the change in the annual payroll in hotel establishments in the North Central Region of the U.S. from 1998 through 2000.
Chapter 3: Methods

Introduction

This chapter describes methodology employed to address the hypotheses introduced in Chapter I. It describes data sources and variable selection criteria and procedures. This is followed by a discussion of the dependent and independent variables included in the study and the analytical techniques used to explore the relationships among these variables. The creation of the dataset is described. Descriptive statistics for the dependent and independent variables used in the analysis are provided as well as an overview of the procedure. The chapter concludes with the empirical specification of the theoretical model and specific procedures to test each hypothesis.

The Data Set

Sources of Data

The major obstacle to this and similar analyses was overcome by merging multiple public use data sets using Federal Information Processing system (FIPS) codes. Census County Business Patterns (CBP) provided hospitality industry data. The Northeast Regional Center for Rural Development provided social capital data; USDA Cooperative Regional Research Project NC 1030 provided human, economic, physical
and natural capital data. The University of South Carolina provided Spatial Hazard Events and Losses Data for the U.S (SHELDUS).

SHELDUS data are available online for eighteen types of natural hazard events such as thunderstorms, hurricanes, floods, wildfires, and tornados ([http://webra.cas.sc.edu/hvri/products/sheldus.aspx](http://webra.cas.sc.edu/hvri/products/sheldus.aspx)). The observation unit in the online data base is a natural disaster. The database includes information such as the county and state of the hazard; property losses; crop losses; injuries; and fatalities associated with the hazard for each county affected. These data were used to obtain information on the types of hazards affecting each county and the amount of dollar damage per county resulting from the hazard.

These data were derived from national data sources: National Climatic Data Center’s (NCDC) monthly storm data publications and National Geophysical Data Center’s (NGDC) Tsunami Event Database note all events that report at least one death and all events reported in NCDC’s Storm Data with a specific dollar amount of damage, regardless of the amount since 1995. Data and maps were compiled and geo-referenced by the Hazards Research Lab at the University of South Carolina. This database was supported by grants from the National Science Foundation (Grant No. 99053252 and 0220712) and the University of South Carolina’s Office of the Vice President for Research.

Selection Criteria

Constraints on data manipulation capacity limited the number of observations that could be included to less than the number of counties in the U.S. Consequently an
officially recognized geographic region was chosen. The North Central Region of the U.S. was selected because it has the highest amount of per capita damage in the country resulting from exposure to natural disasters (Pielke, Jr. & Downton, 2000).

Only businesses included in the North American Industry Classification System NAICS code 72 Accommodation and Food Services were eligible for inclusion in the study. Sector 72 includes the major components of the hospitality industry (Kusluvan, 2003). Section 722 includes foodservice establishments, represented as restaurants in this study. Section 721 includes accommodations, represented as hotels in this study.

**Description of the Data**

The unit of analysis in this study is counties in the North Central region of the U.S. from 1998 to 2000 (n=983). The County Business Patterns data is an annual series that has provided economic data by industry annually since 1964. The data set was chosen because it contains a census, the universe of all counties in the North Central region of the U.S. The series contains economic actions and data for most of the country’s economic activity. It excludes data on self-employed individuals, employees of private households, railroad employees, agricultural production employees, and most government employees. The data are classified by the North American Industry Classification System (NAICS) basis since 1998 and the Standard Industrial Classification (SIC) System for 1997 and earlier years (U.S. Census Bureau, 2008). The County Business Pattern data were used to collect the number of hotel and restaurant establishments; the number of employees in each sector; and the annual payroll of U.S. hospitality businesses in the North Central region of the United States.
Accommodation establishments (NAICS 721)

The hotel industry subsector provides lodging or short-term accommodations for travelers, vacationers, and others. There is a wide range of establishments in this subsector. Some provide lodging only, while others provide meals, laundry services, and recreational facilities, as well as lodging. Lodging establishments are classified in this subsector even if the provision of complementary services generates more revenue. The types of complementary services provided vary from establishment to establishment (U.S. Census Bureau, 2009).

Food Services and Drinking Places (NAICS 722)

Businesses in the restaurant subsector prepare meals, snacks, and beverages to customer order for immediate on-premises and off-premises consumption. Some restaurants in this sample provide food and drink only; while others provide various combinations of seating space, waiter/waitress services, and incidental amenities, such as limited entertainment. The businesses in the subsector are grouped based on the type and level of services provided. Subsector groupings include full-service restaurants; limited-service eating places; special food services, such as food service contractors, caterers, and mobile food services; and drinking places.

Food and beverage services at hotels and motels; amusement parks, theaters, casinos, country clubs, and similar recreational facilities; and civic and social organizations are included in this subsector only if these services are provided by a separate establishment primarily engaged in providing food and beverage services. Excluded from this subsector are establishments operating dinner cruises. These establishments are classified
in Subsector 487, Scenic and Sightseeing Transportation, because those establishments utilize transportation equipment to provide scenic recreational entertainment (U.S. Census Bureau, 2009).

Characteristics of the Sample

The population of interest is restaurant and hotel establishments at the county level within the North Central region of the U.S. The sample years from the CBP database are 1998 and 2000. Descriptive statistics are provided for the dependent variables in 1998 and 2000 at the end of the chapter in Tables 4 and 5.

Dataset Creation

Data from multiple sources were merged using the Federal Information Processing System (FIPS) code in each data set. FIPS codes are unique for each county. Several sets of data had to be reformatted to create one observation per county. The county business pattern data are recorded with one observation for each NAICS code and size establishment for each county for each year. NAICS codes 721 and 722 were downloaded and then summed across establishment size categories within each county; restaurant and hotel data were saved for each county within the North Central region. SHELDUS data were recorded for each disaster and had to be reformatted to create a county observation from multiple disaster observations. Next, data for each county in the North Central region had to be selected from the social capital data on the NRCRD website and the human, economic, physical, and natural capital data for each county were selected from the NC1030 dataset. The final step in data creation was merging data from
the four sources, using FIPS codes for each county, to create a dataset complete with business, hazard, and capital data for each county.

Specific steps included:

a) The years of interest to be used in the analyses were selected and information was downloaded from the eleven states that comprise the North Central Region of the US from the CBP website, hosted by the US Census Bureau. North Central Region states include Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, and South Dakota.

b) All files were unzipped and extracted to ensure all data were in a readable text format. This was important to avoid compatibility issues due to different types of software.

c) Data was imported to SPSS using the Read Text File function by the FIPSTATE variable. The County Business Pattern (CBP) data import was performed for each state in the North Central Region. The newly created data set was saved as North Central Hospitality (NCH). The data import syntax is included in the Appendix A.

The disaster data housed within the SHELDUS website also had to be downloaded and reformatted. Data were available and downloaded on a state-by-state basis for the calendar year 1999. SHELDUS data were exported into excel and saved as a North Central Disaster (NCD) data file. Specific steps included:

*Importing From SHELDUS to Excel*

a. Data for the North Central region were downloaded from the SHELDUS website on a state-by-state basis. The data were saved in tab delimited format.
b. After opening Excel, the command *data-import-external data* was executed and the formatting and delimiter commands in Excel were used: tab and space; text qualifier in double quotes ("").

c. The SHELDUS data file can then be saved as an Excel file and manipulated using Excel utilities. The data file is now ready to open.

d. The spreadsheet was sorted by FIPS code, checked for errors; column alignment was corrected; and missing fields and all unneeded fields were eliminated.

**Importing From Excel to SPSS**

e. SPSS was then opened and SHELDUS data were brought into SPSS using the open data dialogue box to show all excel files.

f. To facilitate merging data sets, the FIPS codes in each data set had to have the same variable name; the FIPS code was subsequently renamed fips and incorporated the name of the county, the postal code, and the state name.

g. Variables were then re-ordered based on a meaningful proximity to each other: fips, county, state, damage, hazard, natural capital, human capital, social capital, economic capital, physical capital.

Having been created, a North Central Disaster (NCD) data set was saved. Both data sets were sorted in ascending order. The earlier created NCH file was opened and ‘merge data’ from the data menu in SPSS was selected. The option to add variables from NCD was chosen next. The final step was to sum merged hospitality and property damage disaster data for each county across all hazards.

The remaining task was to merge data on community capital stocks.
Candidates for social capital were downloaded from NRCRD for each county in the North Central Region. Counties in the North Central Region were selected from the NC1030 data file and candidates for indicators for natural, human, economic and physical capital were saved. One indicator for each type of community capital was selected. Previous empirical analyses of each of these types of capital provided candidate indicators. Candidate indicators for capital stocks are included in Table 2. From among the candidate indicators, that set of indicators, one for each type of capital that was least correlated with other types of capital was chosen.

Analytic Procedure

A multiple regression strategy was used to estimate all equations. Gliem (2007) recommends a simultaneous model for exploratory research, such as this, when there is no theoretical basis for considering any independent variable prior to any other independent variable. Similarly, Leech, Barrett, and Morgan (2004, p. 104), comment that when the researcher has no prior guide relative to which variables will create the best prediction equation and has a reasonably small set of predictors, the simultaneous regression procedure is preferred to a stepwise. Additionally, the dependent variable required a log transformation to compensate for heteroscedasticity.

Collinearity statistics were performed as their existence may inflate the variances of the parameter estimates, result in lack of statistical significance of individual independent variables while the overall model may be very significant, and produce wrong signs and magnitudes of regression coefficient estimates, leading to incorrect conclusions about relationships between independent and dependent variables. Because
the variables include both rank-order and continuous variables, both Spearman and Pearson correlation coefficients were estimated. A Spearman correlation applies to rank-order data while the Pearson correlation is applied to interval data. The correlation matrix indicated that physical capital (urban influence codes) and economic capital (median household income) were significantly correlated (Spearman $r=.670$) and (Pearson $r=.675$). Social and physical capital were also highly correlated (Spearman $r=.673$). Social capital and economic capital were moderately correlated (Spearman $r=.555$). Disaster frequency and disaster damage were moderately correlated (Spearman $r=.512$, $p<.01$).

Collinearity statistics for the regression equations also indicated multicollinearity may be problematic. Multicollinearity should be suspected when none of the partial regression coefficients is statistically significant but the $R^2$ for the full model is significant. High tolerance values near 1.0 indicate that multicollinearity is not a problem, while values near 0 indicate multicollinearity. High values of Variance Inflation Factor (VIF) indicate that a particular independent variable is a linear combination of the other independent variables; a rule of thumb researchers have followed is that if a VIF exceeds 20 there is reason to be concerned (Gliem, 2007). Values for the Tolerance statistic for restaurants ranged from .001-.344. Values for the Tolerance statistic for hotels ranged from .000-.421. Values for VIF for restaurants ranged from 2.91-1337. Values for VIF for hotels ranged from 2.51-3278. Other than the interaction effects constructed from other variables the VIF statistics were reasonable for all variables except property damage. Collinearity diagnostics on variables are found in Appendix B.
The Empirical Model

Using established criteria, the regression equation that specifies various levels of capital stocks, controlling for the frequency and dollar damage amount the disasters yielded was selected as the best method. These criteria included a percentage of variance explained that was the largest and a mean square error that was smallest among the alternative regressions. All financial variables were scaled to thousands of dollars to permit comparisons of the same order of magnitude.

Description of the Dependent Variables

Ecologists use the concept of resilience in the study of managing ecosystems and human–environment interactions, mainly to describe and understand how humans affect the resilience of ecosystems. (Janssen, 2006). Holling (1973, p 17) states that “resilience determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist.” In this study, resilience was measured by the change in: the number of hospitality and tourism business establishments within each county; the number of jobs in these establishments within each county; and the annual payroll in the business establishments within each county. Change states were measured by the number of units in the year 2000 minus the number of units in 1998. After computing the change, a natural log transformation was performed.
Methodology

This research used Mayunga’s community disaster resilience model to guide empirical analyses of the effects of the community on hospitality and tourism industry resilience after natural disasters. The central thesis of this research is that community pre-disaster levels of human, social, economic, physical, and natural capital are positively associated with post-disaster hospitality and tourism industry resilience. The types of community capital were measured separately to facilitate identification of the more important types of capital for the hospitality and tourism industries.

Analysis

Hospitality industry resilience was a function of community capital stocks, controlling for disasters and their damage. In this section of Chapter III, the measures of hospitality industry resilience, community capital stocks, and disasters are described and the empirical equations to be estimated are specified.

Community Capital Stocks

Social capital includes features of networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit reflecting the quantity and quality of social cooperation (Putnam, 1995). Social capital is measured in this study by the percentage of religious associations as of the calendar year 1997.

Human capital is probably one of the most important determinants of Resilience (Mayunga, 2007) and reflects the capacity for people to engage in productive work. It was measured in this study by the percentage of the county population of individuals over the age of 25, with four (plus) years of college as of 1990.
Economic capital represents the capacity for achieving livelihoods, increasing a county’s resilience by absorbing disaster impacts and accelerating the recovery process (Mayunga, 2007). This study measures economic capital by household median income (in thousands). Household income is the result of earning a living through a livelihood.

Physical capital includes components of the built environment such as residential housing, public buildings, critical infrastructure, and business and industry. Physical capital is measured in this study by the Urban Influence code (USDA). Urban influence increases the number of built structures or density of an area. The Urban Influence Code ranges from 1-9. Although the scale is called “urban influence,” the larger the number the more rural the county. Physical capital was reverse coded in the present study to be consistent with Mayunga’s theory of disaster resilience, which posits that increased capital stocks lead to increased resiliency.

Natural capital includes the entire ecosystem and other natural resources such as water, minerals and oil, and land (Smith, Simard, & Sharpe, 2001). Natural resources are measured in this study by a natural amenities scale used by USDA Cooperative Regional Research Project NC 1030. Natural amenities are on an ascending scale, with 1 being low amenities and 5 being the highest amenity.

**Disaster Variables**

Control variables used in this study are the number of disasters occurring in 1999 and the dollar amount of property damage incurred in 1999, the years occurring between 1998 and 2000 and the years for which the components of the dependent variables were measured.
Regression analysis was used where positive, significant effects for the capital variables were interpreted as support for the central thesis.

**Direct Effect Equations**

\[
\ln \Delta Y_i = \alpha + b_1 X_1 + b_2 X_2 + \ldots + b_3 + \ldots + e_i
\]

\(i = 1, \ldots, 7\)

where

\(Y_1 = \text{change in } \# \text{ restaurant establishments} \text{ in the county from 1998-2000};\)
\(Y_2 = \text{change in } \# \text{ hotel establishments} \text{ in the county from 1998-2000};\)
\(Y_3 = \text{change in } \# \text{ restaurant jobs} \text{ in the county from 1998-2000};\)
\(Y_4 = \text{change in } \# \text{ hotel jobs} \text{ in the county from 1998-2000};\)
\(Y_5 = \text{change in restaurants’ annual payroll} \text{ in the county from 1998-2000};\)
\(Y_6 = \text{change in hotels’ annual payroll} \text{ in the county from 1998-2000};\)
\(X_1 = \text{Number of disasters, 1999};\)
\(X_2 = \text{Property damage $\$, 1999};\)
\(X_3 = \text{Social capital};\)
\(X_4 = \text{Economic capital};\)
\(X_5 = \text{Physical capital};\)
\(X_6 = \text{Human capital};\)
\(X_7 = \text{Natural capital}.\)

**Indirect Effect Equations**

\[
\ln \Delta Y_i = \alpha + b_1 X_1 \ast X_3 + b_2 X_2 \ast X_3 + \ldots + bX_i \ast + e_i \text{ where } i = 1, \ldots, 7
\]

where
The hypotheses are tested by observing the change in $R^2$; the F statistic Change; and the value of $p \leq .05$ in the model. The first model in the analysis is the variance explained in the change in the dependent variable after disaster frequency and property damage are included. Model 2 in the analysis is the additional variance explained after community capital stocks are included. Model 3 is the additional variance explained after the interaction of disaster frequency variables and capital stocks are included; model 4 is the additional variance explained after the interaction of disaster damage variables and capital stocks are included in the model. Model 4 was significant for restaurant establishment changes only.
Table 5: Descriptive Statistics (Community Capital Stocks)

<table>
<thead>
<tr>
<th>Capital Stock</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Capital (Natural Amenity Rank: 1-5)</td>
<td>1</td>
<td>5</td>
<td>2.70</td>
<td>.69</td>
</tr>
<tr>
<td>Human Capital (25 yrs+, 4 yrs college: %)</td>
<td>4.20</td>
<td>44.00</td>
<td>12.80</td>
<td>5.24</td>
</tr>
<tr>
<td>Social Capital (Religious Associations: %)</td>
<td>0</td>
<td>1880</td>
<td>41.97</td>
<td>92.92</td>
</tr>
<tr>
<td>Physical Capital (Urban Influence Code: 1-9)</td>
<td>1</td>
<td>9</td>
<td>6.08</td>
<td>2.72</td>
</tr>
<tr>
<td>Economic Capital (Log HH Income in $ 1,000)</td>
<td>9.70</td>
<td>11.08</td>
<td>10.32</td>
<td>.20</td>
</tr>
</tbody>
</table>

Table 6: Descriptive Statistics (Disasters)

<table>
<thead>
<tr>
<th></th>
<th>Disaster Frequency</th>
<th>Disaster Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td>840</td>
<td>840</td>
</tr>
<tr>
<td>Mean</td>
<td>4.34</td>
<td>1.08^6</td>
</tr>
<tr>
<td>Mode</td>
<td>1.00</td>
<td>.00</td>
</tr>
<tr>
<td>SD</td>
<td>3.71</td>
<td>7.52^6</td>
</tr>
<tr>
<td>Minimum</td>
<td>1.00</td>
<td>.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>23.00</td>
<td>1.48^8</td>
</tr>
</tbody>
</table>
Table 7: Descriptive Statistics of the DV
(Number of Establishments, Jobs, and Annual Payroll, 1998)

<table>
<thead>
<tr>
<th>DV</th>
<th>N</th>
<th>Min.</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotels units (1998)</td>
<td>980</td>
<td>1</td>
<td>466</td>
<td>12.45</td>
<td>24.42</td>
</tr>
<tr>
<td>Restaurant units (1998)</td>
<td>911</td>
<td>1</td>
<td>9310</td>
<td>116.21</td>
<td>400.78</td>
</tr>
<tr>
<td>Hotel jobs (1998)</td>
<td>980</td>
<td>0</td>
<td>25147</td>
<td>242.35</td>
<td>1065.03</td>
</tr>
<tr>
<td>Restaurants jobs (1998)</td>
<td>911</td>
<td>0</td>
<td>145614</td>
<td>1858.80</td>
<td>6905.72</td>
</tr>
<tr>
<td>Hotel Payroll (1998)</td>
<td>980</td>
<td>0</td>
<td>570481</td>
<td>3549.31</td>
<td>21725.68</td>
</tr>
<tr>
<td>Restaurant Payroll (1998)</td>
<td>911</td>
<td>0</td>
<td>1778748</td>
<td>17680.13</td>
<td>77609.80</td>
</tr>
</tbody>
</table>
Table 8: Descriptive Statistics of the DV

<table>
<thead>
<tr>
<th>DV</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Sum</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotels units (2000)</td>
<td>914</td>
<td>1</td>
<td>479</td>
<td>11828</td>
<td>12.94</td>
<td>26.24</td>
</tr>
<tr>
<td>Restaurant units (2000)</td>
<td>969</td>
<td>1</td>
<td>9017</td>
<td>105053</td>
<td>108.41</td>
<td>381.54</td>
</tr>
<tr>
<td>Hotel jobs (2000)</td>
<td>914</td>
<td>0</td>
<td>28074</td>
<td>243088</td>
<td>265.96</td>
<td>1185.70</td>
</tr>
<tr>
<td>Restaurants jobs (2000)</td>
<td>969</td>
<td>0</td>
<td>148660</td>
<td>1766457</td>
<td>1822.97</td>
<td>6874.12</td>
</tr>
<tr>
<td>Hotel Payroll (2000)</td>
<td>914</td>
<td>0</td>
<td>689825</td>
<td>3873136</td>
<td>4237.57</td>
<td>26328.89</td>
</tr>
<tr>
<td>Restaurant Payroll (2000)</td>
<td>967</td>
<td>0</td>
<td>2008128</td>
<td>18154833</td>
<td>18774.39</td>
<td>84958.25</td>
</tr>
</tbody>
</table>
Table 9: Descriptive Statistics of the DV (1998-2000)

<table>
<thead>
<tr>
<th>DV</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotel units</td>
<td>912</td>
<td>-29.00</td>
<td>30.00</td>
<td>.14</td>
<td>3.22</td>
</tr>
<tr>
<td>Restaurant units</td>
<td>909</td>
<td>-293.00</td>
<td>66.00</td>
<td>-1.51</td>
<td>12.17</td>
</tr>
<tr>
<td>Hotel Payroll</td>
<td>912</td>
<td>-42967.00</td>
<td>119344.00</td>
<td>451.19</td>
<td>4805.69</td>
</tr>
<tr>
<td>Restaurant Payroll</td>
<td>909</td>
<td>-23258.00</td>
<td>229380.00</td>
<td>2236.45</td>
<td>10271.01</td>
</tr>
<tr>
<td>Hotel Jobs</td>
<td>912</td>
<td>-1515.00</td>
<td>2927.00</td>
<td>9.18</td>
<td>156.83</td>
</tr>
<tr>
<td>Restaurant Jobs</td>
<td>909</td>
<td>-2656.00</td>
<td>4214.00</td>
<td>77.73</td>
<td>353.83</td>
</tr>
</tbody>
</table>
Table 10: Inter-correlations

<table>
<thead>
<tr>
<th>Spearman's rho</th>
<th>Freq</th>
<th>Damage</th>
<th>Natural Capital</th>
<th>Human Capital</th>
<th>Social Capital</th>
<th>Econ Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>.512**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Damage</td>
<td></td>
<td>.014</td>
<td>.036</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Capital</td>
<td>.085*</td>
<td>.070*</td>
<td>-.088**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human Capital</td>
<td>.178**</td>
<td>.032</td>
<td>-.147**</td>
<td>.218**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Capital</td>
<td>.098**</td>
<td>.001</td>
<td>-.283**</td>
<td>.456**</td>
<td>.555**</td>
<td></td>
</tr>
<tr>
<td>Economic Capital</td>
<td>.089**</td>
<td>.011</td>
<td>-.144**</td>
<td>.227**</td>
<td>.673**</td>
<td>.670**</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).
Chapter 4: Results

In this chapter, the results of the estimation of the empirical equations in chapter III are reported. The analysis examines the direct and indirect effects of community capital stocks on business establishments in the hospitality industry. First, the results regarding changes in restaurants are presented. Second, the results regarding changes in hotels are presented. Within each segment of the hospitality industry, results are presented first for change in number of establishments, then change in number of jobs and, finally, change in payroll.

Regression Results: Direct and Indirect Effects

All hypotheses in this section were tested using statistics generated by regression analysis of the equations specified in Chapter III. Tables 11-16 summarize the results of the regression analyses. To serve as the basis for testing the hypotheses, the dependent variables were each regressed on two disaster variables and the five community capital stocks, including the interaction between the disasters and the capital stocks. Generally, the proportions of variance explained ranged from 23.3% to 49.5% for restaurants and from 23.2% to 35.1% for hotels. Each equation was significant. All hypotheses were supported or partially supported. All six equations yielded results with a significant ($p$
effect of community capital stocks on the dependent variables in the North Central Region of the U.S. The statistically significant effects of every type of community capital stock, with the exception of natural capital, were in the hypothesized direction. As an industry sector, restaurants were more affected, directly and indirectly, than hotels by natural disasters.

The first hypothesis $H_1$ proposed that community capital stocks would have positive significant effects on the change in the number of restaurant establishments in the North Central Region of the U.S. from 1998 through 2000. This hypothesis was supported (See Table 11.). The direct effects of community capital stocks, alone, explained 31.7% of the variance in change in number of restaurant establishments ($F_{(8,974)}=19.21, p \leq .05$) and the interaction effects explained another 7.7% of the variance ($F_{(5,227)}=21.194, p \leq .000$). The interaction effects of community capital stocks and disaster frequency explained 4.8% of variance ($F_{(5,227)}=3.34, p \leq .01$), and the interaction effects with disaster damage explained 2.9% of the variance ($F_{(5,217)}=2.21, p \leq .10$). Three types of capital had significant positive effects on the change in number of restaurants. Human capital had a positive direct effect ($B=.044, p \leq .001$). Economic and social capital had significant positive interaction effects with disaster frequency ($B=.040, p \leq .001$ and $B=.000, p \leq .10$ respectively). Social capital had a significant positive interaction with disaster damage ($B=.000, p \leq .05$).
Table 11: Effect of Community Capital on Restaurant Establishments

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE</th>
<th>Beta</th>
<th>p-value</th>
<th>Δ R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>-3.128</td>
<td>3.631</td>
<td>.390</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disasters</td>
<td>.005</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disaster Frequency</td>
<td>.008</td>
<td>.073</td>
<td>.033</td>
<td>.917</td>
<td></td>
</tr>
<tr>
<td>Disaster Damage</td>
<td>.000</td>
<td>.000</td>
<td>-.275</td>
<td>.887</td>
<td></td>
</tr>
<tr>
<td>Capital Stocks</td>
<td>.317***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Capital</td>
<td>-.109</td>
<td>.124</td>
<td>-.085</td>
<td>.379</td>
<td></td>
</tr>
<tr>
<td>Human Capital</td>
<td>.044</td>
<td>.013</td>
<td>.325</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>Social Capital</td>
<td>.001</td>
<td>.001</td>
<td>.126</td>
<td>.222</td>
<td></td>
</tr>
<tr>
<td>Economic Capital (ln)</td>
<td>.348</td>
<td>.350</td>
<td>.089</td>
<td>.321</td>
<td></td>
</tr>
<tr>
<td>Physical Capital</td>
<td>.056</td>
<td>.035</td>
<td>.171</td>
<td>.116</td>
<td></td>
</tr>
<tr>
<td>Interactions: with Disaster</td>
<td>.048*</td>
<td></td>
<td></td>
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Adj. R²=.352  SE=1.25  F(8,974)=8.46  n=983  *** p≤.001  ** p≤.005  * p≤.10
The second hypothesis H2 proposed that community capitals would have positive significant effects on the change in the number of restaurant jobs in the North Central Region of the U.S. from 1998 through 2000. This hypothesis was partially supported (See Table 12.). Community capital stocks explained 23.6% of the variance in change in number of restaurant jobs ($F(5, 308)= 19.413, p \leq .000$). However, only physical capital had a significant positive effect ($B= .138, F =6.63, p \leq .009$). None of the interaction effects was significant.
Table 12: Effect of Community Capital on Restaurant Jobs

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Adj. $R^2=.233$ SE=1.25 $F_{(8,974)}=6$ n=983 *** $p\leq.001$ ** $p\leq.005$ * $p\leq.05$
The third hypothesis $H_3$ proposed that community capital stocks would have positive significant effects on the change in the annual payroll of restaurants in the North Central Region of the U.S. from 1998 through 2000. This hypothesis was supported (See Table 13). The direct effects of community capital stocks, alone, explained 47.3% of the variance in change in the annual payroll of restaurants ($F(5, 390) = 75.14, p \leq .000$) in the North Central Region of the U.S. Three types of capital had significant positive direct effects on the annual payroll of restaurants. Human capital had a positive direct effect ($B = .051, p \leq .001$), as did social capital ($B = .003, p \leq .018$) and physical capital ($B = .213, p \leq .000$). No interaction effects were significant.
Table 13: Effect of Community Capital on Restaurant Payroll

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Adj. R²=.495  SE=1.14  F_{(8,974)}=23.90  ***P≤.001 ** P≤.005 * P≤.05
The fourth hypothesis H₄ proposed that community capital stocks would have positive significant effects on the change in the number of hotel establishments in the North Central Region of the U.S. from 1998 through 2000. This hypothesis was supported (See Table 14.). The direct effects of community capital stocks explained 32.1% of the variance in change in number of hotel establishments ($F_{(5,213)}=22.26$, $p \leq 0.000$). Two types of capital had significant effects on the change in number of hotels. Human capital had a positive direct effect ($B=0.044$, $p \leq 0.001$). Natural capital had a negative effect ($B=-0.221$, $p \leq 0.038$).
Table 14: Effect of Community Capital on Hotel Establishments

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Adj. R²=.351 SE=.63 F(8,974)=8.0 n=983 ***P≤.001 ** P≤.05 * P≤.05
H₃ proposed that community capitals would have positive significant effects on the change in the number of hotel jobs in the North Central Region of the U.S. from 1998 through 2000. This hypothesis was supported. The direct effects of community capital stocks explained 24.6% of the variance in change in number of hotel jobs ($F_{(5,273)}=18.42$, $p \leq .000$). Two types of capital had significant positive effects on the change in hotel jobs. Human and social capital had positive direct effects ($B=.052$, $p\leq.010$; $B=.003$, $p\leq.038$ respectively) on the change in number of hotel jobs in the North Central Region of the U.S. from 1998 through 2000.
Table 15: Effect of Community Capital on Hotel Jobs

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<td>.269</td>
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Adj. R^2=.232  SE=1.23  F_(_8,974_)=5.984  n=983  ***P<.001  **P<.005  *P<.05
$H_6$ proposed that community capitals would have positive significant effects on the change in the annual payroll of hotels in the North Central Region of the U.S. from 1998 through 2000. This hypothesis was supported. The direct effects of community capital stocks explained 32.0% of the variance in change in the annual payroll of hotels ($F(5,335)=33.11, p \leq .000$). Three types of capital had significant positive effects on the change in the annual payroll of hotels in the North Central Region of the U.S. from 1998 through 2000. Human, social, and physical capital had positive direct effects ($B=.084, p \leq .000$; $B=.004, p \leq .017$, and $B=.114, p \leq .044$ respectively).
Table 16: Effect of Community Capital on Hotel Payroll

<table>
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<tr>
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Adj. $R^2 = .328$  SE=1.36  $F(8,974)=8.46$  n=983  *** $P \leq .001$  ** $P \leq .005$  * $P \leq .05$
In summary, for restaurants, community capital stocks most affected the change in the annual payroll; for hotels, community capital stocks most affected the change in the number of establishments. See Table 17 below for a graphed summary.

Community capital stocks were moderated only in the case of restaurant establishment changes. The direct and indirect effects of community capital stocks explain 35.2% of the change in the number of restaurant establishments and direct effects explain 35.1% of hotel establishments in the North Central Region of the U.S. from 1998 through 2000. The direct effects of community capital stocks explain 23.3% of the variance in change in number of restaurant jobs and 23.2% of the variance in change in number of hotel establishment jobs in the North Central Region of the U.S. from 1998 through 2000. Finally, direct effects of community capital stocks explain 49.5% of the variance in change in the annual payroll of restaurants and 32.8% of the variance in change in the annual payroll of hotel establishments in the North Central Region of the U.S. from 1998 through 2000.
<table>
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<th>Industry Sector</th>
<th>Significant Capital Stocks</th>
<th>Direct Effects Of Community Capital Stocks</th>
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</thead>
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<td>Restaurant Establishments</td>
<td>Human w/disaster freq: Social, Economic; w/damage: Social</td>
<td>31.7% 4.8% (indirect effect) 2.9% (indirect effect)</td>
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<td>Restaurant Jobs</td>
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<td>23.6%</td>
</tr>
<tr>
<td>Restaurant Payroll</td>
<td>Human, Social, Physical</td>
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<tr>
<td>Hotel Establishments</td>
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</tr>
<tr>
<td>Hotel Jobs</td>
<td>Human, Social</td>
<td>24.6%</td>
</tr>
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<td>Hotel Payroll</td>
<td>Human, Social, and Physical</td>
<td>32%</td>
</tr>
</tbody>
</table>
Chapter 5: Discussion

The main objective of this research was to explain hospitality industry resilience. The capital approach was employed to assist in our understanding of hospitality industry resilience because of community resilience to the risk from a natural disaster. Hospitality industry resilience can be understood and explained as a function of direct effects of capital stocks as well as indirect effects.

Business and industry effects from natural disasters are amongst the most understudied areas in disaster research. This continues in the face of their sizeable inputs to the gross national product, jobs, taxes, and the staggering socio-economic costs of natural disasters (currently $1 billion per week and 300,000 affected lives per year in the US alone). Disasters are steadily increasing due to the confluence of more people and infrastructure in disaster-prone areas (van der Vink, Allen, Chapin, Crooks, Fraley, Krantz, Lavigne, 1998) and climate changes (Global Climate Change, June 2009). The Global Climate Change report, issued by the Obama administration on June 16, 2009 suggests, among other scenarios, that with no human intervention climate change will produce, “rising sea levels and extreme weather events: floods in lower Manhattan; a
quadrupling of heat waves deaths in Chicago and water levels in the Great Lakes falling by up to two feet by the end of the century under the higher emissions scenario; withering on the vineyards of California; the disappearance of wildflowers from the slopes of the Rockies; and the extinction of Alaska's wild polar bears in the next 75 years” (Global Climate Change, p 3, June 2009).

While hindsight might suggest that community resilience is quite naturally an indicator of industry resilience, this research is the first research of its type, using a population, to investigate the link between community and industry resilience in a hospitality context (LeCuyer, MacColl, Morgan, Ries, Robinson, Rodriguez, Smith, & Sponberg, 1998).

Cutter and Emrich (2006) report that as of 2003, over 53% of Americans, many of them racially and ethnically diverse; service workers; or the elderly, lived in a coastal county, an increase of 28 percent since 1980. Over the last decade, while disaster preparedness and mitigation measures such as improvements in forecasting, warning systems, and building codes have greatly reduced the number of fatalities from natural disasters, economic losses have increased several fold. As demonstrated in the current research and other researchers (Chang & Falit-Biamonte, 2002), indirect effects often produce losses beyond the direct effect of disaster damages. Our efforts to reduce the loss of life from natural disasters are successful, while our attempts to reduce costs have not been.

This chapter is organized in the following manner. First the most meaningful findings from the empirically specified model will be discussed, including direct effects;
indirect effects; and nonsignificant relationships in the hypotheses, with possible explanations for their findings. The remaining sections discuss limitations of the research and future research directions.

Direct and Indirect Effects

This research began with the idea that what matters to a community matters also to businesses within the community; that the more capital resources, or stocks, a community possesses the less disruption the community will suffer from the consequences of natural disaster. Kates (1977) suggests that disasters, rather than fundamentally changing existing social and economic trends in places, simply magnifies trends. According to Kates (1977), if an area is economically distressed pre-disaster, that distress is almost certain to be exacerbated post-disaster.

The results of this research support the conceptual and empirical premise that community resilience is an indicator of industry resilience in the hospitality industry. See Table 16 for summary findings of the effects of community capital stocks.

Restaurants

For the restaurant sector of the hospitality industry, the largest amount of variance explained among all the dependent variable equations was through changes in annual payroll; almost 50% of the change was explained (in order of effect size) through the direct effects of physical, human, and social capital stocks. With respect to the change in the number of restaurant establishments, nearly 32% of the change was attributable to the direct effect of human capital stocks; the interactions of capital stocks and disasters explained another nearly 8% of the change due to economic and social capital.
Regarding jobs in restaurants, physical capital stocks explained around 24% of the change in jobs from 1998-2000.

Restaurant establishments, jobs, and annual payroll were primarily impacted by physical and human capital stocks; while economic and social capital were significant interaction terms, their effect size (.040, .000 respectively) was relatively small.

*Hotels*

The results for the hotel sector of the hospitality industry indicated similar results for the effect of community capital stocks for the change in establishments and the change in annual payroll. The direct effects of community capital stocks explained 32% of the change in establishments through human and natural (in the negative direction) capital stocks and the change in annual payroll through; physical, human, and social capital stocks. As in the restaurant sector case, capital stocks account for the least comparable change of all the dependent variables in the area of jobs, explaining almost 25% of payroll changes through human and social community capital stocks.

*Human Capital*

Consistent with the conclusions of social scientists who study community resiliency, many cross-disciplinary studies demonstrate the role social and human capital play in extending collective well-being and community resilience. In their social capital index equation, Rupasingha et al. 2006 found educational attainment (the indicator for human capital here) returned the highest standardized beta coefficient among all other candidates. Maynuga suggests that of all capital stocks, human capital is the most
important contributor to resilience; these stocks made a difference as well in the current research.

In every equation, with the exception of restaurant jobs, human capital was a significant and positive indicator of industry resilience. Natural disasters exact tremendous costs from businesses and communities. Governance activities, such as communicating, preparing, and learning from the effects of a disaster are the kind of activities likely to be taken on by an educated public, the human capital indicator in this investigation. Intentional mitigation strategies, knowledge, skills, and abilities to anticipate and respond to disruptions from natural disasters are the types of characteristics one would expect to find within communities with higher levels of education; thus, businesses in a more highly educated community should find itself more resilient to natural disasters.

Physical Capital

Physical capital effects changes in restaurant jobs and annual payrolls; physical capital was a significant indicator for hotels only for changes in annual payroll. Physical capital was operationalized in this research as the number and quality of built environments. In the case of hotels, physical capital may offer inherent resilience by their larger size (as compared to restaurants) and enforcement to current building and zoning codes due to safety concerns for guests; and may be more likely to have engaged in preparedness routines that should aid in protecting the physical capital attribute.

Restaurants may also benefit more immediately than hotels from post-recovery activities such as repairing and rebuilding tasks from construction and building related
firms. Due to the smaller scale of restaurants vis-à-vis hotels, the need for long distance recovery crews versus local ones might be dampened. Zhang, Lindell, and Prater (2009) note that hospitality businesses may initially suffer sharp losses in the immediate aftermath of a disaster; sales may rebound as a function of increased demand for their products and services from recovery-related businesses involved in restoration efforts. The present investigation however was unable to capture this type of fine-grained analysis.

Social Capital

Social capital was positive and significant for changes in jobs and annual payroll in hotels, and for annual payroll in restaurants. While social capital was the second most frequently significant independent variable for all equations (following human capital) its influence was minimal. This is of minimal concern however; rescaling the variable to smaller unit sizes would increase coefficient size. Rescaling social capital, presently scaled as the actual number of religious associations in the county, to the number of religious associations/100 would magnify the coefficient. Social capital was nonsignificant for changes in restaurant and hotel establishments and, surprisingly, restaurant jobs, but perhaps it is not insignificant.

Social capital’s non significance for industry establishment changes is unremarkable; of all the indicators conceptually germane to changes in the number of establishments, the number of religious associations in the county seems to be less important than educational attainment, natural amenities, rural vs. suburban influences, and household income.
In prior research (Putnam, 2000), it was found that “P-Groups” religious affiliation in a community influenced community well-being and that the role of religion had important implications for generating and sustaining thriving communities (Schwinn, 2001). This study also finds that social capital is positively associated with hospitality industry resilience.

**Natural Capital**

Because the hospitality industry is comprised of many establishments that intentionally locate in amenity-rich environments as part of its strategic advantage (tourist resort destinations for example), it was expected that natural amenities would contribute positively to industry resilience. This was not the case; natural amenities returned significant effects for the change in hotel establishments only, in the negative (unspecified) direction. What this means is that for every 1% increase in the proportion of natural amenities, there is a 22% decrease in the number of hotel establishments.

This capital presents thorny interpretations. Natural capital is the means by which communities experience their ecosystems that sustain life and represent renewable and non-renewable resources, such as land, water, and air quality. In prior research, natural amenities have produced significant results as an indicator of community vulnerability (Cutter, 2003).

The negative and unexpected direction of natural capital in the equation for hotel establishments may represent vulnerability in the current context. The North Central Region of the US, used in the current study, is comprised of miles of coastal shorelines. Flooding is the most frequent natural disaster in the region. It might be reasonable to
imagine that large bodies of water such as rivers, lakes, and streams may exacerbate natural disasters, such as floods. Hurricane Katrina is one such example. Hotels that locate in disaster-prone areas that are also high on the natural amenities scale, might expect, given a natural disaster, to be vulnerable to a reduction in establishments.

However, as Manyena (2006) suggests, vulnerability is not the other side of resilience; disaster variables were nonsignificant in the equation; and there were no multicollinearity concerns between disaster damage and natural amenities. An alternative or additional explanation for the negative sign before natural capital relates to the temporality of the data. Perhaps a one-year observation time is insufficient for communities to recover from the effects of a disaster through natural amenities.

*Economic Capital*

The household income variable was significant for the interaction term with disasters in the case of restaurant establishment changes only. The higher than desired correlation between economic and physical (Spearman’s rho = .670) may be muting the effect of economic capital.

*Disaster Damage and Frequency*

Non-significant results were found for disaster frequency and damage in most cases, perhaps due to the temporality of the data. The effects from a natural disaster can be enduring as people adapt to a new-normal; these effects may not be instantly recognized or accounted for. Equally compelling however is Kates’ (1977) observation that disasters exacerbate trends rather than fundamentally changing existing states.
The literature speaks to the weak or nonsignificant correlation between physical disaster damage such as inventory, building structure, and equipment, and loss (Dahlhamer, 1998; Zhang, Lindell, & Prater, 2009; Webb, Tierney, & Dahlhamer, 2002). Indirect effects such as competitive pressures, business disruptions, and disaster effects on customers can cause failure and long term loss with little evidence of physical damage. For example, indirect effects such as multiplier effects of ‘damage’ to hotels via business interruptions of their suppliers might influence business resiliency. Likewise the hospitality industry experiences indirect effects through effects experienced by employees. For example, if a sizeable enough proportion of a hotels’ or restaurants’ employees are significantly affected by a disaster’s effects, human resource scarcities through population dislocation is a viable threat.

Theoretical Implications and Contributions

The findings of this research advance our knowledge of industry resiliency. First this study suggests that resilience to a natural disaster follows a holistic course; businesses do not stand alone in their ability to weather this type of storm but rather, their resiliency can be modeled as a function of the communities in which they locate.

The study provides theoretical insight in understanding the factors that influence hotel and restaurant establishments, changes in payroll, and how jobs might be impacted after a natural disaster. This study is the first study of its type; moreover the sample analyzed is a population of all counties (983) that represent the North Central Region of the United States, a region that experiences more disaster damage per capita than any in the country.
While the scant few previous studies on businesses in the hospitality literature focus on disaster preparedness versus business continuity, this study extends our understanding of communities and businesses by measuring community capital stocks successfully used by others as resilience indicators.

The model proposed in the current study attempts to measure industry resilience from the effects of natural. As such, it represents a benchmark, reference, and a guide for fellow researchers inclined to investigate these effects.

Limitations

The choice of the research design used here forced certain concessions that could limit generalizability of the findings. The need to identify capital stocks of a large number of counties constrained the design to use data gathered by external sources, such as the US Census Bureau. Consequently, the findings of this research can be confidently extended only to the eleven counties that comprise the North Central Region of the US. Any county outside this area may have characteristics and nuances that deviate significantly from the counties analyzed here. Nevertheless, because this is a population, the greater concern may concern the data themselves. Aggregated data, such as found at the county level may mask the distinctive characteristics of communities that allow for uniqueness.

Second, the extraordinarily large size of each of the three datasets limited this first analysis to a two year analytic frame. Thus, the temporality of this research might not allow sufficient time for resiliency effects to be detected.
Third, capital stock indicators were specified by a single variable. One indicator is unlikely to describe all the complexities of any county. This may produce misleading interpretations and tell only part of the whole story.

Finally and perhaps most important, the resilience of a community is first a function of how well resilience is specified and modeled at the operational level. Bruneau’s et al., (2003) aspects of resilience suggest that resiliency is temporal and can be both reduced consequence from failure and reduced time to recover. Given these degrees of resilience, the research design subtle enough to capture the distinction between reduced consequence from failure and reduced time to recover is the most preferred design. The design employed in the current research does not distinguish between these two phases.

Community and business resilience changes over time; communities and businesses experience in and out migration; communities develop, learn, and respond to change. Over time, resilience can be considered as an input and an output; as a result and as a catalyst for a future hazard event. Consistent with GST, businesses experience enhanced resilience thru community resilience and communities are often created through the decisions of businesses to locate in a community, demonstrating the interdependencies that exist between a community and its businesses and the permeable membranes inherent in both.

**Opportunities for Future Research**

This research is exploratory and would benefit greatly in four fundamental ways: better model specification; a longer observation interval; multiple indicators for
community capital stocks; and qualitative investigations to better understand underlying latent effects of natural disasters.

Model Specification

Currently Mayunga’s model suggests an additive approach: the more capital stocks a community possesses the more resilient it is to the effects of a natural disaster. Under this approach, an increase in capital stocks may be masking itself as a growth variable, revealing growth as the variable of determination rather than capital stocks. Even if capitals are additive, they may also be interrelated (Ahmed et al., 2004), and combine and/or generate new capitals, significantly transforming the utility of other capitals (such as increasing levels of economic capital creating technological innovations implemented by human capital).

Other researchers have approached resiliency from a diversity frame (Hollings, 1973; Horne & Haynes, 1999). Magis (2007) posits that diversity, referencing the principle of requisite variety, is mandatory for resilience, due to its ability to commandeer system complexity and variety to manage uncertainty and external shocks. Another potentially fruitful area of research would be to understand if the true model is really a diversity model or an additive model with a diversity component.

The diversity argument may be expanded by explaining hospitality industry outcomes as a function of disaster type. Differences in the type and/or severity of natural hazards may suggest that the diversity of disasters itself have multi-faceted capital stock allocations and outcomes.
The researcher should be advised that the current Mayunga model does not address any mechanisms by which capitals provide resilience, leaving open the question of moderation and mediation.

Observation Interval

Second, while this preliminary research suggests that capital stocks do matter within the two year window analyzed (1998-2002), earlier in the current research was the notion that resilience happens in degrees and aspects or stages. It might also be that certain capitals matter more during different stages of resilience, suggesting a hierarchy or sequence of capital stock importance as a function of recovery stage and time. As such, disaster frequency might emerge as a significant contributor to resiliency with an expansion of the number of years analyzed, leaving one to speculate that disaster frequency might be at least partially responsible for costs increases of natural disasters.

Multiple Indicators for Community Capital Stocks

Third, this research may benefit from using multiple indicators of capital stocks. Over-reliance on one indicator may easily distort the true picture of disaster effects and allow for cursory analyses and implications. Using multiple indicators can be accomplished in several ways. First, the researcher may, driven by empirical evidence, expand the total number of indicators for each capital. This may be a formidable task as there are few signposts to highlight the way given the paucity of disaster business studies in general and the scant empirical studies devoted to hospitality and tourism.

Alternatively, using exploratory factor analysis in an effort to isolate latent and common variance amongst capital stock indicators may aid the research, possibly
improve variance explained, and effect size as well. This research corroborates the observation that capital stocks are not independent and exhibit inter-correlations. While none of the inter-correlations were outside the zone of tolerance (r=.7) in the current research, smaller correlations should yield higher confidence in analysis results.

Third, a resiliency index specified for the hospitality industry may prove productive. Several researchers have developed indices that appear to lend themselves to more easily replicated results, hence creating viable theoretical approaches and constructs (See for example Cutter’s SoVi index, 2003; Horne & Haynes’ Socioeconomic Resiliency Scale, 1999; Rupasingha’s Social Capital Index, 2006). An industry-specific resilience index or scale has the added advantage of potentially capturing industry nuances inaccessible by roughly-hewn quantitative measures.

Lastly, this research may benefit from qualitative research methodologies. Qualitative research may be undertaken in an attempt to better understand quantitative results; to launch a new set of indicators that are supported by these findings; or to capture additional/latent resilience variables in concordance with the earlier discussion of model specification recommendations.

Qualitative Inquiry

This research began as an attempt to understand the quantitative effects and consequences of natural disasters on the hospitality industry. Community capital stock measures were used due to their successful application in other areas, as well as to test an innovative conceptual model specifically designed for resilience to disasters (Mayunga, 2007). While merging three large data sources with capital stock and disaster information
for the 983 counties comprising the North Central region of the US (US Census’ County Business Patterns; Hazards and Vulnerability Research Institute (HVRI) at University of South Carolina’s SHELDUS; North East’s Regional Center for Rural Development at Pennsylvania State University); finding the best set of orthogonal indicators and subsequently calculating formulas and transforming variables produced the initial results of industry resilience, much of the variance in the dependent variables remain unexplained.

While the disaster literature, business disasters, hospitality literatures were fully employed in the research, it is nonetheless a first-ever attempt to understand disaster effects on an industry, in this case businesses that define themselves as hotels and restaurants. Much work remains to be done to specify a reliable, reproducible empirical model.

Perhaps the addition of a qualitative methodology to answer the questions contained in this investigation would be useful. Qualitative methods provide results that are usually rich and detailed and perhaps provide guidance to underlying, latent constructs and variables. Qualitative methods are frequently used in social capital research in order to illuminate the underlying power of social networks as reported in other studies such as Rupasingha et al., 2006 (church attendance vs. church activities like praying/meditating, community outreach; “O” group rent-seeking organizations versus “P” group organizations that promote trust).
REFERENCES


APPENDIX A: REGRESSION RESULTS
Table 18: Effect of Community Capital on Restaurant Establishments

<table>
<thead>
<tr>
<th>Variables</th>
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Adj. R²=.352  SE=1.25  F_{8,974}=8.46  n=983  *** p≤.001 ** p≤.005 * p≤.10
Table 19: Effect of Community Capital on Restaurant Jobs

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Adj. $R^2=.233$  SE=1.25  $F(8,974)=6$  n=983  *** $p\leq0.001$ ** $p\leq0.005$  * $p\leq0.05$
Table 20: Effect of Community Capital on Restaurant Payroll

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Adj. R²=.495        SE=1.14        F_{(8,974)}=23.90        ***P≤.001 ** P≤.005 * P≤.05
Table 21: Effect of Community Capital on Hotel Establishments

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Adj. R²=.351    SE=.63    F(8,974)=8.0    n=983    ***P≤.001    **P≤.05    *P≤.05
Table 22: Effect of Community Capital on Hotel Jobs

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Adj. $R^2=.232$  SE=1.23  $F_{(8,974)}=5.984$  n=983  **P≤.001  **P≤.005  *P≤.05
Table 23: Effect of Community Capital on Hotel Payroll

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<td>.002</td>
</tr>
<tr>
<td>Damage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Capital</td>
<td>.000</td>
<td>.000</td>
<td>-.234</td>
<td>.713</td>
<td></td>
</tr>
<tr>
<td>Human Capital</td>
<td>.000</td>
<td>.000</td>
<td>-.491</td>
<td>.555</td>
<td></td>
</tr>
<tr>
<td>Social Capital</td>
<td>.000</td>
<td>.000</td>
<td>.097</td>
<td>.544</td>
<td></td>
</tr>
<tr>
<td>Economic Capital (ln)</td>
<td>.000</td>
<td>.000</td>
<td>.066</td>
<td>.924</td>
<td></td>
</tr>
<tr>
<td>Physical Capital</td>
<td>.000</td>
<td>.000</td>
<td>.052</td>
<td>.919</td>
<td></td>
</tr>
</tbody>
</table>

Adj. R²=.328  SE=1.36  F_{18,974}=8.46  n=983  *** P≤.001  ** P≤.005  * P≤.05
APPENDIX B: MODEL SYNTAX
MODEL SYNTAX

[COUNTY BUSINESS PATTERN (CBP) DATA RECODE SYNTAX]

AUTORECODE
  VARIABLES=naics /INTO NAICSR /PRINT.

*COMMENT 'Having created NAICSR, you now have to scroll down and find the new
code for naics 721 and 722 and use those new codes in the next step, select cases'.

USE ALL.
EXECUTE .

COMPUTE fips = (1000 * fipstate)+fipscty .
EXECUTE .

SORT CASES BY fips .
CASESTOVARS
  /ID = fips
  /GROUPBY = VARIABLE .
FILTER OFF.

[DATA REFORMAT]

COMPUTE ptaxmil = protax92 /1000000 .
EXECUTE .

COMPUTE medinc1k = medinc95/1000 .
EXECUTE .

COMMENT 'SUMMING ALL DISASTERS BY EVIDENCE OF PROPERTY
DAMAGE'.
Compute dis981 = 0.
EXECUTE .
Do If (property_damage.1 > 0).
  Recode dis981 (0 = 1).
End if.
EXECUTE .

Compute dis982 = 0.
EXECUTE .
Do If (property_damage.2 > 0).
Recode dis982 (0= 1).
End if.
EXECUTE.

Compute dis983 = 0.
EXECUTE.
Do If (property_damage.3 > 0).
Recode dis983 (0= 1).
End if.
EXECUTE.

Compute dis984 = 0.
EXECUTE.
Do If (property_damage.4 > 0).
Recode dis984 (0= 1).
End if.
EXECUTE.

Compute dis985 = 0.
EXECUTE.
Do If (property_damage.5 > 0).
Recode dis985 (0= 1).
End if.
EXECUTE.

Compute dis986 = 0.
EXECUTE.
Do If (property_damage.6 > 0).
Recode dis986 (0= 1).
End if.
EXECUTE.

Compute dis987 = 0.
EXECUTE.
Do If (property_damage.7 > 0).
Recode dis987 (0= 1).
End if.
EXECUTE.

Compute dis988 = 0.
EXECUTE.
Do If (property_damage.8 > 0).
Recode dis988 (0= 1).
End if.
EXECUTE .

Compute dis989 = 0.
EXECUTE .
Do If (property_damage.9 > 0).
Recode dis989 (0= 1).
End if.
EXECUTE .

Compute dis9810 = 0.
EXECUTE .
Do If (property_damage.10 > 0).
Recode dis9810 (0= 1).
End if.
EXECUTE .

Compute dis9811 = 0.
EXECUTE .
Do If (property_damage.11 > 0).
Recode dis9811 (0= 1).
End if.
EXECUTE .

Compute dis9812 = 0.
EXECUTE .
Do If (property_damage.12 > 0).
Recode dis9812 (0= 1).
End if.
EXECUTE .

Compute dis9813 = 0.
EXECUTE .
Do If (property_damage.13 > 0).
Recode dis9813 (0= 1).
End if.
EXECUTE .

Compute dis9814 = 0.
EXECUTE .
Do If (property_damage.14 > 0).
Recode dis9814 (0= 1).
End if.
EXECUTE .
Compute dis9815 = 0.
EXECUTE .
Do If (property_damage.15 > 0).
Recode dis9815 (0= 1).
End if.
EXECUTE .

Compute dis9816 = 0.
EXECUTE .
Do If (property_damage.16 > 0).
Recode dis9816 (0= 1).
End if.
EXECUTE .

Compute dis9817 = 0.
EXECUTE .
Do If (property_damage.17 > 0).
Recode dis9817 (0= 1).
End if.
EXECUTE .

Compute dis9818 = 0.
EXECUTE .
Do If (property_damage.18 > 0).
Recode dis9818 (0= 1).
End if.
EXECUTE .

Compute dis9819 = 0.
EXECUTE .
Do If (property_damage.19 > 0).
Recode dis9819 (0= 1).
End if.
EXECUTE .

Compute dis9820 = 0.
EXECUTE .
Do If (property_damage.20 > 0).
Recode dis9820 (0= 1).
End if.
EXECUTE .

Compute dis9821 = 0.
EXECUTE .
Do If (property_damage.21 > 0).
Recode dis9821 (0= 1).
End if.
EXECUTE .

Compute dis9822 = 0.
EXECUTE .
Do If (property_damage.22 > 0).
Recode dis9822 (0= 1).
End if.
EXECUTE .

Compute dis9823 = 0.
EXECUTE .
Do If (property_damage.23 > 0).
Recode dis9823 (0= 1).
End if.
EXECUTE .

Compute dis9824 = 0.
EXECUTE .
Do If (property_damage.24 > 0).
Recode dis9824 (0= 1).
End if.
EXECUTE .

Compute dis9825 = 0.
EXECUTE .
Do If (property_damage.25 > 0).
Recode dis9825 (0= 1).
End if.
EXECUTE .

Compute dis9826 = 0.
EXECUTE .
Do If (property_damage.26 > 0).
Recode dis9826 (0= 1).
End if.
EXECUTE .

Compute dis9827 = 0.
EXECUTE .
Do If (property_damage.27 > 0.
Recode dis9827 (0= 1).  
End if.  
EXECUTE .

Compute dis9828 = 0.  
EXECUTE .  
Do If (property_damage.28 > 0).  
Recode dis9828 (0= 1).  
End if.  
EXECUTE .

Compute dis9829 = 0.  
EXECUTE .  
Do If (property_damage.29 > 0).  
Recode dis9829 (0= 1).  
End if.  
EXECUTE .

Compute dis9830 = 0.  
EXECUTE .  
Do If (property_damage.30 > 0).  
Recode dis9830 (0= 1).  
End if.  
EXECUTE .

Compute dis9831 = 0.  
EXECUTE .  
Do If (property_damage.31 > 0).  
Recode dis9831 (0= 1).  
End if.  
EXECUTE .

Compute dis9832 = 0.  
EXECUTE .  
Do If (property_damage.32 > 0).  
Recode dis9832 (0= 1).  
End if.  
EXECUTE .

Compute dis9833 = 0.  
EXECUTE .  
Do If (property_damage.33 > 0).  
Recode dis9833 (0= 1).  
End if.
EXECUTE.

Compute dis9834 = 0.
EXECUTE.
Do If (property_damage.34 > 0).
Recode dis9834 (0= 1).
End if.
EXECUTE.

Compute dis9835 = 0.
EXECUTE.
Do If (property_damage.35 > 0).
Recode dis9835 (0= 1).
End if.
EXECUTE.

Compute tdis98 =
dis981+dis982+dis983+dis984+dis985+dis986+dis987+dis988+dis989+dis9810+dis9811
+dis9812+dis9813+dis9814+dis9815+dis9816+dis9817+dis9818+dis9819+dis9820+dis9821
+dis9822+dis9823+dis9824+dis9825+dis9826+dis9827+dis9828+dis9829+dis9830+dis9831+dis9832+dis9833+dis9834+dis9835.
EXECUTE.

RECODE
  PROPERTY_DAMAGE.1 PROPERTY_DAMAGE.10 PROPERTY_DAMAGE.11
  PROPERTY_DAMAGE.12
  PROPERTY_DAMAGE.13 PROPERTY_DAMAGE.14 PROPERTY_DAMAGE.15
  PROPERTY_DAMAGE.16
  PROPERTY_DAMAGE.17 PROPERTY_DAMAGE.18 PROPERTY_DAMAGE.19
  PROPERTY_DAMAGE.2
  PROPERTY_DAMAGE.20 PROPERTY_DAMAGE.21 PROPERTY_DAMAGE.22
  PROPERTY_DAMAGE.23
  PROPERTY_DAMAGE.24 PROPERTY_DAMAGE.25 PROPERTY_DAMAGE.26
  PROPERTY_DAMAGE.27
  PROPERTY_DAMAGE.28 PROPERTY_DAMAGE.29 PROPERTY_DAMAGE.3
  PROPERTY_DAMAGE.30
  PROPERTY_DAMAGE.31 PROPERTY_DAMAGE.32 PROPERTY_DAMAGE.33
  PROPERTY_DAMAGE.34
  PROPERTY_DAMAGE.35 PROPERTY_DAMAGE.4 PROPERTY_DAMAGE.5
  PROPERTY_DAMAGE.6
  PROPERTY_DAMAGE.7 PROPERTY_DAMAGE.8 PROPERTY_DAMAGE.9
(MISSING=0).
EXECUTE.

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Compute tdmg98 =
  property_damage.35+property_damage.34+property_damage.33+property_damage.32+
  property_damage.31+property_damage.30+property_damage.29+property_damage.28+
  property_damage.27+property_damage.26+
  property_damage.25+property_damage.24+property_damage.23+property_damage.22+
  property_damage.21+property_damage.20+property_damage.19+property_damage.18+
  property_damage.17+property_damage.16+
  property_damage.15+property_damage.14+property_damage.13+property_damage.12+
  property_damage.11+property_damage.10+property_damage.9+property_damage.8+
  property_damage.7+property_damage.6+
  property_damage.5+property_damage.4+property_damage.3+property_damage.2+proper
  ty_damage.1.
EXECUTE.

Compute tdmg98hk = tdmg98/100000.
Execute.

COMMENT 'ELIMINATING DUPLICATE CASES.'
* Identify Duplicate Cases.
SORT CASES BY fips00(A) est.72100(A) est.72200(A) emp.72100(A) emp.72200(A)
ap.72100(A) ap.72200(A)
  est.72198(A) est.72298(A) emp.72198(A) emp.72298(A) ap.72198(A) ap.72298(A)
  medinc95(A) mt4yrs90(A)
  natamen(A) ptaxmil(A) pvote96(A).
MATCH FILES
  /FILE=*
  /BY fips00 est.72100 est.72200 emp.72100 emp.72200 ap.72100 ap.72200 est.72198
  est.72298
  emp.72198 emp.72298 ap.72198 ap.72298
  /DROP = PrimaryFirst  /FIRST=PrimaryFirst.
VARIABLE LABELS  PrimaryFirst 'Indicator of each first matching case as Primary'.
VALUE LABELS  PrimaryFirst 0 'Duplicate Case' 1 'Primary Case'.
VARIABLE LEVEL  PrimaryFirst (ORDINAL).
FREQUENCIES VARIABLES=PrimaryFirst.
FILTER  BY PrimaryFirst.
EXECUTE.

[COMMENT 'STEPWISE REGRESSION' SYNTAX].

REGRESSION
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS R ANOVA
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT est721change
/METHOD=STEPWISE pvote96 mt4yrs90 medinc95 ptaxmil natamen.

[CORRELATION MATRIX SYNTAX]

CORRELATIONS
/VARIABLES=medinc95 mt4yrs90 natamen ptaxmil pvote96 est721change est.72100 emp.72100 ap.72100
tdis98 tdmg98hk
/PRINT=ONETAIL NOSIG
/MISSING=PAIRWISE.

NONPAR CORR
/VARIABLES=medinc95 mt4yrs90 natamen ptaxmil pvote96 est721change est.72100 emp.72100 ap.72100
tdis98 tdmg98hk
/PRINT=SPEARMAN ONETAIL NOSIG
/MISSING=PAIRWISE.

[COMMENT 'OLS REGRESSION FOR ALL IVs USING TOTAL DISASTERS AND DAMAGE' SYNTAX].

REGRESSION
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA
/Criteria=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT est721change
/METHOD=ENTER medinc95 mt4yrs90 natamen pvote96 tdmg98hk tdis98 ptaxmil.

COMMENT 'OLS REGRESSION FOR ALL IVs excluding USING TOTAL #DISASTERS'.

REGRESSION
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA
/Criteria=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT est.72198
/METHOD=ENTER medinc95 mt4yrs90 natamen ptaxmil pvote96 tdmg98hk.

REGRESSION
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA CHANGE ZPP
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT est721change
/METHOD=ENTER medinc95 mt4yrs90 natamen ptaxmil pvote96 tdis99 tdmg99hk
/RESIDUALS NORM(ZRESID).

[COMMENT 'COMPUTING PAYROLL CHANGE AND EMPLOYEE CHANGE ' SYNTAX].

COMPUTE ap721change=ap.72100 - ap.72198.
EXECUTE.

COMPUTE ap722change=ap.72200 - ap.72298.
EXECUTE.

COMPUTE emp722change=emp.72200 - emp.72298.
EXECUTE.

COMPUTE emp721change=emp.72100 - emp.72198.
EXECUTE.
[INTERACTION COMPUTATION SYNTAX]

"COMMENT COMPUTING MODERATOR VARIABLES'.

COMPUTE modr_disdmg_natamen=disdmg * natamen. EXECUTE.

COMPUTE modr_disdmg_relig97=disdmg * relig97. EXECUTE.

COMPUTE modr_disdmg_college90=disdmg * college90. EXECUTE.

COMPUTE modr_disfreq_LnEconomicCapital=disfreq* LnEconomicCapital. EXECUTE.

COMPUTE modr_disdmg_LnEconomicCapital=disdmg* LnEconomicCapital. EXECUTE.

COMPUTE modr_disdmg_urbinf93=disdmg * urbinf93. EXECUTE.

SHELDUS RECODE SYNTAX

SORT CASES BY fips .
CASESTOVARS
/ID = fips
/GROUPBY = VARIABLE .

COMMENT 'SUMMING ALL DISASTERS BY EVIDENCE OF PROPERTY DAMAGE'.
Compute tdmg99.1 = 0. EXECUTE .
Do If (tdmg99.1 > 0).
Recode tdmg99.1 (0 = 1).
End if.
EXECUTE .

COMMENT 'SUMMING ALL DISASTERS BY EVIDENCE OF PROPERTY DAMAGE'.
Compute tdmg99.2 = 0. EXECUTE .
Do If (tdmg99.2 > 0).
Recode tdmg99.2 (0 = 1).
End if.
EXECUTE.

Compute tdmg99.3 = 0.
EXECUTE.
Do If (tdmg99.3 > 0).
Recode tdmg99.3 (0 = 1).
End if.
EXECUTE.

Compute tdmg99.4 = 0.
EXECUTE.
Do If (tdmg99.4 > 0).
Recode tdmg99.4 (0 = 1).
End if.
EXECUTE.

Compute tdmg99.5 = 0.
EXECUTE.
Do If (tdmg99.5 > 0).
Recode tdmg99.5 (0 = 1).
End if.
EXECUTE.

Compute tdmg99.6 = 0.
EXECUTE.
Do If (tdmg99.6 > 0).
Recode tdmg99.6 (0 = 1).
End if.
EXECUTE.

Compute tdmg99.7 = 0.
EXECUTE.
Do If (tdmg99.7 > 0).
Recode tdmg99.7 (0 = 1).
End if.
EXECUTE.

Compute tdmg99.8 = 0.
EXECUTE.
Do If (tdmg99.8 > 0).
Recode tdmg99.5 (0 = 1).
End if.
EXECUTE .
Compute tdmg99.9 = 0.
EXECUTE .
Do If (tdmg99.9 > 0).
Recode tdmg99.9 (0 = 1).
End if.
EXECUTE .

Compute tdmg99.10 = 0.
EXECUTE .
Do If (tdmg99.10 > 0).
Recode tdmg99.10 (0 = 1).
End if.
EXECUTE .

Compute tdmg99.11 = 0.
EXECUTE .
Do If (tdmg99.11 > 0).
Recode tdmg99.11 (0 = 1).
End if.
EXECUTE .

Compute tdmg99.12 = 0.
EXECUTE .
Do If (tdmg99.12 > 0).
Recode tdmg99.12 (0 = 1).
End if.
EXECUTE .
Compute tdmg99.13 = 0.
EXECUTE .
Do If (tdmg99.13 > 0).
Recode tdmg99.13 (0 = 1).
End if.
EXECUTE .

Compute tdmg99.14 = 0.
EXECUTE .
Do If (tdmg99.14 > 0).
Recode tdmg99.14 (0 = 1).
End if.
EXECUTE .
Compute tdmg99.15 = 0.
EXECUTE.
Do If (tdmg99.15 > 0).
Recode tdmg99.15 (0 = 1).
End if.
EXECUTE.

Compute tdmg99.16 = 0.
EXECUTE.
Do If (tdmg99.16 > 0).
Recode tdmg99.16 (0 = 1).
End if.
EXECUTE.

Compute tdmg99.17 = 0.
EXECUTE.
Do If (tdmg99.17 > 0).
Recode tdmg99.17 (0 = 1).
End if.
EXECUTE.

Compute tdmg99.18 = 0.
EXECUTE.
Do If (tdmg99.18 > 0).
Recode tdmg99.18 (0 = 1).
End if.
EXECUTE.

Compute tdmg99.19 = 0.
EXECUTE.
Do If (tdmg99.19 > 0).
Recode tdmg99.19 (0 = 1).
End if.
EXECUTE.

Compute tdmg99.20 = 0.
EXECUTE.
Do If (tdmg99.20 > 0).
Recode tdmg99.20 (0 = 1).
End if.
EXECUTE.

Compute tdmg99.21 = 0.
EXECUTE.
Do If (tdmg99.21 > 0).
Recode tdmg99.21 (0 = 1).
End if.
EXECUTE .

Compute tdmg99.22 = 0.
EXECUTE .
Do If (tdmg99.22 > 0).
Recode tdmg99.22 (0 = 1).
End if.
EXECUTE .

Compute tdmg99.23 = 0.
EXECUTE .
Do If (tdmg99.23 > 0).
Recode tdmg99.23 (0 = 1).
End if.
EXECUTE .

DATASET ACTIVATE DataSet1.

AUTORECODE VARIABLES=
HAZARD_TYPE_COMBO.1 HAZARD_TYPE_COMBO.2
HAZARD_TYPE_COMBO.3
HAZARD_TYPE_COMBO.4 HAZARD_TYPE_COMBO.5
HAZARD_TYPE_COMBO.6
HAZARD_TYPE_COMBO.7 HAZARD_TYPE_COMBO.8
HAZARD_TYPE_COMBO.9
HAZARD_TYPE_COMBO.10 HAZARD_TYPE_COMBO.11
HAZARD_TYPE_COMBO.12
HAZARD_TYPE_COMBO.13 HAZARD_TYPE_COMBO.14
HAZARD_TYPE_COMBO.15
HAZARD_TYPE_COMBO.16 HAZARD_TYPE_COMBO.17
HAZARD_TYPE_COMBO.18
HAZARD_TYPE_COMBO.19 HAZARD_TYPE_COMBO.20
HAZARD_TYPE_COMBO.21
HAZARD_TYPE_COMBO.22 HAZARD_TYPE_COMBO.23
/INTO H1 H2 H3 H4 H5 H6 H7 H8 H9 H10 H11 H12 H13 H14 H15 H16 H17 H18 H19 H20 H21 H22 H23
/GROUP
/BLANK=MISSING
/PRINT.
RECODE H1 H2 H3 H4 H5 H6 H7 H8 H9 H10 H11 H12 H13 H14 H15 H16 H17 H18 H19 H20 H21 H22 H23
  (MISSING=0).
EXECUTE.

RECODE H1 (0=0) (ELSE=1) INTO H1R.
  VARIABLE LABELS H1R 'H1DUMMY'.
EXECUTE.
RECODE H2 (0=0) (ELSE=1) INTO H2R.
  VARIABLE LABELS H2R 'H2DUMMY'.
EXECUTE.
RECODE H3 (0=0) (ELSE=1) INTO H3R.
  VARIABLE LABELS H3R 'H3DUMMY'.
EXECUTE.
RECODE H4 (0=0) (ELSE=1) INTO H4R.
  VARIABLE LABELS H4R 'H4DUMMY'.
EXECUTE.
RECODE H5 (0=0) (ELSE=1) INTO H5R.
  VARIABLE LABELS H5R 'H5DUMMY'.
EXECUTE.
RECODE H6 (0=0) (ELSE=1) INTO H6R.
  VARIABLE LABELS H6R 'H6DUMMY'.
EXECUTE.
RECODE H7 (0=0) (ELSE=1) INTO H7R.
  VARIABLE LABELS H7R 'H7DUMMY'.
EXECUTE.
RECODE H8 (0=0) (ELSE=1) INTO H8R.
  VARIABLE LABELS H8R 'H8DUMMY'.
EXECUTE.
RECODE H9 (0=0) (ELSE=1) INTO H9R.
  VARIABLE LABELS H9R 'H9DUMMY'.
EXECUTE.
RECODE H10 (0=0) (ELSE=1) INTO H10R.
  VARIABLE LABELS H10R 'H10DUMMY'.
EXECUTE.
RECODE H11 (0=0) (ELSE=1) INTO H11R.
  VARIABLE LABELS H11R 'H11DUMMY'.
EXECUTE.
RECODE H12 (0=0) (ELSE=1) INTO H12R.
  VARIABLE LABELS H12R 'H12DUMMY'.
EXECUTE.
RECODE H13 (0=0) (ELSE=1) INTO H13R.
  VARIABLE LABELS H13R 'H13DUMMY'.

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EXECUTE.
RECODE H14 (0=0) (ELSE=1) INTO H14R.
VARIABLE LABELS H14R 'H14DUMMY'.
EXECUTE.
RECODE H15 (0=0) (ELSE=1) INTO H15R.
VARIABLE LABELS H15R 'H15DUMMY'.
EXECUTE.
RECODE H16 (0=0) (ELSE=1) INTO H16R.
VARIABLE LABELS H16R 'H16DUMMY'.
EXECUTE.
RECODE H17 (0=0) (ELSE=1) INTO H17R.
VARIABLE LABELS H17R 'H17DUMMY'.
EXECUTE.
RECODE H18 (0=0) (ELSE=1) INTO H18R.
VARIABLE LABELS H18R 'H18DUMMY'.
EXECUTE.
RECODE H19 (0=0) (ELSE=1) INTO H19R.
VARIABLE LABELS H19R 'H19DUMMY'.
EXECUTE.
RECODE H20 (0=0) (ELSE=1) INTO H20R.
VARIABLE LABELS H20R 'H20DUMMY'.
EXECUTE.
RECODE H21 (0=0) (ELSE=1) INTO H21R.
VARIABLE LABELS H21R 'H21DUMMY'.
EXECUTE.
RECODE H22 (0=0) (ELSE=1) INTO H22R.
VARIABLE LABELS H22R 'H22DUMMY'.
EXECUTE.
RECODE H23 (0=0) (ELSE=1) INTO H23R.
VARIABLE LABELS H23R 'H23DUMMY'.
EXECUTE.

COMPUTE
H14R,H15R,H16R,H17R,
EXECUTE.

COMPUTE
disdmg=SUM(tdmg99.1,tdmg99.2,tdmg99.3,tdmg99.4,tdmg99.5,tdmg99.6,tdmg99.7,tdmg99.8,tdmg99.9,