Social Vulnerability and Adaptation to Natural Disasters in Latin America and the Caribbean

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A thesis submitted for the degree of PhD in

Sociology

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December 2012

Abstract

My thesis analyzes the determinants of the differential impact of natural disasters in Latin America and the Caribbean identifying the political, social and economic structures that determine social outcomes of natural disasters. It studies two adaptation tools, one individual (social capital) and one institutional (public spending and humanitarian aid) that could reduce the social impact of natural disasters.

At aggregate level (countries) I conduct a time-series cross-section (TSCS) analysis, between 1960 and 2010, to analyze the impact of social capital, international aid, and public spending on the number of deaths caused by natural disasters. At individual level, I use logistic regression models to predict the probability of becoming poor after the Haitian and Chilean earthquakes in 2010.

Findings at aggregated level confirm that higher the levels of social capital, disaster relief aid and public spending lower the number of casualties due to a natural disaster. However, the efficacy of these tools depends on the institutional framework of the country. Countries with higher democratization levels public spending is more effective in reducing the death toll after natural disasters. On the contrary, in more autocratic governments humanitarian aid becomes more efficient in reducing the death rate.

The individual level results show that the social participation and network ties are fundamental in reducing the impact of the earthquakes on the levels of poverty with some differences between the countries. Regarding institutional mechanisms, both in Haiti and Chile the previous levels of public spending and aid within societies do help in mitigating the impact of disasters, however, results demonstrate the funding distributed afterwards encounter several limitations.

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List of acronyms and abbreviations

CAP	Consolidated Appeal
CASEN	Encuesta de Caracterización Socioeconómica Nacional
CCCM	Camp Coordination Camp Management
CRED	Centre for Research on the Epidemiology of Disasters
DRC	Disaster Research Center (DRC)
EM-DAT	Emergency Events Database
IASC	Inter Agency Standing Committee
IHRC	Interim Haiti Recovery Commission
IHRC	Interim Haiti Recovery Commission
IHSI	Institut Haitien de Statistique et d´informatique
IOM	International Organization Migration
LAPOP	Latin American Public Opinion Project
LDC	Least Developed Countries
MINUSTAH	United Nations Stabilization Mission in Haiti
MLE	Maximum likelihood estimation
NET	Net Aid Transfers
NGO	Non Governmental Organization
OCHA	Office for the Coordination of Humanitarian Affairs
ODA	Official Development Assistance
TSCS	Time-series Cross-section
UNDP	United Nations Development Program
USGS	U.S. Geological Survey

Acknowledgements

I would like to thank my supervisor Dr. Yasemin Soysal and Dr.Noah Uhrig, chair of my board, for the invaluable support they have given me. I thank further Sandra Moog for the comments and contributions made in the early stages of my PhD research.

I am grateful to my colleagues and friends, Juan Carlos, Gulzat and Daniel, for their encouragement, support and important discussions about my work. Their input made my thesis stronger and my academic life enjoyable. Also, I thank Carla, Debbie, Valerie and Marina, for their unconditional friendship and companionship.

Finally, I would like to acknowledge the priceless encouragement of Santiago, my partner in life. His tireless support made my thesis empirically stronger and theoretically challenging. He gave me the strength and energy needed to enjoy the experience of writing a PhD thesis.

I. Introduction

Almost half a million people have died and two hundred million have been affected by earthquakes, storms, floods or droughts in Latin America and the Caribbean since 1960 (EM-DAT, 2011). More than 750 natural events have been registered over that period, with the frequency of natural disasters steadily rising (EM-DAT, 2011).

In January 2010 a 7.0 Richter scale earthquake hit Haiti, killing 270 thousand people and leaving thousands more displaced and injured, generating an humanitarian crisis in one of the poorest countries of the world. A few hours after the catastrophe, hundreds of volunteers and members of international agencies arrived to take control of the recovery process. The reconstruction has been long and difficult, leaving thousands of Haitians still living in displacement camps (IASC, 2012) and in need of both health and food provision two years after the quake.

In February 2010, a month after the Haitian earthquake, Chile suffered an 8.8 Richter scale earthquake with its epicenter in the Bio Bio region (EM-DAT, 2011). 520 people died and thousands were displaced, reaching a total of 1.8 million people affected by the quake and with total economic losses estimated at 30 billion US dollars (EM-DAT, 2011). The reconstruction process was led by the national government with almost no participation from international agencies or local communities.

The impact of the December earthquake on Haitian society was significantly more severe than the effects of the Chilean disaster. Three main elements, across three specific moments, shaped the differential outcome. First, the pre-existing social, political and economic structures determined a differential vulnerability and exposure in each society. The economic conditions, political framework and socio demographic characteristics conditioned a far more severe impact on Haiti, despite the Chilean quake being of

greater magnitude. Second, the reaction and response from each government, population and international agencies in the immediate hours following the disasters shaped a disparate result in the number of casualties and those who were displaced. The lack of coordination of foreign aid together with the weakness of the Haitian Government led to severe problems in the distribution of help and attention in the first hours after the disaster. Thirdly, in the reconstruction stage, problems with distribution of funds, supposition of responsibilities and lack of coordination determined the course the recovery process of the Caribbean country would take (McGreal, 2010; Provost, 2012).

However, despite the enormous differences, some similarities can be identified. First, in both countries the lack of participation and the involvement of the affected communities have been revealed as common denominators. Furthermore, the provision of a permanent housing solution for those affected has been slow and arduous, resulting in hundreds of families remaining in camps or informal settlements for two years. In addition, in both countries the redistribution of funds and subsidies has proved difficult and problematic and characterised by a lack of transparency and efficiency. Both in Chile and in Haiti, the difficulties and delays in the provision of permanent solutions to the affected populations has led to the occurrence of protests and manifestations of demands for better transparency and solutions for the affected and displaced.

The differences and similarities between the Haitian and Chilean earthquakes raise several questions regarding how societies and institutions prepare, adapt and cope with natural disasters. The increasing occurrence of disasters, and the lack of research in the region, calls for further studies on how disasters impact on Latin America and Caribbean countries and how they respond and prepare for the effects of catastrophes.

The aim of this thesis is to contribute to overcoming this void in research by studying the determinants of a differential impact of natural disasters in Latin America and

identifying what political, social and economic structures determine the social outcomes of natural disasters.. I discuss how institutional mechanisms, such as public spending and humanitarian aid, and individual tools, such as social capital, can potentially enhance the adaptive capacity of societies and how they can potentially reduce the impact of natural disasters.

1. Theory and Argument

The sociology of disasters emerged in the 1950s in the United States and mainly focused on the study of social responses to natural disasters in the developed world (Dynes, 1970; Fritz and Marks, 1954; Quarantelli and Dynes, 1977). Several contributions from this perspective serve as the theoretical background to my thesis. First, such studies were pioneers in the study of social responses of individuals to natural disasters, acknowledging that human beings react and respond to the threat rather than being the mere victims of a catastrophe. Second, the theory has largely contributed to the study of the role of social organizations in attenuating the negative consequences of natural disasters, exposing potential problems that can emerge between existent and emergent groups after disasters.

A different account, known as social vulnerability theory, has been devoted to the study of the differential impact of natural disasters on a population, especially in the global south (Blaikie *et al.*, 1994; Cutter, 1996; Wisner, 1993). This theory claims that disasters affect societies in different ways and such differences are explained by reference to existing social, political and economical inequalities. The focus of vulnerability theory, contrary to sociology of disasters, is to study the social and political determinants of vulnerability under the assumption that disasters reflect social inequalities and unequal

access to resources throughout the developing world. From this perspective, disasters occur when human beings are affected by a particular hazard.

Extended research within social vulnerability theory has stressed the unequal consequences of natural disasters for developing and developed countries (Blaikie *et al.*, 1994; O'Keefe *et al.*, 1976; Wisner, 1993). Yet, both the sociology of disasters and vulnerability theory has often neglected the existing heterogeneity within the developing world. On one hand, the sociology of disasters has focused on the United States with the emphasis lying on how the American society organizes responses to different events. On the other hand, social vulnerability research notably fails to explain why some developing countries are better prepared and are able to protect their populations against the dramatic effects of natural disasters than others. Furthermore, existing studies devote little empirical effort in demonstrating the mechanisms under which societies adapt and respond to natural disasters. Notable exceptions exist, such as the research carried out in the field of adaptive capacity and adaptive potential (Adger, 2003; Brooks *et al.*, 2005; Kelly and Adger, 2000; Pelling, 1998), or the early work done in the sociology of disasters regarding social responses to natural disasters in the United States (Dynes, 1970; Quarantelli and Dynes, 1977). Adaptive capacity, or potential, refers to the mechanisms activated by societies to cope, respond and adapt to the impact of a hazard (Ersing and Kost, 2012; Kelly and Adger, 2000; Pelling, 2002). Within the literature, one of the most studied tools of societies in adapting to disasters and climate change has been social capital. The role of social capital as a mitigation mechanism has been studied both by social vulnerability theory (Adger, 2003; Ersing and Kost, 2012; Pelling, 1998; Pelling and High, 2005) and within the sociology of disasters (Buckle, 2006; Dynes, 2006). Findings from these studies suggest that the strength of network ties and social relationships between individuals could provide information, support and knowledge to communities and therefore decrease the impact of a natural disaster.

Far less attention has been devoted to the study of how institutions react and respond to the impact of natural disasters. On one hand, some research has been dedicated to studying the role of governments in reducing the effects of natural disasters on their populations (Besley, 2002; Kahn, 2005; Plümper and Neumayer, 2009; Stromberg, 2007). Findings of these studies have suggested that countries with stronger institutions and higher levels of democratization appear to have fewer casualties following natural disasters. (Kahn, 2005; Platt, 1999; Plümper and Neumayer, 2009; Raschky, 2008; Sen, 1991; Stromberg, 2007). On the other hand, several scholars have directed their attention to the study of the effectiveness of international agencies and humanitarian aid in decreasing the impacts of disasters. Results have shown that agencies pursue strategic objectives when distributing funding, and these are not in every case directly related to the needs of the population but more to geo-political decisions (Pankaj, 2005; Woods, 2005). In addition, academics have pointed to the problems of coordination and overlapping that the distribution of disaster relief faces caused by numerous donors pursuing several objectives in the same territory (Pankaj, 2005; Rey, 2001; Woods, 2005). Finally, the involvement of communities in the reconstruction process has also been studied with findings suggesting that agencies have systematically failed to include the affected population in the preparedness, mitigation and reconstruction process in the wake of disasters (IASC, 2010; McGreal, 2010; O'Connor, 2011; Telford and Cosgrave, 2007).

I have identified several gaps in research exploring the role of social capital, international agencies and nation states as relievers of the impact of disasters. First, social capital has typically been taken as a one-dimensional concept, and studied in relation to specific case studies after disasters have occurred. I argue that in this approach it is not clear how different components of social capital operate to decrease the impact of disasters and how time and space shape those actions. Second, with reference to international agencies

and disaster relief aid, the majority of research has been devoted to analyzing the effectiveness of their actions on an aggregated scale (countries) but without providing a theoretical account of the micro-foundations underpinning such aggregated results (Raschky and Schwindt, 2009; Stromberg, 2007).

The research on the institutional capacity of societies to adapt to climate change and natural disasters is particularly new and emergent. A number of scholars have identified several limitations to the actual research. Eakin and Luers (2006:376) have pointed out that '[t]he challenge remains (…) to account for the dynamic nature of vulnerability and to represent spatially some indicators (e.g., social capital, institutional relations) that may well be the determinant of vulnerability in particular places'. Adger has also stated the need of better understanding the role of institutions and the governance process combined with measures of vulnerability, taking into account the dynamic characteristic of the concept (who is vulnerable today might not be vulnerable tomorrow) (Adger, 2006).

Motivated by these contributions, demands and gaps this thesis analyzes two different adaptation tools, one individual (social capital) and two institutional (public spending and humanitarian aid) that could potentially reduce the impact of natural disasters on a population. I differentiate between an individual mechanism (social capital), referring to the tools used by individuals to potentially mitigate the impact of natural disasters, and institutional mechanisms (humanitarian aid and public spending), referring to the actions taken by governments and agencies to reduce the impact of disasters on a population. I further propose to study each mechanism on several scales and in different moments of time to account for the fluctuating nature of vulnerability to disasters.

Social capital

First, as an individual tool of adaptation, I argue that the levels of social capital within a society enhance the adaptive capacity of individuals and in this way decrease the social impact of natural disasters. Putnam (1995:664) defines social capital as 'features of social life—networks, norms and trust—that enable participants to act together more effectively to pursue shared objectives'. Putnam (1993) further distinguishes between bonding social capital, referring to the strength of the relations between individuals, and bridging social capital, referring to ties between different groups or segments of the population. I suggest that bonding social capital (ties between individuals) and bridging social capital (ties between population groups) operate in dissimilar ways to enhance the adaptive capacity of individuals.

I sustain that ***bonding social capital*** develops the adaptive capacity of individuals through several mechanisms in different stages or periods surrounding the event. In the preparedness stage, before disasters occur, social relationships constitute one of the most important mechanisms for transmiting knowledge and information regarding how to react and respond to possible threats. Second, in the early recovery phase social networks can constitute a primary source of help, providing healthcare, food and shelter to those affected. Finally, in the reconstruction stage, retaining strong network ties could imply more opportunities for individuals, such as access to jobs, moving abroad or receiving income from family and friends.

Bridging social capital, which refers to the ties between different groups in the population, increases the adaptive capacity of societies in several ways.

First, social organizations have the potential to operate as a bridge between community demands and authorities. For example, protests and demonstrations commonly occur

following disasters as a way of communicating demands to authorities regarding the reconstruction process. Such protests are generated through groups and organizations and have potentially successful outcomes according to the nature of their demands. Second, new groups and organizations can emerge after catastrophes mainly with the purpose of taking over certain tasks that were not successfully carried out by the responsible entity. Also, community organizations that were already present in the territory tend to extend their activities and help in the reconstruction process. The action taken by these organizations can potentially reduce the impact of natural disasters by preparing and contributing to the adaptive capacity of individuals to respond to hazards. Such activities could include the provision of public goods (food, shelter, healthcare) and also participating in search and rescue operations. Finally, the existence of pre-established mechanisms of participation, as community committees or local NGOs, could potentially help in the inclusion of the community in the reconstruction plan being implemented by governments or international organizations.

Despite the vast research conducted so far on social capital and natural disasters I argue that the concept is rarely unpacked and in disaster research is usually taken as an aggregated model. I contribute to the study of social capital and disasters in several ways. First, I distinguish between the role of bridging social capital and bonding social capital as stimulators of the adaptive capacity of individuals. I propose to unpack the concept of social capital in two dimensions to better understand how social relationships enhance the adaptation of individuals. Second, I add a temporal and spatial dimension to the analysis, sustaining the argument that the role of social networks fluctuates in the different stages of disasters and also on several scales (local, regional, national). I propose that the study of social ties is highly relevant, not only at local level, but also in capturing the aggregated outcomes of a society with strong social networks.

Public Spending and Humanitarian Aid

As **institutional mechanisms of adaptation,** I propose that actions taken by governments, reflected through public spending, and those taken by international agencies, measured through humanitarian aid inflows, could potentially enhance the adaptive potential of individuals and reduce the impact of disasters.

It is undeniable that public spending and humanitarian aid have the potential to shape the social determinants of vulnerability in the form of educational levels, unemployment, housing conditions, amongst others. Second, apart from the effect on the social determinants of vulnerability, I propose that on the same levels of exposure or vulnerability, aid and spending can mitigate and stimulate the adaptive capacity of individuals. The first mechanism is activated through the establishment of measures implemented prior to disasters, such as the establishing of construction codes and early warning systems. Also, preparedness can include disseminating information and communicating the likely occurrence of natural disasters. Second, after disasters take place funding is required to meet the early recovery process, in the form of search and rescue operations, setting up displacement camps the provision of food, water and healthcare attention. Finally, spending is needed in the long-term reconstruction process to restore damaged houses, infrastructures, and the general economy.

In sum, I contribute theoretically to disaster research by proposing that public spending and humanitarian aid constitute institutional tools that enhances the adaptive capacity of societies to disasters. I maintain that the way they operate varies with time and space; therefore the actions taken both by nation states and international agencies before, within and after disasters changes at every stage. Moreover, I propose that the manner in which funding is distributed is geographically determined. Funding is primarily designated to the epicenter of disasters, to the most visible and problematic areas.

Therefore the effectiveness of disaster relief aid or public spending should be studied across several regions and scales. Finally, I suggest that the way spending and aid are invested in preparation, mitigation and recovery fluctuates regarding the institutional framework of the country. I propose that the levels of democratization within the country serve to mediate the efficiency of public spending in reducing the impact of natural disasters. The association between democracies and natural disasters has been principally tackled in several investigations (Besley, 2002; Kahn, 2005; Plümper and Neumayer, 2009; Stromberg, 2007). Supported by these project findings, I argue that democracies depend on their constituency for reelection and therefore have greater incentives to protect their population from the impact of natural disasters, both before and after they occur. Autocracies, on the other hand, depend on elites for mandates; therefore providing public goods and adaptation tools to their citizens is not necessarily a priority. In this sense democracies have more incentives than autocracies to mitigate the impact of disasters and to become involved and lead the reconstruction process. Public spending has become a tool of democratic governments in achieving these goals. In sum, I propose that public spending tends to be more effective in reducing the impacts of natural disasters in democratic social environments where they are the result of stimuli and pressure from within the constituency. In contrast, I suggest that international institutions face fewer obstacles in autocratic rather than democratic countries when implementing disaster relief aid as they can take the lead in the preparedness, responses and reconstruction process without necessarily consulting or taking into account the national government.

2. Data and Methods

Empirically, my thesis aims to distinguish between several countries in Latin America and the Caribbean, under the assumption that each political, economical and social context determines a differential level of social vulnerability towards natural disasters. My research constitutes the first comparative and historical analysis of social vulnerability to natural disasters in the region. To capture the temporal dimension of social vulnerability and adaptation a time dimension is included in order to better understand how social vulnerability and coping mechanisms vary over time. At the individual level I propose a new measure of the impact of natural disasters: changes in the levels of poverty. I argue that apart from being a determinant of social vulnerability, becoming poor is one of the most severe outcomes that natural disasters have on societies. Finally, I test both at the individual and aggregated levels (countries), the role of social capital, humanitarian aid and public spending in decreasing the impact of natural disasters on populations. Empirically, I test the predictions for two levels of analysis in order to better understand the micro foundations behind the adaptive capacity of societies to natural disasters.

The selection of Latin America and the Caribbean as case studies is grounded mainly in two dimensions. First, data shows that natural disasters are steadily increasing in Latin America, with two hundred million affected since 1960. Second, I maintain that research has largely neglected the existent differences within the developing world. I therefore argue that each country, and every region within the countries, react and respond differently to possible hazards. In this sense, comparison of all developing countries (against the developed) could be misleading in so far as understanding the micro foundations of the adaptive capacity of the societies in concerned. The social, political

and economical structures of Latin America differ radically from African or Asian realities. Although an interesting line to pursue, it would be beyond the scope of this thesis to analyze how public spending, aid and social capital operate in African or Asian countries in comparison with Latin America.

Under the assumption that social vulnerability and the adaptation mechanisms should be studied across several scales of analysis, this thesis proposes the testing of hypotheses both at the aggregated level (countries) and micro level (individuals) in Latin America and the Caribbean. On both levels, I first identify the social, political and economical determinants of the impact of disasters (measured in different ways at country or individual level) and second I test the predictions that social capital, international aid and domestic spending enhance the adaptive capacity of individuals and decrease levels of social vulnerability to natural disasters.

On the aggregated level, I present a time-series cross-section (TSCS) analysis of all Latin American and Caribbean countries between 1960 and 2010. The analysis is based on an unbalanced pooled time series analysis. The dataset is constructed based on social, economical and political variables relevant to showcasing my argument. The analysis also includes several control variables. Information on natural disasters is extracted from the CRED natural disasters database (EM-DAT, 2011) and contains a total of 785 natural events, including earthquakes, floods, droughts, storms and mass movements from 1960 through to 2010.

On the individual level, two study cases are selected: the Chilean and Haitian earthquakes in 2010. The decision to include both countries as case studies is grounded in several dimensions. First, the levels of humanitarian aid, public spending and social capital differ significantly among the countries. Chile holds high levels of public spending per capita, with high levels of democratization (Marshall and Jaggers, 2002) and a low inflow of aid

within the country. Furthermore, they exhibit strong bonding social capital (interpersonal trust, remittances inflow) and low levels of bridging social capital (social participation, community involvement) (LAPOP, 2010). In contrast, Haiti is one of the countries with the highest levels of aid inflow in the region, according to the World Bank. Also, they hold lower levels of democratization than Chile (Marshall and Jaggers, 2002) and also higher bridging social capital levels, based in public opinion surveys (LAPOP, 2010). A second reason for the selection of Chile and Haiti is that both suffered the same type of natural disasters in a similar historical moment. This aspect is relevant as the role of institutions and individuals in adapting or preparing for the impact of a potential hazard could be different in relation to the length and type of natural disaster.

I based my analysis in data from the LAPOP survey (2010) for Haiti and the Casen[1] survey for Chile (2010). A logit regression model is applied for Haiti and a multilevel logit model for Chile, including the social determinants of the impact of the earthquake together with measures for public spending, humanitarian aid and social capital levels.

To measure social vulnerability, the dependent variable of my thesis, various academics have supported their empirical approach with a deductive methodology, based on the attempt to identify vulnerable populations after disasters occur (Dilley, 2005; UNDP, 2004). Others, following an inductive methodology, have designed measures of vulnerability based on the selection of socio demographic and exposure data (Cutter, 2003; Vincent, 2004).

[1] The Chilean analysis was based on the Post Earthquake Survey. I thank the Chilean Ministry of Planification, intellectual owner of the survey, in allowing me to use the database. All the results are my responsibility and does not compromise the Ministry.

Several scholars have pointed to the methodological, theoretical and empirical limitations of many of the existent indexes and measures of vulnerability (Füssel, 2009; Gall, 2007; Pelling, 2006). On one hand, those that follow a deductive methodology have limitations in predicting future events (Pelling, 2006) and it is also difficult to predict where the vulnerable population is going to be when the next disaster strikes. Another problem with these measures is that because the data is gained post-disasters, this omits any analysis of the population that suffered no consequences. The inherent problem here is that the fact of have not been affected in the past does not necessarily imply that you are not going to be affected in the future.

On the other hand, the indexes that follow an inductive methodology have the risk of mixing the determinants of vulnerability with vulnerability itself. The assumptions made in order to create these indexes are questionable, and many times suffer from endogeneity problems. Being uneducated, poor or young does not necessarily make a person vulnerable to a disaster. Furthermore, assuming that some population is vulnerable in the context of certain social and economic characteristics could exclude a population that is vulnerable, but did not meet these particular conditions.

I argue that social vulnerability is the likelihood of being affected by a natural disaster, lying on a continuum between low probability and high probability. Following a deductive methodology used to measure vulnerability to natural disasters at the aggregated level (countries) I use mortality rates due to floods, droughts, earthquakes, storms and mass movements in Latin American and other countries from 1960 to 2010. This measure has equally several limitations and contributions. On one hand, following a deductive methodology covers for endogeneity and tautological problems where the consequences and the determinants of vulnerability are interlinked. At a country level, any population killed by a natural disaster was vulnerable beyond doubt before the

disaster occurred. Here there is a clear and straightforward linear causality, between the disaster, its outcome, and the number of casualties. Another advantage of this measure is that mortality has been widely used in previous research on disasters (Neumayer and Plümper, 2007; Plümper and Neumayer, 2009; UNDP, 2004) allowing for comparative analysis.

However, I acknowledge that this measure holds several limitations. First, because the prediction is on the number of deaths due to natural disasters I have to exclude from the analysis the factor in which all affected did not die. In this same sense, I only include in the analysis countries that suffered at least one natural disaster in that year, from 1960 to 2010. Second, data on disasters can be inaccurate and poorly collected or disseminated by governments or institutions. Finally, the determinants of vulnerability are dynamic and change across time and space; therefore the results have limited prediction capacity (Pelling, 2006).

At the individual level, I measure the impact of the disaster in terms of changes in the levels of wealth or populations that became poor after the Haitian and Chilean 2010 earthquakes. Using this measure at the individual level allows for the inclusion of the entire population in the analysis whilst following a deductive methodology. Subsequently the whole of the Haitian and Chilean populations are included in the study although they were not all directly affected by the quake. Both measures also have several limitations. The causes of changes in levels of wealth could be exogenous to the earthquake, the determinants of poverty are multi-causal and therefore attributing an increase in poverty to an earthquake could be seen as problematic. Second, the measure holds the risk of an endogenous causal mechanism; the cause of vulnerability and the outcome could be linked in a cyclical loop. Despite these limitations, the measure contributes theoretically and empirically to vulnerability research by including, as a possible consequence of

natural disaster, an increase in levels of poverty. The consequences suffered by the population can be found not only in mortality or injuries, but also in changes in their levels of well-being and quality of life. One of the most important indicators of well-being is the poverty level and for this reason it seems theoretically relevant to distinguish between the role of poverty as a determinant of vulnerability and poverty as a social consequence of natural disasters. Both concepts have been related within the literature although many scholars have pointed out that not every poor individual is vulnerable to natural disasters and in the same sense not all those vulnerable to floods or earthquakes are poor prior to disasters (Blaikie *et al.*, 1994; Schneiderbauer, 2006). I propose to measure changes in the levels of wealth as an outcome of natural disasters, therefore a determinant of levels of poverty of a country is also confined to the occurrence of natural disasters.

3. Findings and thesis structure

The following chapter introduces the theoretical framework of the thesis and presents the contributions of, and gaps in, the sociology of disasters and social vulnerability theory. It then introduces the main theoretical argument together with the hypotheses.

Chapter III discusses the aggregated level results (countries). Through a Time Series Cross Sectional comparison of Latin American and the Caribbean countries it predicts if social capital, humanitarian aid and public spending reduced the likelihood of dying from a natural disaster between 1960 and 2010. The findings of the analysis confirm the prediction that bonding and bridging social capital enhance the adaptive capacity of individuals by decreasing the number of deaths after natural disasters. Results also show that public spending and humanitarian aid reduce the impact of natural disasters on the population conditioned by the level of democratization. At the country level, disaster

relief aid is more effective in reducing the death rate due to natural disasters in autocratic contexts. In contrast, public spending is more efficient among democracies.

Chapter IV introduces the two case studies, the Haitian and Chilean earthquakes in 2010 and provides a detailed description of the main effects of the earthquakes on both societies. It further explains the role of social capital, disaster relief aid and public spending in the response and reconstruction process.

Chapter V predicts the impact of the Haitian and Chilean earthquakes on levels of poverty and wealth within the two societies. It tests the hypotheses that social capital, humanitarian aid and public spending reduce the impact of the earthquakes on each society. The results discussed in the chapter suggest that previous levels of social participation (bridging social capital) tend to effectively reduce the impact of natural disasters on societies. Also, the levels of trust and remittances inflows, as measures of bonding social capital, do decrease the social vulnerability levels of the societies in question.

Results show that previous levels of public spending within societies have helped in mitigating the impact of disasters, however, funding distributed afterwards encounter several limitations in terms of effectiveness. Speed, transparency and lack of coordination are some of the difficulties that both international agencies and governments face when distributing public expenditure. In addition, it is clear that governments or international organizations were not particularly successful in including the community in the reconstruction process after the earthquakes.

Finally, Chapter VI summarizes the main findings and theoretical, empirical and policy implications.

II. Vulnerability and Adaptation to Natural Disasters

1. Introduction

The main purpose of this thesis is to study the differential impact of natural disasters on the population and the adaptive capacity of societies to mitigate those effects. These objectives introduce at least two main theoretical assumptions. Firstly, that disasters impact unequally on the population and secondly that human beings and institutions hold the potentiality to prepare, adapt and respond in different ways to the impact. These postulations have been previously addressed by two fundamental theories: the sociology of disasters and social vulnerability theory. I argue that both perspectives provide useful insights to better understand the role of the societies in adapting, coping and responding to natural disasters.

On the one hand, sociology has played a fundamental role in the development of the study of disasters since the 1950s, especially in the United States. This work was based on the study of social structures, agency, convergence and emergence in the response mechanisms to disasters (Dynes, 1970; Fritz and Marks, 1954; Quarantelli and Dynes, 1977). Several contributions from this current of thought shape the theoretical background of this thesis, especially their conceptualization of disasters and the role played by organizations and individuals when faced with disasters. On the other hand, social vulnerability theory, especially the orientation stemming from political economy and political ecology perspectives, mainly focuses in the differential impact of natural disasters on the population, especially in the global south (Blaikie *et al.*, 1994; Cutter, 1996; Wisner, 1993). Important elements of this theory are included in the theoretical framework of this thesis, particularly those relating to the differential impact of disasters

in terms of social, political and economical inequalities and the concept of adaptive capacity or adaptive potential (Pelling, 2003).

This chapter is organized as follows. First, it introduces a discussion of the literature on natural disasters relevant for the purpose of this thesis followed by the presentation of the main theoretical arguments. It then outlines the hypotheses that give shape to this research.

2. The Main Theoretical Orientations: The Sociology of Disasters and Social Vulnerability Theory

As suggested, two main theoretical orientations serve as grounds for this thesis, the sociology of disasters and social vulnerability theory. For some researchers, social vulnerability theory is grounded in sociological thought: more specifically in Marxian and conflict theories (Peacock *et al.*, 1997; Stallings, 2002) whereas for others social vulnerability theory derives from the political ecology arena (Bolin, 2006). Despite this discussion, researchers and academics from both orientations increasingly cross the boundaries of their disciplines, aiming for a more flexible and adaptable theoretical framework (Adger, 2006; Dynes, 2006; Pelling, 2003; Rodriguez *et al.*, 2006; Tierney, 2006).

2.1. Sociology of disasters

The studies of disasters from a sociological perspective emerged in 1950, principally in North America, and was centered in the work of three universities: University of Chicago, led by Marks and Fritz at the National Opinion Research Center, (1954); University of Maryland (Powell, 1954) and Oklahoma (Logan, 1952). Initially, the

majority of researchers studying disasters were sociologists, mostly funded by American military institutions anxious, or driven, by the possible social consequences of an enemy attack on the United States (Quarantelli, 1994). A few years later, in 1963 the Disaster Research Center was established funded by three of the most influential sociologists in the history of disaster research: Russell Dynes, Eugene Hass and E.L. Quarantelli. The Center was located first at Ohio State University and in 1985 moved to the University of Delawere, and today remains one of the main sources of sociological research on disasters.

This perspective, influenced by sociological thought, shaped the disaster research arena for decades making invaluable contributions to the development of disaster studies. Firstly, they conceive disasters as disruptions of social routines, wherein social structures can be visualized and easily studied (Rodriguez *et al.*, 2006). Within this definition the view of disasters as opportunities to study human behavior, structures and social processes is implicit (Rodriguez *et al.*, 2006). Therefore, studying social structures and processes when disasters occur gives a deep insight to the social structures of society. As Dynes and Drabek (1994:7) point out a disaster is a 'natural laboratory' to study society and develop new social theories.

My thesis is based on this sociological perspective of disasters for several reasons. Firstly, I sustain that social structures do count in determining how a given society deals and responds to natural disasters. Societies respond and react as a direct result of the social structures previously existent. Second, despite new social processes emerging as a response to disasters, I argue that they are related to existing social dynamics among communities. In sum, disasters are socially constructed as a reflection of the inherent social structures of the society in question.

A second fundamental contribution from sociological theory in the study of disasters, and adopted by this thesis, is the identification of the mechanisms used by societies and institutions to respond, cope and recover from disasters. Initially, in the 1950s, the dominant orientation among sociologist was to study responses to disasters at an individual level. After the creation of the Disaster Research Center (DRC), in 1963, there was a shift in sociological research to the study of how societies reorganize to face disasters, and specifically how catastrophes stimulate the emergence of new groups and organizations (Kreps and Bosworth, 2006). Apart from the types of organizations surrounding the response to disasters, sociology also contributed by showing that humans do not panic and behave chaotically when disasters occur but instead helped and collaborated with the community to overcome the crisis. As (Quarantelli, 1986) points out:

> People as a whole do not panic. In fact, instead of flight away from the danger site, there is much more likely to be convergence on an impacted area. Disasters victims´ are usually quite frightened, but that does not mean they will act selfishly or impulsively (Quarantelli, 1986:4)

They also found that anti-social behavior such as crime and looting were not part of the actions taken by the citizens in the western world (Quarantelli, 1986; Quarantelli and Dynes, 1977). Quarantelli even goes further to state that 'crimes rates will usually drop' (Quarantelli, 1986:3). From this perspective, disasters stimulate the altruistic side of human beings, instead of one that is primarily criminal or selfish. Problems arising after disasters are, in this view, not caused by society but rather by organizations (Quarantelli, 1986) who tend to perform poorly based on misguided assumption of populations' reactions.

> People almost always rise to a collective crisis occasion. Groups usually stumble around. But organizations do worst when they assume the worst about human beings in a disaster (Quarantelli, 1986:3).

An invaluable theoretical input for this thesis, derived from the sociology of disasters, addresses the fact that organizations find it difficult to coordinate and react suitably to the challenge, with a tendency to assume that the citizens are 'victims' without any capacity to contribute to the recovery process and who additionally need 'outsiders' to handle the reconstruction process (Quarantelli, 1986; Rodriguez *et al.*, 2006). Investigations also showed that the presence of outsiders leading the reconstruction process can bring many difficulties with regard to the involvement of the community, especially in the coordination of tasks and the implementation of new policies due to the friction with local organizations (Quarantelli, 2005b).

In conclusion, sociological research on disasters bring to light the importance of not seeing human beings as mere passive victims of crisis who resort to chaotic behavior, but rather as social actors with resources to respond to the impact of natural disasters. Also, sociological theory on disasters demonstrates the importance of social organizations in stimulating and coordinating social action, although not always with great success. It therefore provides an account of the problems that could be found when there is a lack of coordination between new and old organizations, external and internal to the community.

Despite these major contributions, I identify several gaps in the sociological research on disasters. First, the focus of the sociology of disaster has been on cases in the United States, where most of the researchers originate and where most of the fieldwork has been conducted. Although this limitation has been widely acknowledged (Quarantelli,

1986; Rodriguez *et al.*, 2006) further research is needed to study the mechanisms through which populations in the developing world adapt and cope with natural disasters.

Another gap in the sociological research of disasters is the lack of comparative macro analysis. The cross-sectional research on this aspect in sociology is remains rare (Britton, 2006). Sociology's empirical approach to the study of disasters has been mainly focused in case studies that lack any substantial comparative content.

Another limitation is the focus given to the response to natural disasters and not to the preparedness processes (Rodriguez *et al.*, 2006). The relevance of preparedness mechanisms to attenuate the impact of disasters is unquestionable. The more prepared a society, the less the negative impact of disasters. In this sense, studying social structures before a disaster happens also coincides with a better understanding of the social processes inherent to disasters.

Sociological research has also systematically neglected the differential impact of disasters, not only between the developed and developing world but also within countries. The social inequality of disasters should be seen as a major driver of sociological research, and has been more or less dismissed by the main representatives of the discipline.

Finally, I argue that one of the most severe gaps in existing sociological research is the lack of study of the social, political and economical contexts where disaster occurs. Very little has been done within sociological research regarding how political structures and systems determine a differential impact of disasters, or how the economic policies could attenuate disasters (Kreps and Bosworth, 2006).

Social vulnerability theory, for some academics outside of sociological thought but also for those within it (Stallings, 2002), comes into play and fills the void created by some of these theoretical and empirical problems.

2.2. Social Vulnerability Theory

Natural disasters occur when hazardous events affect the population. Intrinsic to this definition is the social dimension of natural disasters: disasters exist when humans are affected. The probability of being harmed by natural disasters is related to social, economical and political characteristics, both of individuals and the society to which they belong. This is the main contribution of social vulnerability theory and the central theoretical pillar of this thesis (Blaikie *et al.*, 1994; Cutter, 1996; O'Keefe *et al.*, 1976; Wisner, 1993).

The theory adds a deep and broad explanation for the dissimilar impacts of natural disasters among society. It is located in the idea that different likelihoods of being harmed exist and that the probabilities of these are strictly related to social, economical, political and geographical variables.

The approach has been classified in at least three frameworks, mainly differentiated by the purpose, the concepts and the scale (Eakin, 2006). First, the risk hazard perspective, where the epicenter of the discussion is hazard characterization and adjustment to environmental risk. The work of White, Kates and Burton (1993), for example, is associated with this perspective. A second viewpoint on vulnerability is ecological resilience. This perspective mainly focuses on the ability to absorb the consequences of disasters and the maintaining of interaction with the environment. One of the pioneers of the field, Timmerman (1981), stated the importance of understanding the vulnerability phenomenon towards natural disasters as well as studying the capacity of certain communities in adapting to environmental hazards, a concept he called resilience.

Finally, the political economy orientation, in which this thesis is based, is centered in the analysis of the social, political and economical processes surrounding vulnerability to

natural hazards, acknowledging the relevance of studying the concept at different scales of analysis (Blaikie *et al.*, 1994; Pelling, 2003; Wisner, 1993).

This perspective contributes in several ways to the better understanding of the impact of disasters among populations and constitutes the major theoretical inputs for my thesis.

Initially, from the perspective of political economy, disasters are not considered a 'natural' event but instead are social events. In O´Keefe, Westgate and Wisner's (1976) emblematic paper 'Taking the naturalness from natural disasters' the need of viewing natural disasters as related to the societies they affect, and not as a mere effect of climate shocks, is made clear. In their view, a disaster occurs when society is harmed or affected, differentiating between hazards (that refers to the event) and disasters (referring to events that affected the population). Based on their work, disasters are consistently seen as social events triggered by a specific hazard (Blaikie *et al.*, 1994; Pelling, 2003; Schneiderbauer, 2004). This perspective challenges the view of disasters simply as hazards, but instead views disasters not as mere climatic or physical events but results of a combination of the event and the vulnerability of human beings (Schneiderbauer, 2004).

The theory of social vulnerability also contributes to acknowledging that disasters affect populations in different ways (Hewitt, 1997). This likelihood of being affected is determined by the existing social, economical and political characteristics of the individual and the society in which s/he belongs. Social vulnerability, as has been defined by Blaikie *et a*l. (1994:11) refers to:

> The characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard (an extreme natural event or process). It involves a combination of

> factors that determine the degree to which someone´s life, livelihood, property and other assets are put at risk by a discrete and identifiable event in nature and society.

Another fundamental input of social vulnerability theory is the focus given to the study of the determinants and causes of vulnerability to disasters. Early research conducted in the 1990s identified the main determinants of vulnerability in ethnicity, class and gender (Blaikie *et al.*, 1994; Cutter, 1996). As the research progressed, new dimensions were included, not only centered in individual characteristics, such as gender, ethnicity, age, class, but also in institutional variables, in the form of political regimes, policies and economical context. Vulnerability, both for Pelling (1997) and Adger (1999) is indicated not by economic poverty and inequality alone, but also by institutional weakness.

Another contribution of social vulnerability theory is the multi-scale perspective for studying the impact of natural disasters. As Schneiderbauer (2006:85) suggests 'the average vulnerability of an individual is made up of a set vulnerabilities connected to different social levels that each individual belongs to'. The author identifies several levels in which vulnerability is developed: individual, household, national, and regional, amongst others. This recognition, also made by Blaikie (1994) and Hewitt (1997), is fundamental both theoretically and empirically. From a theoretical point of view, vulnerability theory takes into account different levels of determinants of disasters, not only at the individual level, but recognizes also that economic and political contexts determine a differential impact of disasters on societies (Bolin, 2006). What makes an individual more or less vulnerable can be found at local, community, regional and national levels. From an empirical point of view, this reveals the relevance of studying vulnerability within a society both at the local level and at the macro and comparative levels, thus incorporating evaluations of large-scale determinants of vulnerability.

Finally, one of the most important contributions of social vulnerability theory is research carried out on adaptation and adaptive capacity, referring to the mechanisms used by societies to prepare, cope, and respond to natural disasters (Kelly and Adger, 2000; Pelling, 2002). The literature has identified the determinants of the adaptive capacity of societies as aspects of types of infrastructures, resources, environmental conditions, financial credit and network strength, amongst others (Smit and Wandel, 2006; Watts and Bohle, 1993). These aspects can be found at local levels while others can be shaped by the contextual economical and political system at the macro level (Adger, 1999; Kelly and Adger, 2000). These levels of adaptative capacity are interlinked, with the capacity of one particular individual depending not only on the household s/he lives in, but also as shaped by the community and the country.

Despite the vast development of the theory over recent years, several gaps can still be found in their postulations. First, there is no unified definition of vulnerability and even less is said about its determinants. Eaking and Luers (2006) raised the need to better clarify not only the meaning but also the use given to the concept of vulnerability among researchers. Research acknowledges that different levels of vulnerability determine differential impacts of disasters, but what exactly is vulnerability? And in the same line of argument, how is it caused? I maintain that within the literature the concept is not clearly defined and on some occasions what determines vulnerability (low income, illiteracy, health problems) is interlinked with vulnerability itself. I further maintain that recognizing the differences between the concept and its determinants contributes to a better understanding of how societies can adapt to a changing environment. In this thesis vulnerability constitutes the probability of an individual being affected by a natural disaster. It refers in particular to the likelihood of being affected on a continuum between low probability and high probability. I distinguish between the causes and

consequences of vulnerability to disasters and therefore isolate the determinants of vulnerability from the probability of being harmed by a disaster.

A second important gap, acknowledged by some leading researchers in the field (Adger, 2006), is viewing the characteristic of being vulnerable as fixed and immobile. At times, the literature suggests that the socio-demographic determinants of vulnerability are conceived as the social conditions of human beings, but in so doing neglects the dynamic and cyclical characteristic of social structures. On several occasions the concept of vulnerability already presupposes certain personal characteristics, leaving outside the equation everyone that does not necessarily meet those conditions. Hewit (1997:8), one of the most prominent vulnerability researchers points out in this respect that 'we use the term to mean those who are more at risk: when we talk of vulnerable people it is clear that we mean those who are at the "worse" end of the spectrum'. But who are the ones that are at the 'worse' end? And furthermore, what happens to those who are not at the end of the spectrum but still suffer the consequences or impact of the disaster? I maintain that vulnerability is a status, changing in time and place, and for that reason the degree to which an individual is vulnerable to disasters is constantly shifting. Being 'vulnerable' is not a social characteristic, as is being female, young or illiterate, but instead is a probability of being affected by a shock.

However, this aspect leads us to the next limitation: the lack of research conducted on how the micro causes of vulnerability and aggregated determinants interconnect. The determinants of the likelihood of being affected by a disaster and the adaptive capacity of societies can be identified at several levels of analysis. Social characteristics or the individual, geographical characteristics of an area, its local and national government policies, international organizations' actions, can all be determinants of either an increase or decrease in vulnerability at certain moments in time and across space. From a

theoretical point of view, it is important to disentangle different types of determinants regarding the scale, and subsequently acknowledge the multi-scalar dimension of vulnerability. Empirically, studying vulnerability at the micro level (individuals) would entail omitting from the analysis the aggregated social, economical and political context. In the opposite direction, only studying aggregated level data would neglect the individual mechanisms by which adaptation capacities reduce the impact of disasters.

An additional gap is evident in so far as the theory tends towards a homogenizing standpoint, taking the 'south' as a whole without distinguishing between countries. The outcomes of this may be useful when trying to address the ecological debt (Simms, 2005) that the wealthier nations have to the poorest nations of the planet, but may also mislead in terms of understanding the differential consequences of natural disasters in dissimilar countries. Understanding these differences and the particularities is a central issue in order to study the determinants of vulnerability to disasters and adaptation capacities.

3. Theoretical Construction

Based on social vulnerability theory and the sociology of disasters I pursue the idea that disasters are a social construction generated as a reflection of the social inequalities of the societies in which they happen. In this sense disasters constitute a social crisis, a social disruption of daily routines. How societies react, respond and recover from such a crisis depends on certain established mechanisms existing before the disaster occurs and emergent mechanisms after they happen.

Throughout my research I study two possible enhancers of the adaptive capacity of societies: social capital, as an individual attribute to cope with natural disasters (Adger, 2003; Dynes, 2006; Pelling, 1998; Pelling and High, 2005) and international and public spending, as institutional actions that increase adaptation levels within the society in

question (Plümper and Neumayer, 2009; Raschky and Schwindt, 2009; Stromberg, 2007; Van Ommeren *et al.*, 2005). The distinction between individual and institutional tools is based on a similar conceptualization by Pelling (2002), who suggests two ways of adaptive potential: coping and institutional modification. For the author, coping refers to the direct decline in the likelihood of being harmed by a hazardous event. Institutional modification implies changes implemented by institutions in order to mitigate the impact of disasters on the population[2].

In this thesis I propose a quite different definition. I differentiate between an individual mechanism of adaptive capacity (social capital), referring to tools that could potentially increase the mitigation and response capacity of individuals to the impact of hazards, and institutional actions (humanitarian aid and public spending), referring to the measures applied by governments and agencies to reduce the impact of disasters on the population.

The role of social capital as a mitigation mechanism both in the literature of social vulnerability theory (Adger, 2003; Ersing and Kost, 2012; Pelling, 1998; Pelling and High, 2005) and within the sociology of disasters (Buckle, 2006; Dynes, 2006) is considerable. Social capital has been regarded as one of 'our most significant resource in responding to damage caused by natural and other hazards' (Dynes, 2006:2). Although already studied in the 1990s by a small number of researchers (Blaikie *et al.*, 1994; Pelling, 1998), in the last decade the inclusion of social networks and social capital as determinants of vulnerability has been extended among the literature (Adger, 2003; Ersing and Kost, 2012; Pelling and High, 2005).

2 Note that throughout my thesis I refer to adaptive potential or adaptive capacity as the same concept: the capacities of individuals to adapt, respond and recover from natural disasters.

Social capital refers to the strength of network connections and social ties within society. The concept can be originally traced to the work of Bourdieu (1986), Coleman (1988) and Putnam (1993). For Putnam social capital is 'features of social life—networks, norms and trust—that enable participants to act together more effectively to pursue shared objectives' (Putnam, 1995:664). He classifies social capital as bonding, referring to the ties between individuals, and bridging, referring to the ties between different segments of the population (Putnam, 2001). Additionally, bridging social capital can be further classified as linking capital, which refers to relationships between different groups, for example the relations between communities and donors (Putnam, 2001).

Despite the enormous growth in studies on social capital and natural disasters, research has largely neglected exploring how different aspects of social capital operate to decrease the impact of natural disasters. I contribute to the social theory on disasters by proposing two new elements to the study of social capital.

First, based on the distinction made by Putnam (2001) which conceptually separates bridging and bonding social capital, I argue that both forms function to enhance the adaptive capacity of individuals. Bonding social capital is generated by the strength of network relationships between individuals. One example would be the help provided by friends and family members in the provision of food, shelter or healthcare after disasters. The second mechanism, bridging social capital, refers to social participation and community involvement. This could be, for example, participation in protest or community groups. However, importantly, the way both components of social capital function to decrease the impact of disasters is dissimilar[3]. Bonding social capital contributes through the tighter network, directly mitigating the effects of a disaster through the provision of goods, shelter or emotional support. Bridging social capital

[3] The mechanism under which bridging and bonding social capital enhances the adaptive capacity of individuals is presented in Section 4 of this chapter

operates in more extensive and sometimes indirect ways. Organizations or community groups function to reduce the impact of disasters on the affected population, but the target population is in general much more extensive than the closest family circle. For this reason my thesis theoretically proposes to distinguish between bridging and bonding social capital in order to better understand how both mechanisms enhance the adaptive capacity of individuals to disasters.

Second, I add a temporal dimension to the effects of social capital. The literature has largely dismissed differentiating between the effects of social capital at different phases of disasters. I claim that the manner in which network ties (bonding) and social participation (bridging) operate in the societies is different at each phase of a disaster (preparedness, response, recovery). Before disasters, groups and individuals are involved in the provision of information and also operate as mechanisms to demand public goods. After disasters, individuals and groups provide services, support and help. Consequentially, these distinctions can lead to a clearer and more straightforward study of the effectiveness of social capital as an adaptive measure in the face of natural disasters.

This thesis also explores two institutional actions, taken by Governments and International Agencies, which enhance the adaptive capacity of societies: ***public spending and humanitarian aid***.

Regarding the role of governments in mitigating the impact of disasters, existing research has mainly centered around the idea that accountable and efficient governments tend to be more effective in reducing the impact of the disasters within societies (Besley, 2002; Kahn, 2005; Plümper and Neumayer, 2009; Stromberg, 2007). Others studies have also found that the weaker the institutional framework of a country, the higher the social and economic impact of disasters (Kahn, 2005; Raschky, 2008). Similarly, Raschky (2008),

confirms that countries with stronger institutions appear to have fewer victims due to disasters while also other researchers have shown that democracies appear more effective in reducing deaths from natural disasters (Kahn, 2005; Platt, 1999; Plümper and Neumayer, 2009; Sen, 1991; Stromberg, 2007). The reasons behind these associations seem straightforward; the levels of responsibility and accountability attributable to democracies towards their citizens is higher than in autocracies. A democratic government depends on its citizens for reelection, therefore they have more incentive to meet demands and expectations (Besley, 2002; Kotov and Nikitina, 1995; Li, 2006). Furthermore, the freedom of the press together with the information flow tend to be higher within democracies and can be an important tool to stimulate the accountability of governments at the same time as providing information to societies (Barrett and Graddy, 2000; Besley, 2002; Telford and Cosgrave, 2007). Good access to information in moments of crisis could establish better decisions amongst the population, and also provide a mechanism for avoiding corruption and lack of transparency in the reconstruction process. Among autocracies the control group is not the citizens but instead a small elite that is easily manipulated and corruptible (Scruggs, 1999).

Despite some contributions both from the sociology of disasters and vulnerability theory concerning the relevance of governmental measures in diminishing the impact of disasters (Besley, 2002; Kahn, 2005; Stromberg, 2007), I claim that existing research has largely neglected the specific role of ***public spending*** as an stimulator of the adaptation capacity to natural disasters.

I propose that public spending constitutes one of the most important tools of institutional adaptation to disasters. I argue that countries with strong state participation and high public spending levels will tend to suffer less from the impact of natural disasters. Public spending operates at two levels. First, it shapes the determinants of

vulnerability, in the form of educational levels, combating unemployment and poor housing conditions, amongst others. Second, it has a direct impact on the adaptation tools available to individuals to respond and cope with disasters.

I further maintain that the mechanism through which public spending enhances the adaptive capacity of individuals to disasters fluctuates across time and space. First, regarding a temporal dimension, I argue that before, during, and after disasters the role of spending in mitigating the impact of disasters changes, from provision of indirect measures of mitigation to, following the catastrophe, direct efforts to decrease the social impact. In terms of space, I argue that the ways in which each government decides to devote funds to the preparedness, response and reconstruction varies from one country to another; and even from one region to another. I propose that one of the most important determinants of these variations is the institutional framework of the country.

Apart from public spending, I suggest that the actions taken by international agencies, reflected by ***humanitarian aid*** is a second fundamental institutional tool available to societies, especially in less developed countries, to adapt and mitigate to the impact of disasters.

Research on the effectiveness and role of humanitarian aid in reducing the impact of natural disasters is still emerging and therefore rare, with some important exceptions. First, some research has shown that decisions on where to allocate aid are based on geopolitical strategies originating in the donor country, and sometimes not strictly related to the characteristics of the recipient countries, therefore caution should be taken regarding the objectives and motives of donors (Pankaj, 2005; Woods, 2005). Secondly, as Woods (2005) has pointed out, international organizations systematically dismiss national governments, forwarding the motivations of international agencies over the preferences of national governments. Also, investigations have identified that different

donors follow different interests, which results in an overlapping of activities. Coordination and implementation problems suffered by international organizations subsequently constitutes a major setback to the effectiveness of aid (Rey, 2001).

Scholars specifically researching disaster relief aid have found that donors tend to be more prominent, and successful, in relation to high profile events where the impact of their help can be easily advertised among their supporters (Stromberg, 2007)., They also lean towards supporting countries that are closer both geographically and politically and economically relevant to their own interests (Alesina and Dollar, 2000; Stromberg, 2007). Linnerooth-Bayer *et al.* (2005) argue that humanitarian aid has mainly focused on post disaster support, consequently being totally ineffective in enhancing adaptive capacity or preparedness policies before disasters occur. Linnerooth-Bayer *et al.* argue that more aid should be dedicated to mitigation mechanisms rather than response after the natural events happen. Finally, the intervention of international agencies has long been questioned in so far as it fails to fully integrate local communities into their work,, taking the population as mere victims lacking any capacity for reconstruction (IASC, 2010; McGreal, 2010; O'Connor, 2011; Telford and Cosgrave, 2007).

Despite these contributions to the study of humanitarian aid and natural disasters, disaster relief aid has not been theoretically conceived by the literature as a component of the adaptive capacity of societies nor studied from a comparative multi-level perspective. Theoretically, I contribute to the disaster research by claiming that humanitarian aid is an institutional mechanism that enhances the adaptive capacity of societies, therefore the aid inflows to a country could potentially mitigate the possible impact of natural disasters. Also, I claim that the roles of aid as stimulator of adaptive capacity should be observed from a temporal and spatial dimension, before, during and after a disaster occurs. Actions taken by international organizations are not static and

unidirectional but rather are capable of rapid adaptation to situations. As with public spending, I further argue that the institutional context and political regime of a country where the disaster occurs determine a differential role for disaster relief aid.

A considerable proportion of the literature has been devoted to studying the association between aid and political regimes with different, and often contradictory, outcomes. On one hand, scholars have found that aid promotes democracy, supporting good governance practices, accountability, and economic growth (Barro, 1999; Burnside and Dollar, 1997; Svensson, 1999). Authors such as Stevensson (1999) and Burnside (1997) have demonstrated that aid has a positive effect on growth in democratic countries.

On the other hand, researchers claim that aid can operate in the opposite direction by diminishing democracies through a decrease in governmental accountability under the pressure of international agencies (Alesina and Dollar, 2000; Grossman, 1992; Knack, 2004; Svensson, 1999). Governments need to meet the conditions set out by donors in order to receive support; these conditions might not be necessarily in concordance with the political strategies and policies that the national government was carrying out. Aid, therefore, could imply a change in existing public policies. In addition, other academics have argued that the provision of aid could cause, or amplify, domestic civil conflicts between groups that receive subsidies and sections of the population that do not. The provision of aid could, in this sense, exclude part of the population and generate erosion amongst social relations within the society (Grossman, 1992; Svensson, 1999).

This thesis maintains that the role of humanitarian aid is shaped by the institutional context of national governments. In contrast to the role of public spending, disaster relief aid tends to be more effective in weaker institutional contexts. I argue that the lack of a strong national government implies an easier and less bureaucratic process in the distribution of aid. International agencies can potentially take the lead with almost no

consultation and subsequently have total freedom in applying those policies they consider relevant or which are deemed by them as geopolitically important. However, democratic governments tend to be more accountable to their citizens and place more barriers and controls in the way of plans to be implemented, potentially slowing down the process of distribution of aid and subsidies.

4. Argument and Hypothesis

The main theoretical objective of this thesis is the in-depth analysis of two potential tools, one central to society (social capital) and the second derived from institutions (aid and welfare policies), that enhance the adaptive capacity of individuals to disasters and therefore decreasing the levels of social vulnerability to natural disasters. Empirically, both at the aggregate level (countries) and the micro level (individuals) I measure the determinants of vulnerability to natural disasters and verify how social capital and aid, both public and international, operate to enhance the adaptive capacity of the communities and countries concerned.

From the theoretical construction introduced in the last section, I extract three hypotheses that will be empirically tested along this thesis:

H1. 'Higher levels of social capital within a society have lowered the impact of natural disasters on populations in Latin America and the Caribbean from 1960 to 2011'

H2. 'Higher levels of public spending within the country lessen the impact of natural disasters among the population, conditional on the democratization levels in the country'

H3. 'Higher levels of humanitarian aid lessen the impact of natural disasters, conditional on the democratization levels within the country'

Throughout this section I unpack the mechanisms behind each hypothesis, presenting the micro foundations that support each assumption.

Hypothesis 1: Social capital increases the adaptive capacity of individuals decreasing the effects of disasters

I argue that both bonding and bridging social capital[4] enhance the adaptive capacity, reducing the impact of natural disasters on the population.

Bonding social capital, referring to the ties between individuals (Putnam, 2001), improves the adaptive capacity due to several mechanisms. First, the importance of the role of family, friends and community members during the first hours following a natural disaster is unquestionable. The support could operate in several ways, through the provision of food, shelter, healthcare and also taking care of children and the elderly. Data from Chile shows that after the 2010 earthquake, the main activities adopted by families as a collective strategy were the provision of food, water and security in the neighborhood (CASEN, 2010). Assistance may be required for long periods especially in cases where the reconstruction process is slow, support from the outside is delayed, or in the case of long-term disaster situations (such as floods or droughts). As an example, numbers suggest that after the earthquake in Haiti in 2010, 600,000 people stayed with host families for several months without the possibility of returning to their homes (CAP, 2012). In summary, network ties between individuals serve as prime resources for societies in time of disasters, however this support is conditional on the strength of relationships, that is, on the levels of bonding social capital.

[4] Bonding social capital reflects the strength of the horizontal ties between communities and bridging refers to the ties between different segments of the population Putnam, R. 2001. "Social capital: Measurement and consequences." *Canadian Journal of Policy Research* 2:41-51.,

A second form through which bonding social capital enhances the adaptive capacity of individuals is the provision of information before, during and after natural disasters (Dynes, 2006; Takeuchi *et al.*, 2011). In the preparedness phase, the role of families and friends as providers of information constitute a fundamental contribution of social capital (Takeuchi *et al.*, 2011). The knowledge of how to predict and cope with the possibility of a disaster is often transmitted within the family. In the case of earthquakes, the actual event may only last a few minutes, but in case of droughts and floods the catastrophe can play out over several months adding an unpredictable element to its effect. Consequently, information of how to proceed could be fundamental in reducing the impact of such a disaster. Finally, during the recovery process, the provision of information can bring opportunities to the population in terms of seeking work or alternative means to earn money if their jobs were affected by the disaster.

Another mechanism through which bonding social capital can reduce the impact of disasters is the provision of emotional support. Research shows that individuals with family support tend to recover better emotionally from the impact of disasters than those that have to cope alone (Solomon *et al.*, 1993). The emotional impact of disasters could include suicide (Krug *et al.*, 1998) and post traumatic shock (Steinglass and Gerrity, 1990). In brief, family and friends can ease the emotional stress suffered by individuals, contributing to the recovery process, via a faster reassertion of community life.

As a form of bridging social capital, referring to network ties between different groups in the society (Putnam, 2001), social organizations have been identified as one of the most effective mechanisms societies have in adapting to the impact of natural disasters (Eakin, 2006; Gruberg, 2004; Moore, 2005; Pelling, 2003; Pulgar, 2010). Community participation is crucial not only during the first few hours after the event, but also in the reconstruction process through an involvement in policy planning and implementation.

Firstly, they provide support for community members when facing the immediate aftermath of a disaster through the provision of shelter, health awareness, search and rescue tasks and food distribution.

Apart from the provision of public services, organizations can also operate as intermediaries between societies and local and national governments. These groups could be generated after disasters occur, often as the result of the population's dissatisfaction with how governments undertake the reconstruction process. The existence of protests and demonstrations following disasters is not unusual. Both in Haiti and Chile, after the 2010 earthquakes, people gathered to protest: against the United Nations in the Haitian case, and against the national government in Chile (Carroll, 2010; CEME, 2012). Protests therefore constitute a mechanism for communicating dissatisfaction with the processes being implemented and are frequently led by an emergent group or organization.

Besides protests, pre-existent groups or structures can operate as mechanisms for communicating with governments. For example a parents' group established for the maintenance and operation of a school can be transformed and begin to officiate as a link between the society and government. Pre-existent groups tend to adapt quicker and be more effective than an emergent group (those that emerge suddenly after the disaster), as they have previously functioned collectively with clear knowledge of the dynamics and leaderships within the group.

Finally, social participation can contribute to a more effective and inclusive reconstruction plan wherein the needs of the population are self identified resulting in more accurate policies. The participation of communities in the reconstruction process has been widely identified as a mechanism of coping with disasters (Pelling, 1998; Quarantelli, 1986; Rodriguez *et al.*, 2006) although this is often difficult to achieve. Both

in Haiti and Chile, despite the economic and social differences of the two countries, governments and international agencies were unsuccessful in including the community and affected population in the reconstruction process (HaitiGrassrootsWatch, 2011; IASC, 2010; Lizana, 2011; Pulgar, 2010). The policies were applied without the consent of communities leading to the emergence of several social problems and conflicts. A few months after the earthquakes, protests and demonstrations occurred both in Chile and Haiti demanding a more inclusive reconstruction process. Despite one process being led by international organizations, in Haiti, and a second by a democratic government, in Chile, both encounter the difficulty of integrating the society in the process of recovery and reconstruction (Carroll, 2010; IASC, 2010; Pulgar, 2010).

Hypothesis II: Public spending enhances the adaptive capacity of human beings to natural disasters, conditional on the democratization levels within the country

I argue that governments, through public spending, can potentially increase the adaptive capacity of individuals and in this way reduce the impact of natural disasters, conditional on the level of democratization in the country.

The mechanism under which public spending reduces vulnerability and enhances adaptive capacity appears straightforward. Firstly, before disasters occur, the policies designed to prepare the population for a possible hazard are in general implemented with resources from local and national governments. These programs can include spreading awareness of risks and potential disasters, transmitting important information and education. Apart from this communication task, in the same phase, governments have the responsibility of creating prevention mechanisms, as early warning alerts or the design of norms to prevent disaster damage (such as construction codes or housing regulation). In all of these tasks, public spending is required and could potentially reduce the effects of natural disasters on the population.

Secondly, public spending is needed when disasters occur. The provision of food, shelter and healthcare as well as search and rescue operations, amongst others, cost millions to national governments[5]. Governments can directly target some parts of the affected population and can also provide support as a form of public good to all individuals who have suffered the effects of the disaster. These tasks can be well or poorly accomplished and consequentially imply a direct mitigation or amplification of the disaster's impact on the population. Finally, in the reconstruction process, governments can be more, or less, effective in the provision of permanent shelter, reconstruction of roads and infrastructure. The existence of subsidies, insurance or benefits for the affected could lead to a faster recovery and therefore a decrease in the impact of the disaster.

Despite the seemingly simple mechanism behind public spending, and because of the opportunistic nature of governments, sometimes there is no stimulus to designate funding to prepare, mitigate and adapt to natural disasters. Governments calculate the benefits of reducing spending against the probability of the occurrence of a natural disaster, and in this way decide on the funding designated to early warning measures, construction code regulations, and other measures. The preferences of the electorate to increase public spending on preparedness and mitigation measures are divided regarding their levels of vulnerability. Individuals that are more likely to be affected tend to prefer an increase in spending, whereas those with less likelihood of suffering the impact of a disaster pressurize governments not to increase spending on such tools. A similar combination of preferences can be witnessed after disaster strikes where the affected population makes demands for prompt and effective solutions, meaning an increase in public spending devoted to reconstruction activities; however, those elements of the

[5] Is not the objective of this thesis to study monetary costs of natural disasters but the information is available at the International Disasters Database. EM-DAT. 2011. "The OFDA/CRED International Disaster Database." *WHO Collaborating Centre for Research on the Epidemiology of Disasters*.

population who remain unaffected prefer to confine public spending to areas that were designated before the disaster occurred.

Autocratic governments, in contrast, need to satisfy the demands of a small elite to remain in power, and not those of the entire citizenship (Plümper and Neumayer, 2009). The stimulus for autocratic governments to extend public spending on mitigation and reconstruction is reduced to the demands of elitist minorities and therefore not everyone affected by the disaster is going to be heard by national governments. In sum, as a main hypothesis, I argue that higher the levels of public spending lessen the impact of natural disasters – but the effect is mediated by the levels of democratization within the country.

Hypothesis 3: Humanitarian Aid increases the Adaptive Capacity of individuals to natural disasters, decreasing the social effects

Besides national governments, I claim that international agencies are central actors in the prevention and mitigation of natural disasters in the developing world, especially through the provision of disaster relief aid.

I argue that aid reduces the effects of natural disasters under several mechanisms. Firstly, funding from international aid is frequently directed into the preparedness phase, where information and education become fundamental to mitigate a possible impact of a hazard on the country. Secondly, large proportions of funds are channeled into the emergency response, especially in the first hours following disasters, where search and rescue operations can potentially save many lives. Moreover, funding is invested in the provision of housing, food and healthcare for the affected population. Finally, aid is also implemented in long-term reconstruction programs and plans.

Despite this clear-cut potential intervention of disaster relief aid, I maintain that the efficacy with which aid is invested depends on the political decisions and social

characteristics of the country. Specifically, I argue that the way in which humanitarian aid operates depends on the levels of democratization of the country. As with public spending I argue that the levels of democratization in the country determine the effectiveness of disaster relief aid in reducing the social effects of the disaster. In autocracies international aid organizations find easier mechanisms to apply the funds, meeting almost no obstacles from the national government. Contrary to public spending in democratic governments, autocratic governments find almost no incentives for investing public funds for either reconstruction or prevention of disasters, but do possess several incentives for allowing international agencies operate within the territory.

III. Explaining the Death Toll from Natural Disasters in Latin America and the Caribbean

1. Introduction

The aim of this chapter is to explore the social, political and economical determinants of social vulnerability and adaptation tools at the aggregated level, through the implementation of a Time Series Cross-Sectional analysis of Latin American and Caribbean countries from 1960 to 2010. I evaluate the role of social capital, public spending and humanitarian aid in enhancing the adaptive capacity of societies to natural disasters. I claim that the higher the level of social capital in a society, the lower the number of casualties caused by a natural disaster. Also, I suggest that both public spending and humanitarian aid reduce the impact of disasters, although not in every scenario. In democratic contexts, public spending tends to be more effective than humanitarian aid in reducing the death toll of disasters. However, in autocratic environments, humanitarian aid becomes more efficient; with less control and supervision from the nation state they have more freedom of action and to make decisions on how to implement programs and reconstruction plans.

The sections in this chapter are organized as follows. First, based on the theoretical discussion presented in Chapter II, I derive a set of hypotheses to be tested at the aggregated level. Next, turning to the empirical section of the chapter, I conduct a general analysis of the socio-demographic and economic variables that determine social vulnerability to disasters. Following this, I test the main empirical implications from the theory, demonstrating how deadly natural disasters prove to be depending on levels of

social capital, international aid, and levels of domestic public spending in Latin America and the Caribbean. Finally, a number of brief conclusions close this chapter.

2. Reducing the impact of natural disasters

This chapter empirically tests the predictions that social capital, public spending and international aid enhance the adaptive capacity of individuals and therefore reduce social vulnerability to natural disasters in Latin America and the Caribbean. The three hypotheses, presented in detail in Chapter II, are tested at an aggregated level (countries) through a time series cross sectional analysis of Latin American countries from 1960 to 2010.

The **first hypothesis** predicts that social capital expands the adaptive capacity of individuals to natural disasters, decreasing the likelihood of being affected. Social capital provides an account of the structure quality and strengths of social networks (Coleman, 1988; Putnam, 1995) and has been classified as bonding, referring to the ties between individuals, and bridging social capital, referring to ties between different groups (Putnam, 2001).

Summarizing the mechanism described in depth in the second chapter of this thesis, I argue that social capital levels within the country can reduce the number of deaths after a quake, flood or storm through several mechanisms[6]. First, concerning bonding social capital, family and friends can provide food, shelter and attention to those affected by the disaster. They can also operate as an information source disseminating relevant knowledge on how to deal with the catastrophe and how to recover. In addition, and

[6]A deeper analysis of the social capital concept, the mechanisms by which reduce the impacts of disasters and the theoretical contribution were presented in Chapter II.

also a fundamental aspect, maintaining tight relationships with family and friends may reduce the emotional shock experienced in the wake of extreme events.

In relation to the concept of bridging social capital, referring to network ties between different groups in the society (Putnam, 2001), social organizations constitute a fundamental component of the preparedness, response and reconstruction process in the face of natural disasters (Eakin, 2006; Gruberg, 2004; Moore, 2005; Pelling, 2003; Pulgar, 2010). At the country level, I argue that higher levels of social participation lower the impact of natural disasters. As discussed in depth in Chapter II, organizations can operate as providers of shelter, healthcare, search and rescue operations and food provision. These tasks, effectively done, could reduce the number of deaths due to a catastrophe. A second mechanism under which organizations could potentially reduce the number of deaths is through the provision of information and communication between national and local governments and the population. Also, regarding bridging social capital, I suggest that societies with high levels of political activism are more prone to be involved in the preparedness, implementation and reconstruction process after disasters, possessing more pre-existent tools to channel demands and needs to governments and international organizations. I forward the idea that societies with high levels of political participation prior to the occurrence of a disaster, and with pre-established participation mechanisms, cope better with the impact through the provision of resources and help to the community in the initial hours of the disaster. Well-organized communities can minimize the number of injured and fatalities, via better coordination of emergency activities and directing attention to the displaced and injured.

In sum, I propose as my ***first hypothesis*** that a higher level of social capital within the country lowers the death toll after natural disasters. The predictions are empirically

divided into two models, first a measure of bonding social capital is included (network ties) and secondly a proxy of bridging social capital (social participation).

Apart from social capital, a coping tool originating from within societies, I argue that two institutional mechanisms can enhance the adaptive capacity and reduce the number of deaths: public spending and humanitarian aid[7]. Furthermore, I argue that this relationship is conditional on the democratization levels of the country.

Public spending can potentially reduce deaths in several ways. Firstly, the impact of disasters depend, besides many other issues, on how prepared the society is. The preparedness and mitigation policies implemented necessarily involve public funds to be executed, as early warning mechanisms, application of construction codes, organized urbanization processes, education and diffusion of risks, etc. Secondly, once disasters occur, the provision of food, shelter, and healthcare requires immediate funding from national governments. The success of these policies in the immediate aftermath could potentially reduce hundreds of deaths and can also represent a faster recovery process for those affected. Moreover, the reconstruction process implies high costs for governments but could result in the reduction of more disaster-related casualties from the spread of disease or famine.

I argue that this mechanism is enhanced or conditional on the levels of democratization in the country. The type of political regime has long been related to more effective policies aimed at mitigating the impact of disasters (Besley, 2002; Kahn, 2005; Stromberg, 2007). Democratic systems tend to protect their population from environmental hazards in ways that are more efficient than those of autocratic regimes,

[7] Detailed descriptions of the mechanisms by which spending and aid decrease the likelihood of being affected by a natural disaster were discussed in the last chapter. Nevertheless I introduce here a brief summary.

mainly because the provision of goods and public acceptance is vital for reelection. The success of a democratic government is centered on its desire for further terms in office and thus attending to the population's demands and needs, whereas an autocratic government does not need the population's acceptance in order to rule, of course with some exceptions. Furthermore, democracies are also associated to better communication mechanisms and freedom of the press, issues that become fundamental to mitigate the potential impact of disasters. More information implies more freedom of action and decision, providing the population with more tools to become aware and prepared for the potential impact of disasters.

These attributes make democracies more apt in easing the impact of disasters on the population through the provision of those goods and public services that assist the community in the preparedness, response and reconstruction process. These aspects stimulate democratic governments in taking the lead in the reconstruction process. In conclusion, I propose as a **second hypothesis** that higher levels of public spending lower the number of deaths from natural disasters, conditional on the levels of democratization in the country.

Having discussed to issue of public spending, I now propose that international aid contributes to the preparedness and reconstruction process for enhancing the adaptive capacity of a society, reducing the number of deaths caused by natural disasters. The relevance of aid as a mitigation mechanism has been widely studied, alongside the problems arising from intervention (Raschky and Schwindt, 2009; Stromberg, 2007; Van Ommeren *et al.*, 2005). International organizations, together with resources (aid), play a fundamental role in the recovery and preparedness process meeting the effects of natural disasters in Latin America. I suggest that the effect of humanitarian aid in reducing the number of deaths is conditional on the democratization levels of the country. In this

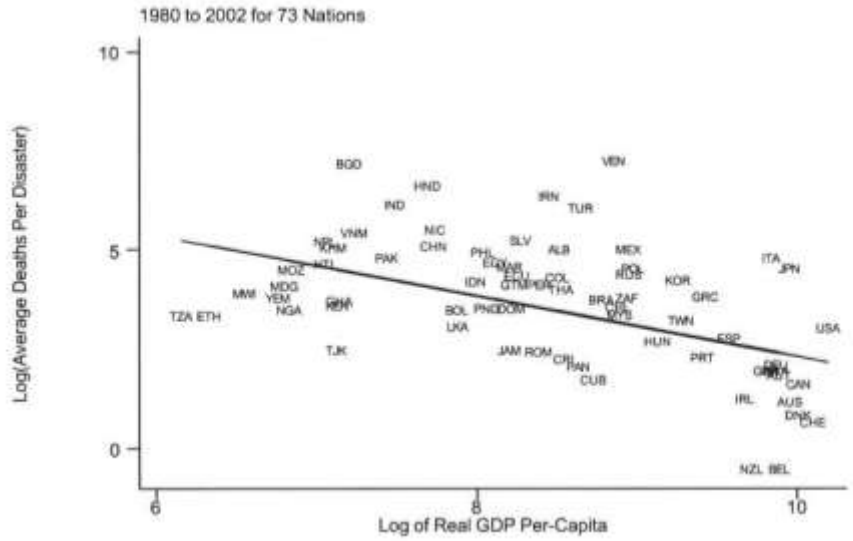
chapter, and as my **third hypothesis**, I intend to show that more international aid decreases the number of deaths at the aggregated level, but the effectiveness is disparate among democratic and undemocratic countries. Within autocracies, international organizations have more autonomy and freedom to operate. In countries with stronger governments and institutions international aid does not decrease the likelihood of dying in a natural disaster.

Finally, based on the assumption that diverse political, social and economic processes determine a differential impact of natural disasters among the population, I include certain variables that might predict the levels of vulnerability within a society. The determinants included in my analysis are population density, urban growth, GDP per capita, GDP growth, and population under 14 years of age (Fig. 1). Urbanization and population growth have been widely associated in the literature to an increase in the likelihood of being affected by natural disasters (Cuny, 1983; Cutter, 2000; Mitchell, 1993; Pelling, 2003). As presented in the theoretical chapter of this thesis, disasters occur when human beings are affected, being a socially constructed event. In consequence the increasing process of urbanization in Latin America determines an increase in risk, especially for those living in the marginality of big cities (Greenfield, 1994; Pelling, 2002). Urbanization has contributed to an increase in precarious settlements, often located in areas of potential flooding or mass movements. One case of the impact of urbanization on vulnerability levels can be found in the precarious settlements around large cities in Brazil. In January 2011 a summer storm, followed by floods and mass movement hit Rio de Janeiro, in Brazil, causing 900 deaths and 21,500 homeless. The deaths occurred mainly in the mountain area, peripheral to Rio de Janeiro and home to 600,000 people, living in precarious settlements or 'favelas' as they are known in Brazil. The urbanization process in Brazil was triggered in the mid 1980s and 1990s after a boom in the cities' textile industries and the lack of agricultural work in rural areas. The population

migrating to the cities settled on the outskirts in precarious and instable locations, being affected systematically by the increasing occurrence of floods and mass movements occurring in Brazil (Economist, 2011). In sum, the rapid urbanization process encountered in most Latin American and Caribbean countries increases levels of the vulnerability of the population to natural disasters.

Apart from urbanization processes, studies analyzing vulnerability levels in countries generally include GDP per capita as a way of controlling differences caused by the economic wealth of the country (Kahn, 2005; Neumayer and Plümper, 2007; Raschky, 2008; Yang, 2006). Therefore, higher GDP per capita within the country lowers the number of casualties and those affected by natural disasters (see Graph 1).

Graph 1: National Average Deaths per Natural disasters and GDP per Capita (Kahn, 2005)



Finally, I incorporate the population 'less than 14 years of age' under the assumption that the age composition within the country may have an impact on their levels of vulnerability to natural disasters. It has been suggested that both children and the elderly tend to suffer the most from natural disasters due to the lack of tools for adapting,

coping and recovering (Blaikie *et al.*, 1994; Cutter, 2000; Donner and Rodriguez, 2011; Hewitt, 1997; Morrow, 1999)

To empirically test these ideas I firstly propose an empirical model for studying the socio-demographic and economical determinants of the number of deaths by natural disasters. In this model I include the already identified, although not always tested, social and economical determinants of social vulnerability: population density, urban growth, GDP per capita, GDP growth, and population under 14 years of age, among others (Birkmann, 2006; Schneiderbauer, 2006). The objective is to study a basic set of social and economic characteristics that might shape social vulnerability to natural disasters and in subsequently to test the theoretical relevance of each dimension for the Latin American context.

I then predict the impact of social capital, humanitarian aid and public spending in reducing the death rate from natural disasters, testing for the three main hypotheses of this thesis.

3. Explaining deaths from natural disasters

Research Design

Data

Results are based on an unbalanced pooled time series analysis. The panel data combines cross-sectional and time-series information with cross-sectional dominant data (CSTS) (Sevestre, 2008). The datasets consist of historical data, from 1960 to 2010, from Latin American and the Caribbean countries including economic, political, social and environmental variables. The database is constructed based on different sources: the World Bank Dataset, Economic Commission for Latin America and the Caribbean (CEPAL., 2007), Database of Political Institutions (Beck *et al.*, 2001), Database of Educational Attainment (Barro and Lee, 1994), Database of Donor Performance (Roodman, 2007).

The data on natural disasters is extracted from the CRED natural disasters database (EM-DAT, 2011). It contains a total of 785 natural events, composed by earthquakes, floods, droughts, storms and mass movements from 1960 to 2010.

Dependent Variable

The Emergency Disasters Database (EM-DAT) provided by the World Health Organization Collaborating Centre for Research on the Epidemiology of Disasters (CRED), contains information on the number of people affected, made homeless or having died as a consequence of different types of natural disasters from the 1960s to today at a world level. Based on data from the EM-DAT, I use as dependent variable the rate of deaths by total population due to earthquakes, floods, droughts, storms and landslide in Latin America from 1960 to 2011.

The impact of disasters can be assessed in many ways, through the number of displaced, money losses, number of casualties, loss of jobs, income or health problems[8]. Because of limited availability of country data I decided to use the number of casualties by natural disaster in Latin America as a proxy of the impact of the disaster on the population. This measure holds several limitations as well as a number of advantages as an indicator of the impact of natural disasters.

Regarding the limitations, as Pelling (2006) has previously noted, those that did not die are excluded from analysis as vulnerable, limiting the identification of the causes of vulnerability. Because I am predicting the number of deaths caused by natural disasters I can only include in the macro analysis countries that suffered at least one natural disaster between 1960 and 2010. Secondly, the mortality data can be inaccurate due to problems in collection and subsequent declarations by national governments. Furthermore, the causes of deaths after natural disasters can be direct, as in the case of people who died from the quake in Haiti in 2010, or indirect, as in the population that died several months later due to an outbreak of cholera. The population dying from other causes, although linked to the primary natural disaster, are not taken into account in the data available from the International Dataset of Disasters (EM-DAT, 2011). Finally, the determinants of vulnerability are dynamic and change across time and space; therefore the results have limited prediction capacity (Pelling, 2006).

However, despite these limitations the measure has several potential advantages. Firstly, the populations that died due to a natural disaster were undoubtedly vulnerable before the natural shock, making clear the causal mechanism between the occurrence of a disaster and the outcome. This avoids one of the most widespread criticisms of inductive type of measurement, whereby the causes of vulnerability and outcome are interlinked

[8] At individual level I use changes in the level of income or population that became poor after the event as a measure of the impact of the disaster. The individual level results are presented in the next two chapters.

and almost tautological (Füssel, 2009; Gall, 2007; Pelling, 2006). As Pelling (2006:181) points out 'mortality is arguably the most reliable comparative indicator of human loss at the global scale'. Secondly, since the publication of the EM-DAT dataset of natural disasters, the death toll has been systematically used as a measure of the impact of natural disasters (Neumayer and Plümper, 2007; Plümper and Neumayer, 2009; UNDP, 2004), allowing for an increasing development of comparative disaster research.

Table 1: Dependent Variable Descriptive

Variable	Obs	Mean	Std. Dev.	Min	Max
Deathratio	739	.0000715	.0004833	0	.0101291

Around 661,000 people have died due to natural disasters in Latin America and the Caribbean since 1960. Earthquakes, including the 2010 Haitian earthquake that took 222,570 lives, have caused around 65% of the deaths. The second type of natural disaster that caused more deaths in Latin America is flooding, resulting in 20% of total of deaths during this period (a total of 132,340) and finally storms with 45,013 casualties.

Explanatory Variables

Four main independent variables are included in the analysis of the hypothesis presented above: international aid, public spending, social capital and regime type.

First, the measurement of social capital has been at the center of debate among social scientists for many years. On one hand, bonding social capital has been widely measured through interpersonal trust (Fukuyama, 1995; Pelling and High, 2005). Trust, as defined by Fukuyama (Fukuyama, 1995:26) is:

> The expectation that arises within a community of regular, honest and cooperative behavior, based on commonly shared norms on the part of other members of that community

Based in survey data, both at local and national levels, researchers have traditionally used interpersonal trust as a measure of social capital (Newton, 2001; Paxton, 2002; Putnam, 2001), frequently measured through the survey question 'Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people' (Latinobarómetro, 1996-2010). A second indicator often used to measure bonding social capital is the transfer of funds a population receives from family or friends that have emigrated (Adger *et al.*, 2002; Levitt, 1998).

Bridging social capital, or vertical social capital, has been widely measured through the social participation of individuals in associations or organizations (Grootaert and Van Bastelaer, 2002; Paxton, 2002; Putnam, 2001).

Based on this debate, I have chosen several variables that represent bonding social capital at the aggregated level in the form of ties between individuals (Putnam, 2001), and bridging social capital, referring to links between different groups within the society (Putnam, 2001). To measure bonding social capital two indicators are included: interpersonal trust and remittances (i.e. the transfer of funds from abroad). The available data for measuring social capital along years and countries is scarce and traditional measures applied at the individual level, based on surveys, as trust in the community and social participation are not available for all the years and countries included in the analysis. However, Latinbarometer (1996-2010), a public opinion survey applied every year for 18 Latin American and Caribbean countries includes a measure of interpersonal trust for 18 countries from 1996 to 2008[9]. I aggregated the results for each country and year and constitute the first measure of bonding social capital included in the model. The

[9] The survey also includes community participation and social involvement in activities although not measured for every year and every country. The World Values Survey also measures social capital but is only available for four years (four waves) and with limited coverage in Latin America.

model analyzing bonding social capital will, therefore, only include 12 time points in the analysis. Results of the survey for Latin American and the Caribbean show that interpersonal trust is higher in countries such as Dominica, El Salvador and Guatemala with almost 30% of the population answering that 'most people could be trusted' (Table 2). On the contrary, the lowest levels of interpersonal trust are measured in Brazil (7.5%) and Paraguay (11%). The results appear to fluctuate with time although not necessarily in one or the opposite direction for each country. Venezuela increased from 11% of the population believing that most people could be trusted in 1996 to 23% in 2009. However, Paraguay decreased from 23% in 1996 to 11% in the last survey.

Table 2: Interpersonal Trust, Latinbarometer (1)

	1996	1997	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Dominican								12.9	23.6	27.1	20.3	20.3	33.8
Guatemala	28.0	29.3	26.2	14.4	11.1	14.1	18.3	14.2	20.0	32.8	30.2	23	29.2
El Salvador	23.0	29.6	21.3	14.9	14.3	20.6	12.3	16.0	24.6	16.9	20.1	30.8	28.2
Bolivia	17.4	13.6	20.7	17.2	13.7	28.0	21.2	13.8	19.6	22.5	20.9	22.3	25.6
Uruguay	33.0	30.9	33.9	22.9	23.6	35.9	35.0	24.5	34.2	30.3	27.3	27.3	25.5
Mexico	20.8	42.8	39.8	34.6	36.1	22.0	18.9	16.7	24.7	27.7	19.8	19.7	24.3
Venezuela	11.3	11.0	15.9	15.4	16.6	11.9	13.3	16.9	25.7	29.0	25.5	25.5	23.2
Costa Rica	11.0	29.8	33.6	11.1	12.4	13.9	10.6	7.7	14.7	17.2	8.1	23.2	21.6
Panama	24.8	19.8	18.1	15.7	24.0	27.9	24.9	20.3	15.9	13.4	22.7	22.7	20.5
Colombia	22.9	31.7	19.9	17.7	13.5	17.5	13.4	21.9	19.5	17.9	8.8	13.8	19.6
Ecuador	19.8	17.0	21.6	16.3	17.7	23.8	19.7	18.7	17.2	28.8	11.8	34.1	19.5
Nicaragua	20.3	34.8	10.5	9.0	30.5	16.8	17.8	11.9	10.7	20.5	20.8	21.9	19.3
Argentina	22.9	18.3	23.2	10.7	15.6	22.2	17.8	15.4	29.8	24.1	14.1	19.3	18.6
Honduras	24.6	28.3	16.1	9.6	12.1	15.0	17.9	20.4	13.4	22.9	16.4	21.4	17.2
Chile	17.7	17.6	14.8	13.4	14.6	13.3	9.9	19.3	13.7	12.8	9.0	15.7	15.5
Peru	13.4	13.1	12.9	10.4	12.9	14.5	15.0	16.0	15.0	22.2	14.0	14.0	13.8
Paraguay	23.4	8.5	13.2	17.8	17.2	5.8	7.2	6.0	14.0	13.0	5.8	5.8	11.0
Brazil	11.1	4.8	4.6	4.1	2.4	3.1	3.7	4.1	5.6	5.3	5.6	8.6	7.5

(1) Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people

The second variable included as a measure of bonding social capital is the Migrant Remittance Inflows (US$ million), extracted from the World Bank's World

Development Indicators. In Chile, the percentage of remittance inflows in the total GDP of the country represent 0% whereas in El Salvador, Honduras and Jamaica represented in 2010 almost 15% of the total GDP (WorldBank, 2010). The variable, frequently used as a component of social capital (Adger *et al.*, 2002; Levitt, 1998) gives an account of the strength of the network ties within individuals and family members.

To measure bridging social capital two variables are included: participation in demonstrations and a civil liberties index. Both constitute proxies of social involvement and participation in different activities.

Ideally, a measure of participation in social organizations should be included (Grootaert and Van Bastelaer, 2002; Paxton, 2002; Putnam, 2001). However, data on participation is scarce for Latin America and although some surveys do measure these variables (Latinbarometer, LAPOP) it is insufficient for the years and countries included in the analysis. This constitutes a limitation on studying social capital at the aggregated level. To solve this problem I include two measures already used as proxies for social capital by macro level comparative studies (Collier, 2002; Grootaert and Van Bastelaer, 2001; Knack, 2002): firstly civil liberties, as an indicator of social capital stimulated by the government, and secondly participation in demonstrations as an indicator of social involvement.

The number of anti-government demonstrations is defined as any peaceful public gathering of at least 100 people for the primary purpose of displaying or voicing their opposition to government policies or authority, excluding demonstrations of a distinctly anti-foreign nature. The data is originally from Banks (2008) but extracted from Norris (2009). The Civil liberties Index is calculated by Freedom House (2009) and includes freedom of expression and belief, associational and organizational rights, rule of law, and personal autonomy without interference from the state. The index ranges from 1 (most

free) to 7 (least free), however I have reversed the scale for the purpose of the analysis, therefore 1 is the least free and 7 the most free (FreedomHouse, 2009).

As a measure of international aid I include the Net Aid Transfers (NAT), made public by Roodman (2007). The measure incorporates two changes to the traditional Overseas Development Assistance (Net ODA). Firstly, NAT measures the net transfers whereas ODA is a capital flow concept. Secondly, NAT excludes cancellation of old non-ODA loans. It is measured in constant 2005 US Dollars. I generate a new variable that is the NAT per capita to include in the model.

For public spending I use a measure from the International Monetary Fund and World Bank Indicators. This is calculated regarding levels of GDP per country.

To measure the differential impact of aid regarding the regime type I include 'regime type' as an explanatory variable. I will use the variable from the Project POLITY IV (Marshall and Jaggers, 2002). This is calculated as the difference between the 10-point DEMOC index and the 10-point AUTOC index. The 10- point DEMOC measures democratic characteristics, while the 10-point AUTOC measures autocratic characteristics. The final indicator fluctuates, therefore, from -10 reflecting the most autocratic countries, to +10, the most democratic. For some models, and following previous research, I dichotomize this variable between autocracies and democracies to simplify the analysis (Neumayer and Plümper, 2007; Plümper and Neumayer, 2009).

Control Variables

A measure of the population affected divided by the total amount of population within the country is included as a proxy of the intensity of the natural disaster[10]. The number of population affected is extracted from EM-DAT. The definition of population is

[10] The same variable has been applied by Neumayer, to control by strength of Natural Disasters (Neumayer, E. and Plümper, T. 2007. "The gendered nature of natural disasters: the impact of catastrophic events on the gender gap in life expectancy, 1981–2002." *Annals of the Association of American Geographers* 97:551-566.

'People requiring immediate assistance during a period of emergency, i.e. requiring basic survival needs such as food, water, shelter, sanitation and immediate medical assistance. Appearance of a significant number of cases of an infectious disease introduced in a region or a population that is usually free from that disease' (EM-DAT).

I include the variable 'year' in order to control for possible time trends that may influence changes in the homeless and death rates from a natural disaster. One possible change due to time could be technological acquisition; another could be changes in the natural disaster types.

Different types of natural disasters might cause differential outcomes and therefore five variables representing different types of disasters are included as dummy variables: earthquakes, droughts, floods, storms and mass movements. The dataset includes 107 droughts, 134 earthquakes, 454 floods, 344 storms and 115 mass movements[11]. A simple count of disasters by year and country is incorporated as a way of controlling by the tendency of each country to suffer a disaster. Also, fixed effects per country are included in order to control per country differences effects.

Two economic variables are incorporated as controls. Firstly, the log gross domestic product per capita and secondly the output gap, measure that compares the actual GDP of an economy and the potential GDP, showing possible gaps between the two. Following literature in political economy in Latin America, I recognize the relevance of profound income shocks. Therefore, I control for the output gap to avoid spurious correlation with business cycles (Kaufman and Segura-Ubiergo, 2001; Wibbels, 2006). This is a relevant measure to include in the Latin American case due to the fluctuating economy and with the understanding that the tools that a government, international organizations and societies can have access to in moments of positive or negative

[11] Mass movement includes landfalls, avalanches, rock falls and subsidence http://www.emdat.be/classification

efficiency [12]. Several measures of social vulnerability to natural disasters have traditionally included economic variables as determinants of the impacts of natural disasters. To see a detailed comparison refer to Birkmann (2006).

'Urban population growth' is included as a control variable based on previous research that demonstrates an association between urbanization processes and vulnerability (Birkmann, 2006; Pelling, 2003). The percentage of the population under 14 years of age is integrated to the analysis to control for possible differential impacts of natural disasters regarding the age distribution of the population. Finally, I include a measure of the education level of the country: 'illiteracy'. The level of illiteracy is extracted from Barro and Lee's dataset for Educational Attainment (Barro and Lee, 1994). The following table (Table 3) summarizes the main dependent, independent and control variables of the analysis. It also suggests the predictions behind each independent variable.

[12] I have estimated the output gap as the difference between changes in real per capita income and changes in trend per capita income as calculated using an Hodrick-Prescott filter.

Table 3: Description of variables and hypothesis

VARIABLES	Description	Mechanism	Prediction
Dependent variable			
Death rate	Rate between dead population and total population (EM-DAT)		
Independent variables			
Aid	National Aid Transfers, extracted from Roodman (2007)	More aid less the death rate after natural disasters	-
Public Spending	Public spending as a percentage of GDP. Extracted from International Monetary Fund and World Bank indicators	More public spending lower the rate of deaths after disasters	-
Interpersonal trust	Survey question: 'In general, You would say that you can trust in most of the people'' (Latinobarómetro, 1996-2010)	More interpersonal trust less people dead after natural disasters	-
Remittances	Migrant remittance Inflows (US$ million), World Bank.	More remittances inflows less deaths after natural disasters	-
Demonstrations	The number of anti-government demonstrations, defined as any peaceful public gathering of at least 100 people for the primary purpose of displaying or voicing their opposition to government policies or authority, excluding demonstrations of a distinctly anti-foreign nature. Originally from Banks (2008) but extracted from Norris (2009).	More demonstrations more deaths after natural disasters	+
Civil Liberties Index	Civil liberties Index includes freedom of expression and belief, associational and organizational rights, rule of law, and personal autonomy without interference from the state. The index goes from 1 (most free) and 7 (least free) but I reversed the scale for the purpose of the analysis, therefore 1 is the least free and 7 the most free (FreedomHouse, 2009)	Less civil liberties more deaths after natural disasters	-
Polity	Continuous variable from -10 (autocracies) to +10 (democracies)(Marshall and Jaggers, 2002)	Higher the level of democratization lower the death rate after disasters	+
Politydummy	Dummy variable. Democracies = 1. Extracted from Polity IV project.	Democracies have lower probability than autocracies of having deaths after natural disasters	+
Control variables			
Illiteracy	Extracted from Barro and Lee, Educational Attainment Dataset (Barro and Lee, 1994)		
Affected ratio	Affected population by total population of the country year		
Log GDP per capita	GDP per capita from world bank		
Population under 14 years old	From World Bank		
Output Gap	Gap between effective GDP and potential GDP.		
Type of disaster	5 dummy variables summarizing the type of disaster: earthquake, droughts, floods, storms and mass movements. Extracted from (EM-DAT, 2011). Note that in a year in certain country more than one disaster can occur, for that reason they are included as five different variables.		
Count	Total of disasters per year per country (EM-DAT, 2011)		
Urban Population growth	From World bank		

Models

To study count or rate data Generalized Linear models are generally used, as Poisson, Negative Binomial or Zero Inflated Models. A negative binomial regression is applied when the Poisson distribution is highly overdispersed (Gelman, 2007). The likelihood ratio test for overdispersion in the data shows that alpha is not significantly different from zero; therefore we are able to use a Poisson distribution for the analysis. Under the Poisson distribution the variance equals the mean; if there is overdispersion we expect the variance to be larger.

Another possible model to predict count variables would be a zero inflated model, used to explain both variations between the count results but also the zero number. Because the objective of the chapter is to analyze how certain mechanisms operate to reduce the number of deaths after disasters, I have decided to keep only the countries that suffered from at least one natural disaster and the relevant years following Plumper and Neumayer's (2009) research. For this reason a zero inflated model is not applied in this analysis.

I will add fixed effects, a dummy variable per country, to control for possible differences between the countries, assuming that there might be variables out of my model that could cause some changes in my coefficients. I also include a time trend assuming that there may be some natural changes in the coefficients due to the time.

The empirical analysis is divided in two main parts. Firstly a model is presented introducing the demographic, social and economical variables that might determine vulnerability towards disasters at the country level. The variables included respond to previous research carried out in the field although not always tested for Latin America. The second part of the analysis proposes testing for the three hypotheses introduced in

this chapter. It includes social capital, aid and public spending as enhancers of the adaptive capacity of the countries, and mitigation mechanisms of the impact of disasters.

Because of the lack of availability of independent variables for all the countries and years, the number of cases of the models fluctuate from between 170 cases, in the model of social capital, to 475 cases in the model predicting determinants of vulnerability.

The model of social capital, the one with less number of cases, includes 14 countries, with values from 1996 to 2008, although not for every country and every year. For most of the countries I hold data for 12 repetitive observations.

The models for international aid and public spending are more extensive and include data from 1970 to 2008, for 20 countries. The regression includes 389 cases.

Ideally the higher the number of cases and repetitions during time, the more accurate the results are likely to be. Beck (2001) points out there is no lower limit to the number of cases but in general around 14 repeated observations are used. He further suggests that the central concern should be the number of repeated observations and not necessarily the number of countries included in the sample (if included as fixed effects). Therefore, taking into consideration these aspects, when reading the results for the social capital model caution should be taken in the analysis of the regression results. However, through the inclusion of fixed effects and several repetitions for country and year I can be seen to be strictly controlling for possible misleading results.

The equation of the model is:

$$y_{i,t} = b_1 + b_2 x_{i,t2} + b_3 x_{i,t3} + e_{i,t} \text{ for } i=1,2 \text{ and } t=1, \ldots, 20$$

Empirical results and Discussion

Table 4 presents the results of the social and economical determinants of social vulnerability to natural disasters in Latin America and the Caribbean. As predicted, natural disasters do not impact in equal ways among the countries, and the dissimilarities can be identified in the social, economical and political characteristics of the nations. Firstly, urbanization levels do have an impact on the likelihood of being affected by natural disasters. At a 1% increase of the urban population per year the ratio of dead population by disasters increases by 1.26, holding every other variable constant. The increasing demographic pressure on the cities has as a consequence a decrease in the quality of life of the population. In 1970 only half of the population of Latin America lived in urban areas, whereas in 1995 the percentage was 73% reaching 79% in 2010 (CEPAL, 2010a). Those with fewer resources are marginalized to the periphery of the cities and construct their houses in precarious conditions, in general with fragile materials and in lands more prone to floods or mass movements. In addition to urbanization, a second possible determinant of the death rate constitutes the age of the population. As the proportion of youth rises there is an increase in the death rate after a natural disaster, holding every other variable constant. For every one unit that the percentage of children increases, the death toll rate increases by 0.53 ($p < 0.01$). Countries with high levels of young amongst their population appear to suffer more deaths after natural disasters.

Another relevant socio demographic variable is population density. Results presented in Table 4 indicate that a higher population density raises the death rate after a natural disaster. A one percent increase of the population density leads to an increase of the death rate by 0.06, holding everything else constant ($p <0.01$).

Health levels of the population before natural disasters have been seen as one of the determinants of social vulnerability to disasters (Birkmann, 2006; Schneiderbauer, 2004). Countries with a strong healthcare system are more capable of coping with disasters subsequently leading to a decrease in deaths. One variable that could represent health status within the country is Child Mortality, measured through a mortality rate per 1000 live births among a population less than 5 years old. The indicator is a leading indicator of the level of health among children and also used as an overall development measure for countries and is included as an indicator in the Millennium Development Goals (U.N., 2006). Results from the regression indicate that the higher levels of mortality within the country, then the higher the death rate after a natural event. At one unit the mortality rate increases with the dead population increasing by 0.05.

Levels of illiteracy within the country constitute another crucial and fundamental determinant of social vulnerability to natural disasters. Countries with higher levels of education tend to suffer fewer deaths after disasters, being in general more prepared and possessing more tools to cope with and mitigate the impact of potential disasters. Table 4 shows a positive relationship between illiteracy levels and the rate of the dead population after disasters. For every one unit that the illiteracy rate increases the rate of dead population of disasters increases by 0.10, holding every other variable constant. I argue that education lowers the levels of vulnerability to disasters through several mechanisms. Firstly, being educated implies also being informed about the risks and challenges that the society faces. Preparedness techniques implemented by the country are more successful in contexts where the population is more aware and informed about the risks and possible consequences of natural disasters. Secondly, more educated people also possess more tools to react earlier and faster to the disaster, not only with general healthcare and emergency medical attention but also by being aware of the risks arising after natural disasters such as sanitation and health problems.

Moving now to the economical determinants, GDP growth of countries seems to have a huge impact on the rate of deaths after disasters. A one percent shift in GDP is associated with a decrease in the death rate by -21.9, holding everything else constant. Economic growth appears to operate as an economic insurance against the impact of disasters. The output gap, that is the difference between potential GDP and the actual GDP that the country has, is significantly correlated with the rate of deaths after disasters. A one unit increase of output gap is associated with an increase in the death rate by 0.08, controlled by other variables.

As a final economic dimension, I include the percentage of GDP due to agriculture. GDP in agriculture is associated with higher rates of deaths after disasters. With a one percent increase of GDP in agriculture the death rate increases by 0.270. In conclusion, both socio-demographic and economical variables do determine the likelihood of the population dying from natural disasters. Urbanization levels, education, health quality, age distribution, GDP per capita and growth determine the impact that disasters have on Latin American countries.

Table 4: Socio demographic and economic determinants of deaths caused by natural disasters

	Model 1
Urban population growth (annual %)	1.26***
	(0.34)
Population under 14 years old	0.53***
	(0.15)
Population density	0.06***
	(0.02)
Under-5 Mortality Rate (per 1,000 Live Births)	0.05**
	(0.02)
Illiteracy	0.10***
	(0.03)
GDP growth per capita	-21.95***
	(4.50)
Log GDP per capita	-0.16
	(1.49)
Output Gap	0.08***
	(0.02)
% Of GDP due to agriculture	0.27***
	(0.05)
Affected by total population	16.43***
	(1.11)
Number of natural disasters	1.09***
	(0.24)
Droughts	-3.02***
	(0.59)
Earthquakes	-0.43
	(0.49)
Floods	-0.64
	(0.44)
Storms	-1.76***
	(0.65)
Mass movements	0.60
	(0.62)
Year	0.47***
	(0.09)
Fixed effects (Country dummies)	Yes
Constant	-979.1***
	(173.3)
Observations	475

Social capital and Natural Disasters

This section is focused on testing the hypothesis that social capital enhances the adaptive capacity of the countries and attenuates the impact of natural disasters on the population. Following the theoretical argument presented in Chapter II, I maintain that societies hold a certain adaptive capacity, or potential, to prepare, adapt and cope with natural disasters. Human beings are not passive or mere victims of an external threat but instead are social actors, capable of responding and reacting to the impact of natural disasters. In this thesis, I argue that social capital is one of the most relevant mechanisms for mitigating the impact of possible natural disasters. I further propose that the manner in which social capital operates varies regarding the type of social capital between ties between individuals (bonding social capital) and ties between groups and segments of the population (Putnam, 2001).

Results support the hypothesis that bonding social capital decreases the likelihood of being affected by a natural disaster, holding constant all the other determinants of vulnerability. The first model (1, Table 5) includes interpersonal trust as a measure of bonding social capital and a predictor of deaths after natural disasters. The second model incorporates remittances inflows (2) also as a predictor of the strengths of network ties between individuals.

The regression shows that interpersonal trust is associated with a decrease in deaths due to natural disasters, holding everything else constant. Focusing on the first equation (Model 1) presented in Table 5, results indicate that at a one unit increase of interpersonal trust, the rate of deaths after natural disasters decreases by -3.15, with a significant coefficient. The trust between individuals seems to mitigate the impact of disaster. Also giving an account of bonding social capital, the inflow of remittances from abroad appear to have a positive effect in reducing the number of deaths after natural

disasters (Model 2). Both concepts of horizontal network strength, interpersonal trust and remittance flow, do decrease the number of deaths after disasters, holding everything else constant.

In sum, I found evidence to confirm that both bonding social capital decrease the death rate from natural disasters in Latin America and the Caribbean. Higher levels of interpersonal trust and remittance inflows lower the death rate, holding every other variable constant.

Table 5: Bonding Social Capital and deaths by natural disasters. Poisson Regression.

	Model 1	Model 2
Interpersonal Trust	-3.15**	-3.67**
	(1.55)	(1.50)
Remittances inflow		-0.00*
		(0.00)
Polity dummy	-0.19	-0.16
	(0.70)	(0.75)
Illiteracy	0.26***	0.22**
	(0.10)	(0.10)
Affected per population	18.39***	19.14***
	(1.24)	(1.31)
Output Gap	-0.16***	-0.18***
	(0.06)	(0.06)
Urban population growth (annual %)	1.58**	1.92**
	(0.79)	(0.82)
Population	5.92	5.56
	(7.06)	(7.58)
Population under 14 years old	-0.30	-0.36*
	(0.22)	(0.22)
Log GDP per capita	14.94***	16.88***
	(5.15)	(5.47)
Year	-0.25	-0.27
	(0.24)	(0.26)
Country dummies	Yes	Yes
Number of disasters	0.61***	0.63***
	(0.14)	(0.14)
Droughts	-0.88*	-0.89*
	(0.52)	(0.53)
Earthquake	-0.20	-0.25
	(0.29)	(0.30)
Floods	-0.66*	-0.73*
	(0.40)	(0.39)
Storms	0.72**	0.70**
	(0.28)	(0.29)
Mass movement	-0.05	-0.02
	(0.27)	(0.28)
Constant	267.83	294.92
	(371.45)	(395.19)
Observations	170[13]	170

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The next model presented in Table 6 captures the strength of civil society or interrelations between different segments of the population (bridging social capital) within the country as a determinant of deaths by natural disasters (Model 3). The prediction is that higher levels of civil society participation and involvement lower the

[13] Due to the lack of data for interpersonal trust for every year and every country the number of cases is reduced to 170.

death rate from natural disasters. The model presented in Table 6 includes two variables to measure the involvement of civil society: participation in demonstrations and a civil liberties index. Results suggest that at a one unit increase of the quantity of demonstrations per year the death rate after disasters decreases by -0.37, holding every other variable constant. The second variable included in the analysis, as a proxy of bridging social capital, is the index of civil liberties, which measures freedom of expression and belief, associational and organizational rights, rule of law and personal autonomy without interference from the state, also has a decreasing effect of the number of casualties. Regression results show that for every one unit that the index of liberties increases, the rate of deaths after natural disasters decreases by -0.48. These results support the prediction that higher the levels of political involvement and participation lower the amount of casualties after disasters. Societies with high levels of participation can apply more pressure on governments to better prepare for possible natural disasters. Protests and demonstrations can become a measure to communicate demands to institutions and nation states, and to demand the implementation of a transparent, inclusive and participative reconstruction process. Furthermore, once the disaster has occurred, high levels of participation and civil involvement can determine a more efficient and speedier recovery process. Any plan designed without community involvement could fail if does not contemplate the needs and context of the affected population. Social participation and involvement in the reconstruction process is increasingly seen as fundamental in easing the impact of disasters (Nakagawa and Shaw, 2004; Pulgar, 2010). From a policy point of view, results indicate that any work done in empowering the local community and civil society can reduce the effects of natural disasters, both before and after they occur.

Table 6: Bridging Social Capital and deaths by natural disasters. Poisson Regression.

	Model 3
Number of Demonstrations within the country	-0.37***
	(0.12)
Index of Civil Liberties	-0.48**
	(0.22)
Polity dummy	1.13
	(0.75)
Illiteracy	0.24***
	(0.04)
Affected per population	13.87***
	(1.30)
Output Gap	0.05
	(0.03)
Urban population growth (annual %)	0.51
	(0.36)
Population	-6.65
	(8.41)
Population under 14 years old	0.45**
	(0.19)
Log GDP per capita	-8.08***
	(2.66)
Year	0.39***
	(0.09)
Country dummies	Yes
Number of disasters	1.44***
	(0.30)
Droughts	-2.88***
	(0.82)
Earthquake	-0.95**
	(0.48)
Floods	-1.90***
	(0.50)
Storms	-1.55***
	(0.48)
Mass movement	-0.007
	(0.46)
Constant	-744.0***
	(178.2)
Observations	335

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

International Aid and Public Spending

In this section I propose an empirical model that predicts the death rate from natural disasters in relation to different levels of international aid and public spending, thus testing the hypotheses that higher levels of international aid and public spending lower the amount of deaths from natural disasters, conditional on the political regime.

Firstly, I study whether governments, through public spending, can stimulate the adaptive capacity of societies to natural disasters. Governments are mainly responsible for instigating preparedness measures among countries. I argue that they attenuate a possible impact of disasters both through mitigation of the determinants of vulnerability (increases in education, healthcare coverage, unemployment insurances, organized urbanization processes) or through direct intervention to prepare for a possible occurrence of a disaster as information dissemination, construction codes, and the implementation of early warning systems. Secondly, public spending is also crucial after disasters. Governments can choose between targeting certain segments of the population, through meeting particular demands, or can also provide public goods, such as shelter, healthcare coverage and food provision to all the affected population. Public spending is needed in the reconstruction process, through the provision of permanent solutions, reconstruction of roads, communications and restoring the economy. However, not every political context gives rise to public spending having an impact on reducing the number of deaths in the population. I predict that public spending is more efficient in reducing deaths due to natural disasters in democratic governments. Different investigations have demonstrated that democracies tend to be more effective in reducing the impacts of natural disasters (Besley, 2002; Kahn, 2005; Plümper and Neumayer, 2009; Stromberg, 2007). Democratic governments have more incentives to provide public goods to respond and recover from natural disasters.

Second, I predict that international aid can also stimulate the adaptation capacity of societies through several mechanisms before, during and after the occurrence of disasters. Programs and plans from the international community implemented to prepare a society for disasters are often the only source of funding developing countries can receive. These preparation mechanisms could imply the spreading of awareness within the population or even direct changes in constructions or infrastructures. After disasters occur, humanitarian aid is fundamental in implementing search and rescue operations and ensuring early attention to the affected population. Finally, long term reconstruction could involve huge amounts of funding that national governments are unable to spend.

As discussed in the theoretical chapter of this thesis, I further argue that the democratization level of a country determine the differential effectiveness of the distribution of humanitarian aid. Within autocracies aid encounters fewer obstacles to redistribution and the allotting of funds to the affected population. In addition intervention tends to be more direct and free from governmental control or supervision.

Table 7, Model 1, shows that public spending tends to be more effective in reducing deaths among democracies than autocracies. In autocracies, government spending does not have a significant effect on decreasing the death toll, however results change when an interaction term with democracies is included. The interaction term between domestic spending and regime type (in a dummy variable) became negative and significant. The results therefore support the hypothesis that among democracies public spending appears to be more effective in reducing the death toll than in autocracies, holding everything else constant.

To further analyze these mechanisms the next model (Model 2, Table 7) includes both public spending levels and international aid within the country. Results show that public spending within the country decreases the levels of deaths after disasters, as well as

international aid, both with significant results. Illiteracy levels are still included in this model to control by education levels within the country. Results demonstrate that if we keep constant public spending by the government, and every other independent variable, a dollar increase of international aid leads to the death rate decreasing by -0.02. In the same direction, keeping constant international aid, an increase of one unit in the domestic spending would decrease the death toll from natural disasters by -0.14. In sum, both public spending and aid are effective, although the effectiveness varies regarding the regime type of the country.

Table 7: Public spending and deaths by natural disasters. Poisson regression.

	Model 1	Model 2
Government spending	-0.08*	-0.14**
	(0.04)	(0.06)
International aid per capita		-0.02**
		(0.006)
Polity dummy	2.28	-0.07
	(1.64)	(0.77)
Government spending*polity dummy	-0.14**	
	(0.07)	
Illiteracy	0.22***	0.23***
	(0.07)	(0.07)
Affected per population	13.09***	12.20***
	(2.78)	(2.55)
Outputgap	-0.06**	-0.06**
	(0.02)	(0.03)
Population (Logan)	8.72*	13.22**
	(6.47)	(7.32)
Urban population growth	0.75*	0.14
	(0.49)	(0.42)
Population under 14 years old	0.56**	0.79**
	(0.28)	(0.32)
Log GDP per capita	1.33	0.76
	(1.10)	(1.12)
Year	0.31***	0.35***
	(0.12)	(0.13)
Number of disasters	1.37***	1.32***
	(0.38)	(0.37)
Droughts	-3.35***	-3.47***
	(0.95)	(0.99)
Earthquake	-0.60	-0.47
	(0.62)	(0.64)
Floods	-0.99**	-0.79
	(0.49)	(0.48)
Storms	-1.87**	-1.83**
	(0.82)	(0.78)
Mass movement	-0.20	-0.39
	(0.56)	(0.59)
Constant	-667.9***	-754.4***
	(239.6)	(262.9)
Observations	389[14]	389

Supporting these results, Table 8 provides strong evidence to support the hypothesis that international aid decreases the number of deaths after natural disasters (Model 1, Table 8). Holding everything else constant, every dollar of international aid decreases the death rate by -0.02, keeping constant all the other variables. Model 2 (Table 8) includes

[14] Data on Government spending in Latin America and the Caribbean is limited. This variable integrates two different sources, World Bank and IMF, but anyway decreases the amount of cases of the total equation to 389.

an interaction term with democratization levels, to study if democracies attenuate or reinforce the effectiveness of aid on the death toll. The results show that international aid is more effective in reducing deaths in autocracies, where democracy is not consolidated. In cases where international aid is null, higher levels of democratization leads to fewer people dying after disasters. However, the interaction term shows a positive effect on deaths, indicating that the higher the level of democratization. the impact of aid in reducing the death toll tend towards 0. As suggested in the theoretical argument of the thesis, aid organizations may encounter more freedom of action in weaker governments where they can design and implement policies without further consultation processes. This aspect of international aid has been widely criticized by pointing out that the process should be integrated with national governments and civil society, and not consist of a unilateral set of decisions without the integration of the affected population (Lizana, 2011; Pankaj, 2005; Rey, 2001; Woods, 2005). The result of the regression captures that in stronger democracies the direct impact of aid on reducing the death toll is not as powerful as in autocracies, where international agencies mainly dictate the implementation.

Table 8: International Aid and death rate from natural disasters. Poisson regression.

	Model 2	Model 3
International aid per capita	-0.02***	-0.05***
	(0.007)	(0.02)
Polity dummy	0.07	-0.70
	(0.35)	(0.49)
Aid*polity dummy		0.04*
		(0.02)
Illiteracy	0.05*	0.04*
	(0.03)	(0.03)
Affected per population	16.16***	15.43***
	(1.38)	(1.43)
Outputgap	-0.02	-0.02
	(0.03)	(0.03)
Population (Logan)	9.08*	9.57**
	(4.86)	(4.85)
Urban population growth	1.64***	1.60***
	(0.34)	(0.33)
Population under 14 years old	0.09	0.15
	(0.14)	(0.14)
Log GDP per capita	-1.68	-1.44
	(1.19)	(1.18)
Year	0.15**	0.16***
	(0.06)	(0.06)
Number of disasters	0.52**	0.54**
	(0.27)	(0.26)
Droughts	-2.69***	-2.62***
	(0.63)	(0.61)
Earthquake	-0.04	-0.05
	(0.73)	(0.73)
Floods	-0.12	-0.10
	(0.49)	(0.48)
Storms	-0.92	-1.06
	(0.82)	(0.79)
Mass movement	0.36	0.30
	(0.70)	(0.69)
Constant	-308.1**	-323.5***
	(124.9)	(118.1)
Observations	538	538

4. Conclusions

Results of this chapter suggest that the social, political and economical structures of the country determine a differential impact of natural disaster. Urbanization levels and population density increase the death rate due to natural disasters. Additionally, the age composition of the countries is related to a differential impact of natural disasters; the greater proportion of children within the country the greater the number of deaths from natural disasters. Furthermore, the healthcare levels in the country and education achievements are potential determinants of the probability of dying due to natural disasters. Finally, economic variables, such as GDP per capita, GDP growth and GDP in agriculture function as mitigation mechanisms for the impact of natural disasters.

Apart from the determinants, the findings in this chapter confirm the predictions that social capital, international aid and public spending shape levels of the adaptive capacity of societies to cope with natural disasters, at least at the country level. These findings have theoretical and empirical implications. Firstly, from a theoretical point of view, acknowledging the relevance of the affected society as capable of mitigating a possible impact of disasters is fundamental for the further development of disaster research. The discussion regarding the role of societies and possible responses should certainly include social capital as a major dimension of the inherent adaptive capacity. Furthermore, it seems relevant to study further the ways in which international aid and domestic spending are implemented among different countries. The results in this chapter indicate that both are effective in reducing the death rate although with differential success among democracies and autocracies. The democratization level seems to be a crucial mediator of the efficiency of aid, both domestic and international, in reducing the number of casualties after natural disasters. It has been argued that international aid, at

least food aid, was more effective in reducing famine mortality in democracies than in autocracies (Plümper and Neumayer, 2009). However, my results suggest that humanitarian aid is more effective in reducing deaths in autocracies than in democracies, at least in Latin America and the Caribbean.

As discussed in the theoretical chapter, one possible explanation can be that the aim of a democratic government is to be reelected, and the manner in which a government deals (or does not) with a natural disaster can determine if a part of their constituency is lost. On the contrary, autocracies respond to the demands of elites without a direct incentive to increase spending. In this sense, democracies have the stimulus both to increase spending and to take the lead in the reconstruction process. Autocracies, on the other hand, carry all the incentives to reduce government spending and to allow international organizations, bringing international aid, to intervene in the countries when they suffer a natural disaster. Secondly, the effectiveness of aid, or lack of it, might reveal the difficulties international organizations encounter in successfully providing assistance through strong national governments. These difficulties might be caused by a lack of adaptation skills in each country context or by more constraints emplaced by powerful governments on the implementation of aid.

These predictions are further studied in the following two chapters at the micro level with the selection of two case studies, the Haitian and Chilean earthquakes in 2010.

IV. Chile and Haiti: The earthquakes

1. Introduction

Chapter III empirically tested the role of international aid, public spending and social capital as possible attenuates of deaths due to natural disasters at an aggregated level of analysis (countries). This chapter, and the following, aims to explore how social capital, humanitarian aid and public spending enhance the adaptive capacity of societies and decrease the levels of social vulnerability to natural disasters at an individual level. The objective of this micro analysis is to disaggregate the micro foundations behind the results found at the country level and to better understand the role of social capital, disaster relief aid and public spending in attenuating the impact of disasters. With this purpose in mind, two case studies are selected: Haiti and Chile.

In 2010, Latin America experienced two of the most devastating earthquakes ever-recorded in the history of human kind, the Haitian and Chilean earthquakes. In Haiti 270 thousand people died and millions were affected generating a humanitarian crisis in the already extremely poor country. In Chile 520 people died and thousands were displaced or affected in other ways, increasing the levels of poverty and inequality already existing in the country.

This chapter describes the main impacts of the quakes on the two societies. It also analyzes the role of social capital, public spending and humanitarian aid in the preparedness, response and reconstruction process after the quakes. The following chapter empirically tests the role of social capital by introducing two models: , humanitarian aid and public spending relating to the Haitian and Chilean earthquakes. The objective of including both countries is not to make a direct comparison between

the impacts of the quakes on each society, but instead to study how previous levels of aid, spending and social capital determine a different outcome in two different countries that suffer the same type of natural disaster.

The chapter is structured as follows. Firstly, I present a discussion of the decisions behind the selection of Haiti and Chile as cases studies. Second, I describe the main social and economic impacts of both earthquakes on the given societies. Finally, I provide an account of the roles of social capital, humanitarian aid and public spending in the preparedness and reconstruction process after the two earthquakes.

2. Case Study selection

The selection of Haiti and Chilean earthquakes as case studies for this thesis is grounded in three main dimensions. Firstly, both countries suffered the same natural event within a couple of months, with almost similar intensity. Each type of natural disaster affects societies in dissimilar ways and therefore, causing different consequences. For example, in the case of floods or droughts which tend to develop slower, sometimes even spanning several months, more time is available for communities, governments and the international community to respond. In the case of earthquakes which tend to happen within the space of a few hours but with devastating results, a country can be left almost immediately without electricity, water supply and suffer extreme infrastructural damage. Taking this into account, it seems relevant to include two case studies that suffered the same type of disaster.

A second reason to include both countries is found in their differential levels of international aid, public spending, democratization and social capital – crucial tools to mitigate the impact of natural disasters and the main theoretical argument of this thesis. Concerning international aid, prior to the earthquake Haiti was already played host to hundreds of NGOs and international organizations, and was one of the most significant recipients of humanitarian aid from the international community. In Chile, despite the presence of several NGOs within the country, international aid was considerably less. According to data from the World Bank, the Net Official Development Assistance (ODA) per capita, the measure of the amount of aid given by international donors, for Chile in 2009 was 4.7 (US dollars) against 113.59 (US dollars) per capita in Haiti during

the same year [15]. In 2010, after the quakes, the ODA increased to 3021 (US dollars) for Haiti and to just 198 (US dollars) for Chile. The levels of public spending in both countries also substantially differ. Chilean levels of spending per capita in $US for 1998 is 289 whereas the same indicator for Haiti is 21 (World Bank Indicators).

Regarding democratization levels, based on the widely used Polity IV project (2009), the Haitian regime scores 6 in a scale that ranges from -10, for autocratic governments, to 10 for democratic systems. However, Chile scores a 10, as a stronger democratic system. Associated to democratic institutionalization, the civil liberties index from Freedom House presents an integrated index from 1 (min) to 7 (max) measuring civil and political liberties within the country. Haiti holds a 1.5 index of civil liberties whereas for Chile the score is 5 (FreedomHouse, 2009).

With reference to social capital, both countries considerably differ in their levels of civil participation (bridging social capital) and interpersonal trust (bonding social capital), variables selected to operationalize the concept of social capital at the aggregated level of analysis. Haitian society appears to have higher levels of civil engagement than the Chilean. In Haiti, 11% of the population in 2010 declared participating in meetings for community improvement, committees or associations at least once or twice a month (Table 9). In Chile, in response to the same question, the level of participation just reaches 2%, being similar to the 2008 results (LAPOP, 2010).

[15] Net official development assistance (ODA) per capita consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients; and is calculated by dividing net ODA received by the midyear population estimate. It includes loans with a grant element of at least 25% (calculated at a rate of discount of 10%). Data are in current U.S. dollars.

Table 9: Participation in meetings for community improvement, committees or associations during the last year

	Haiti		Chile	
	2008	***2010***	***2008***	***2010***
Once a week	10.9	11.2	2.1	2.3
Once or twice a month	21.4	26.9	7.0	11.2
Once or twice a year	24.0	18.4	15.4	15.6
Never	43.6	43.5	75.5	70.9
Total	100	100	100	100

Source: LAPOP survey, Haiti

In contrast, regarding bonding social capital, Chilean society seems more trustful than Haitian, based on the LAPOP survey results. In Haiti, during 2010, in response to the question of how trustworthy their social environment is, only 2% declared that they believe it 'is very trustworthy' (Table 10). whereas 27% of Chileans consider their social environment to be very 'trustworthy' (LAPOP, 2010) (Table 11).

Table 10: Interpersonal Trust, Haiti (LAPOP surveys)

	2006	2008	2010
Very trustworthy	14.11	8.72	2.1
Somewhat trustworthy	21.29	30.2	18.89
Not very trustworthy	42.32	36.78	53.12
Untrustworthy	22.28	24.3	25.89
Total	100	100	100

Source: LAPOP survey, Haiti

Table 11: Interpersonal trust, Chile.

	2006	2008	2010
Very trustworthy	24.2	20.9	27.3
Somewhat trustworthy	39.1	39.8	44.3
Not very trustworthy	26.9	28.8	19.2
Untrustworthy	9.8	10.5	9.2
TOTAL	100	100	100

Source: LAPOP, Chile

In conclusion, Haiti holds higher levels of bridging social capital, referring to the strength of the network ties between segments of the population, and Chile has higher levels of bonding social capital, referring to network strength between individuals (Putnam, 2001).

Table 12 summarizes how Haiti and Chile differentiate in the main independent variables and theoretical arguments of this thesis.

Table 12: Case Selection. Institutional and Coping Mechanisms of Adaptive Capacity. Chile and Haiti.

	Haiti	Chile
Humanitarian Aid	+	-
Public Spending	-	+
Democratization Levels	-	+
Interpersonal Trust (bonding social capital)	-	+
Social Participation (bridging social capital)	+	-

Despite these reasons, several constraints on analysis can be found when studying the Haitian and Chilean earthquakes. Firstly, both countries differ in the availability of data prior to and following the earthquake. After the earthquake, in March 2010, the Haitian Government designed an 'Action Plan for National Recovery and Development of

Haiti'(PDNA, 2010a) summarizing not only the main impacts of the quake but also a plan for the reconstruction process. But despite this report, Haiti does not collect annual data on the social and economical conditions of the population and no statistical studies were carried out before and after the earthquake. The Institute of Statistics (Institut Haitien de Statistique et d´informatique, IHSI) carries a survey of the social life conditions of the population conducted in 2003 and a report on the Objectives of the Millennium from 2009, however both are based on projections and estimations (IHSI, 2009). Moreover, the last measure of poverty available for the country, in the World Bank Indicators, is from 2001 (with 77% of the population beneath the poverty line).

A public opinion survey that has been implemented four times in Haiti by the Latin American Public Opinion Project (LAPOP, Venderbilt University)and constitutes almost the only source of statistical data in the country. In 2010 LAPOP applied a post earthquake public opinion survey, in which I base most of the Haitian analysis.

Chile´s data availability is considerably better. The National Institute of Statistics (INE), belonging to the Chilean Government, provides monthly information on social and economic variables. The Instituite conducts a monthly household survey and census every five years, subsequently making the datasets available to the public. Apart from the INE, many other institutions gather and produce public data, such as the ECLAC (Economic Commission for Latin American and the Caribbean), with headquarters in the Chilean capital Santiago. In addition, the Ministry of Education conducts an annual panel survey 'Casen' (CASEN, 2010) that studies the socioeconomic conditions of Chilean households. After the earthquake Casen was applied to assess the

socioeconomic impact on the population, in which I base my analysis of the impact of the Chilean earthquake.

The differences in the type of data suggest that I am unable to apply the same method of analysis for both countries. For the Chilean case I study the impact of the earthquake on the population via a panel survey, for Haiti I simulate and estimate the results based on the available public opinion surveys.

The second constraint on the selection of Haiti and Chile as cases studies is the fact that both countries are diametrically different in their pre-social and economic conditions. The levels of poverty, health conditions, and expectancy of life, among many other indicators, are extremely dissimilar, suggesting very different social realities for the two societies.

The analysis of both countries has, nevertheless, important contributions. Firstly, despite the political and social differences between the countries, the quakes left thousands homeless, caused numerous health problems, the disruption of education and an increase in poverty levels both in Haiti and Chile. At a political level, it also revealed the difficulties that both governments faced in implementing a rapid and effective reconstruction plan. Secondly, the aim of this chapter is not to make a direct comparison between both case studies but instead to showcase how different levels of international aid, public spending and social capital do have an effect in lessening the impact, not only at the country level as demonstrated in last chapter, but also at the individual level.

3. The earthquakes

Chile is one of the richest countries in Latin America and the Caribbean, with one of the highest GDP per capita in the region, ranking 44 out of 187 countries in the Human Development Index (UNDP, 2011), it has a population of 17.3 million and a life expectancy of 79 for men and 82 for women. On February 27, 2010, Chile suffered an 8.8 Richter scale earthquake with its epicenter in the region of Maule and Biobio. According to International Disaster Datasets EM-DAT (2011), 525 people died, 12,000 were injured, 800,000 were displaced and around 370,000 houses, 4,013 schools, 79 hospitals and 4,200 boats were damaged or destroyed after the earthquake and subsequent tsunami. In sum, a total of 1.8 million people were affected in the areas of Araucania, Bio-Bio, Maule, O´Higgins, Region Metropolitana and Valparaiso (Unidad de Evaluación de Desastres, 2010) with a total economic loss estimated at 30 billion US dollars (EM-DAT, 2011).

On January 12, 2010, a 7.0 magnitude earthquake impacted on Haiti, one month before the Chilean earthquake. Almost 230,000 people were killed, making it one of the most harmful and deadliest earthquakes in the history of natural disasters (EM-DAT, 2011).. According to the Environmental Hazard Program (USGS), 222,570 were killed, 300,000 injured, 1.3 million displaced, 97,294 houses destroyed and 188,383 damaged. The pre-existent levels of poverty together with the lack of institutional and political stability created a chaotic and critical situation in the country in the earthquake's wake. Almost 80% of the schools in the capital of Haiti were destroyed or damaged (UNDP, 2010), and 60% of government and administrative buildings were destroyed.

Based on the Richter scale, the Chilean earthquake was of higher intensity (8.8) than the one in Haiti (7.0); however the impact on the population was disparate. The number of population dead in Haiti climbed to 230,000 against 525 people in Chile. Not only did the existing economic, political and social conditions of the countries determine a differential impact on the population from the same type of natural event, but also attenuated or reinforced the social consequences of the quakes.

In both countries the earthquakes affected millions of people and those that survived, found themselves in a very difficult and critical situation. In this section I briefly describe the main impacts of the earthquakes, not with the intention to be exhaustive but to showcase the main social and economical consequences on the population.

Health

Based on a post earthquake survey conducted by the Chilean government a few months after the quake (CASEN, 2010), 3% of the population suffered from health problems related to the earthquake (Table 13). It is important to observe that despite the Chilean earthquake being one of the strongest earthquakes recorded in history, 97% of the population reported that they did not suffer from any health problem related to the event. Besides the effect on the population, there were also consequences on the healthcare infrastructure. The earthquake affected a total amount of 28 hospitals or health institutions.

Table 13: Health problem suffered in the last month, per region (Chile)

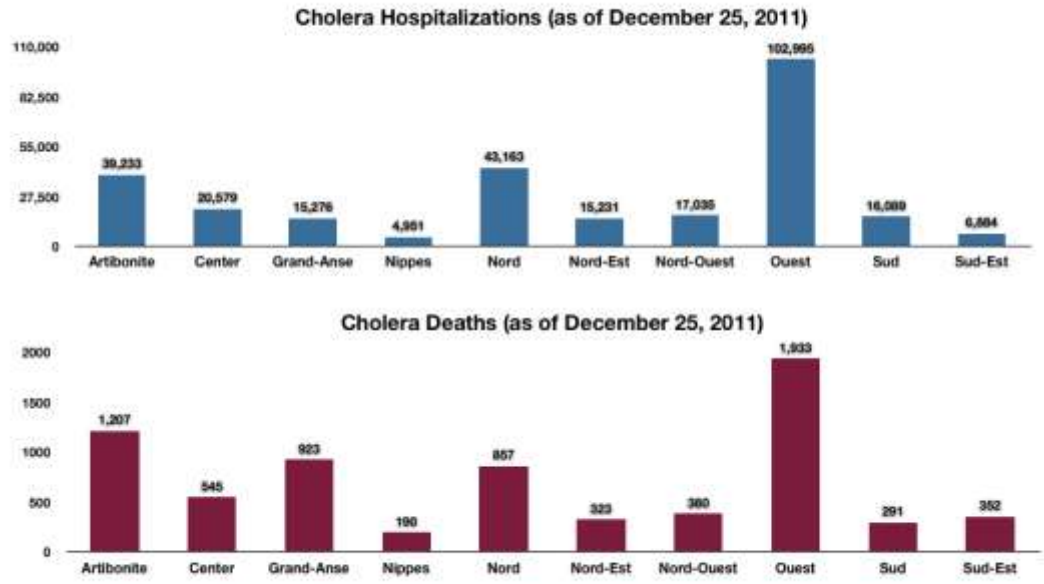
	Yes, as a consequence of the earthquake	Yes, but not as a consequence of the earthquake	No	Total
Valparaiso	2.5	12.4	85	100
O´Higgins	3.4	8.1	88.3	100
Maule	4.7	10.6	84.5	100
Bio Bio	5.5	11.0	83.4	100
La Araucania	2.4	11.4	86.0	100
Metropolitan Region	2.2	7.0	90.7	100
Rest of the country	0.9	9.6	89.4	100
Total	2.9	9.9	87.1	100

Source: Author, based on Post Earthquake Survey (CASEN, 2010)

The health situation after the earthquake in Haiti was significantly more severe than in Chile. After the earthquake, cholera spread in Haiti, infecting over 500,000 people and killing over 7000. The disease was spread through drinking and eating contaminated water and food and was related to the poor conditions the population was forced to live in after the earthquake. The most obvious reason for the outbreak of cholera was that over a million people were living in densely populated camps, with poor access to clean water and food. International and national aid organizations attempted to reduce the level of mortality due to the disease, designating funds not only to take care of the sick population but also to prevent further contamination. The annual hurricane season arrived a few months after the quake, generating floods and aggravating the spread of cholera throughout the entire country. Apart from the impact of the earthquake on the

population, the quake also damaged over 27% of the healthcare infrastructure, diminishing the amount of available medical personnel and further deteriorating the capacity of the healthcare system. The following graphs show cholera hospitalizations and deaths by December 2011, based on data from the Ministry of Health in Haiti.

Graph 2: Cholera Hospitalizations in Haiti after the earthquake in 2010



Source: Ministère de la Santé Publique et de la Population (MSPP)

Education

The impact of the quakes on the education system, and therefore on children, was enormous in both countries; however, the previous fragile condition of education in Haiti determined much more severe consequences.

Before the earthquake, the literacy level among those in the population older than 15 years in Haiti reached 52%, whereas in Chile the level reached to 96% of the population

(CIA, 2010). According to the Haitian Government, over 500,000 children between the ages of 6 and 12 were not receiving schooling before the earthquake and 70% of those attending school had an education deficit (PDNA, 2010a).

After the quake many schools were destroyed in Haiti and the NGOs constructed temporary learning spaces in camps. According to the Ministry of Education, 4,992 schools were totally destroyed, 24% of the total amount in the country and a total of 38,000 students and 1527 lost their lives in the quake (UNDP, 2010). The Ministry calculated that almost 1,000,000 children and teenagers and 55,000 professors were affected by the disaster (Louidor, 2011). The government decided to reopen the schools at the beginning of March, two months after the quake, but more than 2.9 million boys and girls could not start their classes. According to some scholars, the situation of education in Haiti was extremely deteriorated by the quake and two years on is still struggling to recover (Louidor, 2011; Luzincourt, 2010).

Public opinion appears to have been affected by the situation of the education system in Haiti. Based on the LAPOP survey (2010), conducted five months after the earthquake, in response to the question of which priorities the government should adopt in rebuilding the country, 66% of interviewees answered 'building schools' as the main priority over the creation of jobs (15%) and neighborhood security (3%) (Table 14).

Table 14: Actions the national government should be taking to rebuild the country. Haiti, 2010

	Frequency
Building Schools	66.5
Creating jobs	15.0
Roads construction	6.2
Neighborhood security	3.2
Potable water	1.8
Electricity and energy	1.7
Access to health care	0.9
Housing	0.9
Environmental	3.0
Capacity of the national government	0.4
Capacity of the local government	0.1
Other priorities	0.3
Total	100

Source: LAPOP survey, Haiti 2010

The situation of the education system in Chile prior to the earthquake was utterly different. The literacy rate for the population older than 15 years old within the country reached 99% and the matriculation rate 95%, according to UNESCO. However, after the Chilean quake in February 2010, 24.6% of students in the six affected regions could not start the classes in March, as is done every year in Chile. At the epicenter of the quake almost 70% of children could not start the classes, and the rates are even more severe among the poorest population (CASEN, 2010). Those most affected by the natural disaster were people who possessed fewer resources and opportunities. Around 4.5% of students were forced to change schools because of the tsunami or earthquake,

representing close to 117.000 of the total number of school students. More than half the students of the most affected regions started their classes in transitory schools.

The effects of the earthquake on education in both countries had major social consequences. On one hand, children could not continue with their daily lives and lived for months under an emergency situation, going to transitory schools in the case of Chile or to precarious schools assembled in displacement camps in Haiti. On the other hand, keeping children at home meant that fewer possibilities existed for parents to go to work, constraining the economic possibilities of families. Despite the education system being much more developed in Chile than in the Haitian case, the results suggest that schools and children suffered a huge impact after the earthquake, of course not comparable to Haiti, but anyway relevant taking into account the levels of GDP and the wealth of the country. These results theoretically support the conception that those suffering the majority of impacts from the disasters, those more socially vulnerable were people with fewer resources before the disaster occurred. In this case, children and families with children suffered enormous consequences due to the earthquake.

Housing and Displacement

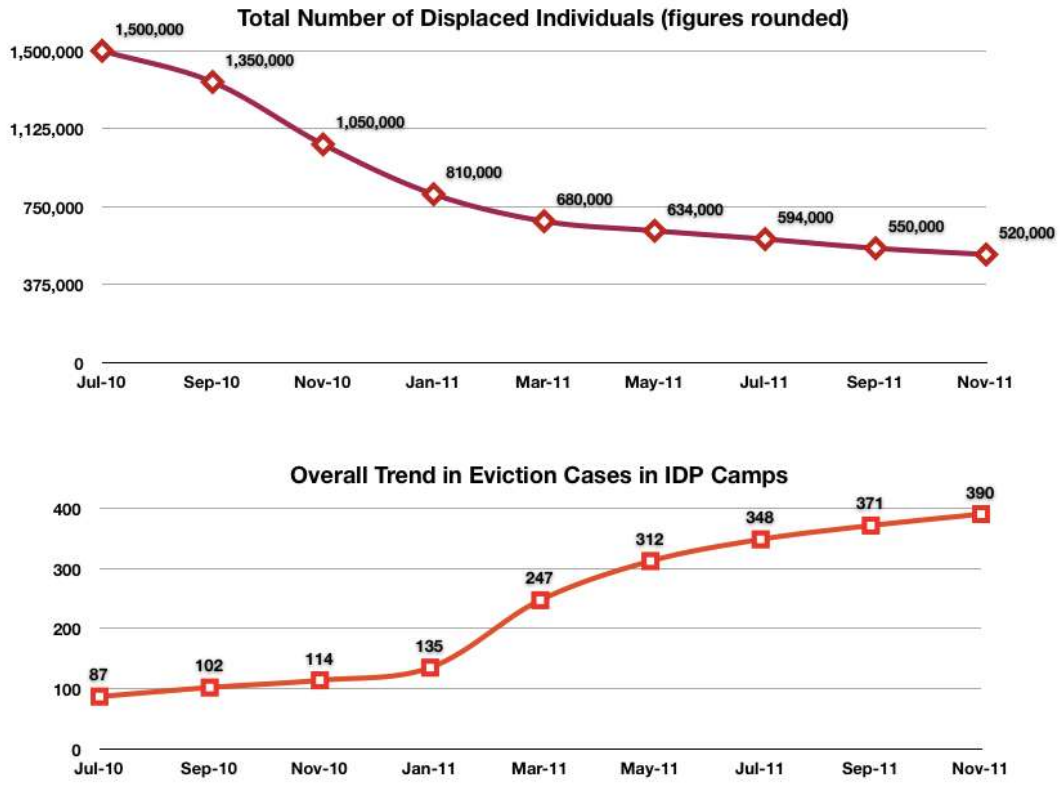
The impact of the Chilean earthquake on infrastructures and houses was severe and one emerged as one of the most devastating consequences of the February 2010 earthquake. According to the Ministry of Housing, a total amount of 81,888 houses were totally destroyed, 108,914 severely damaged and 179,693 with minor damage (Ministerio de Vivienda y Urbanismo, 2010). The majority of the destroyed houses (a total amount of 13%) were located in the Maule region, which was at the earthquake's epicenter, followed by 6% in the O´Higgins region and 4% in the Bio Bio.

The proportion of damaged properties was higher amongst individuals with less income per capita. Almost 8% of the houses of the prime quintile of income were destroyed, against a 4.8% of the higher quintile (CASEN, 2010). The earthquake affected the poorest, with fewer resources to rebuild their houses and also with fewer means of affording a new house. After the quake, temporary camps were created to locate the 800,000 displaced by the earthquake and tsunami. Even in 2012, around 3000 people will be forced to spend another winter in these camps with limited access to water, sanitation and general well being (Bustamante, 2012; CEME, 2012).

As in Chile, but on another scale, one of the major consequences of the earthquake in Haiti was the number of displaced population. Close to 2.3 million people had to leave their homes, 302,000 of them being children. Around 188,383 houses collapsed and almost 105,000 were completely destroyed by the earthquake (UNDP, 2010). After two years, half a million Haitians remain living in internally displaced camps, amounting to two thirds of the initial population (Migration, 2012). According to the International Organization Migration (IOM) this is due to the lack of effective government measures to construct and allocate new houses (2012).

To add even more complexity to the social situation of the displaced population, many of the camps were located on private land and during the last two years (2011, 2012) there has been an increase in eviction cases from the camps. According to the Human Rights Council, it is calculated that around 74% of camps are situated on private land (2011). The graphs presented below show the total number of displaced individual per month and the overall trend in eviction cases in the camps.

Graph 3: Number of displaced and evicted in Haiti after the earthquake in 2010



Source: Camp Coordination and Camp Management Cluster, Haiti - November 2011

Economy and Unemployment

The total economic losses were estimated in Chile at 30 billion US dollars by the U.S. Geological Survey (2010) and in terms of the general economy a reduction in levels of exports and imports occurred. The agricultural sector was severely affected with both crop production and infrastructure impaired (Unidad de Evaluación de Desastres 2010). The impact of the earthquake and tsunami on these industries was accompanied by job losses and especially high levels of unemployment among those belonging to the most affected economic sectors. In these affected regions the population is traditionally employed mainly in areas of agriculture and forestry, commerce and the public sector. Almost 20% of the population working in the agricultural and forestry sector claimed

that their place of work was directly affected by the earthquake, this value rises to 27% for the people working in the public sector – possibly due to the damage to infrastructure and services. Despite the effects of the earthquake, the Chilean economy grew by 5.2% in 2010, with an average growth rate over the last trimester of the year of 6.4% (Dirección de Presupuesto, 2011).

In Haiti the impact on the economy was of course much more severe. The Inter American Development Bank estimated that the earthquake cost $8.5 billion in damage to Haiti´s economy, with a 5.1% contraction of GDP that year.

According to the Haitian Government, the most affected areas were commerce, transport, telecommunications and industry. The inflation was estimated in around 11% for 2010, mainly because the reduction in availability of goods and the increase in transport costsw and also as a consequence of the influx of external aid (PDNA, 2010a).

The Haitians that did survive found themselves in a chaotic and fragile situation immediately after the quake. The country's unemployment rates were already exceptionally high before the event at around 30% for the country and 45% in the metropolitan area. It was estimated that there was a loss of 8.5% in the number of jobs, particularly in the fields of commerce, tourism, transport, and communications (PDNA, 2010b). The absence of a social security system in Haiti caused the situation to become even more fragile for the population made unemployed by the quake.

Poverty

Poverty not only constitutes a determinant of the levels of social vulnerability to natural disasters, but also represents one of the most important impacts of catastrophes. Both in Haiti and Chile, poverty increased after the quake in different magnitudes. This chapter

will present a descriptive analysis of the impact of the earthquakes on levels of poverty levels within the countries[16].

Before the earthquake in January 2010 Haiti was already one of the poorest countries in the western hemisphere. Based on the scarce available data from a survey conducted by the government in 2001, 76% of the population of Haiti was living below the poverty line, with less than 2 dollars per day, and 56% were below the extreme poverty line, with less than 1 dollar per day (Table 15).

Table 15: Poverty Headcount Haiti by region, 2001

	Poverty Head Count
Artibonite	89
Nippes	87.9
Nord	84.4
Nord-Est	94.5
Nord-Ouest	91.1
Ouest	62.1
Sud	87.6
Sud-Est	84.9

Source: Poverty in Haiti (Sletten, 2004)

According to the Haitian government, during the past decade general poverty levels decreased in Haiti at more than 8% across the country but increasing up to 13% in the metropolitan area (PDNA, 2010a). The same report claims that following the quake poverty returned to the 2001 level (71% moderate poverty and 50% extreme poverty), based on several estimations (PDNA, 2010a). In a similar direction, according to a report produced by Vanderbilt University (Zephyr, 2011) supporting the results of the LAPOP survey (2010), levels of wealth changed dramatically after the quake. In 2006 22% of the

[16] In the next chapter I provide a deeper analyze the impact on poverty, proposing two models that predict changes in the levels of poverty (or income) before and after the quake both in Chile and Haiti.

population fell into the first quintile of income whereas in 2010, after the quake, 45% of interviewees fell into the same quintile (Zephyr, 2011). These statistics indicate that the earthquake may have increased levels of poverty among Haitian society, aggravating an already critical social situation in the Caribbean country.

According to the Chilean government, the earthquake in 2010 left 500,00 new poor, a total increase of 3% of the levels of poverty from 2009 (CASEN, 2010). In the region of Bio Bio poverty increased 2%, in O´Higgins 8.5% and in Valparaiso 4.6% (Table 16). The variations in the levels of poverty show that poverty increased in different degrees and were not directly related to the intensity of the quake. For example in Coquimbo, poverty levels increased 6.8%, but in Bio Bio, the epicenter of the quake, the poverty levels increased only by 2.1%. Furthermore, in places where the earthquake hit at mild intensity, as Valparaiso, the poverty levels increased by 4.6%.

Table 16: Chilean poverty per region and year (% of population under the poverty line)

	2006	2009	2010	Variation 2009 2010
Tarapacá	14.5	21.5	22.0	0.5
Antofagasta	7.3	9.5	9.8	0.4
Atacama	10.5	16.7	17.0	0.3
Coquimbo	15.9	13.4	20.2	6.8
Valparaíso (VI)	15.3	17.6	22.2	4.6
O´Higgins (VIII)	11.4	13.2	21.8	8.5
Maule (VIII)	17.7	21.3	17.3	-4.0
Bío Bío (IX)	20.7	22.3	24.4	2.1
La Araucanía (VIII)	20.1	27.7	25.6	-2.1
Los Lagos	14	12.6	17.6	5.0
Aysén	9.2	16.1	10.5	-5.6
Magallanes Y La Antártica Chilena	6.3	10.6	9.8	-0.8
Región Metropolitana (VIII)	10.6	13.0	16.0	2.9
Los Rios	0	26.3	27.6	1.2
Arica y Parinacota	0	18.1	20.0	1.9
Total	13.7	16.4	18.9	2.5

Both in Chile and Haiti simple analysis of the direct results of poverty and the changes per geographical area through simple frequencies can be misleading. I argue that the reasons behind the decrease or increase in poverty for both societies can be the consequence of a combination of factors. I maintain that international cooperation, national spending and social capital can either attenuate or reinforce the impacts of earthquakes on poverty levels[17]. In the next section I provide a brief account of how public spending, international aid and social capital operated to attenuate the impact of the earthquake on the population.

[17] A detailed analysis of the impact of quakes on poverty and the role of international aid and social participation is proposed in the next chapter.

4. Adaptive capacity: States, International Organizations and Civil Society

Having analyzed the main impacts of the quakes on Haitian and Chilean societies, I move towards the analysis of how the governments, international organizations and societies responded and adapted to the impact of the earthquakes. As addressed in the main argument of this thesis, I argue that societies, far from being static actors or mere victims of natural disasters, hold adaptive potential to respond and adapt to possible hazards. I further maintain that social capital, as an individual mechanism, and aid and public spending, as an institutional mechanism, hold the potentiality of enhancing the adaptive capacity of individuals and through this reduce vulnerability to natural disasters.

The social determinants of social vulnerability throughout this thesis refer to the pre-existing social, economic and political conditions within the society. Predetermined social inequalities give form to the future social impacts of natural disasters. Disasters are socially constructed, based on the combination of these social and political structures together with a hazard. In this sense, in order to study social vulnerability levels after a disaster occurs it is also fundamental to disentangle how societies and institutions prepare for, react, and respond to likely threats.

This section presents a descriptive analysis of how social capital, disaster relief aid and public spending operated during the Haitian and Chilean earthquakes to reduce the impact on the respective societies.

Haiti

The capacity of the Haitian Government was particularly affected by the earthquake not only because many national and municipal buildings were destroyed but also because of the number of casualties among civil servants (Committee, 2010). This, together with the already weak state of Haitian Government, caused delays and difficulties in coordinating the responding to the disaster in the initial stages. The government did created six working groups in the days after the quake to coordinate efforts in healthcare, food, water distribution, fuel, temporary shelters and reconstruction but it was not until a few months after the quake that an 'Action Plan for the Recovery and Development'(PDNA, 2010a).was developed by the Haitian Government.

Three months after the quake, an Interim Haiti Recovery Commission (IHRC) was created, co-chaired by former U.S. President Bill Clinton and the Haitian Prime Minister Jean Max Bellerive. International organizations and NGOs were conglomerated in several clusters, a mechanism widely used by United Nations to respond to natural disasters or humanitarian crisis (IASC, 2010). The aim is to include in the cluster system as many NGOs and organizations as possible but as the head of OXFAM acknowledges 'sometimes there are a lot more organizations out there... that don't even know about this cluster system' (OXFAM, 2010). Many of the local NGOs operated outside the clusters without coordinating with the rest of the organizations. The lack of administrative capacity from the Government resulted in the non-regulation or supervision of the NGOs working in the country. This situation was aggravated by the fact that all visa restrictions and border controls were removed, resulting in foreigners being allowed to stay up to 90 days in the country without regulation. In the few days after the quake, hundreds of volunteers, NGO members and international organization officials began to enter the country with no clear mandate and coordination. According

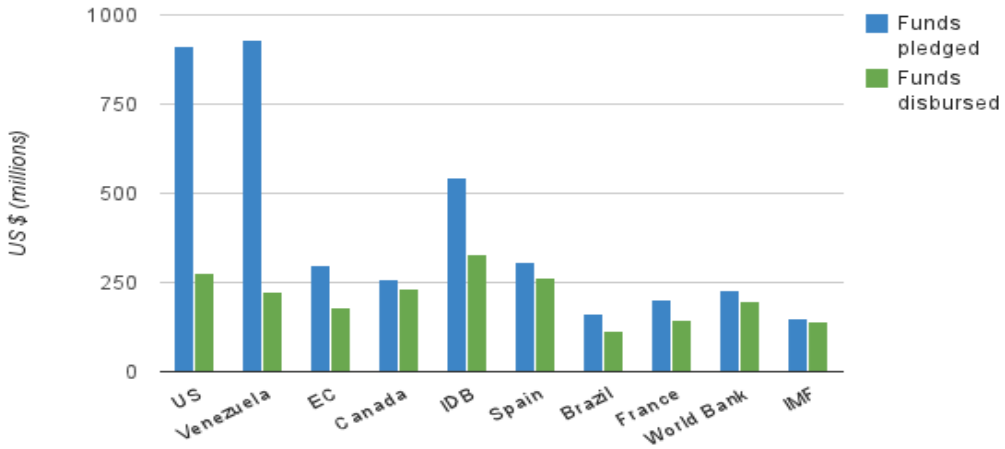
to the Office for the Coordination of Humanitarian Affairs (OCHA), many of the people that entered the country were ill- prepared and unfamiliar with the 'cluster' organization proposed by United Nations. As mentioned in their Bulletin

> The lack of coordination caused problems for the Haitian authorities, who did not always know exactly who was operating in their country. This hampered their leadership role in the emergency response provided by local authorities and also directly affected other international actors trying to perform their work in accordance with the established coordination mechanisms. (OCHA, 2012)

Many scholars, journalists and NGO members have criticize the inefficiency, incapacity and delays with which the Haitian Government, and also the international community, reacted to the disaster (Council, 2011; McGreal, 2010; O'Connor, 2011; Provost, 2012). According to some international aid agencies, the in initial weeks following the earthquake aid failed to reach Haitians due to logistical confusion, disputes over priorities, and chaotic disorganization (McGreal, 2010).

Soon after the quake, in March 2010, US$5.6 billion were pledged by donors to support the Government Action Plan for Reconstruction and National Development for 2010-2011. As of December 2011, only half the money that has been committed by donors had been distributed according to data from the UN special envoy to Haiti (Provost, 2012). The following graphs show the gaps between the pledged funds and those actually disbursed from the main donors.

Graph 4: Aid for reconstruction pledged and delivered by the top 10 donors



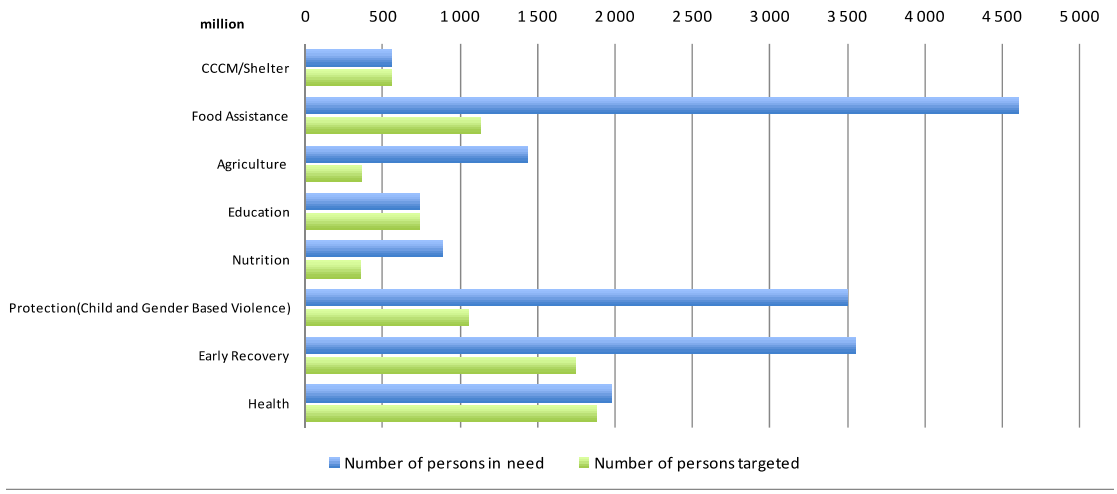
Source: UN Office of the Special Envoy, Haiti December, 2011

According to OCHA (2012) the situation is even more critical in 2012 with only 9% of the pledged budget has been distributed. Of the $53.0 million requested at least 11 million is urgently needed to secure shelter and provide rental subsidies. Another $12.9 million is set to be designated for the provision of water and hygiene promotion to prevent cholera outbreaks. Around $10 million are needed for food provision and 4.8 million to protect woman and children from abuse and sexual violence in camps (OCHA, 2012).

The graph below shows the number of persons that were covered by the aid and the number of persons that still need attention in different areas, based in the funding appeal made by the United Nations cluster system, named the Consolidated Appeal (CAP, 2012). The coverage on food assistance seems critical, with almost 4.5 million people in need and only 1.2 covered by international aid by September 2011. The funding for

protection of children and females against sexual harassment and violence has covered 1 million from a total of 3.5 million that are in need.

Graph 5: Number of persons in need, targeted and covered by 2012



Source: (CAP, 2012)

The majority of the projects embarked on by International NGOs are being conducted at the epicenter of the quake, the capital of Haiti, Port au Prince. By 2012 a total of 369 projects are being undertaken in Haiti, led by 59 organizations. Donors and international organizations have been widely criticized during the last two years, not only because of the gaps between what was promised and what was actually donated, but also due to the fact that only 6% of the total reconstruction process has been implemented through Haitian institutions and less than 1% through the Haitian Government (Provost, 2012). The lack of involvement by national governments in the process of redistribution of disaster relief aid from international agencies is a problem identified by several scholars (Pankaj, 2005; Woods, 2005). The way agencies distribute the money is based on strategic decisions and not only based in the population in need. Where, when and how

the funds are allocated respond to the international organizations needs and priorities, leaving sometimes the less visible injured and affected outside the equation. In a similar context, the funding of the agencies is often related to high profile events, and I argue that whereas most of the funding was distributed at the epicenter of the quake in Haiti, the remainder of the country was systematically overlooked.

The United Nations cluster mechanism comes into operation at the beginning of any reconstruction process with the coordinator of each cluster being an international NGO or multilateral agency. After a while the local governments and agencies are meant to take over and lead the reconstruction process from the inside. However many scholars and members of different organizations have declared that this has not been the case in Haiti where the international agencies are still leading the reconstruction process with very little participation from the Haitian government and even less from Haitian civil society (HaitiGrassrootsWatch, 2011; IASC, 2010).

In this sense, the Interim Haiti Recovery Mission has been widely criticized for failing to ensure the participation of local authorities and civil society in the reconstruction process. According to the Periodic Review Working Group, from the Human Rights Council (2011), the reconstruction plan lacked a consultation process with stakeholders in order to assure efficiency in the implementation and accuracy of policies. They also add that 'the lack of transparency and participation is inconsistent with a human rights based approach, and has resulted in little ownership of the plan by the Government and affected communities' (Universal Periodic Review Working Group, 2011:4). The Inter Agency Standing Committee (IASC)[18] also criticized agencies and NGOs for the lack of inclusion of civil society, acknowledging that such inclusion would have implied a faster and more efficient implementation of the recovery process (IASC, 2010). They further

[18] The Inter-Agency Standing Committee IASC. 2010. "Response to the Humanitarian Crisis in Haiti." *Inter-Agency Standing Committee.* is a unique inter-agency forum for coordination, policy development and decision-making involving the key UN and non-UN humanitarian partners.

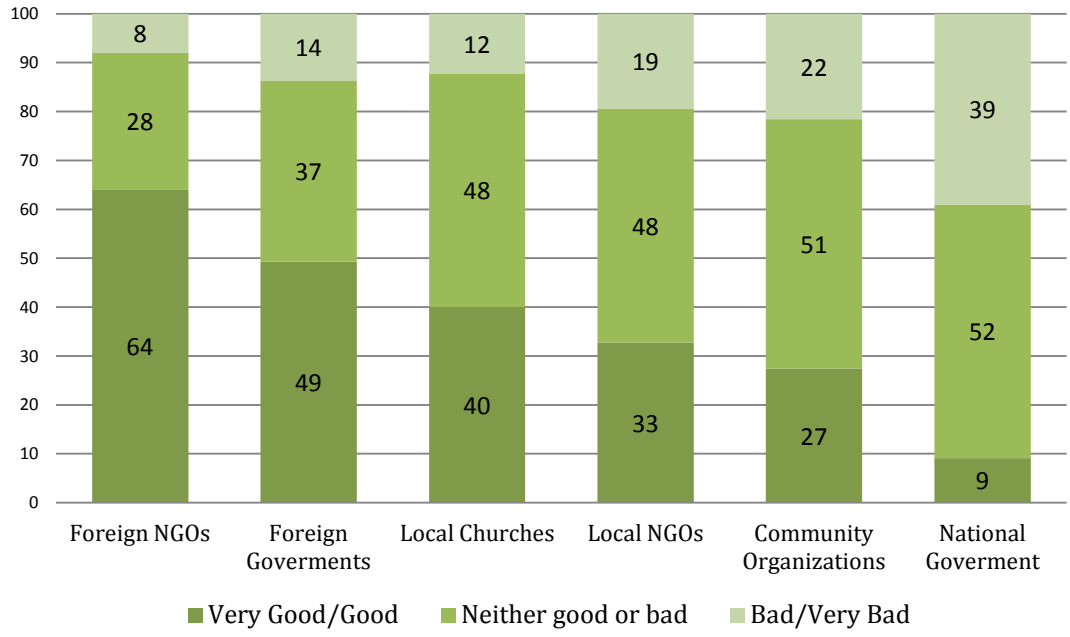
pointed out that coordination between the international community and the national and local governments, and also civil society, was extremely weak resulting in a fragile implementation of the recovery process.

Haiti boasted a vibrant civil society before the quake whose actions were crucial in the first days after the earthquake (IASC, 2010). According to the Haitian Civil Society Organizations Database (2012)[19], before the earthquake there were around 800 organizations working in Haiti, both national and international. After the quake 392 new organizations were created many of which were not included in the 'cluster system' applied by the United Nations and were left outside the centralized recovery process.

Despite the critics of the lack of coordination and non-inclusion of Haitian civil society in the recovery process, in 2010, a few months after the quake the population was asked their opinions regarding the performance of different institutions after the January 12 earthquake (LAPOP Haiti, 2010). The results show that 64% of respondents believe that the action of foreign NGOs was 'good' or 'very good', with 49% believing the same for foreign governments, 33% for local NGOs, 27% for community organizations and finally merely 9% thinking that the Haitian government acted 'good' or 'very good' after the quake.

[19] http://csohaiti.org/

Graph 6: How the government and other institutions responded after the January 12th earthquake?



Source: LAPOP survey, Haiti 2010

The Haitians seem to be more critical towards the national government, community organizations and local NGOs than foreign NGOs and foreign governments. As has been stated, the reconstruction process was led by international agencies and these results suggest that they are receiving the credit, according to public opinion, as main actors and are responsible for the reconstruction process. Despite the multiple complaints from specialized actors, such as academics and NGO members, regarding the lack of coordination and involvement of civil society and national government in the reconstruction process, the society itself appears not to consider that international agencies are to blame. Caution should be taken with these results as the survey was conducted just 5 months after the quake when the cholera outbreak was not as dramatic as it was to become a few months later. The protests and demonstrations by Haitians

came a year later, complaining of the lack of efficiency from MINUSTAH (United Nations Stabilization Mission in Haiti)[20] in preventing the spread of cholera among the society.

Chile

The Chilean government took the lead in the reconstruction process after the earthquake, supported by military forces and the private sector. The first measure taken was to create provisional camps to allocate the population that was left homeless. As analyzed in the previous section, one of the most severe consequences in Chile was the destruction of houses and the subsequent number of the displaced. According to the United States Geological Service the quake resulted in 800,000 becoming displaced in Chile (U.S.GS, 2010). Two years after the event, in February 2012, around 3,000 people were still living in camps and is likely that they will not be given a solution soon (Lizana, 2011). The life in the camps has been harsh and difficult for displaced families. Firstly, access to basic services is limited, without a sanitation service, water or electricity in each house. Secondly, many had to abandon their previous towns, therefore becoming disconnected from their own social networks and institutions. Thirdly, the social tension has increased during the last months mainly as a result of the inefficiency of the government to provide solutions (CEME, 2012). Protests have also spread among the camps with, demands made for more rapid and effective solutions for the families concerned (Figure 1).

[20] http://www.un.org/en/peacekeeping/missions/minustah/

Figure 1: The sign reads: ' The Government lies. Constitucion without Reconstruction' Protest in Constitucion February 2012. (CEME, 2012)

A second policy of the Chilean Government was to distribute subsidies to the families that suffered damage to their houses. The Ministry of Housing followed several steps to allocate the subsidies. Firstly, they identified the damage done to the houses; secondly they listed the individuals that were entitled to receive subsidies, and thirdly they began the distribution (Ministerio de Vivienda y Urbanismo, 2010). However, criticism has been directed at the main Government policy of the provision of subsidies, which was viewed as the same social policy prior to the quake, but which was not effective after a natural disaster of this magnitude. Many scholars have raised the question of the efficacy of giving subsidies to families that have lost everything mainly because of the delays in distribution (Bustamante, 2012; CEME, 2012; Lizana, 2011).

Furthermore, journalists and academics have claimed that not only did the government intervene very slowly in the recovery process, but also that the real numbers relating to the reconstruction process and spending were not transparent (Bustamante, 2012; Lizana, 2011). For example, according to the President, Sebastian Piñera, 47% of the

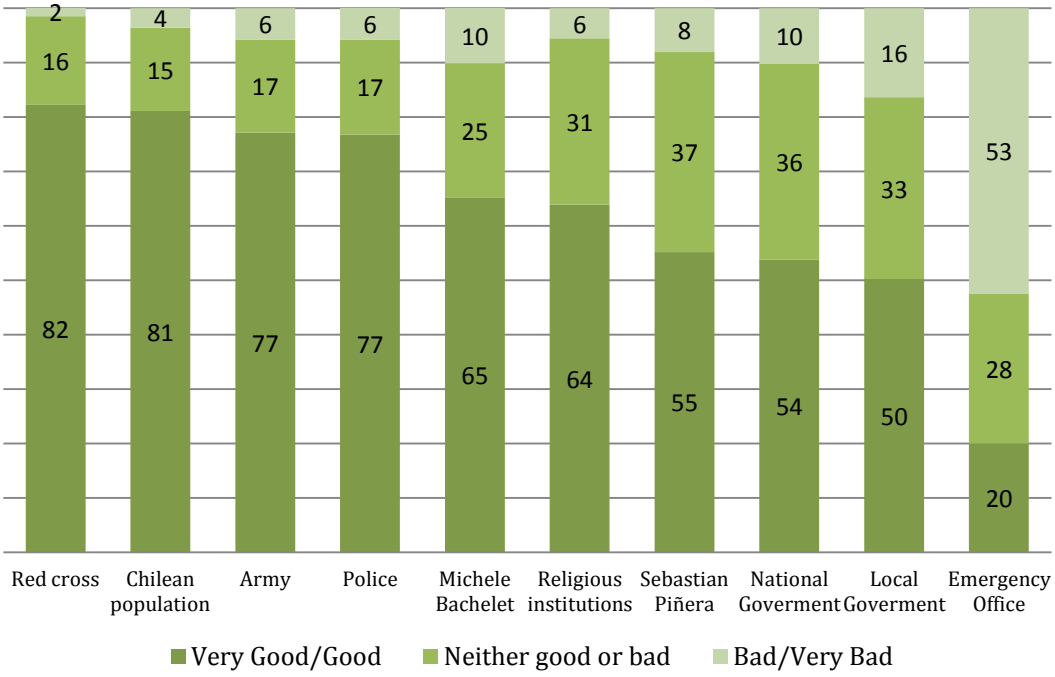
houses had been reconstructed by February 2012, whereas the Observatory of the Reconstruction, from the University of Chile, says the number stands at only 10% (Bustamante, 2012). Similar to what occurred in Haiti, there has been a gap between what was promised and what was actually executed, despite the availability of funds. The Chilean Government did not present disaggregated numbers for the reconstruction process, making the task of evaluating how the funds were spent per area even more difficult (Fazio, 2011).

Most of the reconstruction process in Chile was funded and led by the Chilean government with a readjustment of the annual budget. For the process they were pledged $1.3 million, being primarily designated to areas of healthcare, housing and infrastructure. A fund for reconstruction was also created by the government to allow for private and individual donations (Government, 2010). Some scholars have pointed out limitations in the assignation of funds, because the government did not increase the total expenditure but only reassigned budgets for the reconstruction from the pre-convened annual state budget (Fazio, 2011). The Chilean Government also stimulated the involvement of the private sector within the process, following the model applied in the reconstruction of New Orleans, after Hurricane Katrina. However this model has caused several problems whereby each private company fights for their own financial objectives leading to a more structured and expensive process of reconstruction (Pulgar, 2010).

Based on results from the LAPOP (2010) survey, conducted after the quake, almost eight out of every ten Chileans believes that the police (77%) and the army (77%) reacted 'good' or 'very good' to the earthquake, and 82% consider that Red Cross actions in the aftermath were also 'good' or 'very good'. In contrast, evaluations of the National Office of Emergency, part of the National Government, are mostly critical with more than half

the population claiming that the actions after the earthquake from this organization were 'bad' or 'really bad'. The public opinion seems to be divided when judging the actions taken by the government and local government after the event, with half of the population declaring that the actions where 'good' or 'very good'.

Graph 7: How the government and other institutions responded after the earthquake in Chile? (LAPOP 2010)



Scholars, journalists, and NGO members have also widely criticized the lack of social participation in the reconstruction process after the Chilean earthquake (Bustamante, 2012; CEME, 2012; Lizana, 2011; Pulgar, 2011), claiming that the process of recovery would have been more effective and faster if the civil society had been consulted and included. Also, criticism centered on the fact that the reconstruction process was not proposing long term housing solutions for the displaced but instead a fast and precarious remedy (Pulgar, 2010).

The earthquake revealed the weakness of social networks and civil society organizations, with severe problems in the coordination of activities, adopting more individual

initiatives than collective action to face the reconstruction process. As theoretically stated by the sociology of disasters, catastrophes constitute an ideal moment to better analyze the social structures of the society. The strength of civil society, or lack of it, is easily seen in the eventuality of natural disasters. For the case of Chile, it appears that the participation and involvement of the community in local activities was already weak before the quake even happened, based on the LAPOP results (2008). The lack of participation in the reconstruction process became a mere reflection of the previous lack of involvement of the Chileans in communitarian activities.

Based on results from the post earthquake survey carried out by the Chilean Government (CASEN, 2010) among affected families (65% of the survey), more than half adopted an individual strategy to cope with the aftermath problems (52%), whereas only 14% were collectively organized. At the epicenter of the earthquake 92% of the families were affected and only 37% adopted collective strategies to solve the problems arising from the earthquake. Results further show that the main activities by which families opted for a collective strategy were the provision of food and water and to provide security to the neighborhood, with variations per region. For example in the Bio Bio region almost half of the affected families opted for collective strategies to provide security to the neighborhoods, whereas in Maule, Valparaiso and Araucania the main activity achieved collectively was access to food and water (Table 17).

Table 17. Principal activity in which they operated collectively, percentage only between the people that cooperated

Region	House reconstr.	Water, Food	Security	Child supervision	Taking care old people	Other	Total
Valparaiso	9,6	49,1	12,6	6,0	8,4	14,3	100
Libertador B. O´Higgins	14,7	42,0	9,0	11,8	12,3	10,3	100
Maule	7,1	47,6	27,8	9,8	4,3	3,5	100
Biobío	5,8	40,4	43,6	6,0	2,1	2,2	100
Araucania	4,3	50,1	17,2	11,8	8,7	8,0	100
Metropolitana	4,1	27,2	35,3	10,5	12,4	10,5	100
Total six regions	6,1	39,3	34,9	8,1	5,9	5,6	100

Source: CASEN, 2010

According to Pulgar (2010), from the University of Chile, one of the causes of the lack of civil society involvement has been the government policy of distributing subsidies converting the citizens into beneficiaries, instead of creating and reinforcing an active civil society. In this same sense, the population become simple 'objects' after the earthquake, needing to receive subsidies, shelter and healthcare coverage, without assuming any direct role in their own survival (Pulgar, 2010). Returning to the theoretical argument of this thesis, and in a similar direction, I maintain that society holds an adaptive capacity, with potential to prepare, respond and recover from potential hazards. Therefore, the lack of stimulus to reinforce civil participation could result in a less effective and more problematic reconstruction process. Seeing the civil society as mere victims brings several policy implications. First, because individuals are not capable of acting or responding, no participation mechanism is implemented by the institutions leading the reconstruction process. Second, the plans and programs to be implemented are not designed into consultation with the beneficiaries, frequently resulting in inappropriate plans that are detached from the reality.

5. Conclusions

The earthquakes had consequences for both Chilean and Haitian society, yet revealing the disparity and inequality not only between but also within the countries. The most affected were the most vulnerable, the poor, and those with fewer resources. The impacts of the quakes on both societies were a consequence of previous social inequalities, together with the lack of preparation and mitigation mechanisms implemented by individuals and institutions. Social capital, public spending and disaster relief aid played different roles in Haiti and Chile.

First, the Chilean and Haitian Governments reacted and operated in extremely different ways. The Chilean Government took the lead in the aftermath of the emergency and also in the reconstruction process with the active support of the military forces. In Haiti the government was totally devastated and in the days immediately after the earthquake more than 100 international agencies were working in the country, yet with major coordination and organization problems (McGreal, 2010). The Haitian Government found itself in an extremely weak position with no tools to take over the reconstruction process. Another enormous difference was Chilean economic strength having one of the lowest governmental debt to economic output ratios in Latin America (Smale, 2010), with a strong credit rating together with a low government spending of the country copper reserves. Although the funds needed to face the reconstruction of the country exited which was not the case with the Haitian economic situation. Public spending levels in Chile are extremely superior, being able to reduce the impacts of the quake on the population. In both societies the population assessment of how the government reacted and responded to the quake was extremely negative. Based on LAPOP, both Haitians and Chileans tend to attribute blame and responsibility to their national governments for the lack of efficiency in the reconstruction process. It is clearly stated

that for the citizens the role of safe keeping and providing public goods should be carried out by national governments, and they are the ones to blame in case the needs and demands are not being fulfilled.

Second, apart from national governments, disaster relief aid organizations operated in dissimilar ways in Chile and Haiti. In Haiti they took the lead not only in the initial stages of the reconstruction process, the emergency relief, but also are still, two years after the quake, leading the reconstruction process. In contrast, in Chile, the national government did not ask for international aid during the first hours and it was two days after the earthquake until they asked for generators, water filtration equipment, field hospitals and also for a damage assessment from the earthquake.

Despite these differences, both countries encountered similar problems in the reconstruction process. As analyzed throughout this chapter, one of the most important impacts on the societies was the displacement and subsequent homeless population both in Haiti and Chile. The provision of a long term solution of shelter for those affected by earthquakes still remains to be solved in both countries. The creation of temporary camps was a policy applied in both countries, and today there are still people living in the camps with consequences in health, employment, school attendance and violence.

The sub-execution of promised funds was also a common denominator in both countries. In Chile and in Haiti there was a gap between the promised funds and the money executed. One of the reasons could be the difficulty encountered in implementing and redistributing funds in a effective and prompt manner. To add more complexity, the lack of transparency in the execution of funds was also a common issue both in Chile and Haiti. The existing levels of corruption in Haiti, together with the lack of transparency in the Chilean government, culminated in a very shady accountability of where and how the international and national funds were spent.

Finally, the involvement of civil society in the reconstruction process was limited both in Haiti and Chile. As theoretically argued in this thesis, the participation of the population in the preparedness, response and reconstruction process after natural disasters could lead to a decrease in the impacts of natural disaster. In both countries, no matter who led the process, the population was treated as simple objects or victims of the earthquakes, almost no involvement in the reconstruction design and implementation. The lack of policies designed to engage the community, together with lack of prearranged tools of social participation (mainly in Chile) generated the fact that the process became led by institutions, without consultation or involvement of the affected communities.

V. Social Vulnerability and Adaptive capacity to earthquakes: Haiti and Chile

1. Introduction

Chapter IV introduced the main social, political and economical impacts of the Haitian and Chilean earthquakes in 2010. This chapter analyzes the micro foundations of social vulnerability to natural disasters in Latin America, testing if humanitarian aid, public spending and social capital enhance the adaptive capacity of individuals to natural disasters. It also presents a new conceptual and empirical framework to measure social vulnerability to natural hazards, illustrating that not only do natural disasters impact more on the most vulnerable, but also increase the poverty levels of the population. Chapter III tested at the aggregated level (countries) show that social capital, public spending and humanitarian aid reduce the number of casualties due to natural disasters in Latin America and Caribbean. This chapter predicts the same three hypotheses, at the individual level, under the assumption that vulnerability should be studied at different scales in order to better apprehend the mechanisms behind the adaptive capacity and vulnerability of societies.

Grounded in vulnerability, theory I take forward the idea that the chances of being poor after an earthquake increases conditional on certain economic and social characteristics of individuals prior to the disaster. Disasters are generated as a reflection of previous social inequalities within the society; therefore dimensions such as healthcare quality, educational level, age, gender, type of the house and occupation determine the probability of becoming poor after a catastrophe. Furthermore, I theoretically sustain that human beings are not passive victims of natural events but instead flexible and

permeable actors, with the capacity of preparing, responding and reacting to the threats of a natural disaster. In this sense, I claim that humanitarian aid and national public spending, as institutional mechanisms, and social capital, as coping mechanisms, mitigate or reinforce the adaptive capacity of individuals, decreasing the impact of the earthquakes on the societies.

The chapter is organized as follows. Firstly, I revise the theoretical argument and hypotheses presented in Chapter II, but adapted to the individual level of analysis. In second place, I test the predictions for Chilean earthquakes and finally for Haitian earthquake.

2. Adaptive capacity of Individuals to Earthquakes

This chapter empirically tests if social capital levels, public spending and humanitarian aid, conditional on the levels of democratization, have an effect on the adaptive capacity of individuals and decrease the impact of natural disasters. To test these predictions at the individual level two countries with significantly different levels of social capital, public spending, humanitarian aid inflow and democratization are included: Haiti and Chile. As we have seen, in 2010 both nations suffered two of the most devastating earthquakes of the history of Latin America and Caribbean[21].

The macro level chapter of this thesis (Chapter III) applied as a measure of social vulnerability to natural disasters the number of casualties per country and year due to a natural disaster. At the individual level, I use as a measure of social vulnerability changes in the levels of the household income due to the earthquakes in Haiti and Chile. I maintain that one of the most relevant consequences of earthquakes among the population is an increase in poverty.

I claim that three main mechanisms can enhance the adaptive capacity of individuals and in this way reduce the likelihood of a decrease in income after an earthquake: public spending, social capital and humanitarian aid. Below I review the three predictions, explained in detail in the theoretical chapter of this thesis (Chapter II), to be tested at micro or individual level of analysis along this chapter.

The first hypothesis argues that both bonding social capital, referring to the ties within individuals, and bridging social capital, referring to the strength of the relationships

[21] A detailed argumentation of the case selection was presented in Chapter IV.

between different groups (Putnam, 2001) have the potentiality to enhance the adaptation mechanisms of societies to prepare, adapt and respond to hazards. I argue that in several ways bonding social capital enhances the potential capacity of individuals. Firstly, community members and family represent one of the most important sources of food, shelter and health attention after the impact of an earthquake. Specifically for the case of earthquakes, infrastructures tend to be severely affected, including roads and airport runways. Support from national governments might take longer than expected or may encounter difficulties in the distribution of resources, and in such moments the help provided by family and friends could attenuate or mitigate the effects of the quake on the level of poverty. A second mechanism by which social capital enhances the adaptation of societies is through the provision of information. Information became a crucial element both as a preparation measure, before earthquakes occur, but also after they occur. Holding information of how to react, where to attend, where to find support after an earthquake strike might prevent further damage, and mitigate the economic impact of the quake on the households. Finally, strong network ties could operate as emotional support to face the disaster and the recovery process. The emotional impact of losing family members, being injured or homeless can imply a long and difficult recovery process, decreasing the possibilities of household members to work and receive income. Strong backing from family and friends could help in reducing the emotional crisis, lead to faster recovery, and in this way reduce the probability of becoming poor after a quake.

Bridging social capital, or the relations between several segments of the population, can potentially reduce the social vulnerability of individuals to earthquakes under several mechanisms. Firstly, they also operate as providers of food, shelter and health, mitigating the possible investment of money in the reconstruction process. Already existent organizations, such as schools, churches, community centers and also newly emerging

groups can centralize and provide basic public goods in the initial days after the quake occurs. Also, they can decrease the need of the affected individuals to flee to other cities in search of shelter or food provision, and in this way prevent the loss of jobs and network support. Strong network communities can also officiate as intermediates between the individuals and the governments both after and before quakes occur. In societies with a high propensity to suffer from disasters, active social participation can produce more effective solutions to mitigate its possible impacts. The provision of insurance, subsidies, constructions regulations, early warning systems, amongst others could be stimulated by strong and active pressure from social groups in the community.

The next two hypotheses argue that humanitarian aid and public spending reduce the effects of natural disasters on the population. Both tools are institutional mechanisms that enhance the adaptive capacity of individuals.

Public spending could potentially reduce the likelihood of becoming poor in several ways. Firstly, spending can directly shape the determinants of the vulnerability of a society, as healthcare coverage, educational systems, housing quality and income redistribution, amongst others. Secondly, governments can directly mitigate the potential impacts of natural disasters both before, within and after disasters occur. In the preparedness phase, governments can implement policies to prevent possible impacts, such as early warning systems, centralized emergency response plans, construction codes., They can also inform the population of the potential risks from a possible impact of a natural disaster and how to react.

Humanitarian aid contributes to mitigate the effects of earthquakes in the preparedness, response and reconstruction processes. The funding in preparedness might be invested both in the improvement of national mechanisms of response and also in the dissemination among the population of the risks of natural disasters. Subsequently, after

the earthquakes occur, humanitarian aid could potentially reduce the effects on the population, through the provision of food, shelter and healthcare coverage. International organizations tend to have preexisting operation plans to provide these goods to the populations in case of disasters. Also, in this phase, search and rescue operations could potentially mitigate the effects of the quakes on the societies

Regarding humanitarian aid, as discussed in Chapter IV, its relevance in Haiti after the catastrophe was unquestionable. In the first few hours after the quake hundreds of international organizations sent staff and volunteers to the scene, increasing the already high presence of international members within the country (IASC, 2010; McGreal, 2010; Provost, 2012). In contrast, support in Chile came from the national government, through public spending and help from the international community was almost insignificant. The government voted within a few hours after the quake for the readjustment of the national public budget to designate new public funding for the reconstruction of the country. The lead was taken immediately by the central government, guiding all the plans, programs and actions taken to as response to the earthquake. Although international help was welcomed a few days after the quake, it followed a list of priorities and rules settled by the Chilean government (Perasso, 2010). This differences can easily be seen through the Net Official Development Assistance (ODA) per capita, with the measure of the amount of aid given by international donors being 3,021 (US dollar) for Haiti and just 198 (US dollar) for Chile in 2010.

Taking these elements into account, I test the role of public spending and humanitarian aid in reducing the likelihood of becoming poor in Haiti and Chile. However, because after Chilean earthquake the disaster relief aid coming from international organizations

was almost insignificant, I am not able to test the effectiveness of aid within the country. However, for the Haitian case, both hypotheses are tested.

In conclusion, the three hypothesis tested at aggregated level (countries) are tested at the individual level of analysis for the Haitian and Chilean earthquakes in 2010. The hypotheses are:

> *H1. Social capital enhances the adaptive capacity of individuals and reduces the probability of becoming poor or experiencing a decrease in income due to the earthquakes in Haiti and Chile.*

> *H2. Public spending potentially reduces the probability of becoming poor due to the Haitian and Chilean earthquakes.*

> *H3. Humanitarian aid may reduce the probability of experiencing a decrease in income after the Haitian earthquake in 2010 (not applicable for the Chilean case)*

Based on the population that became poor[22] after the earthquake, for the case of Chile and the population that declared experiencing a decrease in income for Haitian case, I discuss how quakes can affect the personal income under several mechanisms. To begin with, earthquakes can affect both the employability and the self-production capacity of individuals. Many economic enterprises stopped working partially or totally after the Haitian and Chilean earthquakes. Some companies ceased work only for a few days causing a small impact on their production and therefore employees, but others

[22] A discussion of the limitations of this measure is presented in the Research Design Section of this chapter

struggled in recovering their normal productive level, determining a decrease in the amount of human resources they needed. In Chile, for example, the earthquake affected the economic epicenter of the country. According to the Association of Exports, Manufacturing and Services from Chile, only 45% of the companies operated normally after the earthquake (CEPAL, 2010b). In addition, besides the direct damage to infrastructures, there was indirect damage to the productive system caused by problems with the availability of water, gas, energy which generated the closure of companies not only because of the damage to the infrastructure itself, but because of the impossibility of resuming activity after the earthquake (CEPAL, 2010b). The impact of the earthquake on income can also be observed in the case of small producers. Both the products and infrastructures can be easily affected generating a decrease in production and therefore generating a decrease in income. In Chile, for example, industries such as the artisanal fisheries were severely affected mainly because of the impact of the tsunami on the coastal zone of Chile. The artisanal fisherman stopped producing for several days, even months, causing a decrease in their monthly income (Unidad de Evaluación de Desastres, 2010). In Haiti there was a total contraction in the economy of 5% in GDP with a total loss of 8% of jobs, according to data from the Haitian Government.

In addition to impacts on the employment of individuals, another crucial element that can ease or strengthen the effect of the earthquake on the population is the occupational conditions of the employee, both in the type of contract (temporary or permanent) and also in the inclusion in the social security system within the country. On one hand, the population that is employed and covered under the social security system is more likely to receive compensation or support after the event and in this way easing a probable loss of job or decrease in income. Secondly, as seasonal workers they are more permeable to the economic situation of the sector. If the company is affected by a natural disaster temporary workers become almost immediately unemployed without any benefits. In

Chile almost 40% of the total employed population are hired temporally, 25% of the total employed did not sign a contract with their employers and 45% of the employees belong to a social insurance program (in case they are fired or the place where they work closes) (CASEN, 2010). In Haiti, the vast majority of the population are not covered by a social security system, and exist in extremely fragile employment conditions. Based on the public opinion survey conducted in 2010, from the total of employed more than half did not have a contract, and 83% have no health insurance through their employer (LAPOP, Haiti, 2010).

Apart from the occupational characteristics, I discuss that the type and quality of the house where the individual lives can determine not only the chances of being affected by the earthquake, but also the investment people need to make afterwards in order to rebuild the property. First, the ownership of the property, more specifically the legal status of the occupancy, determines how fast or how directly the person can receive support from both government and international organizations. Secondly, the responsibility of rebuilding the property is on the owner, causing them to invest more money than those that are renting a property. Furthermore, the stronger the material the house is made of, then the less the impact of the earthquake and therefore the less the economic effort the family needs to make to rebuild it. In the Chilean earthquake, for example, 3% of houses were totally destroyed and 30% were partially damaged, according to a post-earthquake survey conducted by the Chilean Government (CASEN, 2010). In Haiti, around 188,383 houses collapsed and almost 105,000 were completely destroyed by the earthquake (UNDP, 2010). During the months after the earthquake around 2.5 million people were living in tents and camps. The construction codes in

Haiti before the earthquake did not follow any anti-earthquake measures as they do in Chile, making them extremely vulnerable to disasters (OCHA, 2012).

Moving on in the identification of the characteristics that might predict an impact of the earthquake on income, I argue that the existing healthcare conditions of individuals can help in adapting and coping better with the disaster and therefore recovering easily and faster. Problems with health can affect the capacity for work and therefore cause limitations in generating income, but can also represent an increase in the expenses of the household. Therefore, the less the health quality of the individual, the more chances there are that they become poor after an earthquake.

I maintain that houses with a single female parenthood are more likely to become poor after an earthquake. I argue that specifically in the case of female breadwinners the impact on their employability and possibility to generate income is higher than other types of households. After an earthquake the dynamics of the house can be affected in many ways especially in the presence of small children. School closures, healthcare issues and displacement can cause children to stay at home needing the attention of an adult on a daily bases. Households with two adults are more flexible and allow one of the adults to continue working while the other stays at home. In the same sense, I suggest that households with children have fewer tools to become resilient to the earthquake and tend to be more affected. The presence of children can increase the impact of the disaster in many ways. Firstly, moving from one place to another to overcome the damages to houses becomes more difficult in the presence of children. Taking the children from schools or from their network of support, moving them to another city or

town, can be complicated for many families, causing them to stay in the place where they live despite the damage to their houses. Secondly, in case of impact on the health of any of the children at least one adult needs to stay and take care of the child. This can cause an impact on the income of the adults of the household, making them poorer than before.

Apart from these variables there are many others that might cause a shift in poverty or income levels among the population, although not necessarily related to the earthquake. For this reason a set of control variables are included for the study of each country.

The following section empirically proposes a model to measure the social determinants of social vulnerability to the earthquake in Chile and the role of social capital and public spending to mitigate those impacts. Finally, following the Chilean results, I present an empirical model for Haiti.

3. Explaining social vulnerability to disasters

3.1 Chilean Earthquake

The next section gives an account of the main social and economic characteristics of social vulnerability to earthquakes in Chile and tests the hypothesis that public spending and social capital stimulate the adaptation capacity of Chilean society to the earthquake.

Research Design

The predictions are based in a multilevel logit model. I include as independent variables the social and economic conditions of the individuals before the earthquake and as dependent variable the proportion of the population that became poor after the earthquake, replicating a quasi experimental design. The individuals are grouped regarding the intensity of the earthquake (or treatment) (Shadish, 2010).

Data

In April 2010, two months after the earthquake, the Chilean Ministry of Development implemented a post-earthquake survey, sampling a portion of the population that commonly integrates the household survey that Chile runs every year (MIDEPLAN, 2010). The sample is a representative sample of the whole country and includes general questions on occupation, education and income but also includes new questions on the degree in which the earthquake impacted on the population. The main objective of the survey was to provide information about changes in the quality of the lives of the population affected by the earthquake and tsunami in February 2010. The data used for this analysis, therefore, is a panel survey, composed by two waves of the same households, one before the earthquake (November and December 2009) and the second wave two months after the earthquake (April, 2010).

The questionnaire includes eight parts, covering different social dimensions as education, occupation, income, health, participation, housing and psychosocial impact of the earthquake. The survey was carried out in 27,826 households of the 59,427 interviewed by the 2009 survey. The error margin is not higher than 8% in each region and communities affected by the earthquake or tsunami. It was applied in April of 2010, two months after the earthquake. The person answering the survey was older than 18 years of age.

Because many of the relevant variables are only asked once per household, I only include one individual per house in the model, the person who answered the survey, making a total of 27,271 and a second level of analysis, the geographical area, with a total 15 geographical subdivisions representing the political regions in which Chile is divided.

Dependent Variable

The **dependent variable** of the model is composed by the population that became poor after the earthquake, as a dummy variable, where 1 is only people that changed from being not poor before the earthquake to being poor after the earthquake. The decision of leaving outside of my dependent variable people that were and are still poor helps in the explanation of the causal mechanism. The reasons for poverty in the population that was poor and is still poor might be beyond the earthquake and is more difficult to isolate than just predicting the population that became poor two months after the natural disaster. The variable is created through a measure of poverty that is included in the post-earthquake survey, designed by the Ministry of Development for the CASEN survey (CASEN, 2010). Their method for measuring poverty is based on the settlement of a poverty line, calculated from the basic cost of food and goods for the individual survival. Table 18 summarizes the distribution of the variable.

Table 18: Dependent Variable Distribution. Population that became poor after the earthquake.

	Freq.	%
Not poor	20.928	75.2
Poor in 2009	2.161	7.8
Poor 2009 and 2010	2.147	7.7
Poor 2010 only (dependent variable)	2.590	9.3
Total	27.826	100

Independent Variables

The independent variables of the model are segmented in two major groups based on the theoretical argument of this chapter. Firstly, I include socio-demographic or structural variables that could determine the likelihood of an individual of becoming poor after the earthquake. Secondly, I include social capital and public spending to test the hypothesis that higher levels of social capital and public spending lowers the likelihood of becoming poor.

Regarding the socio demographic determinants of the probability of becoming poor, I include health quality, house quality, occupation in agriculture and fisheries, tenancy of the property, type of occupational contract and membership of the social security system, gender, age, years of education, single female households, and the presence of children in the household, all of them measured at the individual level before the earthquake happened in 2009.

The health condition is measured through the interviewee's perception of his own health, in a scale from 1 being 'very bad' to 7 being 'very good'. The house quality is also included as an aggregated index that includes two indicators: plumbing connections in

the household and the material with which the house is built. The index has three categories: houses with high (3), medium (2) and low quality (1). Years of education is measured by the question of 'how many years have you attended the formal education system', included as a continuous variable. Occupation status and characteristics is measured through three different variables. Firstly, a variable that measures the type of industry in which the individual is employed. I construct a dummy variable that includes as value '1' the population working in agriculture, fisheries and mining; and as value '0' the rest of the population. Secondly, I include as a dummy variable the population that belongs to the social security system, receiving benefits in case of unemployment (1= social security, 0 = no social security). I also include a measure of type of contract of the individual, being category '1' temporary and seasonal workers and category '0' the rest of the population. The tenancy of the house is classified in three categories in the survey. First, people that own the house where they live; second, the population that is renting; and third informal or illegal occupancy. I include the variable as a dummy, recoding the people that own a house as 1 and the rest as 0. Single female households measure the houses that have a single female leading the household. This has only two categories, 1 for female households and 0 for all others. The variable 'children' is a dummy variable addressing if in the house there are children or not (1= there are children, 0= there are not).

As measures of social capital I distinguish between measures of bonding social capital and bridging (Putnam, 2001). To measure bridging social capital I include the levels of social participation in the province, extracted from the LAPOP survey applied in 2010, before the earthquake occurred (LAPOP, 2010). The question applied in the LAPOP survey is 'During the last 12 months have you contributed with your community to solve

any type of problem?' The possible answers are 'once a week', 'once or twice a month', 'once or twice a year' or 'never'. I create an aggregated measure per geographical region with the population that declared having participated and have incorporated the results to the model. At the same level (regional), I also include a measure of interpersonal trust to measure bonding social capital, created based on the question 'Talking about the people of your community, do you think they are very trustworthy, trustworthy, not very trustworthy or not trustworthy'?. As was done for the Latin American comparison (Chapter III), I aggregate the results of the population that answered 'very trustworthy' at the regional level. The inclusion of these variables at the regional level is due to a lack of data at the individual basis. I have information on social capital but only after the earthquake, causing, if included, severe endogeneity problems. These variables are nevertheless presented as supporting information but not included in the regression models.

To measure public spending, I include two variables. First, I include a variable, measured at individual level in the 2009 CASEN survey (before the quake) that provides an account of the proportion of the income of the household due to transfers and benefits from the States. To capture public spending before the quake I include a variable that measures public investment at the regional level (in millions of pesos), extracted from the Ministry of Development (2010). I divide the variable by the total population per region. The variable is also measured before the earthquake. A further variable captures the funding given by the national government to reconstruct houses, however, as it is measured after the quake it is not included in the regression model.

As control variables, I include the number of individuals in the household, income per capita in 2009 (before the earthquake), regional levels of poverty in 2009, and if the individual has insurance against earthquakes on the property.

Also, I incorporate as control variable, or grouping variable, the intensity of the earthquake per geographical strata (cities or communities). For the intensity of the earthquake I use the modified Mercalli scale. The scale was developed in 1931 by Wood and Neumann (Wood, 1931), composed by 12 increasing levels of intensity, classified by the population experiences during the earthquake. The U.S. Geological Survey summarizes the classification of the scale (U.S.GS, 2004) in the following way:

I. Not felt except by a very few under especially favorable conditions.

II. Felt only by a few persons at rest, especially on upper floors of buildings.

III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.

IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.

V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.

VI. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.

VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.

VIII. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.

IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.

X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.

XII. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Although many scales have been developed to measure the intensity of an earthquake the most commonly used are the Richter scale and Mercalli. Because of data availability at the regional level I use the Mercalli scale. In the Chilean earthquake the maximum Mercalli scale intensity was IX at the epicenter of the earthquake. The variable is measured for 15 geographical regions and extracted from the U.S. Geological Survey (2010). The variable is included as a dummy variable, recoding the Mercalli scale in four categories. From 1 to 3 category '1' (reference category), from 4 to 6 category '2', 7 category '3' and finally categories 8 to 9 as value '4'. Table 19 summarizes the distribution of the variable.

Table 19: Mercalli intensity, Chilean Earthquake, 2010.

MERCALLI	POPULATION	%
1	2.739	3.6
2	4.256	5.6
3	1.323	1.8
4	1.088	1.4
5	4.623	6.1
6	6.093	8.1
7	41.620	55
8	11.326	14.9
9	2.598	3.4
Total	75.666	100

The next table gives an account of the main independent variables included in the analysis as well as the mechanism behind.

Table 20: Variables in Multilevel Model. Chilean Earthquake.

Variables	Description	Level*	Time of measure (*1)	Mechanism	Predicted Effect
Dependent variable					
Poverty	Individuals that became poor after the earthquake (dummy 1=poor)	Level 1			
Independent variables					
Government transfers	Percentage of the salary that comes from transfers and benefits from the Government. (MIDEPLAN, 2010)	Level 1	Before	Higher the percentage of salary due to public transfers lower the probability of becoming poor after the quake	-
Public investment per capita at regional level	Total in millions of pesos of the investments projects by region. Source: Ministry of Development. Calculated per capita regarding the total population of the region.	Level 2	Before	Individuals using their own savings to afford the reconstruction are more likely to become poor	-
Social Participation at regional level	Variable that measures levels of participation at regional level. Extracted from LAPOP survey (LAPOP, 2010)	Level 2	Before	Population living in areas that have high levels of participation have lower probabilities of becoming poor after the earthquake	-
Interpersonal trust at regional level	Measure of trust within the community. (1=very trustworthy) Extracted from LAPOP survey (LAPOP, 2010)	Level 2	Before	Population living in areas with high levels of interpersonal trust are less prone to become poor after an earthquake	+
House insurance	Dummy variable that captures the population that did have house insurance against earthquakes (1=yes)	Level 1	Before	Individuals with insurance are less likely to become poor after the quake than the population that does not have insurance	-
Female households	Single female parenthoods (1=yes, dummy variable)	Level 1	Before	Households led by a female parenthood are more likely to be poor after the earthquake than all the other types of households	+
Children	Presence of children in the household (1=yes)	Level 1	Before	Households with children are more likely to become poor after the earthquake	+
Occupational industry	Workers on agriculture, forestry and fisheries (1=yes, dummy variable)	Level 1	Before	Workers on agriculture are more likely than the rest of employers in becoming poor after the earthquake	+
Occupational status	Differentiation between temporary workers and permanent workers. (1=temporary workers, Dummy Variable)	Level 1	Before	Temporary workers have more probability of becoming poor and being affected by the earthquake	+
Social security	Measures if the individual belongs to the social security system (1=belongs to social security system, dummy variable)	Level 1	Before	Population that might have access to unemployment is less likely to become poor after the earthquake	-
House quality	Index of quality of the house 2009 (ordinal)	Level 1	Before	More quality of the house before earthquake less likely to became poor and being affected by the earthquake	-
Health condition	Pre Health condition (ordinal)	Level 1	Before	Higher the health quality before the earthquake lower the likelihood of becoming poor or being affected by the earthquake	-
Years of education	Years of attending to educational institution (individual)	Level 1	Before	Higher the education less likely to be affected or poor after the earthquake	-
Age	Pre Age of the individual	Level 1	Before	Oder the person is more likely to be affected by the earthquake (note that the model includes from 15 years old)	

Control variables					
Mercalli scale	Scale that measures the intensity of the earthquake per region (recoded in 4 categories and treated as dummy)	Level 2	After		
Number people	Quantity of people living under the same roof (continuous)	Level1	Before		
Income in 2009	Income of the individual in 2009	Level 1	Before		
Poverty at regional level	Poverty levels per region	Level 2	Before		

(*) Level 1 refers to individuals and Level 2 to the 15 Chilean geographical regions.

(*1) Refers to if it was measured before or after the earthquake

Model

Based on the hierarchical characteristics of my data and my dependent variable I apply a multilevel logit model, suitable for predicting binary outcomes. Applying a multilevel model instead of a normal logit regression has some advantages for the analysis of the results. Firstly, I am able to analyze how covariates measured at different levels of analysis, in this case geographical clusters, affect the dependent variable. Secondly, ignoring a multilevel structure can result in misleading standard errors and coefficients. The multilevel model in comparison with the ordinary logit produces differences in the coefficients. This is because the logit regression fits overall population average probabilities but the random effects logit model fits subject probabilities for the individuals (Rabe-Hesketh, 2008). The more related the observations are within the cluster the higher the chances of having inaccurate standard errors as a result (Rabe-Hesketh, 2008). Also, the multilevel logit models allows for residual components at each level of the hierarchy. The models presented in this chapter allow for residuals at individual and regional levels. For this reason the residual variance is partitioned into 'within' geographical areas and 'between' geographical areas. The between geographical variance represents unobserved geographical effects that affect individuals (Gelman, 2007).

The regression is calculated through a maximum likelihood estimation (MLE) using an adaptive quadrature, with five quadrature points (Rabe-Hesketh, 2008). MLE is applied as an alternative to non-linear least squares for nonlinear equations (Gelman, 2007). The model contains 27,271 observations at level 1, nested in 15 geographical clusters, at level 2. The model only includes one individual per household. The average observation per group is 1,818 persons, with a maximum of 5,258 and minimum 377. The small number of regions could potentially produce biased estimators, however research has shown that there is no effect on the standard errors of the fixed regression coefficients but mainly in the standard errors of the random part (Maas and Hox, 2004).

The logit model applied is a random intercepts model that calculates the coefficients as with normal logit but it adds a variance component at level 2, in this case geographical strata. The overall regression line is the coefficient, $\beta 0$, but for each group line the intercept is the coefficient plus the variance $\beta_0 + u_j$. Every regression line has the same slope; therefore the random intercepts model is a set of parallel lines. I choose this model, and not a random slopes and random intercepts model, under the assumption that every explanatory variable has a similar effect by geographical region. My theory does not predict that each variable affects differently the outcome regarding each region, but instead the differences are explained by other variables included in the model. I include explanatory variables at level 1 and explanatory variables at level 2 (contextual effects).

The regression equation of the multilevel random intercepts with two levels of explanatory variables is:

$$y_{ij} = \alpha + \beta_0 + \beta_1 x_{ij} + \beta_2 x_{2j} + u_j + e_{ij}$$

⇩ ⇩

Level 1 *Level 2*

Where $\beta_0 \beta_1 x_{ij} \beta_2 x_{2j}$ refer to the fixed part of the model and u_j e_{ij} to the random part

The model tries to replicate a quasi experimental design where all the independent variables are measured before the earthquake (t_0) and the dependent variable is measured after (t_1). It attempts to present a causal mechanism between the occurrence of the earthquake (x) and shifts in the poverty levels. This holds some advantages and several disadvantages. First, I monitor the same individual before and after the earthquake, studying changes in their wealth and quality of life after the quake. With this panel I am able to control by several other causes that might be causing social changes for the person and it better isolates the effects of the earthquake. Second, this model dramatically improves the explanatory power of the prediction, being able to establish causality in a much more clear way. Regarding the disadvantages, several variables that could be related or associated with social capital or public spending after the earthquake occurred cannot be included. Because the purpose is to study causality I am not able to include any action taken by institutions or individuals after the earthquake happened in Chile. For this reason in Chapter IV and also in this chapter I give some descriptions of the role and effectiveness of social capital and public spending in the recovery process, after the earthquake. I am not able to say, empirically, that the actions taken AFTER the earthquake by the government or citizens reduced or increased the likelihood to be poor due to the catastrophe. However, I am able to say that previous levels of social capital and public spending did have an effect (or not) on the social impacts of the earthquake. I will also be able to predict changes in the levels of poverty of Chilean society due to the earthquake, controlling by several other possible factors. Finally, I am also able to identify the social and economic determinants of vulnerability, that is, who is more prone to suffer the social consequences of an earthquake in Chile.

Results

Returning to the theoretical framework of this thesis, I proposed that not only disasters impact in dissimilar ways among the population but also that there are social and institutional mechanisms that might reduce the effects of quakes: public spending and social capital[23]. I maintain that social capital and governmental spending constitute two relevant mechanisms to attenuate the impact of the 2010 earthquake on the population. At the aggregated level (countries), results have shown that education, GDP per capita, population density, urbanization and healthcare quality are determinants of the levels of social vulnerability to natural disasters in Latin American societies. I have also tested the role of social capital, humanitarian aid and public spending as mitigation mechanisms of the number of casualties due to natural disasters.

Throughout this section I study the micro foundations of the results found at the macro level, under the theoretical assumption that earthquakes do not impact equally among the population but, on the contrary, its effects are determined by the previous social inequalities of the societies. As theoretically stated, disasters constitute a social construction shaped by the social, economical and political structures inherent to the society. In this sense, studying the impact of the earthquake on Chilean society also gives a complete picture of the social structures and inequalities in the country.

The first model presented in Table 4 introduces the social and demographic determinants of the probability of being affected by the Chilean earthquake, measured through the likelihood of becoming poor as a consequence.

[23] Humanitarian aid is not tested for the Chilean case due to the lack of involvement and participation after the earthquake in 2010.

To begin with, results show that the presence of children in the family increases the probability of becoming poor, generating a more challenging environment to overcome the earthquake. The log odds of becoming poor after the quake in houses with children are higher, in comparison to households without children, with a significant coefficient. The presence of children might be shaping the probability of becoming poor for many reasons. Firstly, families with children are less flexible in moving to another place, having in general more roots to the local community related to the children´s daily lives. This lack of freedom can be detrimental to the chances of adults to pursue new economic opportunities in situations where their employment status was affected by the earthquake. Secondly, in case of health problems of any of the children the adult needs to stay in the house taking care of the child constraining the possibilities of working and therefore diminishing the income of the household. Thirdly, after the quake in Chile, many schools were closed and stopped operating. This caused thousands of children to remain at home when they should have been at their schools, constraining again the possibilities of the adult to go to work. Adding complexity to these results, Table 21 shows that the households led by a single female parent are also more likely to become poor after the Chilean earthquake in comparison with all other types of household, also with a significant coefficient. The population segment that was one of the most socially vulnerable to the impacts of the Chilean quakes was, therefore, single mums with children in the households.

Moving the analysis towards the occupational characteristics of the individuals, the regression results show that, firstly, being a seasonal worker increases the probability of becoming poor after the earthquake, proving that more stable workers cope economically better with the effect of the disaster. Being a temporal worker against a permanent worker increases the log odds of being poor after the earthquake by 0.37 (Model 1, Table 21), with a significant coefficient, holding constant all other variables.

One possible cause can be that temporal workers are more likely to be fired if the company or business where they worked was closed or production suspended. After the Chilean earthquake 27% of national industries stopped working, according to the results of the post-earthquake survey (CASEN, 2010). From these industries, 15% were still not operating two months after the earthquake. I argue that the fact of being a permanent employee will decrease the likelihood of being fired and will assure more stability than those who are seasonal or non-permanent workers. The reduction in non-permanent workers is an easier and cheaper solution for employers suffering the costs of the natural disaster, whereas firing someone that works permanently involves paying unemployment compensations.

In second place, being entitled to unemployment insurance before the earthquake decreases the chances of becoming poor, holding everything else constant. Between the population economically active in Chile 13% claimed not to have social insurance against unemployment at the time of the earthquake (CASEN, 2010). Once the business stopped working this population would not receive any subsidy or unemployment benefit, and therefore they become more likely to suffer the extreme economic consequences of becoming poor after the earthquake.

Finally, another variable that could be relevant to predict an individual becoming poor after the earthquake is if they work in the agricultural, forestry and fisheries sector. This economic area was one of the most harmed after the earthquake, and of the industries that stopped working after the natural event, 20% belonged to the agricultural sector (CASEN, 2010). The results show that the population working in agriculture and forestry increases the likelihood of becoming poor by 0.05 in comparison with all other economic sectors, holding all the other variables constant. However the results do not

seem significant. Apparently, after having controlled by the type of contract and pertinence to social security system, the economic area appears not to make any difference in the probability of becoming poor after the earthquake.

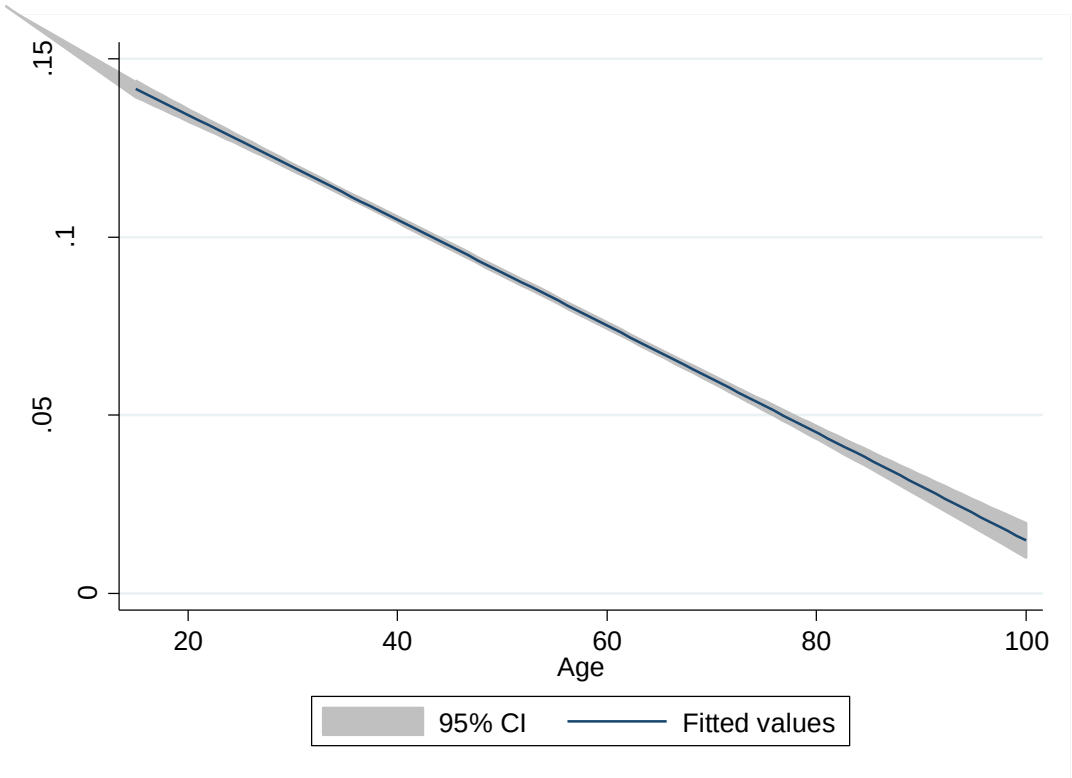
As analyzed in the last chapter, one of the most severe effects of the 2010 earthquake in Chile was the destruction of houses and infrastructures. Results of the regression show that being the owner of the property increases the log odds of becoming poor after the quake in comparison to other forms of tenancy. These results might be caused by the necessity and also the responsibility of the owners to rebuild houses if they were affected. After the Chilean earthquake, 3% of the houses were destroyed and 30% severely damaged. In the most affected areas, 56% of the interviewee's claim that they are going to rebuild their properties with their own savings and only a 9% will be using funds from national or local governments.

Taking all this into account, being the owner of the house would imply economically affording the costs of rebuilding the damaged property and in very few cases the government supported this construction. This data backs the idea that the reconstruction of houses is paid for by owners, generating an increase in the probability of becoming poor after the earthquake. The results support the already analyzed discussion in the previous chapter on the efficiency and efficacy of the subsidies given by the Chilean government. At least 2 months after the earthquake, and the moment when this survey was applied, the subsidies designated to the reconstruction of houses from the government was extremely small, reaching a 9% of the total houses that were destroyed.

Another important variable in this matter constitute the population that did have house insurance against catastrophes. The regression results (Table 21) indicate that having insurance against earthquakes before the event happened also diminishes the likelihood of becoming poor after the quake, controlling by all the other variables.

Besides the contextual characteristics of the house quality, ownership and type of occupation, other socio-demographic variables appear to be predicting the likelihood of becoming poor after the earthquake. Firstly, age seems to be a determinant of social vulnerability to the earthquake in Chile[24]. At one unit the age increases and the log odds of being poor decreases, with a significant coefficient (Model 1 Table 21). The results are presented below (Graph 8). Apparently, the young population found it more difficult to cope with and resist the impacts of the earthquake. These results support the already found association between the presence of children in the household and a higher likelihood in becoming poor due to the quake. In this sense, households with children and the young population hold a higher probability of becoming poor. Based in these results, I argue that the Chilean earthquake does not affect equally among every age segment but more among children and the young population.

Graph 8: Probability of becoming poor per age



[24] The regression analysis includes only individuals older than 18 years old.

In the same line of argument, the health quality of individuals also predicts the likelihood of becoming poor due to the quake. The health status of the individual prior to the catastrophe seems to be a determinant of social vulnerability to the Chilean earthquake. Having health problems could imply more difficulties for the person to adapt to the economic problems arising due to the quake. Health issues can often be translated into a lack of mobility and further dependency on the geographical area where the person lives. Also, health issues could be detrimental to the capacity of individuals to find another job in the case their previous position being affected by the quake. Income, in this sense, could decrease, generating poverty.

In addition, Table 21 shows that being educated decreases the social vulnerability to quakes in Chile. Under a seemingly straightforward mechanism, being educated operates as an insurance against the impact of the earthquake. Education provides knowledge, as information, and above all provides tools to cope, adapt, and respond in a better way to natural disasters. Knowledge is relevant in every state of natural disasters, in the preparedness, response and recovery stages. Being well informed of the risks and challenges of a possible hazard threat might imply less exposure. For example, knowing the risks inherent to living in coastal areas, and in potentially flood areas, could cause the individual to react sooner or more efficiently to a potential risk. Also, being informed after the disaster occurred can save several lives, with faster and more efficient response mechanisms. Afterwards, during the recovery process the more educated are those with the more opportunities to mitigate the economic impacts of the disaster. Education implies opportunities, and these opportunities are fundamental after a hazard shakes the social structures of a society. The educated are those with better and faster access to public goods, to jobs, subsidies, and support from the government. On the other hand, the less educated, with fewer resources, encounter several problems in gaining access to these goods after the disaster.

Finally, results of the regression (Table 21, Model 1) demonstrate that the log odds of becoming poor after the earthquake is -1.89 in an 'average' community, this would be a community with variance at level 2 u0*ij* = 0. The intercept of geographical region j is -1.89 + u, where the variance of u is 0.03. This implies that in the remote case where all the independent variables were 0, the likelihood of being affected by the earthquake would be less than even odds.

Table 21: Probability of becoming poor after the earthquake, random intercepts logit multilevel model (Chile)

	Model 1	Model 2	Model 3
LEVEL 1 VARIABLES			
Government transfers before earthquake			-0.001**
			(0.0006)
Children	0.376***	0.369***	0.452***
	0.061)	(0.062)	(0.059)
Female household	0.245***	0.245***	0.273***
	(0.055)	(0.056)	(0.055)
Education	-0.062***	-0.061***	-0.094***
	(0.012)	(0.012)	(0.012)
Unemployment insurance	-0.069	-0.069	-0.191***
	(0.066)	(0.067)	(0.065)
Quality of house	-0.059	-0.061	-0.124***
	(0.043)	(0.043)	(0.043)
Economic sector (agriculture)	0.066	0.071	0.008
	(0.075)	(0.075)	(0.074)
Health quality	-0.053***	-0.054***	-0.069***
	(0.017)	(0.017)	(0.016)
Temporal employment	0.359***	0.367***	0.356***
	(0.078)	(0.078)	(0.077)
Age	-0.016***	-0.017***	-0.017***
	(0.002)	(0.00)	(0.001)
House ownership	0.126***	0.120**	0.192***
	(0.048)	(0.048)	(0.047)
Number of people in the household	0.126***	0.126***	0.139***
	(0.014)	(0.014)	(0.014)
House insurance	-0.556***	-0.572***	-0.622***
	(0.119)	(0.121)	(0.119)
Income 2009	-0.00***	-0.00***	
	(0.00)	(0.00)	
LEVEL 2 VARIABLES			
Mercalli intensity (1 to 3), base category			
Mercalli intensity (4 to 6)	0.315**	0.276**	0.245*
	(0.126)	(0.123)	(0.127)
Mercalli intensity (7)	0.195	0.188	0.091
	(0.129)	(0.126)	(0.136)
Mercalli intensity (8 to 9)	0.328**	0.323**	0.237*
	(0.137)	(0.135)	(0.143)
Poverty 2009 (regional)	0.005	0.021*	0.012
	(0.013)	(0.011)	(0.012)
Community Participation		-0.009**	
		(0.003)	
Interpersonal Trust		-0.001	
		(0.004)	
Government investment per capita			-0.011***
			(0.002)
Constant	-1.89***	-1.810***	-1.463***
	(0.278)	(0.261)	(0.298)
Random Effects			
Variation	0.033	0.015	0.026
	(0.0188)	(0.012	(0.014)
Observations	27,271	26,529	27,196
Number of groups	15	15	15

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Social capital

This section tests the hypothesis that that both bonding and bridging social capital decrease the social impacts of the Chilean earthquake on the population. Theoretically, I maintain that human beings are not mere victims of natural disasters but instead active actors, capable of preparing, adapting and responding to natural hazards. Network ties have the potentiality to reduce the impacts of disasters through the provision of shelter, food and other basic needs, through the diffusion of information and knowledge and also through pressuring local and national governments to satisfy needs and priorities. Furthermore, social capital can operate as emotional support for individuals. The regression analysis in Table 21 shows mixed outcomes regarding the role of social capital in Chile.

Firstly, regarding bridging social capital, referring to the association between different groups and segments of the population, results show that the higher the levels of regional social participation the lower the probability of becoming poor after the quake, keeping all the other variables constant. The average levels of social participation at regional level, level 2 in the multilevel regression, determine a differential likelihood of becoming poor among individuals. The fact of living in a region that has pre-established mechanisms of social participation results in a decrease in the impact of any disaster in the long term. This variable captures the pre-established structures of participation. Theoretically, I argue that social participation is one of the most relevant mechanisms to enhance the adaptive capacity of individuals and these results confirm this prediction. In this sense, bridging social capital appears to be relevant to mitigating possible impacts of disasters on societies.

The relevance of community participation in the process of reconstruction after any disasters is unquestionable (Dynes, 2006; Quarantelli and Dynes, 1977). Measures of

participation after the earthquake, that is if they organized with neighbors to solve problems and if they reacted to the earthquake collectively or individually, seem not to have been a widespread tool after the earthquake in Chile. The variables reflecting the participation mechanisms after the quake are not included in the model as they measure actions taken after the earthquake, causing endogeneity problems. However, as discussed in the previous chapter, community involvement after the quake has been questioned, where the reconstruction process was not led by the community but, on the contrary, by the national government and the private sector (Lizana, 2011; Pulgar, 2010). In Chile, after the earthquake, 10% of the population claimed that they were organizing with neighbors and among the community to rebuild their houses; obtain food, and take care of children and elderly. At the epicenter of the earthquake, where the Mercalli scale reached level 9, 24% declared having organized with neighbors. A second question, regarding if after the earthquake they solved the problems arising from the quake collectively or individually, only 4% of the individuals in the survey declared having operated collectively to solve issues related to the quake. At the epicenter this percentage raises up to 13%.

Regarding bonding social capital, the variable of levels of interpersonal trust at the regional level does not reveal any significant results. Apparently, the fact of Chilean society having high levels of interpersonal trust, or bonding social capital, did not operate dramatically to diminish the population affected. These results are consistent with the analysis of the role that the population played after the quake, where they opted mainly for individual actions to mitigate the impact of the disaster, and not collectively or supported by family members.

These results could be pointing to the fact that the impact of social capital comes from local organizations (bridging social capital) and not from the individual network ties

(bonding social capital) of those harmed by the quake. For this reason, the aggregated variable of social participation among the community does have an impact in decreasing the likelihood of becoming poor but interpersonal trust does not seem to be operating to decrease the probability of becoming poor. In sum, living in a province that has high levels of social participation does have an effect on the social effects of the quake. The already established and operating mechanisms of social participation seem to have an effect in reducing the likelihood of becoming poor due to the earthquake.

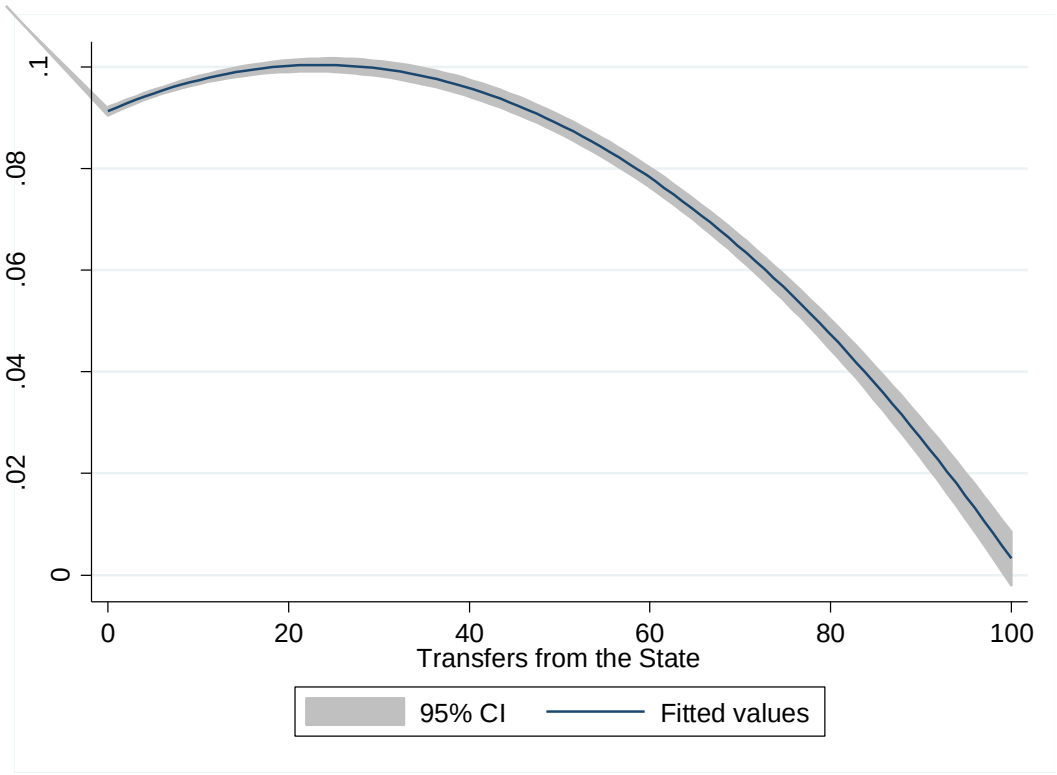
Public Spending

Theoretically, this thesis proposes that governments, through public spending, can potentially increase the adaptive capacity of individuals and in that way reduce the impact of natural disasters, conditional on democratization levels. Firstly, public spending operates in many of the variables that determine social vulnerability to hazards, such as educational level, healthcare coverage and social security systems. Secondly, the actions taken by governments to prepare the country against natural disasters could potentially reduce the impact on the societies. Measures such as construction codes, infrastructures, early warning systems are implemented by nation states through public spending. Thirdly, public spending is crucial after earthquakes occur. Governments can provide public goods, such as shelter, healthcare coverage and food provision to the affected population. In addition, spending is required in the rebuilding process, for the restoration of roads, communications and the general economy.

The analysis of public spending is divided into two items. Firstly, public spending measured as governmental investment per region, to capture investment in infrastructures, constructions and public services before the disaster occur. Secondly, public spending measured in transfers and benefits given to the individual as a proportion of the total income, also before the earthquake.

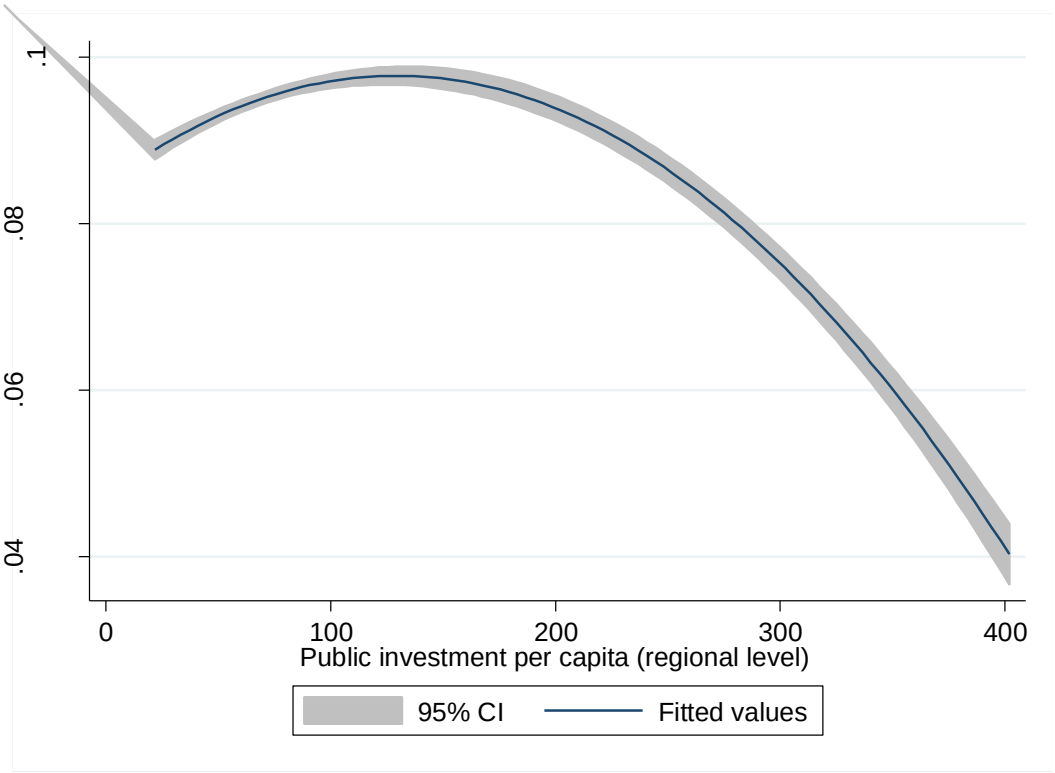
Results of the regression analysis, Table 21 (Model 2) shows that both public investment and benefits before the earthquake do decrease the likelihood of the individual to become poor after the earthquake. Graph 9 shows that the higher the proportion of income of the individual due to subsidies and transfers from the government the lower the predicted probability of becoming poor. The stability that transfers and benefits imply could operate as insurance when the quakes affect the employability of individuals. These results suggest that public transfers of any kind (family subsidies, education vouchers, housing benefits) reduce the social vulnerability to earthquakes in Chile. Individuals with high proportion of their salary due to benefits and subsidies have more tools to face the potential risks of natural disasters. In contrast, populations that depend on occupational income are more prone to be affected.

Graph 9: Predicted probabilities of becoming poor by proportion of the income due to transfers and benefits from the State



Secondly, the level of investment within the region significantly reduces the social vulnerability of the societies (Graph10). Spending on infrastructures and projects at regional level reduces the social vulnerability of the population, controlling for all the other variables. When public investment per capita reaches more than 350 million Chilean pesos, the likelihood of becoming poor after the quake is reduced to less than even odds (less than 0.5 probability). This corroborates the prediction that any public effort by national governments to invest in regions reduces the social vulnerability of the population considerably. The chances of individuals becoming poor are mitigated by public spending both in direct transfers and in regional investment.

Graph 10: Predicted Probabilities of becoming poor by public investment in the region



3.2. Haitian Earthquake

This section tests the three leading hypotheses of this thesis using as a case study the Haitian Earthquake in 2010. The first hypothesis predicts that both bonding and bridging social capital within the society improve the adaptive capacity of individuals and diminishes the social vulnerability to natural disasters. Bonding social capital, referring to the connections between individuals (Putnam, 2001), could mitigate the impact of the earthquake through the provision of food, shelter and health attention in the initial days after the quake impacted. Furthermore, social capital is an important provider of information and knowledge, both in the preparedness face and also in the response and recovery stages after the occurrence of a disaster. Knowing and holding accurate information could potentially reduce the impact of the earthquake. Finally, emotional support can also contribute to a better and faster recovery for the population affected by a catastrophe. Bridging social capital, referring to the association between different groups, could potentially stimulate the power the society has to express demands and concerns to the authorities. Also, pre-existent organizations can operate as providers of food, shelter and medical attention to the victims of the natural disaster.

The **second hypothesis** of this thesis, and being empirically tested for the Haitian 2010 earthquake, is that public spending reduces social vulnerability to natural disasters through the reinforcement of the adaptive capacity of the society. Public funds could operate both in reducing the social determinants of vulnerability, as healthcare coverage, education levels, housing quality, and also by directly supporting the community in the preparedness, responses and adaptation stages of natural disasters.

The **third hypothesis** is that humanitarian aid reduces the effects of natural disasters among the population. In Haiti disaster relief aid played an enormous role in the aftermath of the 2010 earthquakes. US$5.6 billion were pledged by several organizations

in the international community, and were distributed in different areas such as healthcare, food, security and early response activities (CAP, 2012). This aid could potentially stimulate the adaptive capacity of individuals and reduce the social vulnerability to the earthquake.

Research Design

Data

The analysis is based in the final wave of the Americas Barometer applied in Haiti in July 2010, after the earthquake, carried out by the Latin America Public Opinion Project, LAPOP (2010). For comparative purposes the 2008 and 2006 waves are included in some sections of the analysis, with 1,625 and 1,536 cases respectively.

The 2010 wave was designed by LAPOP to specifically assess the impact of the earthquake, including a special sample of population living in tents and in affected areas. The survey was applied to a total of 1,724 people, older than 18 years of age. These were face to face interviews conducted through a stratified sample, representing five main regional areas of Haiti. The sample comprises of 43 primary sampling units and 176 final sampling units. A total of 720 respondents were surveyed in urban areas and1,032 in rural areas. The estimated margin of error for the survey is ± 2.34.

The sample represents five main geographical regions of Haiti and each stratum was further sub-stratified by urban and rural areas. The respondents were chosen in clusters of 6 to 8 interviews in urban areas and 10 to 12 in rural areas. As the dataset includes an oversample of the displaced population living in tents a sample weight was applied in order to achieve representativeness at the national level. The weight was created by LAPOP and included in the dataset.

Dependent Variable

The dependent variable of the model is if individual income decreased during the last two years, constructing a dummy with values '1' for the individuals for whom the income did decrease or '0' for individuals for whom the income did not decrease. Specifically, the question applied in the survey was: *'Over the past two years, has the income of your household: (1) Increased? (2) Remained the same? (3) Decreased?'*

The distribution of the variable resulted in 561 cases where income decreased (40% of the sample) and 855 cases where income did not decrease (60%) (Table 22).

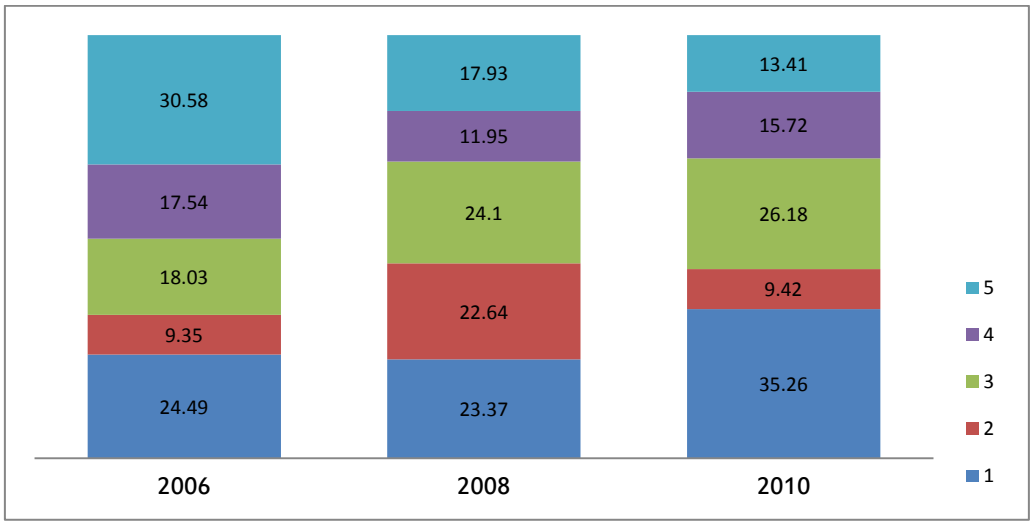
Table 22: Proportion of individuals for whom Income decreased over previous 2 years

	Freq	Percent
Did not decrease	855	60.3
Decrease	561	39.6
Total	1416	100

The variables constitute the best proxy to study changes in the levels of income of the population before and after the earthquake although have several limitations. Firstly, the same measure is not applied in Chile; therefore the comparative power of the study is limited. Secondly, the income might have decreased but this does not necessarily mean an increase in levels of poverty, as shown by the dependent variable applied for the Chilean analysis. Thirdly, because of the lack of a panel design, I am unable to determine a causal effect of the earthquake on income. Despite the limitations I argue that the variable still captures an effect of the earthquake on the income of the individuals. Firstly, although extensive data is limited on the effects of the earthquake on poverty, the LAPOP surveys did measure household wellbeing through a number of indicators (LAPOP, 2010). A comparison of the same index with 2008 and 2006 shows a decrease of wellbeing in the population in 2010, after the earthquake (Graph 11). In 2010, 35.2%

of the interviewees fall in the lowest quintile of wealth, whereas in 2006 the level was 24.5%. The biggest difference occurs in rural areas, where in 2010, almost 6 out of every 10 individuals (57%) fall into the first quintile of wealth, in comparison with 31% in 2008, and 30% in 2006. In contrast, in urban areas the amount of population in the lowest quintile of wealth decreased to 4% in 2010, from 8% in 2008 and 14% in 2010. This results show the changes suffered by the population after the earthquake, especially in the rural areas of the country where poverty is centered (Sletten, 2004). A post-earthquake report conducted by LAPOP researchers (Zephyr, 2011) supports the idea that the main event that Haiti suffered during 2009 and 2010 was indeed the earthquake, validating the pertinence of the question as dependent variable. Secondly, as shown in the previous chapter, the earthquake did have a major economic impact in Haiti, with an increase in unemployment rates and a decrease in the GDP per capita (IASC, 2010). In conclusion, both survey data and structural data show that the earthquake did have a major impact on the social and economical situation of the population. The dependent variable proposed in this model is pertinent in the sense that is the best proxy to capture a change in income before and after the natural disaster.

Graph 11: Percentage of population falling in each quintile of wealth by year



Independent Variables

Three central independent variables are included to measure the hypotheses of this thesis. Firstly, two variables measuring humanitarian aid are incorporated. The international subsidy variable captures if the individual received subsidies for food from an international agency during the last month. The question applied in the survey is '*Did you receive any subsidy for food from an international organization in the last four weeks?'* Secondly, I include a dummy variable that captures the population living in displaced camps (where shelter, healthcare coverage and food was provided) against the population that still lives in houses. The operation of the displaced camps was funded almost entirely by humanitarian aid, in this sense it constitutes a good proxy of the effectiveness of the disaster relief in decreasing social vulnerability to the earthquake. In conclusion, I distinguish between two main actions taken by the international community to palliate the impact of the disaster among the Haitian population: food distribution and shelter provision.

To measure public spending I include the amount of population that did receive food fee from the national government. The question is '*Did you receive any subsidy for food from the government in the last four weeks?'*

To capture bonding social capital I include two measures. Firstly, the proportion of the population that receives remittances from abroad. The measure has been applied as a proxy of the ties between individuals on several occasions. (Adger *et al.*, 2002; Levitt, 1998). It was also applied to measure social capital when studying the aggregated results, in Chapter III. The question in the survey is *'Do you or someone else living in your household receive remittances, that is, economic assistance from abroad?' (LAPOP, 2010).*

The second measure of bonding social capital is the widely used measure of interpersonal trust. The variable has been extensively used as a measure of bonding social capital (Newton, 2001; Paxton, 2002; Putnam, 2001) and I also incorporate it to study the Chilean earthquake and the macro level comparison in Chapter III. The question is '*Now, speaking of the people from around here, would you say that people in this community are very trustworthy, somewhat trustworthy, not very trustworthy or untrustworthy...?'* (LAPOP, 2010). I aggregate the responses between those that answered 'very trustworthy' and "trusthworthy"becoming a dummy variable.

To measure bridging social capital I include two measures. Firstly, a variable capturing if the individual participated in protests during the last year. The question applied in the survey was '*In the last 12 months, have you participated in a demonstration or protest march?'* (LAPOP, 2010). I also dichotomize the variable to two options (did participate and did not participate). This variable was also included to measure social capital in the macro

level comparison, Chapter III. Second, I include a variable summarizing if the person attempted to solve a problem in the community or neighborhood during the last year. The question applied was '*Now, changing the subject. In the last 12 months have you tried to help to solve a problem in your community or in your or neighborhood. Please, tell me if you did it at least once a week, once or twice a month, once or twice a year or never in last 12 months'*. I generate a dummy variable, with value '1' with everyone that at least participated once or twice a year.

Another set of independent variables are included to study the determinants of social vulnerability. In terms of occupation, three variables are included, capturing if the individual is unemployed, if they are a temporary worker and if he or she works in agriculture. Regarding household structure, I include if the household is led by single females, the presence of children in the home and the number of people in the house. Regarding individual characteristics, I include the age, education level, and if the person needed healthcare attention during the last year. Finally, as control variable I include a regional average of household wealth in 2008. Using the 2008 LAPOP wave, I calculate the mean levels of wealth of income by geographical census segments (149 groups), in order to control by the levels of poverty within the region. Because the data is not in panel format I am not able to directly associate the results from the variable in 2008 with the individuals in 2010, for that reason an average per census stratum is calculated.

As independent variable, the intensity of the earthquake is integrated, based on the Mercalli scale declared for each geographical area for the Haitian earthquake (U.S.GS, 2004). As in Chile's model each category of the Mercalli scale is included as a dummy, to control by strength of the earthquake.

Table 23 describes the main dependent, independent and control variables, together with the prediction behind each indicator.

Table 23: Variables and Predictions in Logit Model. Haitian Earthquake.

VARIABLES	Description	Mechanism	Predicted Effect
Dependent variable			
Poverty	Individuals that their income decreased in the two years (dummy 1=decreased)		
Independent variable			
Social capital			
Remittances	Individuals that receive remittances from abroad (dummy = receive remittances)	Individuals that receive remittances are less likely to have affected their total income by the earthquake	-
Trust	Interpersonal Trust among individuals (dummy = very trustworthy and trustworthy)	Higher the levels of interpersonal trust lower the probability of having a decrease in income due to the earthquake	-
Protest	Individuals that participated in protest (dummy = 1)	Social participation reduces the likelihood of a decrease in income after 2010 Haitian earthquake	-
Participation	Individuals that participated in solving community problems (dummy= at least once in the last)	Social participation reduces the likelihood of a decrease in income after 2010 Haitian earthquake	-
Public Spending			
National subsidy	Population that received a food subsidy during the last year from the national government (Dummy =received subsidy)	Population that received subsidy is less likely to have their income decreased during the last year	-
Humanitarian Aid			
Tents	Population that has been internally displaced and is currently living in tents. (Dummy=living in tents)	Individuals that live in tents are less likely to have their income decreased	-
International subsidy	Population that received a food subsidy during the last year from international organizations. (Dummy=received subsidy)	Population that received subsidy is less likely to have their income decreased during the last year	-
Social Determinants			
Children	Presence of children in the household (Dummy = children in household)	Households with children are more likely to become poor after the earthquake	+
Number of people	Number of people in household, interval variable	More people in the household less likely the household income decreased	-
Health attention	Dummy variable that summarizes the population that needed health attention the last year (1=yes)	Individuals that needed health attention are more likely to have their income decreased after the earthquake	+
Female	Dummy Variable 1 Females	Females are more likely to be affected and become poor by the earthquake	+
Work in agriculture	Workers on agriculture (1=yes, dummy variable)	Workers on agriculture are more likely than the rest of employers in becoming poor after the earthquake	+
Unemployed	Dummy variable that distinguishes between unemployed and the rest of the population (1=unemployed)	Unemployed population has more probability of having their income decreased after the earthquake	-
Temporary worker	Differentiation between temporary workers and permanent workers. (1=yes, Dummy Variable)	Temporary workers have more probability of becoming poor and being affected by the earthquake	+
Education Level	Variable that measures 12 levels of education attainment	More educated population is less likely to decrease their income after the earthquake	-
Age	Age of the individual	Older the individual is more likely to have their income decrease after the earthquake	+
Rural area	Dummy variable for rural area (1=rural)	Rural population is more likely to have their income decreased after the earthquake	+
Control variables			
Mercalli scale	Scale that measures the intensity of the earthquake per region	Is used as control for the intensity of the earthquake. I assume that more intensity more likelihood of having the income decreased after the event	+
Poverty in the area	Average of wealth in 2008 per census stratum (149 groups)		

Model

A logit model is applied with clustered standard errors per 149 geographical segments (census strata) and weighted to correct for the oversample of the internal displaced population. The weight was already designed by LAPOP and included in the dataset. The clustering is done to control by interclass correlation (Gelman, 2007). The model uses a logit function, where the changes in the probability are not linear. The equation is:

$$\ln\left[\frac{\hat{\pi}}{(1-\hat{\pi})}\right] = b_0 + b_1 X_1 + b_2 X_2 \ldots + b_k X_k$$

Accuracy of the model is measured by the area under the ROC curve. An area of 1 represents a perfect test whereas an area of 0.5 represents a worthless test. In the Haitian model of social capital, the area under the ROC curve of the model is 0.72, correctly classifying 71% of the cases, for humanitarian aid it correctly classifies 67% of the cases and for the model of public spending 67% of the cases.

A multilevel model is not included due to the small amount of cases in each potential stratum, if dividing the sample in 149 segments. Also, there is not enough contemporary statistical data to aggregate as a second level of analysis.

Results

Results of the regression analysis are presented in Table 25. The first model presents the social determinants of vulnerability to the earthquake in Haiti, without including any mitigation mechanism. The second model tests the hypothesis that social capital decreases the social vulnerability to the quake in Haiti. Thirdly, Model 3 and Model 4 study the hypotheses that public spending and humanitarian aid, respectively, decrease the vulnerability to the earthquake, through a stimulation of the adaptive capacity.

Coming back to the theoretical argument of this thesis, I maintain that disasters, in this case earthquakes, impact in dissimilar way among the population and these differences are a reflection of the social inequalities and lack of opportunities within the society. As both the sociology of disasters and social vulnerability theory propose, disasters occur when human beings are affected, being a socially constructed image of pre-existent social structures. How disasters develop depends on the previous social, political and economical characteristics of the affected area, therefore the impact is dynamic and varies within time and space. For the case of the Haitian earthquake, I suggest that the household structure, occupational characteristics and age, education and health quality can determine the social vulnerability of an individual.

Firstly, regarding demographic determinants in Haiti, I found that age holds a significant effect on the probability of having the income decreased due to the earthquake. Results show the likelihood of being affected increases with the age of the respondent (Table 25, Model 1). In Chile results showed the opposite, with the young population being more prone to becoming poor after the quake. As in Chile, the survey is not capturing children because it is applied to individuals older than 18. However, results seem to be showing that the youth were less permeable to the impact of the quake in Chile and the elderly in Haiti. Many reasons can be shaping these results. Firstly, almost 47% of the people

under 24 years old in Haiti continued with their studies, despite the occurrence of the earthquake. Their income was not affected and most probably stayed the same as before the catastrophe. Secondly, among the population older than 48 years old, around 24% spend their time taking care of the home and 10% are pensioners or retired (Table 24). Despite 30% of the population being older than 48 years old and working, 10% are temporary workers (against 2% of seasonal workers among the population younger than 24). In conclusion, the instability of jobs, the lack of a secure income among the household, and the need of taking care of the elderly and youth results in the older the individual the higher the levels of social vulnerability in Haiti.

Table 24: Occupation of the population by age

	18 to 24	25 to 30	31 to 39	40 to 48	More than 48	Total
Working	15.1	20.86	36.99	39.77	37.45	29.48
Not working, but have a job	1.32	1.91	1.72	3.05	2.91	2.15
Actively looking for a job	23.18	35.99	33.86	24.38	14	26.44
A student	47.28	25.48	5.64	2.61	2.18	17.88
Taking care of the home	6.89	11.78	16.3	21.77	24	15.71
Retired, a pensioner	0	0.16	0.63	1.16	10.18	2.12
Not working and not looking for a job	6.23	3.82	4.86	7.26	9.27	6.23
TOTAL	100	100	100	100	100	100

Source: LAPOP (2010)

Apart from age, females seem to be more vulnerable to the effect of quakes, with a significant positive coefficient of 0.3 (Table 25, Model 1). Also, households led by females, in comparison with the rest, tend to be more vulnerable to the earthquake. Holding everything else constant, households led by a female against those led by a male raise the log odds of having a income decrease by 0.41. The gendered nature of natural disasters have been long analyzed by many scholars (Barry, 2008; Neumayer and Plümper, 2007) my argument supports those findings but also argues that vulnerability is

even deeper in female led households where the female is responsible for maintaining the family. The reasons behind these findings are quite straightforward. Firstly, historically, despite the earthquake, females have more difficulties in entering the job market, and even more when they are head of the family. This inequality becomes more serious after an earthquake when not only the economic situation of the country is affected, causing disruption to many economic activities, but also the daily routine is affected. Closed schools, destroyed houses, and health problems are some of the many problems that families need to face, and such situation become even more difficult to face for single mothers. The survey shows that in Haiti almost 24% of females are responsible of taking care of the home (against 5% among men with the same responsibility) and 30% are working, against 37% among males. The fragile situation of females in the labor market, accentuated when they are head of the household, generates an increase in their levels of vulnerability due to the earthquake. Continuing with other dimensions of the household structure, the number of people in the home also seems to have an impact on the likelihood of a decrease in income. The greater the number of people living in the household the lower the likelihood of a decrease in income after the earthquake. The variable measuring presence of children in the household seems not to have a significant effect on the likelihood of experiencing income decrease, holding everything else constant.

Regarding occupational predictors, seasonal and temporary workers seem to be more likely to have their income decreased, holding everything else constant. The precariousness of employment plays a large role in shaping the vulnerability to natural disasters. As shown in the previous chapter, soon after the Haitian earthquake the economic sector of the country was severely affected. Those that had temporary contracts, and therefore not in permanent positions, suffer the biggest social consequences.

Working in agriculture, being educated, being the owner of the property or needing healthcare attention during the last year does not seem to have a significant effect in the probability of a decrease in income after the earthquake in Haiti.

Finally, is important to point out that the regression shows that the intensity of the earthquake does not increase the probability of having income decreased during the previous two years. Far from that, the first model indicates that living at the epicenter of the earthquake (Mercalli X) reduces the log odds of a decrease in income by -1.13 in comparison with living in an area where the intensity of the earthquake was lower (Mercalli IV), holding everything else constant. Each increase in the Mercalli level reduces the probability of experiencing a decrease in income due to the quake.

Several reasons can be used in explaining these contra intuitive results. Firstly, subsidies and funding from agencies and NGOs might have attenuated the decrease in income mostly in the areas where the intensity of the earthquake was high. The results of the survey show that between those that received national subsidies for food during the last month, 80% were in areas affected by the earthquake (LAPOP, Haiti 2010). In the case of international subsidies, 78% of the population that received funding belonged to the affected areas of Haiti. Against all predictions, belonging to an affected area minimizes the chances of experiencing a decrease in income, whereas the provinces that suffered the earthquake at a lower intensity are more likely to have their income affected. These findings show that it is not only the population living at the epicenter of the earthquake that is vulnerable to disasters. Another reason for these results can be that, coincidently, the epicenter of the earthquake was in the wealthiest region of Haiti, the capital. The incidence of poverty in the capital is lower than in the remainder of the country, being impoverished in Haiti is predominantly a rural phenomenon. As shown by Sletten (2004) in the province Ouest, where the capital is situated, and the poverty headcount is 62%

against 94% in the Nord East province. This context, together with the regression results, could be indicating that despite the intensity of the earthquake the rural areas of the country are still more vulnerable than the capital. The regression model includes as independent variable the population living in rural areas, showing a significant and negative coefficient in predicting a decrease in income. Nevertheless, a control by region, cluster by province, and controls by wealth should control these effects.

Table 25: Probability of decreased income after 2010 earthquake. Logit Model. Haiti

	Model 1	Model 2	Model 3	Model 4
Public subsidy			-0.446**	
			(0.180)	
Living in displacements camps				-1.014***
				(0.245)
International subsidy				-0.0324
				(0.156)
Remittances		-0.630***		
		(0.153)		
Interpersonal Trust		0.256		
		(0.186)		
Protest participation		0.590***		
		(0.185)		
Community participation		-0.356**		
		(0.150)		
Health attention in the last year	-0.114	-0.0697	-0.118	-0.124
	(0.139)	(0.144)	(0.142)	(0.139)
Work in agriculture	-0.254	-0.281	-0.250	-0.174
	(0.341)	(0.356)	(0.336)	(0.344)
Female household	0.418**	0.385*	0.379*	0.356*
	(0.197)	(0.204)	(0.201)	(0.200)
Unemployed	0.711***	0.776***	0.656***	0.676***
	(0.151)	(0.163)	(0.150)	(0.155)
Female	0.305**	0.307*	0.318**	0.311**
	(0.153)	(0.161)	(0.153)	(0.155)
Property owner	0.009	0.0213	-0.0145	0.0244
	(0.148)	(0.157)	(0.147)	(0.151)
Seasonal worker	-0.421***	-0.505***	-0.416***	-0.419***
	(0.147)	(0.157)	(0.149)	(0.149)
Urban area	-0.452**	-0.396*	-0.448**	-0.290
	(0.201)	(0.207)	(0.200)	(0.198)
Education level	-0.025	-0.004	-0.0246	-0.0229
	(0.021)	(0.022)	(0.0210)	(0.0208)
Children in the household	-0.106	0.016	-0.0600	-0.0889
	(0.163)	(0.168)	(0.167)	(0.170)
Age	0.014**	0.015**	0.0137**	0.0135**
	(0.006)	(0.007)	(0.00625)	(0.00624)
Number of people in the house	-0.132***	-0.107***	-0.134***	-0.210***
	(0.028)	(0.029)	(0.0287)	(0.0390)
Wealth of the region 2008	-0.302	-0.401	-0.349	-0.305
	(0.323)	(0.338)	(0.318)	(0.311)
Mercalli V	-0.524**	-0.433**	-0.447**	-0.541**
	(0.216)	(0.220)	(0.215)	(0.218)
Mercalli VIII	-0.994***	-0.976***	-0.869***	-0.895***
	(0.277)	(0.296)	(0.271)	(0.285)
Mercalli IX	-0.562***	-0.448**	-0.459**	-0.434**
	(0.198)	(0.193)	(0.198)	(0.201)
Mercalli X	-1.139***	-1.133***	-1.019***	-0.933***
	(0.289)	(0.313)	(0.277)	(0.286)
Constant	0.466	0.403	0.520	0.888**
	(0.389)	(0.407)	(0.389)	(0.413)
Observations	1,280	1,226	1,267	1,273

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Social capital

From a theoretical point of view, supported by the sociology of disasters and vulnerability theory, I maintain that human beings do not panic or act erratically after a natural disaster, but quite on the contrary, the affected populations have the potentiality (or capacity) to react, respond and adapt to environmental threats. The strength of networks ties, or social capital, is one of the mechanisms of the society that can reinforce the adaptive capacity. I further maintain that two dimensions of social capital, referring to the ties between individuals and secondly to the relations between different groups, operate in dissimilar way to reduce the impact of disasters.

The results, in Table 25 (Model 2), show that the bonds between individuals (bonding social capital) reduce the log odds of having a decrease in income due to the earthquake in Haiti. Having remittances from family abroad is a direct mitigator of the economic impact of the quake on the households. Not only does it represent a measure of network ties but, in this case, also implies a direct influence in the dependent variable that is, experiencing an income decrease. The coefficient is negative, and significant, keeping all other variables constant. The second variable to measure relationship strengths between people is interpersonal trust. In this case the levels of trust between individuals, as a measure of bonding social capital, appear not to be significantly related to the likelihood of having the income decreased during the last two years.

Moving forward to the results regarding bridging social capital, measured through community participation and protest participation, results show that individuals that participated at least once in the year in any type of community action are less likely, by -0.381, to have a decrease in income after the quake in respect to those that did not participate, holding every other variable constant. Results of the regression show that the social participation of the individual has a significant effect on the likelihood of a

decrease in income. People that claim to have participated in any type of community action reduce the log odds of having their income decreased, suggesting a possible positive effect of participating in the local community in attenuating the impact of the earthquake.

As addressed in the theoretical chapter of this thesis, I maintain that one of the most important mechanisms of the resilience of a community against natural disasters is community participation, and in the Haitian case participation seems to be having a positive effect in enhancing the adaptive capacity of individuals, holding everything else constant. A possible reason behind these results could be that the wealthier population is the one that tends to participate in the local community and also those who suffered less from a decrease in income. This would imply a reinforcing cycle between participation and wealth, attenuating a decrease in income after the earthquake. Social vulnerability to natural disasters, therefore, could not only be caused by a low level of wealth but also by the social attitudes that accompany it, low levels of social participation in the local community. Apart from this, the results anyway suggest that at same levels of income (control variable), social participation has a significant influence in attenuating the impact of the earthquake. Participation, hand in hand with bonding social capital, could be offering more tools to socially and economically cope with the disaster.

In relation to participation in protests, Table 8 (Model 2) shows that those who participated in a protest in the last year are more prone to decreased income. Theoretically, I claim that one of the mechanisms under which bridging social capital is used to mitigate impacts of disasters is through the participation in protest, as a way to communicate demands and needs to the authorities. Both in Chile and in Haiti after the quakes protests where used as a way to communicate demands and show discontent with the reconstruction process being carried out by international organizations in the case of

Haiti, and the government in the case of Chile. But those that participated were the ones most affected by the quake, those that saw their house destroyed, their jobs gone and quality of life affected. These facts made them gather and participate in protest or demonstrations to claim and communicate their needs to the authorities. In this case the social action did not bring an immediate mitigation effect on the social results of the quake, showing a significantly positive coefficient between those that protested and a decrease in income, in the case of Haiti (Table 8, Model 2). Many reasons might be shaping these results. Firstly, among the people that protested, 20% lived in areas that have been affected by the quake, against 14% in other areas (significant chi2), and the reasons for the protests were mainly economic factors (48% of these protests where due to economic factors). The results could be capturing that the population that suffered the most from the quake is the one protesting and demonstrating. Secondly, group social action does not necessarily favor those that participate. In the case of protest and demonstrations it might be the case that the whole of Haitian society beneficiates from the action taken by a few.

Public spending and Humanitarian aid

The results of the regression confirm the hypothesis that public spending reduces the probability of a decrease in income due to the earthquake in Haiti. Table 8 (Model 3) shows that having received national subsidies for food, during the last month, decreases the log odds of a decrease in income by -0.446, controlling for all other variables. As predicted, the subsidies seem to be attenuating the economic and social impact of the earthquake, although with this design I am not able to show causality I can acknowledge that both variables, subsidies and a decrease in income, have an inverse relationship.

The predicted probabilities of a decrease in income after the earthquake disaggregated between those who received subsidies and is not presented in Table 26. The results show

that the population living in affected areas and who received national subsidies hold the lowest probability of an income decrease after the earthquake (0.203). In contrast, the population that lives in non-affected areas (Mercalli scale IV and V) hold the maximum social vulnerability.

Table 26: Predicted probabilities of a decrease in income by affected and subsidies

	Public Food fee	
Affected	No	Yes
No	0.5201	0.3799
Yes	0.3112	0.2034

These findings are consistent with the findings of Model 1, where I found that the higher the Mercalli scale the smaller the probability of a decrease in income. Results are consistently indicating that the population that lives in areas where the earthquake had low intensity is suffering the most of the effects, at least in terms of incidences of poverty. One of the reasons behind these results could be a consequence of 80% of the subsidies being mainly distributed around the epicenter of the earthquake. Immediately after the quake occurred, those more vulnerable were most probably at the epicenter. The need for food, shelter and healthcare attention together with search and rescue activities could potentially save hundreds of lives in these most affected areas. However, results of the regression analysis indicate that after a few months, and after public spending was distributed, the population living at the periphery of the epicenter started suffering the most from the social and economical consequences.

Regarding the **third hypothesis** of this thesis, that humanitarian aid enhances the adaptive capacity of individuals and reduces the impact of natural disasters, results go in opposite directions. For the case of international subsidies for food, the effect or

relationship appears to be not significant. Disaster relief in food does not appear to have an impact on the decrease of income. Two main reasons can potentially be shaping these findings. Firstly, results could be showing that international agencies have several problems in the redistribution of resources, despite Haiti being undoubtedly one of the most important donor destinations of money from developed countries (Cavallo, 2010). As pointed out in the previous chapter, some scholars and journalists have addressed this issue of the chaotic situation of the international aid in Haiti, with hundreds of organizations operating in the territory with high levels of disorganization and difficulty in coordinating activities and target populations (OCHA, 2012; Provost, 2012). These results could be supporting the idea that the performance of international aid in Haiti has been problematic, at least in attenuating a decrease in income for individuals. The second possibility behind these results can be that the objective of international aid exceeds the provision of subsidies for food, targeting housing, reconstruction of infrastructures, and healthcare coverage. Therefore, the impact of international aid is being captured by other variables in the model, as housing, healthcare or education. According to the World Bank data, in Haiti in 2011 there were 30 financed activities, working in 320 locations, with a total investment of $594,000 million. Of this aid, only 14% belongs to projects related to food and water. Also, the Consolidated Appeal from International Organizations in 2012 (CAP, 2012) shows that there are around 4,500 million people in need of food and just 1,200 million covered by international food subsidies. As deeply analyzed in the last chapter, the gap in the area of food, between the population in need and that actually targeted, is dramatically larger than the gap existent in any other social area. Furthermore, the population needing food provision extensively exceeds those needing shelter or health attention (CAP, 2012). This lack of coverage and effectiveness in the redistribution of food fees is severely impacting the population, without the capacity to attenuate the social vulnerability levels of the society.

Despite the lack of efficiency of the food subsidy in reducing social vulnerability, Model 3 shows that living in displaced camps, against the remainder of the population, tends to reduce the probability of decreased income, holding every other variable constant. Apparently the fact of living in the camps decreases the vulnerability of individuals. Starting from the understanding that the displaced camps were mainly financed by humanitarian aid, results corroborate the hypothesis that disaster relief does decrease the likelihood of becoming poor (or experiencing income decrease) after the earthquake in Haiti. The reasons seem quite straightforward. Families living in the camps received food, healthcare attention and shelter. However, caution should be taken when analyzing these results because it was not until a few months after the earthquake that enormous problems started to occur among the displaced population. As analyzed in the previous chapter, there was an increase in sexual crime, an outbreak of cholera and increasing social tension due to the absence of a permanent solution for homeless families. Because the survey was applied just two months after the quake it might be possible that my results are capturing the short term effect of humanitarian aid on shelter, without including the long term problems.

4. Conclusions

The quakes had major effects on the probability of becoming poor in Chile and on the likelihood of having income decreased in Haiti. These impacts were not suffered in the same way by the whole population. Mothers with children, seasonal workers, populations with health problems and those not educated were among those with higher levels of vulnerability to both earthquakes in Haiti and Chile.

Regarding the adaptation tools, social capital operated as a mitigation mechanism in both countries, although with some differences. In Chile results show that social participation before the catastrophe occurs, that is pre-established groups or community committees, reduced the immediate impact of disasters. However, bonding social capital, that is the ties between individuals, did not significantly operate to reduce the social impacts of the earthquake. However in Haiti, both bonding and bridging social capital decreased the likelihood of having income decreased after the quake. Caution should be taken with the Haitian results as I am unable to isolate the effects of the quake as well as was possible with Chile, and the model does not clearly study causality. Despite this limitation I am able to say that interpersonal trust, at least remittances inflows, and social participation are associated with a decrease in the likelihood of loosing income after the quake.

To turn to humanitarian aid and public spending which did not operate as predicted in every case. As analyzed in the previous chapter, both Chile and Haiti encounter problems in the distribution of aid and public spending after the disasters occurred. Results in Haiti show that subsidies were successful in reducing social vulnerability within the epicenter of the quake but not as successful in peripheral areas. These findings could be suggesting that not necessarily are the most affected areas the only ones vulnerable, but also the rest of the country, through indirect impacts. Furthermore,

millions of Haitians are still in need of food, meaning that the humanitarian aid has been totally ineffective in covering the needs of the entire population. In the area of shelter provision, the effectiveness of aid was higher, with a decrease in the levels of the vulnerability of the population living in displaced camps.

In the Chilean case, because of the type of model the actions taken by the government after the quake were not included in the model. However, results point to the fact that the Chilean Government was successful in shaping the determinants of social vulnerability through public spending before the disaster occurred. Individuals receiving subsidies and transfers before the quake occurred are less prone to became poor due to the catastrophe.

VI. CONCLUSIONS

Natural disasters occur when a hazard, of any kind, affects a population. The degree in which societies are affected depends on their levels of vulnerability but also on their capacity to prepare, cope and respond. This thesis is centered in studying the adaptation capacity of societies to natural disasters, focusing in possible actions taken by institutions and human beings to reduce the impact of natural disasters.

Regarding the role of institutions, I ground my analysis in the conviction that the incentives of agencies and foreign countries to contribute in the preparedness and reconstruction process after a natural disaster is determined by several political and economical dimensions. Exposure, size, international pressure, and possible economic benefits are some of the numerous drivers behind a foreign country's commitment to contribute assistance and aid in cases of natural catastrophe. National governments also make political decisions regarding how large the impact of the disaster is, where it strikes, how visible the impact is, and the probable political consequences that the lack of action might cause.

But despite how decisions are made and the causes or drivers of aid, this thesis studies how effective disaster relief aid and public funding is in enhancing the adaptation capacity of societies to natural disasters in Latin America and the Caribbean. My thesis contributes to the understanding of how institutions can potentiality diminish the impact of natural disasters, not only operating on the social determinants of vulnerability (such as healthcare, housing, and education) but also acting in the preparedness, response and reconstruction processes before, during and after a natural disaster. I also point out that both temporal and spatial aspects determine a differential role of public spending and disaster relief aid in reducing the impact of disasters. The preparedness, early recovery

and reconstruction phases apply and demand different types of funds to decrease social effects. Finally, throughout the thesis I take forward the idea that the institutional framework of a country mediates the way spending and disaster relief aid mitigate the impact of disasters. Within democracies public spending tends to be more effective in reducing the effects of natural disasters than in autocracies. In contrast, disaster relief aid finds fewer difficulties in applying funding and reconstruction plans in autocratic environments. The incentives, decision process and geo-political strategies vary from autocracies to democracies, generating a differential outcome regarding the investment to be made in preventing, preparing or responding to a natural disaster.

Apart from institutions and national governments, I argue further that the population itself holds the potentiality to prepare, adapt and respond to natural disasters. Social capital has been widely studied as a tool or mechanism of response to natural disasters, both by social vulnerability theory (Adger, 2003; Pelling, 1998) and the sociology of disasters (Buckle, 2006; Dynes, 2006). Throughout this thesis I have argued that social capital reinforces the adaptation capacity of societies to natural disasters in Latin America and the Caribbean. This thesis suggests two new elements for the development of the studies of social capital and disasters. First, I distinguish between the role of bridging social capital and bonding social capital as stimulators to the adaptive capacity of individuals. I claim that the way horizontal network ties operate to enhance the adaptive capacity of individuals is different from the role occupied by social organizations and community involvement. Bonding social capital functions by providing knowledge, assistance and support between family members or closest ties, before, within, and after disasters occur. On the other hand, bridging social capital, operate in a more extensive way, giving support to anyone in need and not necessarily with the aim of solving their own problems but instead community problems. The

beneficiary of the action, in this case, is not the individual or a family member (as with bonding social capital) but instead a collective or community.

Apart from the distinction between bonding and bridging social capital, I also include a temporal and spatial dimension on the analysis of the role of social capital and disasters, sustaining that the role of social networks fluctuates in different stages of disasters and also on several scales (local, regional, national). The way social capital functions varies in the preparedness, early recovery and reconstruction pahses. The actions of social capital can shift from simple provision of information and knowledge, before disasters occur, to actual actions in search and rescue activities or provision of food or shelter after a catastrophe.

In this section I briefly revise the main theoretical contributions of the thesis, afterwards I briefly restate the empirical results. I then provide an account of the possible empirical and policy implications, finishing by suggesting potential ideas for future research.

1. Theoretical Contributions

As discussed in the second chapter of this thesis, sociological studies on disasters have focused mainly in exploring possible responses from human beings after disasters occur, analyzing the role of groups and social action in the recovery and reconstruction process. Apart from the sociology of disasters, vulnerability theory has been profoundly centered in identifying the social, economical and political conditions that make a human being more prone to be affected by a catastrophe. However, during the last decades the idea that human beings hold the potentiality to adapt, prepare and respond has been rapidly growing under both perspectives.

Supported in this general idea, my thesis theoretically challenges and further contributes to the development of the social theory on disasters.

Firstly, I differentiate between individual actions that enhance the adaptation capacity of societies to natural disasters and institutional tools of adaptation. My thesis proposes that different mechanisms, some originating with individuals and others from institutions, have the potentiality to shape the adaptation capacity of societies. Although some scholars have pointed out possible distinctions within the adaptation concept (Pelling and High, 2005) such differences were made regarding the type of action (if it is a coping mechanism or institutional modification) rather than who the actor performing it is. I suggest that in order to understand the possible impacts of disasters on societies we should beforehand understand from a theoretical point of view the possible tools that human beings and institutions hold and currently apply to mitigate these effects. It is fundamental to recognize that actions taken at different levels (individual and institutional) might have different outcomes in to preventing the occurrence of natural disasters. Moreover, it is fundamental to recognize that individual tools are constrained by institutional policies but also that any macro level decision might be reinforced or weakened by individual action at the local level.

A second important theoretical contribution of my thesis is that social capital, as an individual tool of adaptation, operates in different ways to reinforce the adaptation capacity of societies. Theories on the role of social capital (individual tool) in mitigating the effects of natural disasters has been long addressed both by the sociology of disasters and vulnerability theory. However, I maintain that existing theories have largely neglected the role of different dimensions of social capital in reducing the effects of disasters. Also, they have rarely taken into consideration the impact of social capital in different phases of disasters. In this sense, I propose several new elements to the theory

of the role of social capital as a stimulation mechanism for the adaptation capacity of societies. First, I suggest that a distinction between bonding and bridging social capital should be included, taking in consideration that the actions taken by family members or friends (bonding social capital) are very different from the incidence of community involvement (bridging social capital). Also, within each category of analysis a temporal dimension is relevant. Actions taken in a post-disaster phase are not the same as in a preparation phase.

A third important contribution of my thesis is the acknowledgment that institutional action enhances the adaptation capacity of societies. The potential capacity of institutions to prevent the occurrence of natural disasters is unquestionable. Governments, agencies and international organizations hold the capacity of preventing catastrophes. Because natural disasters are evitable events, I argue that the theory of disasters should include institutional action as a main driver of the adaptation capacity of societies to the impact of disasters. Apart from this general starting point, I further suggest that attention should be given to the way today international agencies and national governments face the occurrence of natural disasters. Geopolitical strategies, visibility and exposure are some of the main drivers of institutional action. In this sense I suggest that the level of democratization of a country determines how successful or inefficient the plans implemented by governments or international agencies are. Finally, as in studying the role of social capital, I also argue that the institutional action shifts and changes in every phase of disasters.

2. Results

The thesis firstly studies the role of public spending, humanitarian aid and social capital at the country level, with a Time Series Cross Sectional analysis of Latin American and the Caribbean countries, from 1960 to 2010. It further selects two case studies, Haiti and Chile, to show how these mechanisms operate at an individual level.

Empirically, several researchers have claimed the need for associating macro-comparative studies with local study cases, arguing that this could lead to a better understanding of the adaptive capacity of individuals. Pelling and High (2005:313) suggest that 'a combination of local qualitative studies linked to larger scale quantitative surveys may be a more appropriate way to proceed in comparative studies of adaptive capacity'.

Taking their suggestion on board, my thesis studies the social determinants of vulnerability and adaptation mechanisms to natural disasters in Latin American society through a cross-country historical analysis. It further includes two cases studies to better understand the micro foundations behind the adaptation and vulnerability mechanisms.

I study the national determinants of social vulnerability, such as economic growth or political regime, together with micro conditionings, such as health quality of the individual, house status, amongst others.

Through a macro level design I am able to compare the effectiveness or inefficiency of countries to attenuate or reinforce their degree of vulnerability against natural disasters. The micro level models give me information regarding the micro foundations behind the effectiveness of social capital and international aid in reducing the likelihood of becoming poor after disasters. I study the effectiveness of social capital, humanitarian aid

and public spending both at the country level, through a cross country time series analysis, and at the individual level, through the selection of Haiti and Chile as case studies.

The macro comparative analysis between countries showed that the higher the levels of social capital, disaster relief aid and public spending of the country the lower the number of casualties due to a natural disaster. However, the micro level analysis of this thesis pointed out that the micro foundations of these arguments are far from being simple. Spending, strong social networks and aid do not always operate in the same way and effectively reduce the social vulnerability levels of the societies concerned.

2.1. Social Capital

The initial hypothesis of this thesis claimed that holding strong network ties, or high levels of social capital, decreases the likelihood of being affected by a natural disaster. I further maintain that bridging social capital (associations between different groups) and bonding social capital (referring to the ties between individuals) operate in dissimilar ways to enhance the adaptive capacity of individuals to natural disasters.

Concerning **bonding social capital**, results at the aggregated level show that the levels of interpersonal trust and remittances inflow of a country decrease the number of casualties caused by natural disasters. The support of social networks before, during and after a natural disaster occurs could potentially decrease the impact of the catastrophe on individuals and countries. However, at the individual level, the way bonding social capital operates was dissimilar for Haiti and Chile. In Chile most of the affected population did not have support from family, friends or the community to recover from the earthquake, but mainly they opted for individual mechanisms. At the epicenter of the quake, only ten out of every hundred declared having been supported by friends or network ties in order

to recover from the disaster. The analysis shows that bonding social capital in Chile did not significantly reduce the social effect of the quake on the affected population. Regarding the levels of interpersonal trust before the earthquake occurred, that is, levels of bonding social capital, these did not significantly reduce the likelihood of becoming poor after the quake.

In Haiti, on the contrary, bonding social capital appears to decrease the impact of the earthquake on the society. Despite the levels of interpersonal trust does not seem significant, receiving remittances significantly reduced the effects of the earthquake. The fact of holding strong network ties provides more opportunities and resources to the affected families, operating as a buffer to the social impact of the 2010 earthquake. Thousands of Haitians lived with family members or friends after the quake, the network being one of the most important providers of shelter after the catastrophe. Also, family support provided solutions for healthcare attention, looking after children and job opportunities. As discussed in the selection of Haiti and Chile as cases studies, before the earthquakes the levels of bonding social capital in Chile were higher than those in Haiti. However, in terms of effectiveness in reducing the impact of the earthquakes, it seems that the levels of bonding social capital in Chile did not significantly reduce the probability of becoming poor due to the earthquake. In Haiti, however, network ties did operate to decrease the dramatic social and economic situation of the affected population.

Concerning **bridging social capital**, results at the country level indicate that political involvement and social participation decrease the death rate from natural disasters. Highly organized societies, with strong participation tools, are more successful in the preparedness, early recover and reconstruction process. Before disasters occur bridging social capital (or social participation, community involvement) can operate by being a

major provider of information and knowledge regarding possible impact of disasters. Also, organized communities, with high participation, tend to be more effective in identifying possible risks and communicating the demands to the authorities. Also, they can pressure governments to provide solutions for populations living in highly vulnerable areas, prone to flood or to suffering mass movements. After disasters, the levels of organization and participation of the community can lead to a better and faster recovery process. It is unquestionable, and largely studied by several scholars and researchers, that the inclusion of the affected population in the recovery process determines a much more successful outcome (Eakin, 2006; Gruberg, 2004; Moore, 2005; Pelling, 2003; Pulgar, 2010).

At the individual level, in Chile, results show that the higher the levels of regional social participation, before the earthquake occurred in 2010, the lower the probability of becoming poor due to the disaster, keeping everything else constant.

In Haiti community involvement did reduce the effects of the earthquake. Individuals that participated in any type of community action at least once in the year are less likely to have their income decreased due to the earthquake, holding every other variable constant. Of course, this is not directly comparable with the Chilean results, because they are different variables, but in specifically studying Haiti the analysis illustrates that the people that participated in community activities during the last year hold less probability of having their income decreased. Regarding participation in protests, those that did participate are more prone to have their income reduced. The findings could be indicating that protests and manifestations are carried out by the most affected population and for that reason there is a positive correlation between participation and more severe social consequences of the earthquake.

Finally, the role of social participation (bridging social capital) and bonding social capital depends also on a temporal dimension. Results suggest that the pre-existent groups or community committees are more likely to reduce the immediate impacts of disasters than emergent groups, created only after the catastrophe. In the Chilean case, the emergent groups were not necessarily successful, where the real impact came from organizations that they were already present in the region. This implies that higher levels of participation in the community, no matter in which area, could potentially operate as a reduction factor of the social impacts of disasters. The population living in areas with high participation levels can potentially be more successful in communicating demands, acquiring public goods, being informed and emotionally supported. Regarding bonding social capital, the results of the thesis show that the help from family and friends received after the disaster occur did not significantly reduce the likelihood of becoming poor in Chile. However, the previous levels of interpersonal trust and ties between individuals did have an impact in decreasing the effects of the quakes. This could be showing, as with social participation, that the most significant role of social capital is occurring before a disaster happens, giving form and shape to possible tools that society might need in the preparedness and early recovery, but not necessarily in the reconstruction process. In the long term reconstruction process agencies and governments seem not to be finding the tools to include the affected community in the rebuilding plans. These results are indicating that although social relationships and participation significantly operate to enhance the adaptive capacity of societies before disasters occur, they seem not to be included in the reconstruction process.

2.2. Humanitarian Aid and Public Spending

As institutional mechanisms of adaptive capacity, I study the role of humanitarian aid and public spending in decreasing the social impacts of natural disasters.

At the aggregated level (countries) both disaster relief aid and public spending are effective in reducing the death rate from natural disasters. However, the democratization level of the country seems to be a crucial mediator of the efficiency of aid, both domestic and international, in reducing the number of casualties after natural disasters. Regarding humanitarian aid, results show that disaster relief aid is more effective, in reducing deaths, in weaker institutional frameworks. Disaster relief aid encounters fewer obstacles to implement and apply their own policies and programs where the institutional framework is weaker, or was weakened, by the natural disaster.

In contrast, public spending seems to be more efficient in reducing the death toll from natural disasters in democratic contexts. Pressure from the constituency in asking for prompt and effective solutions after natural disasters, together with plans and programs to mitigate climate change, could be causing a more efficient distribution of public funds within democratic contexts than autocratic.

Despite this direct and straightforward results found at the aggregate level, on the individual level humanitarian aid and public spending did not in every case operate as predicted. First, in Chile results show that any transfer of benefits or subsidies before the earthquake did reduce the probability of becoming poor. This shows that the transfer in any type of social policies from the government does decrease the social vulnerability of societies to natural disasters. Furthermore, the money invested in infrastructure and projects at the regional level seems significantly reduce the social effects in Chile. However, the subsidies given by the government after the 2010 quake occurred did not prevent the families from becoming poor, quite to the contrary, families receiving subsidies seem to be more prone to fall into poverty than those receiving help from families and friends.

These results confirm that the Chilean government encountered several limitations in the distribution of public spending among the affected population after the earthquake. In Chile, despite its being one of the richest countries in Latin America, two years after the quake there are still people living in settlements and precarious houses. One of the reasons for this has been that the government did not adapt the provision of housing subsidies to the new demand after the 2010 earthquake, but instead used the same procedures that led the subsidy provision before the disaster took place (Bustamante, 2012; CEME, 2012; Lizana, 2011). The accountability and transparency of how the funding is distributed and spent became a difficult task for the Chilean government. Problems in superposition of activities enhanced by problems with the budget design and implementation are rife in governments facing disasters. Despite not being a central concern from the population in the initial days of disasters, it is not long before citizens start demanding a transparent account of how the money has been designated and spent. Governmental structures tend to be slow and heavy, generating problems in the implementation of plans, programs and policies to respond to natural disasters.

Results in **Haiti** showed the subsidies were successful in reducing the impacts of the earthquake within the epicenter but not as successful in peripheral areas. Because the aid was focused at the epicenter of the earthquake, the areas that experienced the earthquake in a lower intensity still suffered the economic and social consequences but were not helped by international aid or national subsidies. These findings could be suggesting that investing all the efforts at the epicenter of the disaster could be leaving a considerable part of the population outside the support system, without preventing them to suffer the social consequences of the disaster.

In Haiti, several problems emerged in the distribution of funds. The non-existence of a centralized governmental coordination entity generated superposition and overlapping of

tasks and responsibilities in the Caribbean country. Thousands of volunteers and NGO members were deployed to Haiti in the first hours after the quake, with no clear or unified mandate on how to act to help the affected population. This lack of coordination, lack of involvement of the local population, and lack of transparency are some of the many difficulties found surrounding disaster relief aid distribution in Haiti after the earthquake in 2010. These difficulties are clearly affecting the effectiveness of the aid distribution and support, causing hundreds of Haitians to remain living in displacement camps, needing food and healthcare attention, two years after the quake.

3. Policy Implications

Governments, agencies and the international community hold the responsibility of assuring the wellbeing of the population and decreasing the occurrence and the posterior impact of natural disasters on the population.

From this starting point, the results of this thesis hold several policy implications. First, I argue that the policy design targeted to prepare, adapt to and cope with disasters should take into account the dynamic characteristic of vulnerability. Previous social conditions of individuals, for example being wealthy or educated, cannot assure that they are not going to be harmed or affected by a disaster, and vice versa, being poor does not necessarily imply that they are completely affected. In this respect, the study of vulnerability should acknowledge the risks intrinsic to identifying certain communities as vulnerable only based on their previous social, economical and political characteristics. Policy makers should have an inclusive and extensive perspective regarding the actions being made in the preparedness, mitigation and recovery plans against natural disasters, conceding that the levels of vulnerability changes dramatically at daily bases, especially in

the face of shocks, and that someone that is vulnerable today might not be tomorrow and vice versa.

Second, the results of this thesis show that both governments and agencies systematically dismissed the affected communities in the recovery and reconstruction plans in Haiti and Chile. External actors have the tendency to view local communities as incapable of dealing with the disaster and recovery process. This has enormous implications at the time of applying policies and programs designated to the preparedness and mitigation towards natural disasters. The population should be taken into account as the most informed actor in terms of needs and demands regarding possible effects of disasters. In addition, their involvement in the reconstruction process could lead to a more efficient and accurate implementation. I argue that insiders better identify the specific requirements and adaptation tools needed by the population than outsiders. No one knows better the social and political situations than the population itself and local institutions. In the same sense, the population should be seen as active participants of the reconstruction and assessment process and not as mere victims of a natural catastrophe needing help from external actors to rebuild their country.

Findings also demonstrate that public spending and humanitarian aid prioritizes the population living at the epicenter of the catastrophes and tends to dismiss the social effects that the disaster had on in the remainder of the country. I propose that attention should be given to the dynamic aspect of the social vulnerability as well as the potential negative side effects of distributing public funds and disaster relief aid only in the most affected areas. In the case of Haiti, the areas surrounding the disaster became extremely vulnerable with almost no support from national governments and international agencies. The opportunistic intentions from governments and international organizations generates that the funding is applied in the most visible areas, those that

were more affected in the early stages of the disaster. These decisions are extremely costly for the population living on the periphery of the epicenter that is nevertheless affected by the economic and social problems derived from the disaster. The motives of international agencies are far from altruistic and pursue their own political and economical agenda. The conception that their unique main goal is to help the affected population is naive. Therefore, in countries where national governments are weak, and international agencies take the lead in the reconstruction process the interests of the citizens are being (or could potentially be) neglected.

Until today, international aid and public spending is helping to decrease the number of death in the population and also decreasing the likelihood of becoming poor; however, the individual level analysis show that in areas where the earthquake was not that severe the likelihood of becoming poor increases, mainly because the amount of international aid is smaller and ineffective.

This implies that parts of the population could be dismissed because of a lack of visible relevance to the donor. The assessment regarding the needs of the population is carried out regarding exposure and visibility, and not necessarily under exhaustive and extensive assessment of whom and where the most vulnerable to the disasters actually are.

Finally, the results of my thesis indicate that in regard to participation and humanitarian aid, and to public spending, the efforts made before the disaster occurs are significantly more important than the policies adopted after.

4. Future research

A further development of the theory on disasters is needed, maybe associating perspectives from sociology, human rights and political economy. The way human beings react, adapt and respond is still a mystery within the developed world. My thesis provides a first glimpse of how the adaptation machinery operates in Latin American and the Caribbean context although I suspect these mechanisms differ from those applied in other geographical regions. A next useful step to the further development of disaster research would be to recognize the differences within the developing world and study further how the adaptive capacity of societies is constructed in different regions.

Empirically, although my thesis contributes to a comparative study of the macro determinants of social vulnerability and adaptation, I acknowledge the limitations that quantitative methodologies hold. Variations and differences between countries are often neglected, the quality of the data is questionable and the assumptions made to test the hypothesis are sometimes blurry or too demanding. For this reason I would claim the need of including qualitative study cases to the work already done in my thesis. Showing how social participation or community groups worked in a certain territory linked to the aggregated level actions could lead to a better understanding of the micro-foundations of adaptive capacities of societies. Along similar lines, because of possible flows in the data on funding distribution and disaster relief aid, a qualitative study in a small region that explores the institutional support after or before natural disasters would be extremely valuable. As Birkmann (2006) suggests, the reasons behind the actions taken by individuals and families in coping with a disaster are only possible to be studied through local qualitative methodologies.

Furthermore, empirically the decision to apply a quasi-experimental design to the Chilean case has several constraints. I am not able to study through the regression how the role of institutions and societies shaped a differential probability of becoming poor or not poor. All actions taken after the quake cannot be included (because of cofounding effects problems). However, I am able to isolate the effects of the quake on the probability of becoming poor. A possible next step in the analysis of the Chilean earthquake would be to replicate a similar model as the one applied to Haiti (logistic regression), removing the panel and temporal conditions but including actions taken by individuals and government after the quake.

For the case of Haiti, contrary to the Chilean analysis, I am not able to establish causality and to isolate the effect of the quake. This might be causing spurious results. For this reason a deeper qualitative study could be beneficiary to showcase my argument.

In theoretical terms, I argue that the social sciences still have a lot to offer to the development of disaster research. The role of institutions, governments and societies should be studied further. In this sense I claim that sociology has several contributions to make to the development of disaster research, especially in the field of adaptation and vulnerability. Not with the aim of dividing but with the aim of contributing, I believe it is important to broaden the limits of disaster theory and to take on board decades of social theory in the areas of organization, social behavior, institutions and structures.

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