

THE SOCIOECONOMIC CONSEQUENCES OF NATURAL DISASTERS IN CHILE

By

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ABSTRACT:

The aim of this project is to analyze the economic effects over time that Chile has encountered due to natural disasters. I will provide information about Chile as country, breaking down several crucial regions to highlight the key threats to each. Several natural disasters used in my research will be defined and a brief account of their occurrences throughout the country's history will be given. My paper will demonstrate how Chilean society has shaped their way of life around these economic consequences, with a unique look at the short-term effects on small businesses. The primary focus will be on how the economic impact of an exogenous variable, such as a natural disaster, varies based on certain endogenous variables such as location and prosperity.

I. Intro

"La Cordillera (...) de pronto se acuerda de su vieja danza de ménade y salta y gira con nosotros a su espalda" -Gabriela Mistral (1934)

Chile is known for various things around the world: its long, narrow shape, the Andes, the dictatorship of Pinochet, and for Spanish speakers, the country with the most slang. However, when I told friends and family in May 2015 that I would be studying abroad there, the most common reaction I heard was: "Be careful of the earthquakes, and stay far away from the erupting volcanoes". The country of Chile is almost entirely formed on the subduction of the Nazca plate under the South American Plate, forming the Peru- Chile trench; situated along the Ring of Fire, it is home to the most destructive earthquakes in the world. Not surprisingly, Chile has the world's largest earthquake on record since the start of the 20th century, and the largest magnitude earthquake of 2015.¹ In addition, several active volcanoes span the length of this country. Economics is "the study of scarcity, how people use resources and decision-making".² Interestingly enough, natural disasters are an easy way to look at the economics of a country, using an un- confounded exogenous variable. I studied the fundamental ways Chileans of all social standings make decisions. What they choose to risk, how they use resources to protect them against catastrophes and how a country is affected and must react when an exogenous factor creates scarcity of land, supplies, shelter and money.

II. Relevance

Murphy's Law is a well-known theory: anything that can go wrong, will go wrong. The original version states "If there are two or more ways to do something, and one of those ways can result in a catastrophe, then someone will do it".³ What I have found before, during, and after this study, is that this is true for natural catastrophe's as well. If a natural disaster can occur due to the earth's fault lines or another geological characteristic, it is just a matter of time before it will happen. The various reasons why this research is relevant may be different depending on who you are discussing it with. The fact remains that these natural disasters will continue to occur and that Chile, in particular, must endure a never-ending battle of implementing the most effective and economically efficient methods of handling them.

Over the past decade, Chile has secured a spot in what the World Bank now calls a "high-income economy," which was previously called a "developed" or "first-world" country.⁴ However, as with most countries, this does not mean that income equality is achieved nor that each region individually qualifies as a micro high-income economy. When looking at per capita income, the gini coefficient is 0.5045 as of 2013.⁵ A score of 0 would mean perfect equality and a score of 1 is perfect inequality. This information shows the relevance of a study conducted on the socioeconomic consequences of natural disasters. If research suggests that those living in regions with higher levels of poverty are suffering greater losses, we can explore possible interventions to better assist these disadvantaged areas. Stronger efforts placed on lower income areas can result in less physical and financial damage occurring, meaning less personal burden to rebuild and fewer lives and livelihoods lost. Based on extensive research on the topic, it is never too early to prepare for the inevitable occurrence of a natural disaster.

Natural disasters have a strong short-term effect on the economy of a country, and subtle but visible long-term effects. The labor force may also be reduced rather quickly due to injuries,

deaths and illnesses related to the event. Some examples of possible causes for these losses are collapsed buildings, smoke inhalation or contaminated water sources. All of this will result in the inability to work, that is, if there is even a business to return to, which in many cases there is not. For example, if an earthquake were to trigger a tsunami, fishing and shipping industries would not be able to continue their business due to the wreckage of the shore and lack of necessary materials. Chile ranks 41st in the world in the economy of exporting, with a net traded value of \$4.7 billion in 2015, showing how devastating an earthquake associated tsunami could be to Chile's income and labor force.⁶

The other factor that contributes to the positive trade and high- income economy is the mines. Chile has an unexpectedly high share of global exports relative to the size of both its export economy and the products global market. The region of Antofagasta made headlines around the world after 33 miners were trapped underground for months and successfully rescued. Chile is the world's largest metal producer, with a claim to 31 percent of total output globally.⁷ Nevertheless, when the earth is moving, the last place you want to be is in a mine that is already susceptible to collapse due to mining- induced seismicity. The well- justified evacuation and temporary closure of mines during earthquakes affects the supply and sparks worldwide price spikes. In 2015, following the temporary closure of two important mines, prices hit a two-month high immediately.⁷ The prices flattened out shortly after because no damage had been done this time, but the immediate economic effect on Chile's top industry was apparent and if a different outcome had occurred in the mines, it could have become an increasingly long- term problem for their export economy.

Chile has a variety of qualities to offer but many of them can be drastically affected by a natural disaster. Many regions are known for having tourist attractions. Sightseeing in the

Atacama Desert, skiing in the Andes mountains and trekking in Patagonia have all made it on many adventurers' bucket lists. However, a natural disaster can affect the tourist's willingness to engage in the activity out of fear or the actual closure of the area due to damage or risk of danger. Since tourism is a top form of income in many regions, these closures can be extremely costly to the economy.

All the reasons stated above clearly demonstrate why natural disasters are detrimental to a country and its economy. Supply shock reduces the amount of capital and the overall productivity of Chile's economy. Furthermore, the examples of closures in areas of tourism, business, universities, mining, etc. all affect the livelihoods of the individuals within those industries. The problem worsens when natural disasters lead to long term closures of the sectors, leaving the citizens who depend on them for income without a means to recover money or property lost in damages. My hypothesis is that those living in less affluent regions will suffer worse from a natural disaster than those in more prosperous ones.

This research specifically focuses on small businesses because it is a practical way to collect information in each region. Nevertheless, the results of the survey should defend a larger prediction that income inequality affects the severity of damage that is done by natural disasters. If small businesses are suffering worse losses in less affluent regions, that information can be applicable to other areas such as homes or injuries/deaths. For example, research focusing on damage to houses instead of small businesses should find parallel results. All the previously mentioned aspects are relevant factors within the economy, but the original research presented in this paper draws conclusions about small businesses that can further justify inferences of a relationship between prosperity and damage caused by natural disasters on a macroeconomic scale, as well.

quantitative data, and descriptively, also called qualitative data. Mixing quantitative and qualitative information in one investigation allows for more accurate results than a trial that only uses one method.

The survey was intended for small business owners in several regions of the country. I wanted to conduct a completely random and unbiased survey. Due to the use of human subjects while conducting this research project, I was certified in IRB training through CITI to insure the protection of each

contributor's rights throughout the process. The study minimized risks to the participants by allowing their names to be left confidential. The individual survey data was not open to the public, only a mean of the results will be presented. To avoid crossing personal boundaries questions about income, family size, age, etc. were omitted from the survey.

Encuesta de microempresas										
Nombre (opcional) / Nombre de empresa: _____										
Ciudad: _____										
1. Fui precavido al empezar mi negocio debido al daño potencial de un desastre natural.										
1	2	3	4	5	6	7	8	9	10	
No estoy de acuerdo				Neutral						Estoy de acuerdo
2. He tenido que cerrar mi negocio en algún momento debido a un desastre natural.										
1	2	3	4	5	6	7	8	9	10	
No estoy de acuerdo				Neutral						Estoy de acuerdo
3. He sufrido pérdidas de beneficios anuales debido a los desastres naturales.										
1	2	3	4	5	6	7	8	9	10	
No estoy de acuerdo				Neutral						Estoy de acuerdo
4. Por el emplazamiento (lugar) de mi negocio, he perdido inversiones potenciales en mi negocio.										
1	2	3	4	5	6	7	8	9	10	
No estoy de acuerdo				Neutral						Estoy de acuerdo
5. Pago tasas altas de seguros para proteger mi negocio contra daños ocasionados por un desastre natural.										
1	2	3	4	5	6	7	8	9	10	
No estoy de acuerdo				Neutral						Estoy de acuerdo
Estoy disponible para hacer una entrevista adicional sobre este tema: Sí / No										
Numero de teléfono: _____										

From there, I took my survey to the streets. This was to expand my population and sample size. The population was the cities of Viña del Mar and Pucon. The sample size was fifty small-business owners. I walked up and down blocks for weeks, stopping into every privately-owned

shop I passed and asked to speak with the owner. The sampling biases were minimized because shops were not skipped, each was given an equal opportunity to fill out the survey. The random trial is more credible and warrants more accurate results than a trial that is not randomized. One thing that should be noted is the possibility of response bias. If those who did not answer all had something in common that could incorrectly skew the data, it would create a response bias. However, from my experience, no response biases were present that may have greatly misconstrued this survey or its results.

The survey was set up on a scale from 1 to 10. 1 being disagree, 10 being agree and 5 being neutral. The brief survey was explained to store owners, and if they consented to participate, the survey was given to them to complete. For privacy reasons, I made it optional to put your name; however, I requested that they at least put the city they were in so that when I analyze the results of the survey, I could distinguish the patterns in answers according to the city. The first question “I was hesitant to start my business due to potential damage from a natural disaster” was meant to get an idea of the naivety of new business owners, whether they considered this outcome when first starting the business or not. The question was a way of gauging how prepared business owners in each area are for a disaster.

Questions number two and three were about loss of money and time. “I have had to shut down my business at some point in time due to a natural disaster” and “I have incurred loss of annual profits due to natural disasters.” Without asking for personal, open-ended questions such as how much money, inventory, or time was lost, I asked for a more quantitative answer using the same numerical scale. This was a way of limiting risks to the participant. It provided accurate data to work with without compromising personal and sensitive information about their business.

The final two questions were also meant to investigate monetary status of the business. “Due to the location of my business, I have lost potential investments in my business” and “I pay higher insurances rates in order to protect my business against damage from natural disasters.” Investment and insurance are two key parts of a start-up business in the United States. The survey’s purpose was to find how important those extra losses or costs would be to a small business in Chile. Again, no personal information was asked for, just where they believe they fall between agree and disagree.

I traveled between two key regions in Chile, using the same survey in both regions to get more detailed, quantitative and qualitative information about business in each region. At the bottom of the survey there is a place to put a phone number if they were willing to conduct an additional interview on the subject. This insured that no conversation that occurred while filling out of the survey would influence the participant’s answers. However, once I had received the completed survey, I was happy to conduct further interviews with the participants at that time if they were available, to maximize the amount of information I could collect in a six-week project.

Once I returned home, photo copies were made of every single survey. Then the answers were tallied up by region. The results of which will be discussed later. Although study’s have been conducted before on the relationship between natural disasters and the economy, this information is new and original. My survey was based on a certain population and sample size which merited exclusive new data on the theme.

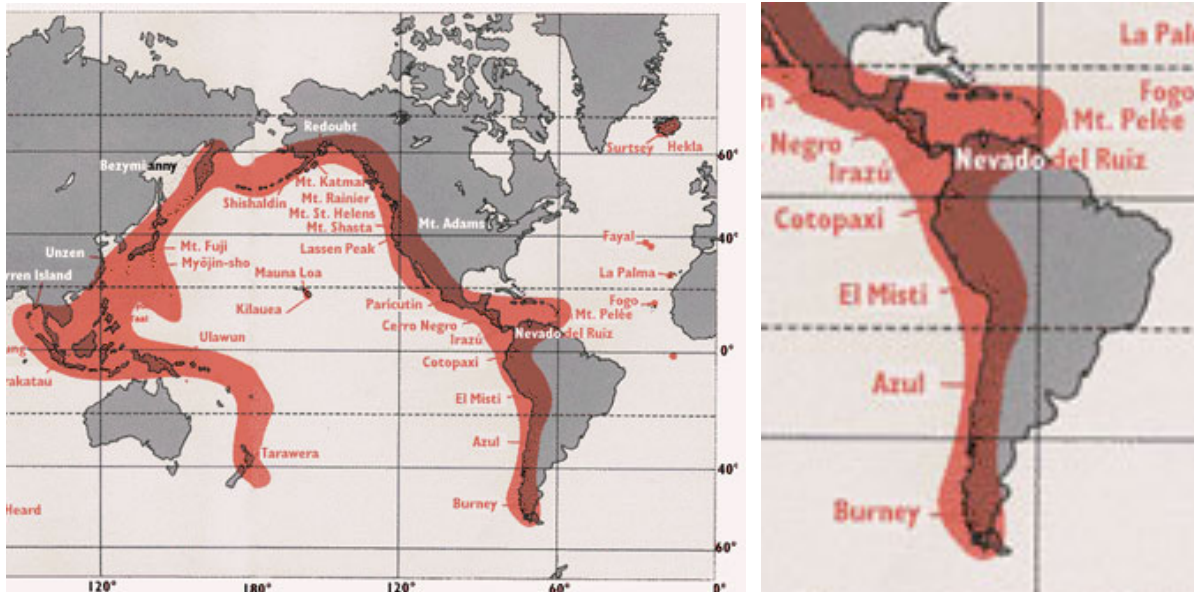
IV. Chile as a country

www.youtube.com/watch?v=dwwe8ats81w

The Republic of Chile gained its independence from Spain in 1826.⁸ The population per the World Bank in 2015 was slightly under 17 million people.⁵ The elongated country has 15 regions, spanning in a climatic range from the Atacama region with the driest desert in the world to the Magallanes region, which includes the Chilean Antarctic and is home to the jaw- dropping Torres del Paine National Park. The northern most region is Arica which was won in a war against Perú. In the center, you will find the country's capital, Santiago which houses more than one- third of Chile's population. Also central, but on the coast, you will find the two cities Viña del Mar and Valparaíso. Further south is the Lake regions, one of which is Pucón, housing the extremely active Volcán Villarrica.

Chile's total GDP is \$240 billion; however, their GDP purchasing power parity (ppp) is estimated at \$436 billion as of 2016.⁵ GDP, or Gross Domestic Product, is determined by four components: consumption, investment, government spending and net exports. Added together, it gives us the overall value of a country's production. Purchasing power parity is the "rate at which the currency of one country would have to be converted into that of another country to buy the same number of goods and services in each country".⁹ It is a more comparative value of the money rather than just the total of money. The United States' GDP is the base rate. The GDP ppp ranks the country of Chile as number 45 in the world.⁵ Chile also qualifies as a high- income economy with a GNI per capita of higher than \$12, 476.⁴ GNI is very similar to GDP, it just includes the flow of income in and out of the country. Per capita takes a total GDP or GNI and divides it by the number of people in the population. This is to determine the average "income" of an individual in the society. An easier way to think of GDP per capita reflects a middle- class worker's salary as a citizen of the country in question.

V. Geographic definition of Natural Disasters



(U.S. Geological Survey)

Chile is located along the Ring of Fire. The Ring is responsible for most earthquakes and volcanic eruptions in the world. Due to its location, Chile is prone to its share of natural disasters. I will be addressing the similarities and differences of how various types of events affect the communities they hit and what the overall economic consequence is. First are earthquakes which are caused by two plates colliding, and the stored-up energy is released in the form of a seismic wave. This sensation is felt in severity depending on the magnitude of the earthquake, the bigger the magnitude, the more intense the shaking will feel to us. Another factor is the location of the epicenter, the location on earth where the earthquake originates. The closer a community is to the epicenter, the stronger the shocks will be felt, both main and after. An earthquake is assigned a magnitude due to information collected at the epicenter, this helps to compare earthquakes and estimate damage.¹⁰ Tsunamis, although a form of disaster on their own and equally destructive, are another outcome of an earthquake. A tsunami is a giant wave that forms because of an earthquake that occurs underwater. Tsunamis travel extremely quickly in

deep water and speed towards land building giant, destructive waves that hit and often destroy coastal communities.¹¹ Lastly are volcanic eruptions. The discharge of lava and gas from these large, powerful openings from the earth's core can be the most catastrophic of all natural disasters. It affects entire populations and can destroy anything in its path, making it different from earthquakes and tsunamis.¹² Volcanos have been measured by Volcanic Explosivity Index (VEI) since the 1980's. The VEI measures various qualities of an eruption including ejection of pyroclastic material (ash, lava flow, etc.) as well as how long the eruption lasts.¹³ This allows scientists and citizens alike to compare past and present eruptions in the same manner that the Richter Scale has assigned magnitudes to an earthquake.

VI. History of Natural Disasters

Centuries before Chile became a country, its boundaries have been rocked by earthquakes. Information can be found, including location and magnitude, dating as far back as 1570. For the next 400 years, the land was terrorized by the shaking of earthquakes, and often the large

(Getty Images)



tsunami waves that follow. These were not small shocks either, the majority recorded at 7.0 magnitude and higher. Northern Chile's territory Arica (previously belonging to Peru) located right on the Peru- Chile Trench, had its

population decimated in 1868 with a magnitude of 9.0 earthquake and following tsunami. A

death count of 25,000 was recorded. Included in the casualties were several navy war ships, both American and Peruvian.¹⁴ In Valparaíso in 1906, an 8.2 magnitude earthquake hit the shipping port/ city and claimed the lives of over 3,800 people.¹⁵ However, Chile's claim to fame in the category of natural disasters is the 1960 Great Chilean Earthquake, known as the world's largest recorded earthquake. Recorded at a magnitude of 9.5 by the U.S. Geological Survey, it destroyed the homes and livelihoods of 2 million people and killed around 5,000 others.¹ "After the earthquake the country's economy grew at a lower rate of 2% in 1961 to 1963, and has a second recession in 1964-65".¹⁶ The government created the 'Ministry of Economy, Development and Reconstruction' which oversaw the reconstruction and rehabilitation of the south.¹⁶ A more recent example of the size and fierceness of earthquakes/tsunamis in Chile is the magnitude 8.8

catastrophe of 2010. With 520 fatalities and 350,000 homes destroyed, it is ranked number 4 of the top 10 costliest world earthquakes and tsunamis by insured losses from 1985-2015.¹⁷ The combination of the earthquake and subsequent tsunami racked up over \$30 billion in damages, only \$8



(Press Association)

billion of which was insured property loss.¹⁷ Although still a substantial number of lives and homes lost in a matter of hours, the numbers are much less extreme than those of 1960. Exactly 70 years later, there were many factors that contributed to the difference in the resulting death toll and destruction. This paper will take a more in depth look at those factors later.

Chile has 36 active volcanoes, although it boasts 500 that are potentially active. It is ranked 5th among nations for the largest number of historically active volcanoes.¹⁸ In 1991 Mount

(Pierre St. Amand/NOAA)



Hudson had one of the largest eruptions in the 20th century. This glacier covered mountain, part of the Andes Mountain range, last erupted on

Halloween 2011. Chaitén volcano became active in 2008 after 9000 years. In 1893 and 1894 an explosive volcano, Calbuco, qualified as a level 4 VEI. Ten more explosions were recorded in the 20th century. In 2015, a level 4 was reached again making recent history with a month of explosive events. Villarrica, the volcano I visited in my studies, has a very active history as well with 66 eruptions recorded since 1558, a few notable ones in 1964, 1971, and once six months before my first visit to the region in March of 2015.¹⁹

VII. Santiago- Earthquake

www.youtube.com/watch?v=iU7LmKPTipE

The capital city, Santiago de Chile, is home to over 6 million people. Santiago, like many capital cities, is densely populated and the economic and political hub of the country. Many historic buildings and churches from early settling have been destroyed in earthquakes.²⁰ As of 1985, all new construction in Chile had to meet seismic design requirements, similar to those of

the US. Their strict building codes are enforced in all infrastructure and urban construction. Conclusions from the U.S. Department of Commerce suggest that Chilean designs are more redundant, and built for seismic force resistance which is predicted to allow buildings to not collapse but endure severe damage.²¹ The people of Santiago do not fear their high-rise crumbling, even amid a high magnitude earthquake. Buildings are designed to sway during these episodes, which is why earthquakes do not have as devastating of an effect as in the past, even though they are still felt by the people in them. Santiago's metro system is resistant against earthquake destruction due to it being well designed and mostly underground.²² These building codes and infrastructural advancements have allowed economic growth in the capital, as well as saving the government millions of dollars in losses to rebuild an entire city and transportation system after every seismic event. However, this process is considerably costlier for the average person in the short- run. For example, when building a business to sell jewelry, a Chilean must spend the time and money to construct a shop that meets all requirements and codes. This requires more time in the construction phase and more money invested in the building itself. In a South American country, such as Ecuador or Bolivia, this process may be much less expensive and allow the prospective business owner to speed through the construction phase and open up shop to earn an income faster.

VIII. Santiago- Wildfire

www.youtube.com/watch?v=BVfDkXHD80E

Santiago is roughly two hours inland, east of the Pacific Ocean. The Andes Mountain Range creates a stunning backdrop to the highly populated city, but they are also a powerful force in

affecting Santiago's climate. The mountains block the wind blowing from the coast, and most precipitation occurs at higher points in the range, creating a semi- arid environment. In the summer especially, the high temperatures and lack of rainfall create a hazard for wildfires. This originally was not a disaster on my list for research; however, with the events occurring in January 2017, it is an ongoing problem. Wildfires burned through 1,433,000 acres in a matter of days, causing many deaths and over 1,500 homes and businesses lost.²³ Chile declared a state of emergency. Minister of Finance, Rodrigo Valdes, announced the cost to the government will be \$333 million. The minister also mentioned that small to medium producers are not included in the estimate, leaving business and home owners who did not have insurance for such an event, without much help or hope. Chile, a country well versed in spending government funds to rebuild after a disaster, must take \$100 million of that total from somewhere else in the budget.²⁴ For a country who has a GDP (ppp) of \$436 billion, that is a large hit and will have a definite impact on economic growth.

IX. Viña del Mar

www.youtube.com/watch?v=RcezFpGZ89o

www.youtube.com/watch?v=v-vbAFtPUN8

The coastal town of Viña del Mar is less than a two-hour drive from the capital, Santiago. Per Barometro Imagen Ciudad 2013, "Viña del Mar is considered Chile's top city to live in, work in and visit, and ranks second behind only Santiago for education".²⁵ The opportunities for business and success are numerous and continue to grow. Its proximity to the ocean is both a draw and a threat. The views make the waterfront properties worth considerably more than those inland and

the area in general is more upscale . The streets parallel to the water are lined with businesses and restaurants. However, building a business by a tsunami- prone coast comes with risks and



(Platforma Urbana.cl)



has consequences.

Walking along the seawall, you can see damage from previous storms. An ice cream shack on the beach was destroyed by waves crashing. Two years later and it still has not been repaired or reopened.

Tierra de Fuego, a five-star luxury seafood restaurant, has a gorgeous layout and view. Made

completely of glass, guests can indulge in fine dining and expensive cocktails while enjoying the ocean views and spectacular sunsets along the Chilean coast. But tsunamis and earthquakes do not discriminate when it comes to luxury glass buildings or expensive bottled spirits.

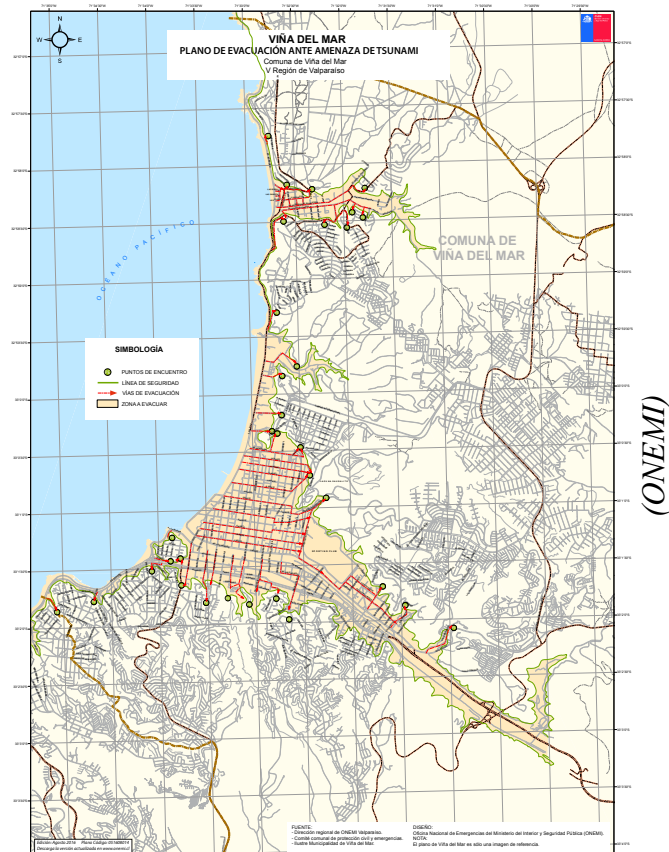
Unfortunately, this establishment was completely destroyed in a storm and the losses were immense. The destruction was shared on twitter and comments were posted insinuating the owners were at fault for building this type of a restaurant on the coast, while others responded that the restaurant could be rebuilt in two days for what they charged to dine there. As predicted

by the tweets, the reconstruction began immediately. Eight months later, when I returned for research, it was up and running with no sign of destruction and still boasting glass exterior and expensive seafood entrees. This restaurant is the exception, however. Many businesses have opted for a more practical approach and built their establishments on the opposite side of the street. The view of the ocean is not

blocked by any buildings, but rather a sidewalk runs down the coast for pedestrians to enjoy and a large seawall made of rocks helps to prevent large waves from crashing over the street or nearing their business. Although this makes no difference during an earthquake, it may prevent damage from a tsunami if the seawall helps to lessen the blow a little on the building itself. It is well understood in the area that waves can easily surpass the height of this

wall, but any type of barrier is welcomed by the owners of nearby homes and shops.

Chile has specialized tsunami evacuation zones in every coastal city. Viña del Mar and Valparaíso have extremely steep hills about one to two miles from the coast. The change in elevation was enough to create a haven from tsunamis. Chile's evacuation system takes advantage of these hills with all zones moving up the hill. In terms of damage, the properties and businesses that are more than a mile away from the ocean suffered less. A city-wide siren alerts



its residents of an impending tsunami. One of the city's issues is that there are only a few roads that take you up the hill with only a lane or two and limited parking. So, when the siren rings, the streets clog and the evacuation is slowed. Many take to hiking the hills, which is not an easy nor fast route. An estimated one million people evacuated in September 2015 after a tsunami warning was issued in the zone, minutes after the magnitude 8.3 earthquake shook the city.²⁶

The earthquake occurred while I was in my home in Viña. It was around dusk with very little sunlight left and it was just my host father and I in the house. It started small and progressively increased in intensity. Figurines started dropping off shelves and dresser drawers were rattling. The locals know that the safest place to be is outside of and away from buildings, in case they collapse. Once outside, I watched as the street lights sparked out and power lines fell. Car alarms were set off by the motion of the ground, creating an environment of panic. I lost all Wi-Fi and cell service. I later discovered that it was intentionally shut off to minimize panic and prevent the service from being jammed, allowing for only messages from ONEMI, the national department who releases country- wide alerts for disasters, to be broadcast. As previously stated, an evacuation was recommended because of the threat of an oncoming tsunami. The episode lasted hours as aftershocks continued throughout the night and into the coming week; however, my friends, family and I were all unharmed.

www.youtube.com/watch?v=QfktMGpOwhw

The oncoming tsunamis full wrath missed Viña del Mar, its land break was further north in the zone of Coquimbo. Waves were reported exceeding 15 feet, destroying homes and businesses, while washing boats and large amounts of debris inland. The effects of the

(Ivan Alvarado/ Reuters)



earthquake did not stop there. Aftershocks, including a 5.5 magnitude tremor, shook the city dozens of times following the initial event. For a town that heavily reliant on fishing and ports for income, the tsunamis

flooding caused significant damage to not only their buildings but also their daily lives. The Mayor of Coquimbo told Reuters that the ocean reached the downtown area causing entire neighborhoods to be flooded. It was declared an emergency area and federal troops were sent to prevent crimes triggered by panic and desperation after the catastrophe.²⁷ Close to 90,000 residents were without electricity and a tenth of those did not have drinking water. Homes were so damaged from the shaking or flooding that 600 residents could not return to them.²⁷ The extent of destruction and time returning home were very different in the region of Valparaíso and Coquimbo. In light of the disaster, the fear of crime was also higher in Coquimbo, showing how the difference in standards of living and socioeconomic status can have an effect on how costly and/or dangerous a natural disaster can be.

X. Pucon

www.youtube.com/watch?v=BxIwCuERmWU

Travelling further South, you enter the region of Araucanía. Eight volcanoes call this region home, some boasting as many as 60 eruptions since the 20th century.²⁸ Within that region lies the



quaint city of Pucon. The main volcano of Pucon, Volcan Villarrica, provides a gorgeous yet haunting backdrop to the city. A large stratovolcano that has a population of 667,788 people living within 60 miles of it, and almost 500 people living as close as 3 miles.¹⁹ That distance might sound adequate, but lava and pyroclastic flow are not the only concerns that come with a volcanic eruption. I had the opportunity to interview Gonzalo, the owner of La Maga, a well-known restaurant in Pucon. According to him, the day

after the recent eruption of Volcan Calbuco, which is about 200 away, the sun did not appear the entire day. He described the sky as black, as if there had been a solar eclipse (Interview, June 2016). The blackened sky comes from the large clouds made of ash and sulfur that suffocate the region after an explosion.

The latest eruptions in southern Chile occurred within a month of each other. Volcan Villarrica in March of 2015 and Volcan Calbuco in April of the same year, both having a tremendous effect on Pucon and other cities in the region. The eruption of Villarrica prompted a red alarm alert and the evacuation of close to 4000 people. The volcano erupted 3000 feet in the air and put the entire town at risk of ash clouds, floods due to large amounts of melted snow that had settled on top of the volcano over the course of winter, and other potential dangers caused by an eruption of this intensity.²⁹



It earned a 4 on the VEI scale.¹⁹ The eruptions from Calbuco, although not in Pucon, were also notable due to the evacuations and economic panic. CNN reported that residents were chaotically trying to pull money out from ATM's and rescuing salmon because it is an important export of the area and would cause harm to the local businesses.³⁰



Pucon, which clearly was established after the creation of the volcano, is well versed in the monitoring of the volcano and keeping its residents aware of any changes in volcanic activity. The city streets are populated with large signs put up by the municipality of Pucon providing information for evacuation routes and a “stoplight” for the alert of the day. Green represents a calm situation, yellow is a warning situation and red is an alarm situation, in which case a siren will sound. However, the alarm may also be the loud and vibrant eruption of the volcano itself.

The government also offers an extensive plan, available to the public on their website, for the process of managing a volcanic emergency.³¹

The city of Pucon's entire economy runs off tourism. There is only one university in the city and it is the Euro-Chilean institute of tourism. The town's main streets are lined with private, small tourism companies offering visitors numerous options and generating significant competition among the businesses. The restaurants thrive during



summer tourism peaks and oftentimes close or change hours during the winter. For thrill-seeking tourists, one of the most popular draws to Pucon is the ascent of Volcan Villarrica. A full day excursion includes enough gear to make any person look like a trained professional, an actual trained professional, and transportation to and from the volcano. It is not a cheap nor relaxing way to spend a day in Pucon, but it offers a once in a life time experience that is often too enticing for an adventurous outsider to pass up. However, the rules of hiking to the crater of an extremely active volcano are specific and strict. Weather is closely monitored and on days that do not call for complete sunshine and very low wind speeds, ascent is prohibited. The volcano is also monitored for activity, and any changes that may shift the “stoplight” from green to yellow would call for immediate cancellation of any scheduled hikes. If climbers are already on the volcano, the guides will be alerted by radio to turn around and descend straightaway.

These scenarios have one thing in common: the loss of profit for the tour company. However, the worst-case scenario for the tourism companies that operate in this region is not one day closures, but an entire season. After the eruption of March 2015, Volcan Villarrica was closed to all tourism until November. This meant the businesses that depend on the volcano to make a living were not able to do so for most of 2015. Gonzalo noted that in the months of May-



September nobody came. “It was a lost year in terms of tourism, we still worked either way but the only clients we had were clients from nearby towns. We had to adjust our seatbelts to survive, but there were many that didn’t” (Interview, June 2016).

XI. Government Involvement

The government of Chile is no stranger to the news that natural disasters affect their economy, along with many other aspects of their country. So, in March of 1974, they created La Oficina Nacional de Emergencia del Ministerio del Interior (ONEMI).³² A ministry that is part of a larger office called El



Sistema Nacional de Protección Civil. They oversee the making and execution of preparation, prevention, response and alerting of the country before disasters and catastrophes both natural and man-made. This is what they call cycle of managing risk; however, they do not handle the entire cycle. ONEMI is not responsible for monitoring the seismic activity in the area, but rather use the information given to them by other institutions who specialize in the geological and scientific side of natural disasters. They are also not the ones to coordinate the reconstruction post- disaster, that is another sector Ministerio de Obras Publicas. This information was all provided directly to me during an interview conducted with Christian Cruz, who works for ONEMI (interview, June 2016).

One of the most important documents ONEMI and the country of Chile refers to in times of disasters is the “Decreto 156 Plan Nacional de Proteccion Civil”. The online document is 55 pages long and offers an in-depth explanatory plan for every step of the risk management cycle. Its opening statement says, “the experience of immediate impact, whether in human or material losses, has developed in Chileans the ability to overcome the innumerable destructive events that have affected the nation throughout its history”.³³ In other words, the Chilean government



recognizes that the citizens of their nation are well versed in catastrophes and their ability to continue thriving as a country and as a people allows the government to continue to improve where they can. There are individual manuals for each type of natural disaster including earthquakes, tsunamis, and volcanoes, as well as plans for preparation and evacuation for most areas.

The decree has a small section on the economics of the national civil protection plan. It states that the cost of execution of the plan will be borne by each municipality and each ministry, service or organization shall use its own resources. Although, their resources may be increased depending on the circumstance (pg 21-22)³³. Nevertheless, this makes a strong point supporting the claim that residents and business owners in regions with less government funding and services do not have the access to the resources for preparation and prevention that those in wealthier areas do. Also, the more remote and further away the affected zone is from main cities, the harder it is for national troops and resources to reach the emergency area.

XII. Nonprofit

The government is not the only way a country gets back on its feet after a disaster. In fact, some countries like Haiti whose government does not have nearly the complexity to support its citizens after a natural disaster, rely almost completely on volunteer efforts and donations.

The Red Cross is a well-known organization that operates around the world during times of need. After the large earthquake in 2010, a team from American Red Cross went to Chile to

work side by side the Chileans giving them the opportunity to learn from their methods. One of the main challenges they found is the ability to communicate with and mobilize large amounts of volunteers on the frontline which is necessary to make an impact. This leadership was essential to maximize the efforts of the volunteers.³⁴

Valpo Surf Project, a nonprofit organization in Valparaíso that teaches children English through surfing and mentoring, aims to educate and inspire underprivileged youth of the area. Surf equipment is supplied by surf shops across the coast of Chile, some of which were damaged in the tsunami in 2015. In a blog post on their site Valpo Surf Project states “although our staff, students and volunteers are safe, we find ourselves affected by the damage caused by tsunami waves to the beach where we surf every week”³⁵ In addition, one surf school Escuela de Surf Chile Extremo was affected when changing areas and other supplies were damaged. Claudio, a local member of the organization, spoke on the subject saying their belief is that “the people with less resources often have no place to go when these things happen. They cannot afford to replace or rebuild the way those with more financial stability” (Interview, June 2016). After the event in 2015, staff at Valpo Surf Project called their students and families to see how they could help. Although their services cater to a specific group of people, they still contribute to the whole community. When a natural disaster affects supplies and a location, it is difficult to raise funds to replace donations. Beach closures, due to poor conditions, also negatively affects their mission and the lives of the children they have set out to help.

Another NGO that is popular in Chile is TECHO. Techo means roof in Spanish, and it is an organization that builds homes for the underprivileged. In 2010, TECHO built 20,000 dwellings after the earthquake hit.³⁶ However, following the earthquake and tsunami in 2015, the organization announced that it would not be assisting in the rehabilitation and reconstruction

process. It listed several reasons in an announcement on their website; they state that the government was not allowing their institution to work alongside the administration. They also state that TECHO was not being considered to assist in the construction of the homes and more than a week after the catastrophe, there was still no mention of constructing or delivering housing to those in need. In other words, a volunteer and donation based solution to the issue of mass homelessness after a natural disaster, was pushed aside by the government.³⁷ Although this is a one- sided claim, it does highlight the necessity of communication and reaction in the rehabilitation stage, which often does not favor those less fortunate. Because areas of poverty do not receive the immediate response that affluent regions do, it is important that organizations like TECHO are kept in the conversation.

XIII. Chile vs.

USA

Although it has the bragging rights to some of the largest earthquakes on record and numerous volcanic eruptions, Chile is not the only country who has suffered great economic setbacks due to mother nature's fury. The west coast of the United States is also home to many faults which have caused seismic activity and damage in the past. The San Andreas fault is one of the more notorious ones, especially after the events of the San Francisco earthquake of 1906.³⁸ The American Red Cross went to Chile in 2010 because "similarities in building codes, socioeconomic conditions, and broad extent of the strong shaking make the Chilean earthquake a very close analog to the impact of future great earthquakes on California".³⁴ Further north,

Washington state is home to the Cascade mountain range, consisting of five key volcanoes including Mount St. Helens, whose eruption in 1980 is well-remembered by many.

The Federal Emergency Management Agency (FEMA) is responsible for providing funds and training to prepare states for an emergency as well as support disaster recovery, rebuilding and relief efforts across the country. Something I noticed while researching the differences between the USA's government sector for natural disaster with the Chilean site, is that ONEMI is more user friendly and welcomes citizens to browse the page for tips on how to stay prepared, etc. In contrast, the official site for FEMA is difficult to navigate and hard to interpret by the average American. The law requires FEMA to post a budget report every 5th day of the month making their spending readily available to the public eye although the legal language and accounting terms used are so complex it is beyond the understanding of the average person.. I browsed through a couple reports from 2015, many stating higher spending due to Hurricane Sandy. In February 2017's report, an asterisk marked the bottom of the page stating “*Current end-of-year projected balance in the Major Declarations is showing a deficit, which FEMA continues to monitor. If warranted, FEMA will take steps to reprogram DRF funds from the base to the majors to cover obligations”.³⁹ The problem with this statement is if projections already show a lack of funding to cover a potential natural disaster, what happens if it strikes in November and all the money allocated for this event has already been spent? The U.S. will be in a very bad economic position. Two months later, the message is still there, with no change to the end of fiscal year balance.

ECUADOR

<https://www.youtube.com/watch?v=MOOUzclELzA>

In April 2016, Ecuador too was sent into a panic when a 7.8 magnitude earthquake hit the coast. Due to its proximity to Chile and recent occurrence, I considered it relevant to the research I conducted for this project and decided to include Ecuador to have a comparison on a larger scale. It provides contrast between nations and not just within Chile. A friend of mine, Andre, is from Manta, one of the central regions the earthquake hit. He gave me first-hand accounts of both the social and economic affects the disaster had on Ecuador. His description was similar to what I had experienced the year before; however, the terror lasted much longer. With more than 500 deaths and thousands more injured, the president declared a state of emergency. The main difference between the countries was the aftermath. The houses and businesses lost were innumerable, the entire business district in Manta was destroyed. The very businesses that brought the healthy economic flow to the area were those that were ruined and much of it has not been rebuilt still. Other than large international hotel and business chains, no one had insurance. This resulted in people sleeping on the streets or in shelters for months (Interview, January 2017).

In terms of government involvement, five main economic measurements were established. The president put into effect a tax rise from 12% to 14% to cover costs of the earthquake. Furthermore, people that earn more than \$1,000 US a month were required to pay a full days salary and those who earn more than \$2,000 had to pay two days worth, etc. The damages were estimated to be \$3 billion U.S. It should be noted that the measurements taken were not a solution to the economic problems the country was already facing, but rather a way to not exacerbate the issues they already experienced before the earthquake occurred.⁴⁰ In addition to the required salary taxations, the recovery aid received was mostly from charitable

organizations and private businesses that were not affected or had the funds to help. Humanitarian aid brought in 18 tanks and 60 trucks to Manta with food, bottled water and water pumps, blankets, clothing, and 3 trucks dedicated to coffins.⁴¹ Armed forces arrived to assist in the aid and recovery of the towns. Foreign aid was a large part of the recovery effort in terms of money, supplies or manpower. The government constructed a new commercial shopping district to encourage owners to move their businesses and get back on their feet.



However, like expected, there was controversy regarding what areas and groups received the most rehabilitation funds. Resource distribution was controversial and overall slow to respond.

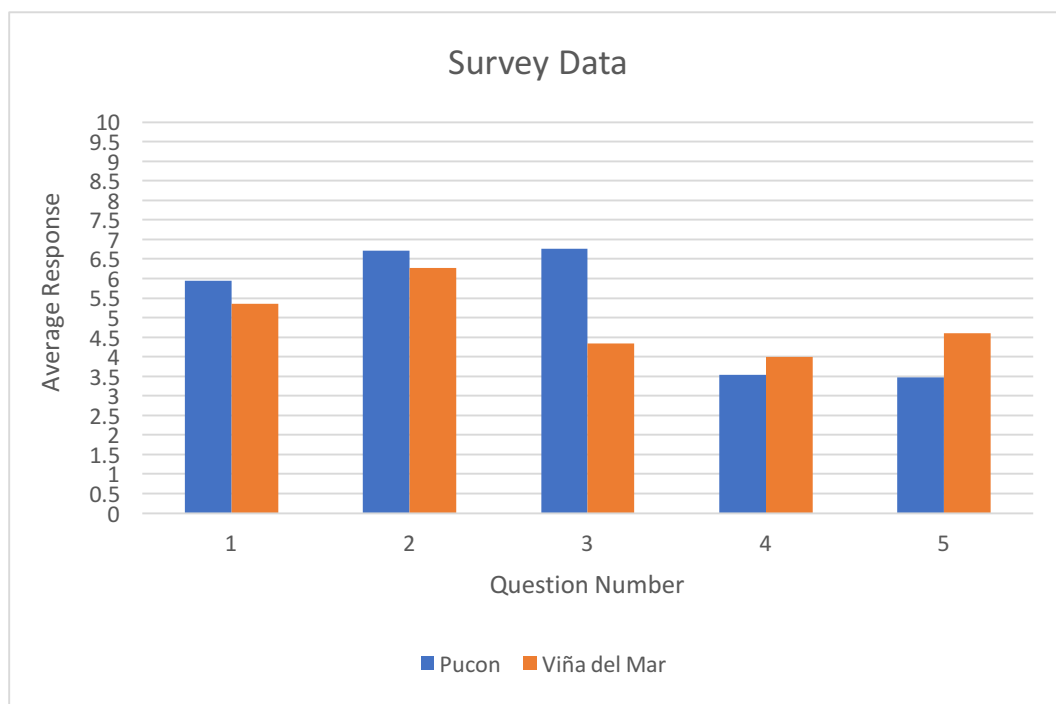
There are several differences between the earthquake in Chile and the one in Ecuador, which occurred within 7 months of one another. The first is the GDP of the two countries pre-earthquake. Ecuador's is less than half of what Chile's was at the time and it does not qualify as a high-income economy. Ecuador's GDP ppp is only \$185 billion while the GDP per capita is \$6,205.⁴² Another factor is preparation. Chile is a country all too familiar with the damage that earthquakes can cause their economy, therefore, they have learned to take precautions. Two months prior to the event, Ecuador, dispersed its "rainy-day funds" due to economic distress. This meant that the back-up money being saved for a disaster was already used for other purposes and therefore unavailable during this catastrophe. Studies show that Ecuador prefers reactive efforts rather than preventative ones, which was proven once again in 2016.⁴³ Also, they lack a government sector dedicated to disasters. Instead, they have boards that are part of the

Ministry of Public Works that specialize in El Niño, which excludes other natural disasters, such as earthquakes.⁴³ These factors alone can make a world of difference in explaining how a disaster that scores lower on a Richter scale can cause a higher level of devastation to a country.

XIV. Analysis of Survey Results

My hypothesis that prosperity affects the outcome of a natural disaster in Chile was supported by the results of the survey. Businesses in Pucon were more reluctant to start a business, had to shut down their business more often, and lost revenue at a higher rate than the business in Viña del Mar. However, Viña del Mar scored higher in terms of paying insurance. Viña del Mar averaged 4.6, considerably above Pucon, suggesting that their affluence potentially provides better protection for business from the financial loss incurred during future natural disasters. Pucon had a mean of only 3.4 when asked about insurance rates, which was well below average to pay high rates to protect against natural disasters. They also scored slightly higher for losing potential investments due to the location of their business, averaging a perfect 4 with Pucon slightly lower at a 3.5. This suggests one of two things. Either their proximity to the sea put them at risk for not just one natural disaster, but two, or, the prosperity of the area meant that businesses were qualifying and asking for investments whereas in Pucon, they did not meet the financial qualifications for bank loans in the first place. Both possibilities are personal speculations to explain the slight difference in numbers between the two cities. Further investigations would be required to prove if either is the cause. The survey responses were combined into a chart and then averaged to get an overall value for each city. The results were later combined into a double bar graph (below) that more clearly presents the difference in

average for each region. Because the survey only had a sample size of about 50 participants, it is hard to say if the gap between cities would grow or shrink if we expanded the number of people surveyed. However, I believe the results have generalizability. This means that we can assume the results would be similar when pooling a larger group of people. If anything, I believe a survey of 200 people would show an even larger contrast between the two cities, especially for questions 2 and 3. The questions also would have been measured more accurately if I had used number values rather than a sliding scale. I chose this method to insure privacy and to obtain a greater number of surveys in a short amount of time knowing that it was a more generalized way to measure answers.



The process of turning the English survey I created into the Spanish version I used to conduct the research was tedious. Although I speak Spanish, translating across languages is almost never a word for word process. It is necessary to phrase it in the most straight forward and unbiased way, and a direct translation often does not provide that. Moreover, surveys are

conducted with formal wording, although oftentimes, other interviews and/or interactions with the business owners was often plagued with Chilean slang. Thankfully, I had previously been exposed to this form of speaking; however, translating back to English for the project presentation was also tricky when I was interpreting the closest English comparison to what they meant.

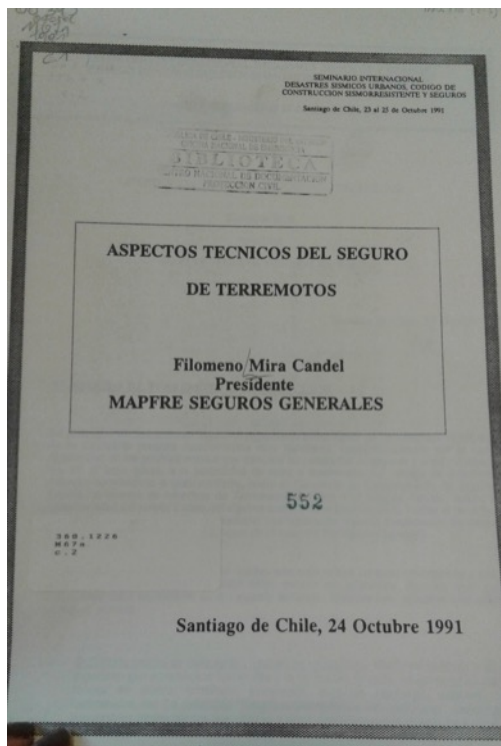
Question number one started off the survey, so I felt it was appropriate to make the question about the startup of their business. A bookstore owner in Pucon scoffed at the question saying, “we are Chileans, if we were afraid to do something because of an earthquake or volcanic eruption, we would never do anything” (Interview, July 2016). I found that answer prevalent. Many people stated that they were aware of the potential damage but it did not impact their desire to start a business because it has always been a part of their life. Others agreed that the fear of losing their business or merchandise because of a natural disaster was very real. The common denominator between all the people I surveyed was that they opened their business anyway, fearful or not. In Viña del Mar, the average response was a 5.36. Meaning that slightly more than half of business owners were hesitant to start a business. In Pucon, the average was 6. In addition, more people answered a 10 in Pucon compared to in Viña del Mar, showing that the residents of that city felt they had on average more risk starting a business because of the potential of a natural disaster affecting it. I predict this had a lot to do with the tourism sector, because a volcano eruption means no skiing or ascents the rest of the season.

Questions number two and three were the most interesting to me; questions that an average person or successful businessman can identify with. The loss of revenue, merchandise, and hours of operation are all threats of a natural disaster striking near their business. Most owners who answered with one, meaning this had never occurred to them personally, noted that they were

either too new of a business or very, very lucky. Others in Viña del Mar stated that their business was located just inland enough that the tsunami evacuation zone did not extend that far back. This limited their chances of being affected by the giant waves that serve as a brutal aftershock of an already damaging earthquake. For both questions 2 and 3, Pucon business owners averaged a 6.7. This demonstrates evidence that businesses already have been affected financially by a natural disaster. In Viña del Mar, they answered an average of 6.2 for question 2, but only a 4.3 for question 3. This shows that in both regions it is common to shut down a business during and after a catastrophe occurs; however, it is more likely for those in Pucon to be financially affected by the closure. A reason could be they did not have the resources to repair and reopen as quickly compared to businesses in Viña del Mar.

The last two questions were ones that would be relevant if asked in the United States. I went to Chile assuming basic things about business: that a privately-owned business has sought investments from private investors or a bank, and that a business whose profits is someone's

livelihood would, of course, have insurance just as a home or car would. I was incorrect. The final two questions I asked, oftentimes, were met with confusion. Even with less consistent findings in this area, it sparked interesting conversations providing me with information that cannot be found in a book or online. Christian from ONEMI noted, “for a private business, the topic is very complex. Very few businesses insure their property because it is not possible to predict the damage” (June 2016). He

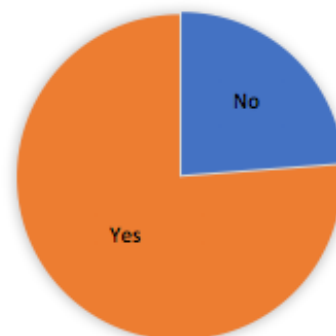


contrasted it with a fire saying “you have your full property value evaluated and how much that loss will be, but with earthquakes you won’t know how much the damage will be, etc”. My opinion is that in a region where earthquakes are so common and there is a risk of losing everything, it would be necessary to insure for the full value of the business just as you would for a fire. Further research showed that Chile has a law that holds building owners liable for any losses resulting from inadequate application of the building code during construction for the first 10 years of a building’s existence (red cross USGS source). This means all proper codes would have to be met and intensive inspections would need to be conducted before insurance would ever consider insuring a building.

XV. Conclusion

Going into this research, I was not sure exactly what I should expect as an American student going into a foreign country. It was difficult to predict how certain owners would respond to a foreign student asking for information about their business. I was received differently by each business owner when I asked them to participate in my study. The majority were generous, welcoming, and willing to help, as the Chilean people tend to be. However, occasionally, an owner or knowledgeable manager was not present, or was unwilling to take the time to answer the questions on the survey. Somedays, I came home with only seven surveys filled out after wandering around for hours. Other

OPEN TO FOLLOW UP INTERVIEW



times, I got lucky. One day, while I was waiting to cross a street, I met a man who was spinning an advertising sign. He struck up a conversation with me and seemed very interested in my project. He said he knew just about every restaurant owner in the span of Avenida Peru, the street bordering the ocean. Without hesitating, he escorted me to ten different privately owned and operated restaurants and proceeded to introduce me to the owners and briefly explain my project. Fortunately, the owners were glad to help. I went home that day with a folder full of surveys and a feeling of acceptance that one may struggle to find alone in a foreign country. It gave me the confidence to step out of my comfort zone. When I traveled south to Pucon, I embodied that feeling and continued to run into the same kindness and “luck” by meeting truly selfless people, who were so eager to help this foreign stranger. The diagram above shows a comparison of owners surveyed who provided contact information and were willing to conduct a follow up interview on the topic of the survey. Although time only permitted for about five in-depth interviews, the connections I made with the Chilean people during this project has opened doors for more research on the topic.

What I was not expecting was how many people were immediately willing to take the time to sit down and have a conversation. The stories were better than I could have imagined and provided a more personal window into an issue that I knew existed, but had never experienced. Only a minority of owners had not encountered a problem and those were the newcomers. It is not that it will not ever happen, just that it has not happened yet.

Catastrophes always cost two things: money and time. They create scarcity, they diminish resources, and they force people to make decisions on how to proceed. My hope was to see not only the macroeconomic effect this century’s earthquakes had on a country having damages costing in the billions, but to also to hear people’s stories to get more personal accounts.

Because, at the end of the day, a country is only as strong as its people and it is the people who are affected during a natural disaster. The personal experiences I had over the past year while conducting this survey greatly influenced my research. This data, along with other research, can provide insight as to the consequences socioeconomic inequality can have on countries prone to natural disasters.

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