LIVING WITH FLOODS: PERSPECTIVES OF MICRO, SMALL, AND MEDIUM ENTERPRISES IN MARIKINA CITY, PHILIPPINES

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Abstract

Micro, small, and medium enterprises (MSMEs) are crucial in facilitating the restoration of the city after a disaster and in strengthening urban resilience. Afterall, they are the primary providers of goods and services, local employment, and revenue to the community. However, MSMEs are greatly at risk when natural hazards strike. Building their resilience, therefore, is vital. The dissertation examines 200 MSMEs located in Marikina City, a Philippine city regularly suffering from inundation.

For the first main chapter, Chapter 3, the objectives were to identify the impacts of flooding focusing both on the direct and indirect consequences of flooding; and determine the factors that affect flood damage using Tobit and Double-Hurdle models. This chapter shows that MSMEs typically suffer from damages because of the physical impact of flooding on the premises and business facilities and content, like inventory and equipment, found in the establishments. However, MSMEs can be physically unscathed but still feel the effects of flooding through its market—its consumers, suppliers, and employees. A decrease in consumer traffic was one of the primary reasons why the enterprise experienced dwindling sales.

To have the ability to recover once they are hit by a calamity and incur damages and losses, MSMEs should know how to protect themselves and reduce their risks. The second main chapter, Chapter 4, addresses the questions on the implementation of disaster risk reduction measures and the role of flood experience, social capital, risk perception, and perceived preparedness on an MSMEs' intention to adopt DRR programs. To analyze the relationship among these variables, the Protection Motivation Theory (PMT) was used as the main framework and assessed primarily through Structural Equation Modeling (SEM). Survey results demonstrate how unprepared enterprises are in protecting themselves against flooding as well as other natural hazards. A large portion of them do not have business continuity plans (BCPs) or insurance. From the SEM, flood experience and perceived preparedness have a positive relationship with willingness to insure and willingness-to-pay for insurance. However, risk perception does not show a statistically significant association. Moreover, obtaining information about flooding and insurance from their social networks can affect MSMEs' willingness to purchase insurance.

The purpose of this dissertation is to emphasize the importance of studying MSMEs in disaster research. Furthermore, it underscores the need for national and local government to craft plans that integrate MSME development and disaster, especially detailing physical and financial support. The study also stresses community-based disaster risk management along with the usual top-down approaches, acknowledging the role of the community and its members including MSMEs.

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To my family,

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Table of Contents

List of Tables

List of Figures

List of Appendices

Chapter 1. Introduction

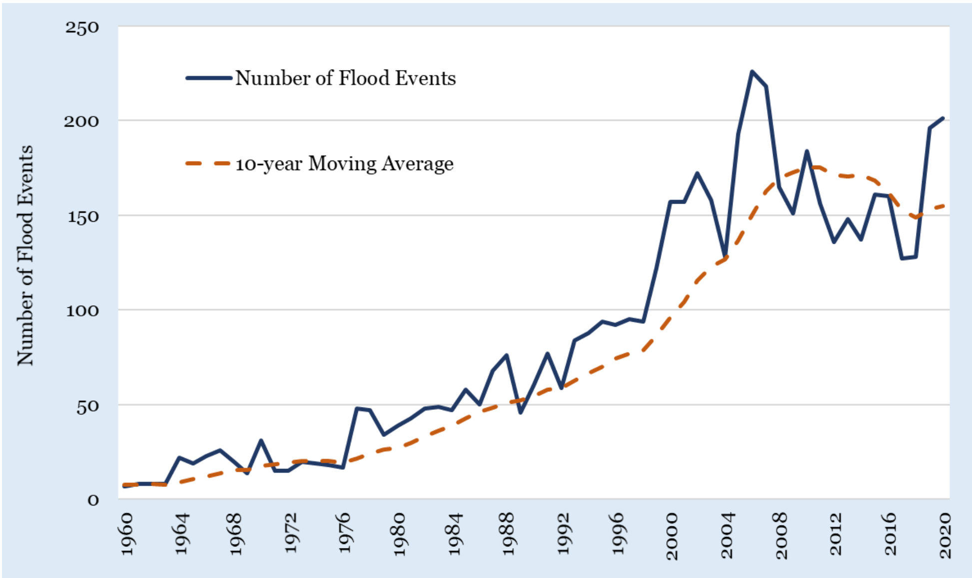
1. Motivation

In the past years, the world has witnessed one extreme weather event after another as nations battle more severe and more frequently occurring typhoons, floods, and droughts. And with the climate changing, these are all expected to wreak further havoc to people, other living things, property, and the economy.

Flood events, which are the most frequently occurring among all the natural hazards recorded based on the Emergency Events Database (EM-DAT)[1], were seen to be increasing over the recent decades, as shown in **Figure 1.1**. Reviewing the top 15 most enormous damages incurred, six were from the last decade. For example, due to two flood events in 2011, Thailand suffered US$40.32 billion worth of losses. China's combined damages for the past decade amounted to US$121.40 billion from 91 flood events, the most devastating of which was in 2016 with US$31.79 billion worth of losses from 12 flood events. India experienced seven flood events in 2014, costing the country US$16.47 billion. The damages and losses in the United States in 2016 were at US$15.15 billion. And in Germany, in one flood event in 2013, the country incurred US$12.9 billion in damages.

[1] For a disaster to be included in the EM-DAT database (www.emdat.be/database), criteria (at least one): reports that ten or more people are killed, 100 or more are affected, state of emergency is declared, call is made for international assistance.

Figure 1.1. Annual Number of Flood Events, Global, 1960-2020



Source: EM-DAT: The Emergency Events Database -Universite Catholique de Louvain (UCL) - CRED, D. Guha-Sapir - www.emdat.be, Brussels, Belgium

The aggregate number of deaths brought about by floods considerably declined over the decades. The damages incurred per decade, meanwhile, are on a rising trend. It indicates that flood risk management mechanisms implemented by various countries seem to be successful in preserving the lives of people. However, the damage to infrastructure, the supply chain, transportation, and markets, and the total number of injured, affected, and homeless remains high. Additionally, total damages reflect only the direct impacts of these flooding events. In contrast, indirect and long-term effects such as the spread of disease, absences in schools, loss of livelihoods, and coping with everyday flooding are not considered due to challenges in quantifying and valuing secondary effects.

Flooding is a serious concern as it devastates the lives and livelihoods of people, especially in the case of low- and middle-income countries. In the Philippines, the entire country is highly vulnerable to climate change and natural hazards like earthquakes, volcanic eruptions, drought, typhoons, storm surges, and flooding, owing to its location along the Pacific Ring of Fire and the typhoon belt. In the Global Climate Risk Index 2021 (Eckstein, Vera, & Schafer, 2021), the country ranked fourth to have suffered from climate-linked disasters for the period 2000-2019. It is considered to be one of the most-disaster-prone countries globally.

Cities are particularly exposed to environmental problems and hazards like flooding, exacerbated further by a changing climate and a lack of proper urban planning and governance (Kahn, 2009). As reported in the United Nation's "The World's Cities in 2016", out of the 1,692 cities with a population greater than 300,000, 56 percent were considered to have high exposure to at least one natural disaster.

Metro Manila cities are prime for flooding—coastal, river, or urban flooding—as it is situated in a semi-alluvial floodplain and surrounded by Manila Bay on the west and Laguna de Bay on the south-east. When heavy rain falls, the rivers and tributaries overflow, thereby inundating the cities. Notable flood events in Metro Manila were in 2009 during Tropical Storm Ondoy and Typhoon Pepeng and the southwest monsoon floods in almost every year of the past decade.

Metro Manila, the Philippines' national capital region, is home to about 13.5 million people as of 2020, or 12.4 percent of the Philippines' total population. It is one of the largest urban agglomerations globally, as it is composed of 16 cities and one municipality. It is the most densely populated region in the country, with a population density of 21,765 people per square kilometer, according to the 2020 Census of Population. Compared to the national level figures at 368 people per square kilometer, the region's population density is 60 times greater. With unabated population growth and urbanization, poor sewage and drainage systems, inferior garbage disposal systems, and ineffective urban planning, flooding will continue to wreak havoc in these cities (Porio, 2011, 2014). For this dissertation, Marikina City, a frequently-flooded city in Metro Manila, was chosen as the study site.

Along with the poor and climate-sensitive sectors, micro, small, and medium enterprises (MSMEs) are also at risk of these events, especially since most belong to the informal sector[2] (Wedawatta & Ingirige, 2012; UNDP, 2013; Ballesteros & Domingo, 2015). Compared to large enterprises, which are more capable of coping with different crises and even see a crisis as an opportunity to grow and innovate, MSMEs find it challenging to access a broad scope of disaster risk management strategies and adaptation measures such as insurance or business continuity plans (BCPs).

According to the Asia-Pacific Economic Cooperation (APEC) (2014), about 67 percent of companies surveyed in 17 APEC economies, large and small, were not knowledgeable about business continuity planning. The numbers increased to 83 percent when looking only at MSMEs. MSMEs cannot widen their supply and demand base, find it challenging to follow norms and regulations set by the national and local government, lack

[2] Following the PSA's definition through Resolution No. 15-Series of 2002, the informal sector "consists of "units"; engaged in the production of goods and services with the primary objective of generating employment and incomes to the persons concerned in order to earn a living. These units typically operate at a low level of organization, with little or no division between labor and capital as factors of production. It consists of household unincorporated enterprises that are market and non-market producers of goods as well as market producers of services. Labor relations, where they exist, are based on casual employment, kinship or personal and social relations rather than formal or contractual arrangements."

employee protection, and struggle to bounce back from disasters, thereby losing long-run competitiveness (UNDP, 2013). Moreover, given the localization of the operations of MSMEs as well as being embedded in local communities, the owners of these enterprises have far more to lose since their personal assets are usually connected with their business assets, thus intensifying their vulnerability (Runyan, 2006; Wedawatta & Ingirige, 2012).

Despite all these constraints, however, MSMEs are more flexible in their operations and can help reestablish the social and economic fabrics of the local economy after disasters, especially if they have support, whether that be from its social networks, the government, and/or non-government organizations (Runyan, 2006; UNDP, 2013; Francisco, Lau, & Mendoza, 2014). The study, therefore, focused on MSMEs as the unit of analysis.

Because of scarcity of data on MSMEs, an interview-assisted survey of 200 MSMEs in Marikina City was conducted. It contained information on the characteristics of respondent and the enterprise; the effects of flooding on the enterprise's suppliers, consumers, workers, income, property, and content; the DRR measures implemented by the MSME to prepare, reduce, and manage the impacts of flooding; the challenges in adopting these measures; risk perception and perceived level of preparedness; willingness-to-pay for insurance; and the enterprise's social networks like family, relatives, neighbors, and community organizations.

2. Summary of Findings

Building the resilience, the ability to adapt and recover rapidly, of MSMEs is crucial. The first step is to identify and examine the impacts of natural disasters and assess the sources of risks faced by MSMEs. One of the aims of the first main chapter of this dissertation, Chapter 3, was to identify the direct damages and losses and the indirect consequences of flooding, such as reduced enterprise performance after a flood. Another objective was to determine the relationship between direct/indirect flood damage and factors such as flood exposure and disaster risk reduction (DRR) measures using Tobit and Double-Hurdle models.

Based on the results in Chapter 3, MSMEs typically suffer from damages because of the physical impact of flooding on the premises and business facilities and content, like inventory and equipment, found in the establishments. The five-year flood hazard map, representing the location, elevation, and distance from the Marikina River, was also a significant factor, specifically the medium flood hazard, on inventory and equipment damage and high flood hazard on building damage. However, MSMEs can be physically unscathed but still feel the effects of the disaster through its market—its consumers, suppliers, and employees. For the chapter, a decrease in the number of consumers was one of the primary reasons why the enterprise experienced dwindling sales.

To be able to recover once they are hit by a calamity and incur damages and losses, MSMEs should know how to protect themselves and reduce their risks. Chapter 4, therefore, addresses the questions on implementation of DRR measures and the role of flood experience, social capital, risk perception, and perceived preparedness on an MSMEs' intention to adopt DRR programs. To analyze the relationship among these variables, the Protection Motivation Theory (PMT) was used as the main framework and assessed primarily through Structural Equation Modeling (SEM).

Survey results demonstrate how unprepared enterprises are in protecting themselves against flooding as well as other natural hazards. A large portion of them do not have BCPs or insurance plans. From the SEM, flood experience and perceived preparedness have a positive relationship with willingness to insure and willingness-to-pay for insurance. However, risk perception does not show a statistically significant association. Social capital variables like if the MSME obtained information about flooding and insurance from their social networks have more inclination to purchase insurance or choose a higher amount that they are willing to pay.

3. Contributions

The dissertation presents several contributions to disaster risk research. One is providing a map of MSMEs in Marikina City integrated with the available hazards maps to illustrate the risks they are exposed to. It also provides additional information on the general profile of MSMEs in Marikina City and a snapshot on who operates these enterprises, their flood experiences, and their responses before, during, and after flooding, and behavior. Although there have been surveys done on MSMEs before, most of them are conducted on a national level, as rapid assessments, and can only be analyzed through a qualitative lens.

Apart from economic factors, this study offers more insight to MSMEs' perception of risk and preparedness, and the influence of the people and the organizations surrounding the enterprise and their role in the MSMEs' DRR behavior. This is a necessity since research on the social-psychological perspective that a disaster preparedness behavior of MSMEs can be explained is limited in the Philippines.

Furthermore, adaptation and disaster risk management studies generally highlight the number of people and households affected, the climate-sensitive sectors, the large enterprises, or the entire region or the nation. MSMEs, which are essential components in local employment and development and important in building community resilience, are often overlooked. Most research are also concerned with the impact of extreme weather events but not on the more frequently occurring flood events.

By identifying and quantifying these factors, the study endeavors to present policy makers to craft DRR policies and technology that can be more readily adopted by MSMEs. The study will provide Marikina City information and examination on who are the vulnerable enterprises. It will also enable the government to analyze how they can communicate better, more quickly, and efficiently and offer possible solutions so that MSMEs are more equipped to assist in strengthening the resiliency of their own community.

4. Limitations

There are, however, some methodological limitations in this dissertation that should be acknowledged. One is that the answers of respondents are subjective and direct verification of damages and losses was not feasible. Moreover, because of the cross-sectional nature of the data, the small sample size, and the absence of experiments, addressing simultaneity and omitted variable bias prove to be challenging. As such, deducing causality was tricky. In Chapter 3, the framework overlooks the cyclical path of flood damage analysis.

Specifically, that flood damage impacts can affect the adoption of disaster preparedness and risk reduction measures. For Chapter 4, omitted variable bias was a main issue and that the PMT framework has potential feedback loops between flood experience, risk perception, perceived preparedness, and intention. However, the survey questions were crafted to, at least, minimize the endogeneity issues and existing literature can provide more insights in establishing the relationships.

5. Organization of the Dissertation

This dissertation is as organized as follows: Chapter 2 discussed what defines MSMEs, its profile in the Philippines, and Marikina City as the study site. Chapter 3 examined the direct and indirect impacts of flooding on MSMEs and the factors that can alleviate or worsen these effects. Chapter 4 reviewed MSMEs' intention to pursue DRR measures and assessed its relationship with flood experience, social capital, risk perception, and perceived preparedness. Lastly, Chapter 5 offered the concluding statements, current policies related to MSMEs and DRR, and possible policy recommendations.

Chapter 2. Vulnerability: A Review of the Relationship Between Micro, Small, and Medium Enterprises and Disasters

1. Introduction

In presenting this section, the study begins by looking at the definition and characteristics of MSMEs. Following this are the risks confronted by enterprises, their exposure to hazards, and resilience in the face of various disasters. The chapter then examines the impact of typhoons and floods based on available literature and government and international reports. It also reviews the risk reduction and management measures implemented by the enterprises and the hurdles that prevent them from pursuing these mechanisms despite the potential benefits and protection they provide against disasters. Finally, the chapter presents a profile of MSMEs in the Philippines, how they are situated in the whole Philippine economy context, discussed the conditions of these MSMEs in relation to disasters, and why Marikina City was chosen as the site study.

2. Definition: Micro, Small, and Medium Enterprises

There is no universal definition of MSMEs since different countries employ various measurements, including employment, yearly turnover, working capital, or investment size. For some countries, their only basis is the number of employees while others consider the financial factors. For the International Finance Corporation (IFC) and the World Bank, they utilize three indicators and define MSMEs as registered businesses that employ less than 300 personnel and have a total annual sales and/or total assets of US$15 million or less **(Table 2.1.)**

Table 2.1 Definition of Micro, Small, and Medium Enterprises

	By Asset Size in US$	By Number of Employees	By Total Annual Sales in US$
Micro	Up to 100,000	1-9	Up to 100,000
Small	100,000-3 million	10-49	100,000-3 million
Medium	3 million-15 million	50-299	3 million-15 million

Source: International Finance Corporation

MSMEs are recognized to be one of the cornerstones of a community's overall well-being, livelihood, and development. They contribute heavily to the growth of the local economy and provide jobs that directly support community networks and enhance community resiliency—a community's capacity to cope and manage various stressors (Aldrich, 2012). This means they usually have a stronger relationship with their host communities than large enterprises. Additionally, they are more likely to hire workers considered to be "less employable" or individuals with low educational attainment, inadequate social protection, and are members of a vulnerable population (Samantha, 2018). MSMEs also offer goods and services that sustain a community, foster business skills, and even alleviate poverty and reduce inequality (UNDP, 2013). For developing countries, MSMEs are considered the pillars of the economy and will likely play a more significant role in the future.

3. Impacts of Disasters on MSMEs

MSMEs are greatly at risk when disasters strike since most belong to the informal sector[3] (Wedawatta & Ingirige, 2012; UNDP, 2013; Ballesteros & Domingo, 2015).

[3] Following the Philippine Statistics Authority's definition through Resolution No. 15-Series of 2002, the informal sector "consists of "units"; engaged in the production of goods and services with the primary objective of generating employment and incomes to the persons concerned in order to earn a living. These units typically operate at a low level of organization, with little or no division between labor and capital as factors of production. It consists of household unincorporated enterprises that

Compared to large enterprises, which can cope better with different crises and even see crises as opportunities to grow and innovate, MSMEs find it challenging to access a broad scope of disaster risk management strategies and adaptation measures such as insurance or business continuity plans (BCPs). As a result, they are unable to widen their supply and demand base, find it challenging to follow norms and regulations set by the national and local government, lack employee protection, and struggle to bounce back from disasters, thereby losing long-run competitiveness (UNDP, 2013).

Moreover, given the localization of the operations of MSMEs as well as being embedded in local communities, the owners of MSMEs have far more to lose since their household assets are usually connected with their business assets, thereby intensifying their vulnerability (Runyan, 2006; Wedawatta & Ingirige, 2012). Environmental and disaster risk events can damage and disrupt the supply chain networks in which many MSMEs are embedded. They can destroy SME assets, premises, and inventories, disrupt their operations, increase their production costs, and reduce their revenues and long-term growth potentials (Asgary, Anjum, & Azimi, 2012).

Samantha (2018) neatly summarized the vulnerability of SMEs to disasters by examining the effects of flooding on SMEs in Sri Lanka. The primary result of the study showed that there were four areas wherein SMEs were at risk: capital, labor, logistic, and markets (see also Ballesteros & Domingo, 2015). The costs of repairing damages and replacing losses exceeded revenues gained previously; employees could not travel to work

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are market and non-market producers of goods as well as market producers of services. Labor relations, where they exist, are based on casual employment, kinship or personal and social relations rather than formal or contractual arrangements."

because they were victims as well; destroyed infrastructure meant supplies and products went undelivered; and demand for basic goods suddenly rose while those of non-essentials went down (Samantha, 2018). This was similar to the case of the 2010 flooding in Pakistan. Aside from the lack of awareness as the businesses were unaware they were located in a flood-prone area, inadequate financial resources, loss of sales owing to the inaccessibility of business facilities and damage to inventory products, and supply chain disruption pushed some establishments surveyed to bankruptcy and eventual closure (Asgary et al., 2012).

In a commentary article for Nature, Lavermann (2014) asserted that impacts of calamities and disasters transcend boundaries—that because of trade and networks, climate hazards, which affect a specific area, also bring about destructive effects on other economies. As such, the government and the private sector should ensure that the supply chain and networks are climate-smart and adapt to these new conditions (Levermann, 2014). The author cited a few extreme weather events to illustrate his point. From 2010 to 2011, heavy rainfall and Cyclone Yasi immobilized coal mining in Queensland, Australia, prompting a 25-percent rise in coking coal prices a year later. In 2011, Thailand suffered from severe flooding during its monsoon season with damages worth US$46 billion—indirect impacts not included—which, according to the World Bank, was considered as the fourth costliest disaster during that period. This devastated and paralyzed the automobile and the electronic manufacturing industry, primarily Japanese-owned companies but based in Thailand, thus causing a deficit in the global supply of hard disks (Levermann, 2014).

Examing the Great East Japan Earthquake, Carvalho, Nirei, Saito, and Tahbaz-Salehi (2017) assessed how its impact spread and magnified through the production and supply chain, distressing both direct and indirect suppliers and consumers of firms hit by the earthquake. The spread of the disaster over input-output networks caused a 1.2-percentage point reduction in the gross output of Japan a year after the disaster (Carvalho et al., 2017). For SMEs, almost all the firms surveyed by the Asian Disaster Reduction Center had to file for bankruptcy as production and supply chains were disrupted during that time (Asia-Pacific Economic Cooperation, 2014)**.** However, despite the decline in supplies and unavailability of products lasting for more than six months following the earthquake, Cavallo, Cavallo, and Rigobon (2014) found that prices remained relatively stable since no significant erratic price movements were seen even for goods that easily ran out. The same scenario was ascertained for the 2010 earthquake in Chile (Cavallo et al., 2014).

In the United States, Barrot and Sauvagnat (2016) looked at idiosyncratic shocks brought about by natural disasters and their impacts on production networks in the country. Their study showed that when suppliers suffer from a natural disaster, the businesses purchasing from them incur a 2-3 percentage point reduction in sales growth. For small business owners, the effects of extreme weather events can last for about four years (Davlasheridze & Geylani, 2017).

4. Coping and Disaster Risk Reduction and Management Mechanisms of MSMEs

Despite their vulnerability and all the constraints they face, MSMEs are more flexible in their operations and can help reestablish the social and economic fabrics of the local economy after disasters. This is especially true if they have support, whether from its social networks, government, and non-government organizations (Runyan, 2006; UNDP, 2013; Francisco et al., 2014). Without consumers, businesses will find it difficult to open again, but without enterprises functioning normally, people may not return to the neighborhood (Davlasheridze & Geylani, 2017). Unfortunately, in general, MSMEs have inadequate protection measures against disasters (Asgary, Ozdemir, & Özyürek, 2020), thereby undermining their resilience.

Runyan (2006) argued that insurance is the main component to recovery in the United States. The businesses that invested in insurance could immediately purchase and replace destroyed assets after being devastated by Hurricane Katrina compared to enterprises without insurance. The lack of business record copies hampered recovery since the documents were necessary to tap into financial assistance from the federal government. However, the author qualified that insurance as a key to recovery applies primarily in the context of the United States. The situation in developing countries is another matter. For Davlasheridze and Geylani (2017), the crucial element for continued survival in the United States was the subsidized small business administration (SBA) disaster loans. Repeated exposure to disasters was also an important factor, like in the case of businesses located on the coast, since experience can drive enterprises to adapt (Davlasheridze & Geylani, 2017)

Following the December 2004 tsunami, De Mel, McKenzie, and Woodruff (2012) found that due to a lack of access to capital and insurance, affected microenterprises in Sri Lanka, especially the retail sector, found it difficult to recover from the disaster. Most businesses, even the larger enterprises, reported that they do not have existing insurance coverage for their assets. But those that received the randomly allocated cash grants provided by the authors recovered two years quicker than firms that could not collect grants. In the context of the same disaster, one of the sectors significantly damaged in Phang Nga in Southern Thailand were tourism-related enterprises and small-scale fisheries (Shaw, 2015). The authors learned that what allowed the Thai businesses to recover included diversifying their livelihood and assistance from their social networks, not simply on government or international donor support (De Mel et al., 2012).

For Pakistan, small enterprises are generally unprepared for disasters since risk mitigation and preparedness practices like BCPs were not in place (Asgary et al., 2012). Nevertheless, most of the businesses were able to resume their operations even without institutional or government aid, similar to the case of Thailand.

In an Asia-Pacific Economic Cooperation (APEC) (2014) study, about 67 percent of companies surveyed in 17 APEC economies, large and small, were not knowledgeable about BCPs. Looking only at MSMEs, the numbers increased to 83 percent. A United Nations Industrial Development Organization (UNIDO, 2020) rapid survey reported that enterprises with no BCP were not knowledgeable about the plans, believed that they are useless, or cannot create one. For those that have BCPs, some respondents stated that their BCPs were not updated or were just crafting ones to fulfill requirements, thereby rendering them ineffective.

5. The Philippine MSME Sector

5.1. MSME Definition and Profile

Businesses are operationally defined in the Philippines in two ways: one is based on the number of employees—the criteria utilized by the Philippine Statistics Authority (PSA), and the other is based on the size of assets as assigned by the Magna Carta for Micro, Small, and Medium Enterprises. However, the informal sector is excluded in the count, thereby underestimating the sector. **Table 2.2** shows the detailed definition of MSMEs and large enterprises. Since the categorization by employment is not consistent with the IFC and the World Bank, the Philippine definition was applied for this study.

Table 2.2. Definition of Micro, Small, and Medium Enterprises in the Philippines

	By Asset Size in PhP* (in US$[4])	By Number of Employees**
Micro	Up to 3 million (up to 60,000)	1-9
Small	3-15 million (60,000-300,000)	10-99
Medium	15-100 million (300,000-2 million)	100-199
Large	More than 100 million (more than 2 million)	More than 200

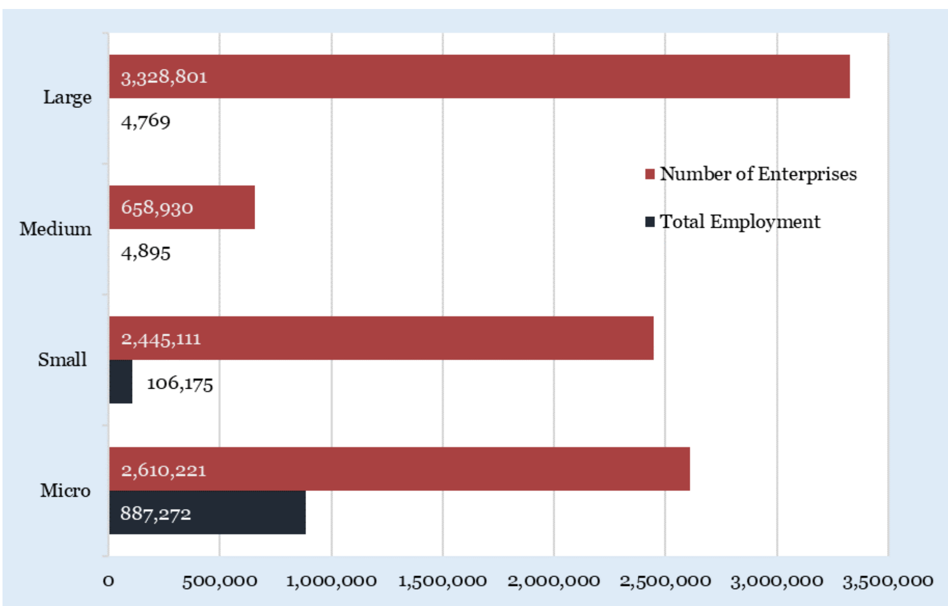
Sources: *Magna Carta for MSMEs, **Philippine Statistics Authority

As of 2018, there were more than a million enterprises operating in the country with MSMEs accounting for 99.8 percent of total establishments (Philippine Statistics Authority, 2020). Microenterprises made up 88.7 percent (or 887,272) of the total, 10.6 percent were small enterprises, and 0.5 percent were medium enterprises. This illustrated how vastly dominated the economy is by microenterprises in number, as shown in **Figure 2.1.**

[4] US$ figures based on a US$1:PhP50 exchange rate.

However, a better measure of contribution would be employment and value-added. According to the PSA, MSMEs provide 64.7 percent of the total employment in the country, equivalent to 5.71 million jobs. Microenterprises accounted for 29.6 percent of the total with 2.61 million jobs, small enterprises provided 2.45 million or 27.7 percent, while medium enterprises contributed 7.5 percent or 658,930 jobs to total employment. When looking at the proportions, the small and medium enterprises significantly exceeded the contributions of microenterprises in the employment sector. Microenterprises delivered around three jobs per business. In comparison, the small and medium enterprises provided an average of 23 and 137 jobs per business, respectively.

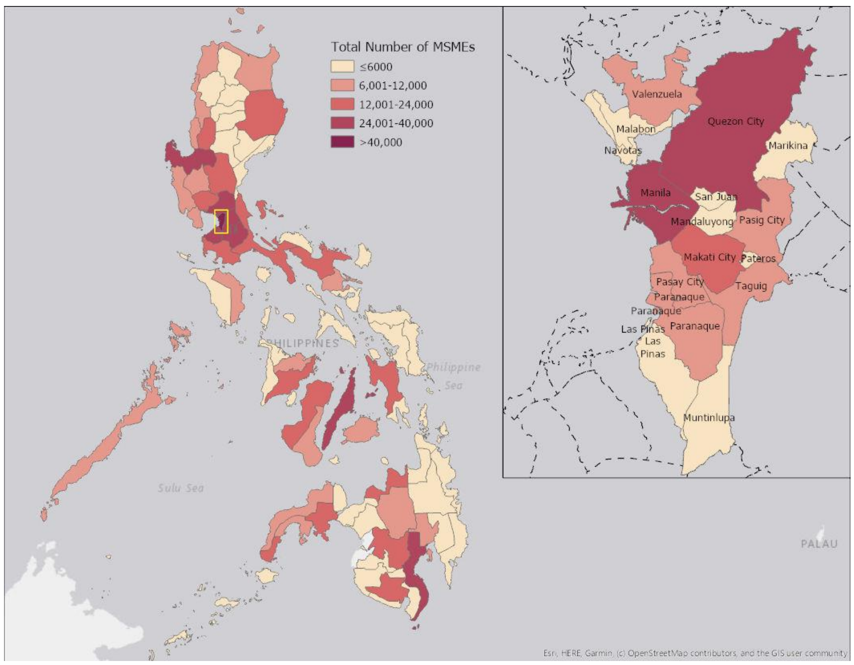
Figure 2.1. Enterprise Type per Number of Enterprises and Total Employment, 2018



Source: 2018 List of Establishments, Philippine Statistics Authority

Although there is available data on value-added, the latest published figures were from 2006 (Philippine Statistics Authority, 2020). MSMEs accounted for 35.7 percent of the national value-added—with small enterprises contributing the largest share at 20.5 percent, followed by medium enterprises at 10.3 percent, and microenterprises at 4.9 percent of total value-added. These figures indicate that despite the existence of nine microenterprises out of ten businesses in the Philippines, their total contribution to national value-added was less than 0.05 percent. However, as mentioned earlier, the information on value-added is more than a decade old and would need updating to measure a more accurate share to value-added.

Figure 2.2. Total Number of MSMEs per Province and Metro Manila Cities, 2018



Source: 2018 List of Establishments, Philippine Statistics Authority

From the geographical breakdown of the enterprises, the highest number of MSMEs were found to be operating in Metro Manila **(Figure 2.2)**. Specifically, there were 154,405 microenterprises, 29,866 small, and 1,647 medium enterprises in Metro Manila, employing 1.4 million workers or around 29.6 percent of total MSME employment in the Philippines**.**

In terms of industry distribution, four sectors account for about 78 percent of the total number of MSMEs in the Philippines. Specifically, the wholesale and retail trade, repair and maintenance of motor vehicles and motorcycles industries with a total of 420,638 MSMEs and employing 1.73 million people or an average of four jobs per MSME; the accommodation and food service activities with 119,718 establishments and providing 664,596 jobs (six jobs per MSME); the manufacturing sector with 115,748 MSMEs and taking on 760,416 employees (seven jobs per MSME); and other service activities sector with 56,566 MSMEs and employing 183,405 workers (three jobs per MSME).

5.2. Exposure and Resilience

In September and October 2009, the Philippines was consecutively devastated by two powerful storms, Tropical Storm Ondoy and Typhoon Pepeng (international names are Ketsana and Parma, respectively), affecting more than 9.4 million people, killing almost a thousand, and injuring more than 700 people. The massive rainfall brought about by Ondoy in the last week of September 2009 overwhelmed Metro Manila's already weak drainage system, resulting in dangerous flooding in Metro Manila and the nearby regions of Central and Southern Luzon. The floods affected 993,227 households, or about 4.9 million people, with 464 deaths, 529 injuries, and damaging 185,004 houses—30,082 were categorized as destroyed (NDRRMC, 2009). Only a few days later, Pepeng brought down heavy rains in Central and Northern Luzon, further exacerbating the flooded cities and municipalities in those areas. The affected population from Pepeng totaled 954,087 families or 4.5 million people in seven regions, with 465 people dead and 47 injured (NDRRMC, 2009).

Not only did the two typhoons damage infrastructure, agriculture, and private properties, they also disrupted the livelihood of people in the affected areas. About 170 million workdays, or approximately 664,000 one-year jobs, were estimated to have been lost due to the effects of Ondoy and Pepeng, according to the Post-Disaster Needs Assessment (PDNA) (2011) report by the Philippine government, with the support of the Asian Development Bank (ADB), the World Bank Group (WB), the UN, and the Global Facility for Disaster Reduction and Recovery (GFDRR). Since more than half of the enterprises in commerce and almost all agriculture and fisheries were self-employed, the report declared that worsening poverty was inevitable. In terms of total income, around a billion US dollars was lost (Saludo et al., 2011). In addition, the typhoons severely impacted informal workers and families with single home-based livelihood as they lost both equipment and inventory needed to operate.

Looking at the private sector (Saludo et al., 2011), damages and losses were severe for the wholesale and retail trade subsectors because inventory buffer stocks for the Christmas season were damaged. The manufacturing sector was also affected since they could not meet the high delivery orders during that time, given their raw materials and inventory stocks were ruined. There was also disruption in the transport sector as public utility vehicles were unable to ply their usual routes.

The World Food Program (WFP) provided information on supply chain disruptions during and after Super Typhoon Haiyan, or locally called Yolanda. In November 2013, Yolanda hit the Visayas region—which was still reeling from an earthquake a month before—Southern Luzon, and Northern Mindanao. It managed to wipe out municipalities and cities with damage totaling approximately US$2.05 billion (NDRRMC, 2013). More than 6,000 people perished—although unofficial counts peg figures at around 10,000—more than a thousand people went missing, and about 29,000 people were injured from the super typhoon.

In its rapid market assessment, the WFP (2013) found that all major ports—whether air, water, or land—in the country, especially Manila and Cebu, were being used for distributing humanitarian aid. As such, there were major delays in the delivery of non-aid and commercial goods to and from other areas. Complete damage of warehouses and stocks of raw materials and finished products, destruction of trucks and roads, and even credit lines were seen in affected areas, causing a stoppage in deliveries. For retail establishments, they had no choice but to travel themselves and pick up their supplies. And because supply was scarce, and their transportation costs rose, consumers had to buy goods at higher prices. Some retailers and public market vendors went back to business relatively quickly despite the damage to infrastructure and stocks by constructing temporary or makeshift stalls or moving to a more secured building. Although anecdotal stories show the recovery of households and microenterprises in devastated areas, only a few reports exist on whether they are more climate-smart, ready to assist in community resiliency, or have pursued more solid disaster risk reduction and adaptation measures.

Francisco, Lau, and Mendoza (2014) assessed how resilient SMEs are in the Philippines when faced with economic and environmental shocks, particularly the 2008 financial crisis and flooding events in 2009 and 2011. Results of their study indicate that compared to their larger counterparts, SMEs found it difficult to survive during these events and may resort to coping strategies, which may have unintended consequences that can undermine their competitiveness in the long run. The authors, however, qualified that the findings were still not conclusive.

Ballesteros and Domingo (2015) analyzed the weaknesses of government policies and programs relating to microenterprises and disasters and summarized the impacts of typhoons on this vulnerable sector. For instance, Tropical Storm Washi, locally known as Sendong, hit Northern Mindanao on December 2011, directly damaging the livelihood sectors, especially the agriculture and informal sectors—like sari-sari store owners and tricycle drivers, vendors. It also indirectly affected mining and quarrying, manufacturing, wholesale and retail, and real estate. To cope with the effects of the storm, some microenterprises decided to discontinue their business operations and look for temporary employment. Others changed the product they were initially manufacturing and some even set up sari-sari stores in evacuation centers.

The PDNA report (2011) mentioned previously illustrated the lack of coping and adaptation mechanisms of urban households and microenterprises. They mostly rely on remittances from relatives abroad or in other provinces and informal moneylenders. As a result, some microenterprises were forced to shut down temporarily or permanently, and others had to open substitute businesses in evacuation centers and shelters (PDNA, 2009).

Unfortunately, like other developing countries, government support and assistance towards these sectors are still quite constrained.

In a 2016 Philippine MSME survey conducted by the Asian Disaster Preparedness Center's (ADPC) (2016), despite having a high awareness of climate hazards and disaster risks as well as experience of damages and losses, understanding of formal coping mechanisms like business continuity plans and insurance is still low. From the survey, only 28 out of 250 enterprises, or 11 percent, answered that they have natural catastrophe insurance and only four percent stated they purchased insurance for profit losses. For BCPs, 77 percent of the companies responded they had not adopted BCP.

6. Study Site: Marikina City

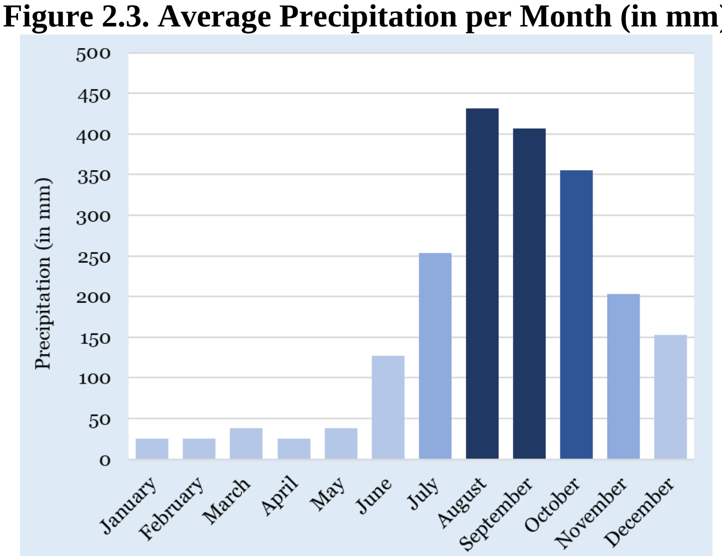
6.1. Marikina City Profile

Marikina City is one of the 16 cities comprising the National Capital Region or the Metro Manila Region in the Philippines. It has a total population of 450,741 and 98,238 households based on the 2015 Census of Population. In terms of economy, Marikina is considered as the "Shoe Capital of the Philippines" as the city is the largest shoe manufacturer in the country, producing around 70 percent of the total number of shoes domestically.

According to the 2018 List of Establishments published by the PSA, 611 manufacturing companies were operating in Marikina, with 73 percent classified as microenterprises. Manufacturing is the second largest industry in the city, following Wholesale and Retail Trade, which accounts for 43 percent of the total number of Marikina establishments. However, the 2016 list from the PSA only pertains to formal business establishments. The Marikina City Business Permits and Licensing Office (BPLO) provided a more comprehensive list of establishments, with a total of 17,072 enterprises as of April 2018.

Marikina City is situated on Marikina Valley and bordered by the Sierra Madre Mountain ranges to the east and Marikina River, which traverses 11 out of its 16 barangays, in the west. The city incurs the worst damage brought about by weather disturbances owing to its location. Flooding, in particular, is common as it occurs at least once a year. Marikina is a catch basin to five surrounding cities and towns during the rainy season, with most of the city sitting at an elevation of about 15 meters above sea level. Other reasons include the rise in water levels in major rivers and tributaries and the overflowing of riverbanks to the low-lying areas. Flooding usually occurs from August to October, shown in **Figure 2.3**, as average rainfall peaks at about 431.9 millimeters (mm) in August, 406.4 mm in September, and 355.6 mm in October.

Figure 2.3. Average Precipitation per Month (in mm)



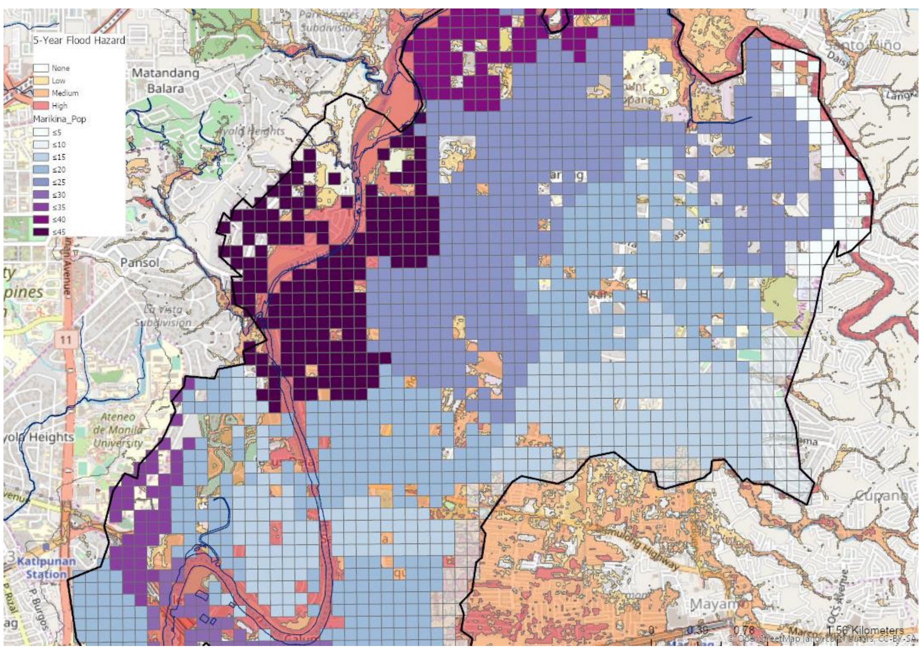
Source: Philippine Atmospheric Geophysical and Astronomical Services Administration

One of the most damaging climate-related disasters that befell the capital region, especially Marikina City, was in 2009. In the last week of September, Ondoy dumped 455 mm of rainfall within 12 hours, a record-high according to the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA), the country's weather bureau. The intense rain inundated Metro Manila's drainage capacity. It generated severe flooding in 239 barangays in Metro Manila, as well as parts of the surrounding regions of Central and Southern Luzon, with the resulting total damages estimated at US$237 million (NDRRMC, 2009). The highest flood height recorded was up to rooftop levels. For Marikina, 14 out of the 16 barangays were flooded as the Marikina River rose to 23 meters above sea level, way beyond the third alarm level system of 18 meters.

Three days after Ondoy exited the Philippine Area of Responsibility (PAR), Typhoon Pepeng entered PAR. It took an irregular track as it went back three times to Central and Northern Luzon, bringing heavy rains and causing further flooding in cities and municipalities in Luzon. Pepeng damaged about US$540 million worth of infrastructure, agriculture, and private property. According to the National Disaster Risk Reduction and Management Council (NDRRMC), the resulting river floods were estimated to have a return period of around 50 years. It means that this event happens once in every 50 years on average. During the 2012 Luzon southwest monsoon floods, these conditions were almost repeated when the Marikina River reached 19 meters above sea level.

The most recent flooding events occurred in August 2018. The usual rains brought by the annual Southwest Monsoon were enhanced by tropical storm Karding, internationally known as Yagi, and resulted in heavy flooding in Metro Manila, with Marikina City being the hardest hit, based on reports by the country's Office of the Civil Defense (OCD). Throughout the weekend, more than 21,000 residents had to be brought to 18 different evacuation centers. According to the local government, this figure was higher than the average of 3,000 to 5,000 evacuees during an ordinary typhoon. Water levels in the Marikina River peaked at 20 meters, just a few meters shy of the deadly Ondoy levels in 2009.

Figure 2.4. Marikina Population Exposed to Flooding



Sources: Marikina Flood Hazard Map, DOST-UP DREAM and Phil-LiDAR Program; Population estimates using High-Resolution Settlement Layer from CIESIN—Columbia University

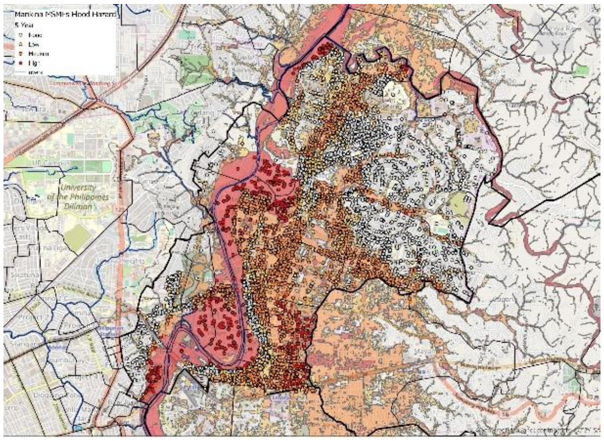
As mentioned earlier, there were 450,741 people and 98,238 households residing in Marikina City. Examining the location from **Figure 2.4**, high flood-hazard areas seem to have the most densely populated zone. For a five-year return period, around 47 percent of the population are exposed to high and medium hazards, already a sizeable number. This percentage rises to 65 percent and 69 percent of the population for the 25- and 100-year return periods, respectively, indicating significant exposure to severe flooding. When the population can no longer travel to establishments, businesses will temporarily close their shops, sales levels of enterprises will drop with some declaring bankruptcy, and others would stop operations completely.

Based on the flood hazard for a five-year return period **(Figure 2.5)**, about 8,290 enterprises in Marikina City were exposed to high and medium flood hazards. Exposed businesses accounted for 51 percent of the total 16,219 enterprises[5] operating in the city. This percentage rose to 74 percent for the 25-year return period. For the 100-year return period, 61 percent of the enterprises will suffer from more than 1.5 meters of flooding. For those located in the medium flood hazard areas, more than three-fourths of the total are exposed. Given the sheer number, flooding events with a 25- or a 100-year return period spells catastrophe for the city and would make it challenging for the city to recover.

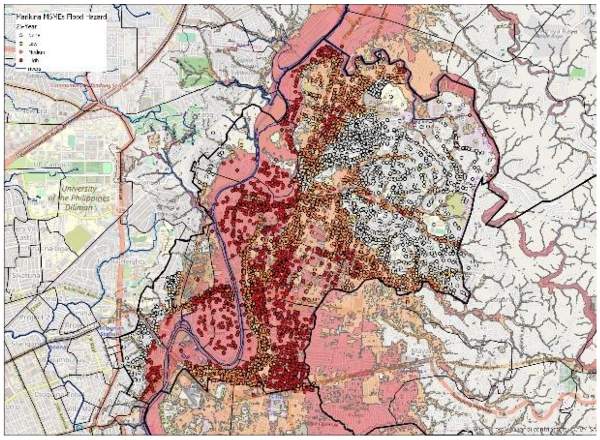
[5] Locations of 733 enterprises were not mapped due to unidentified addresses.

Figure 2.5. Establishments Exposed to Flooding

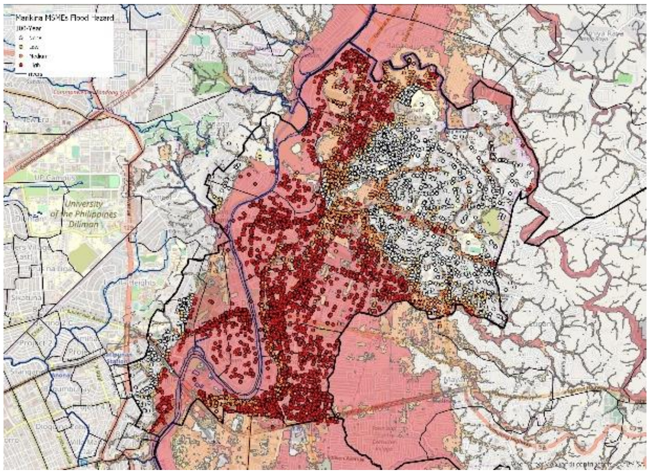
(a) 5-Year Flood Hazard Map



(b) 25-Year Flood Hazard



(c) 100-Year Flood Hazard



Sources: Marikina Flood Hazard Map, DOST-UP DREAM and Phil-LiDAR Program; List of Establishments as of April 2018, Marikina City Business Permits and Licensing Office

Flood hazard was estimated by the Department of Science and Technology-University of the Philippines Disaster Risk Assessment, Exposure and Mitigation (DOST-

UP DREAM) and Phil-Light Ranging and Detection Technology (LiDAR) Program using Rainfall Intensity Duration Frequency. This measure relates rainfall intensity with its duration and frequency of occurrence. For example, a five-year return period means a 20 percent probability of a flood with a five-year return period occurring in a single year. The Rainfall Intensity Duration Frequency in this scenario is 243.100mm. Flooding that reaches 0.1 to 0.5 meters is categorized as low, 0.5 to 1.5 meters as medium, and beyond 1.5 meters is high. A 25-year return period indicates a four percent probability of a flood with a 25-year return period occurring in a single year with Rainfall Intensity Duration Frequency at 373.600 mm. And a 100-year return period suggests that there is a one percent probability of a flood with a 100-year return period occurring in a single year with Rainfall Intensity Duration Frequency at 481.200 mm.

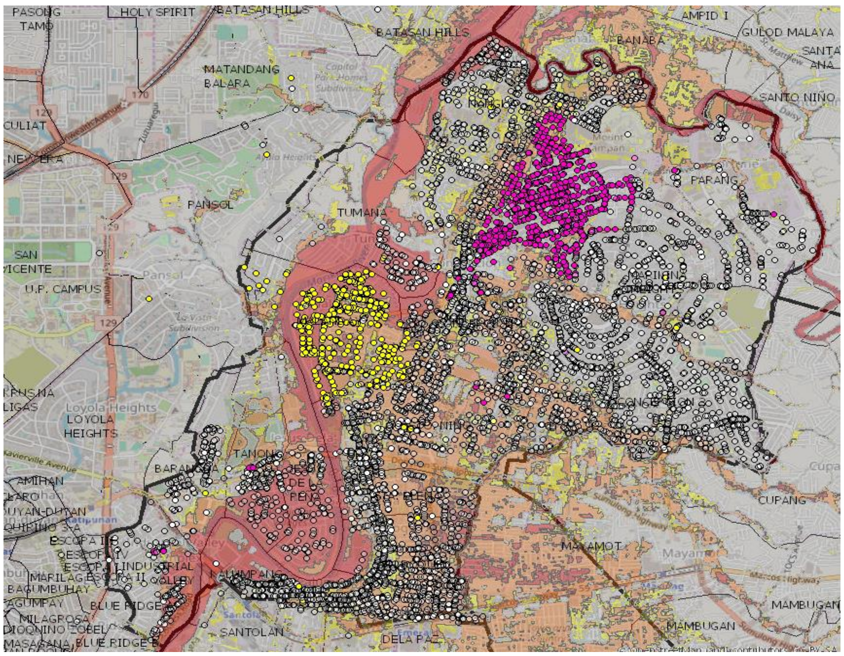
6.2. 2018 Marikina MSME Survey

6.2.1. Sample and Research Design

Given the sparse data on the impacts of flooding on MSMEs and the adaptation and DRR mechanisms they pursue, primary data was collected by administering survey questionnaires in Marikina City. Two-stage sampling was employed to determine the respondents. In the first stage, barangays were selected based on two factors: flood hazard, which comes from PAG-ASA's Flood Risk Maps and the University of the Philippines Nationwide Operational Assessment of Hazards (UP NOAH); and the number of enterprises, which was collected from the Marikina BPLO.

The information was then integrated by creating a map of the enterprises and overlaying this on the flood hazard maps through ArcGIS, as seen in **Figure 2.6**.

Figure 2.6. Flood Hazard Map and Enterprise Map of Marikina City



Sources: Marikina 5-year[6] Flood Hazard Map, DOST-UP DREAM and Phil-LiDAR Program; List of Establishments as of April 2018, Marikina City Business Permits and Licensing Office

Two barangays were chosen. One barangay has a higher flood incidence relative to the second barangay, but the number of enterprises should be close. The barangays chosen were Barangay Malanday, which witnesses moderate to high flooding and has 1,102 enterprises, and Barangay Parang, which experiences zero to low flooding and has 1,398 enterprises registered. In the second stage, the chosen respondents should, preferably, be owners. Within this group, 200 respondents were randomly selected initially from the population, of which 100 came from Barangay Malanday, and the other half was from

[6] Illustrates the inundation extents in the area if the actual amount of rain exceeds that of a 5 year-rain return period. There is a 1/5 (20%) probability of a flood with 5-year return period occurring in a single year.

Barangay Parang. To assess the eligibility of the respondents, screening questions like the age of the business, length of employment of the respondent, the familiarity of the respondent with the operations and financial aspects if they are not the owner, and business permit registration for 2018 were asked. If the respondent did not meet the eligibility criteria, the enumerator moved on to the nearest enterprise available.

6.2.2. Data Collection

A pilot survey was conducted from the last week of August until the first week of September 2018. The feedback from this initial survey was used to modify and update the questionnaire. It was then submitted to Sound Market and Technical (SMART) Research Services, Inc., a local survey firm, to conduct one last round of field testing on the third week of September. The comments were then incorporated, and the questionnaire was translated from English to Filipino. Once the questionnaire was refined, a preparatory meeting for the enumerators and training on survey materials was held a few days later. Further adjustments were made to the questionnaire after the training and even during the survey proper.

The interviews were conducted between September to October 2018. The answers from the survey, which will be referred to as the 2018 Marikina MSME Survey, covered a range of topics: the profile of the respondent and the enterprise; the impacts of flooding on the enterprise's suppliers, consumers, workers, income, property, and inventory stock, among others; the DRR mechanisms adopted by the enterprise to prepare, minimize, and manage the effects of flooding; the barriers hindering the implementation of these measures; risk perception; willingness-to-pay for insurance; and the enterprise's social networks such as family, relatives, neighbors, and community organizations. In December, some follow-up questions were asked on coping behavior.

6.2.3. General Information

Demographically, as shown in **Table 2.3**, majority of the respondents in the 2018 Marikina MSME Survey were middle-aged, with the average age pegged at 47 years old, the youngest being 18 years old only, and the oldest was 82 years old. Respondents are mostly educated, with 119 (59.0 percent) able to enter college. The sample consisted of 132 females or 66.0 percent of the total. The average household size is five and ranged from one to 23 members. About three-fourths of the households have members that included vulnerable groups like senior citizens and minors.

Table 2.3. Respondent and Enterprise Characteristics

	Obs	Mean	SD	Min	Max
Respondent Characteristics					
Owner	200	0.68	0.48	0	1
Female	200	0.66	0.47	0	1
Age	200	47.09	14.01	18	82
Years of education	200	11.98	2.79	3	15
Household size	200	5	2.43	0	23
Household includes minor and/or senior citizens	200	0.72	0.45	0	1
Enterprise Characteristics					
Distance from Marikina River	200	0.89	0.55	0.02	1.92
Five-year flood hazard	200	1.30	1.28	0	3
Enterprise is Wholesale and Retail Trade	200	0.71	0.46	0	1
Enterprise is Services	200	0.22	0.41	0	1
Enterprise is Manufacturing	200	0.08	0.27	0	1
Age of enterprise	200	12.44	8.94	3	31
Asset size (three categories)	200	1.31	0.61	1	3
(Log) Average Income of Enterprise	200	11.99	1.67	8.01	16.99
Total number of employees	200	7.66	18.95	1	174
Enterprise is home-based	200	0.73	0.45	0	1
Enterprise has storage space	200	0.66	0.47	0	1

Source: 2018 MSME Survey

About 73 percent, equivalent to 146 enterprises, were home-based, while the rest were located in commercial buildings or spaces or outside their homes. One hundred thirteen respondents (56.5 percent) own the premises where the business is located, and 182 (91.0 percent) were operating under a sole proprietorship. About 174 (87.0 percent) answered that this business is their primary source of income while the rest acquire additional income from other sources.

Fifty-five percent, or 110 businesses, have been operating for ten years or less, 24 (27.0 percent) were running for more than ten years, but less than 20, and 36 (18.0 percent) have been established for more than two decades. At most, as of the time of the survey, 148 enterprises (74.0 percent) were operating when Ondoy and Pepeng struck.

About 70 percent of the enterprises are from the wholesale and retail trade sector, the majority of which (82 out of 141) were sari-sari stores. Seventeen (8.5 percent) enterprises were involved in manufacturing—with eight in the wearing apparel and shoe manufacturing subsector, while the rest were in the services sector, primarily eateries or restaurants. This breakdown closely follows that of Marikina City establishments.

In terms of employment, 182 enterprises (91.0 percent) were considered micro, 16 (8.0 percent) were small, and two (1.0 percent) were medium. Meanwhile, in terms of asset size, 153 (76.0 percent) were counted as micro, 32 (16.0 percent) were small, and 15 (7.5 percent) were medium.

Mean annual income was around PhP800,000, with the lowest reported at PhP3,000 and the largest at PhP24,000,000. More than half of the businesses have an annual income below the average. The capital to run the business mainly comes from personal savings, followed by loans from friends/relatives, revenue from sales of products/services, and commercial or personal loans and lines of credit from financial institutions. Only nine (4.5 percent) reported they borrowed from informal sources. Mean sales generated per year is PhP250,000 or an average daily turnover of PhP685. About 90 enterprises had less than this average daily turnover. The smallest sales amount provided was PhP10,000 while the largest was PhP30 million.

The enterprises included in the survey were operating, on average, 887 meters away from the Marikina river, with a minimum distance of 22 meters and a maximum distance of 1.9 kilometers; 76 MSMEs (38.0 percent) were located below the average, and more than half were a kilometer or less away. A large majority of the enterprises were found on the first floor; 80 MSMEs (40.0 percent) have only one floor available to them, 102 (51.0 percent) have two floors, while the rest have more than two floors.

From the spatial locations of the enterprises surveyed, 85 businesses (42.5 percent) were found in areas with no flood hazard, 27 (13.5 percent) in the low flood hazard, 32 (16 percent) in the medium, and 56 (28 percent) were in the high flood hazard areas. This is based on the five-year flood hazard map.

6.2.4. Flood Exposure and Experience

A little more than half of the respondents answered that they never experienced minor flooding. Here, minor flooding is considered as inundation less than or equal to 0.5 meters or about knee height. However, ninety-one (45.5 percent) reported suffering from minor flooding, of which 50 underwent it every year while the rest experienced it once every two to five years. For 76 percent of the 91 enterprises, the last time they experienced minor flooding was in August 2018. For those located in the medium and high hazard areas, a large majority of them faced this type of flooding, as shown in **Table 2.4**.

Table 2.4. Flood Exposure of MSMEs for Different Return-Periods

	Flood Hazard				**Total**
Return Period/ Experience of Flood	**None**	**Low**	**Medium**	**High**	
5-Year (Total)	**85**	**27**	**32**	**56**	**200**
Experienced Minor Flooding (%)	18.9	36.0	71.4	82.0	
Experienced Moderate/Major Flooding (%)	14.4	36.0	51.4	90.0	
25-Year (Total)	**97**	**10**	**26**	**67**	**200**
Experienced Minor Flooding (%)	17.5	30.0	73.1	79.1	
Experienced Moderate/Major Flooding (%)	15.5	20.0	50.0	82.1	
100-Year (Total)	**90**	**8**	**18**	**84**	**200**
Experienced Minor Flooding (%)	16.7	12.5	61.1	77.4	
Experienced Moderate/Major Flooding (%)	14.4	0.0	50.0	75.0	

Source: 2018 MSME Survey

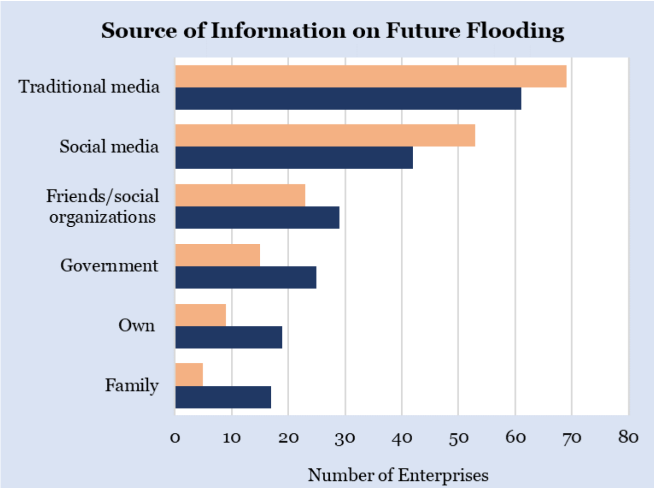
In the case of moderate/major flooding or inundation greater than 0.5 meters, which is measured as beyond the knees, 83 enterprises (41.5 percent) answered they experienced this, with 44 businesses facing moderate/major flooding in August 2018. The others, meanwhile, suffered from Ondoy and Pepeng in 2009 and the Habagat flooding in 2014. More than half of the MSMEs located in the medium flood hazard area and 90 percent of those found in the high flood hazard area encountered moderate/major flooding.

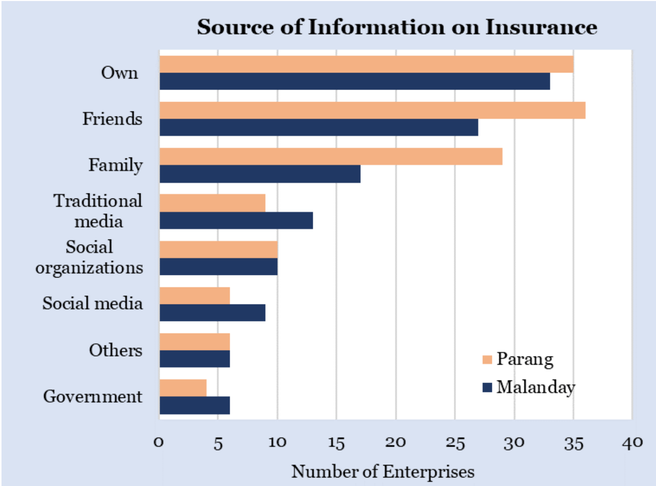
A total of 112 enterprises had endured some type of flooding. Of all the enterprises that experienced some type of flooding, 64 of them suffered from both minor and moderate/major flooding events, 28 faced minor flooding only, and 19 underwent moderate/major flooding. And, as the RIFD rises, the area exposed to high flooding widens, hence the number of enterprises that may be subjected to medium and high flooding increases.

6.2.5. Social Capital

Survey results showed that more than three-fourths of the respondents were not members of any social organizations. Thirty-five respondents answered that they are part of one organization while 12 have three or more. Out of the 47 respondents that have a social organization, 42 answered that they are active and attend meetings arranged by their groups. For local government-arranged meetings, 70 respondents, or 35 percent, indicated that they attend and participate in these discussions.

Figure 2.7 Sources of Information on Flooding and Insurance





Source: 2018 MSME Survey

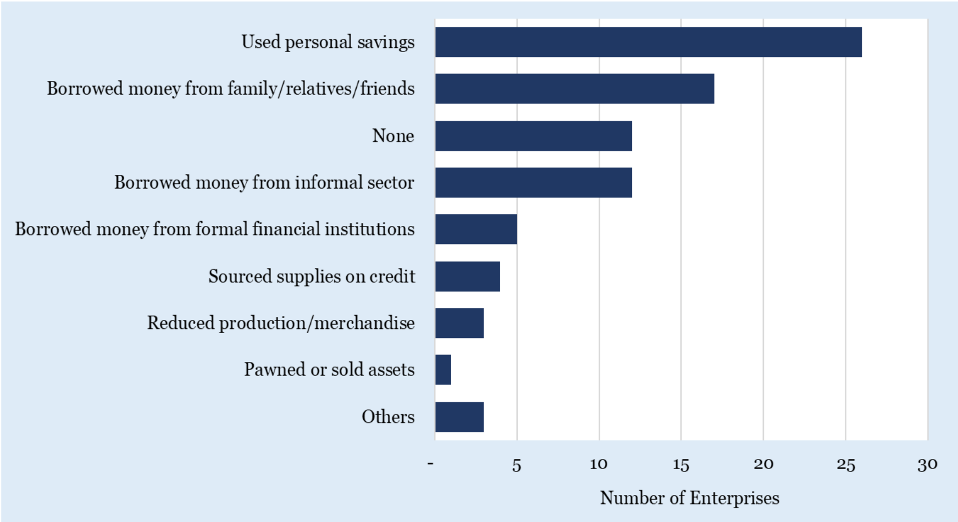
For information about flooding, as seen in **Figure 2.7,** majority answered that they use traditional media like television and radio. Social media is also a useful tool in obtaining information about floods. Information from government mostly goes through traditional media and social media, hence, possibly the reason why a low number of respondents chose the government option.

In obtaining information about insurance, respondents reported that they get them on their own, from friends, and from family and some through traditional media, social organizations, and social media, among others. Only ten respondents answered that they receive information about insurance from the government.

6.2.6. Coping Strategies and DRR Measures

To cope with the various impacts of flooding, 26 enterprises (32.1 percent) reported that they used their own savings for recovery—repairing and replacing the physical structure of the business, the equipment, and the stocks damaged—illustrated in **Figure 2.8**. Some enterprises approach their family, relatives, or friends for financial loans or borrowed money from informal lenders.

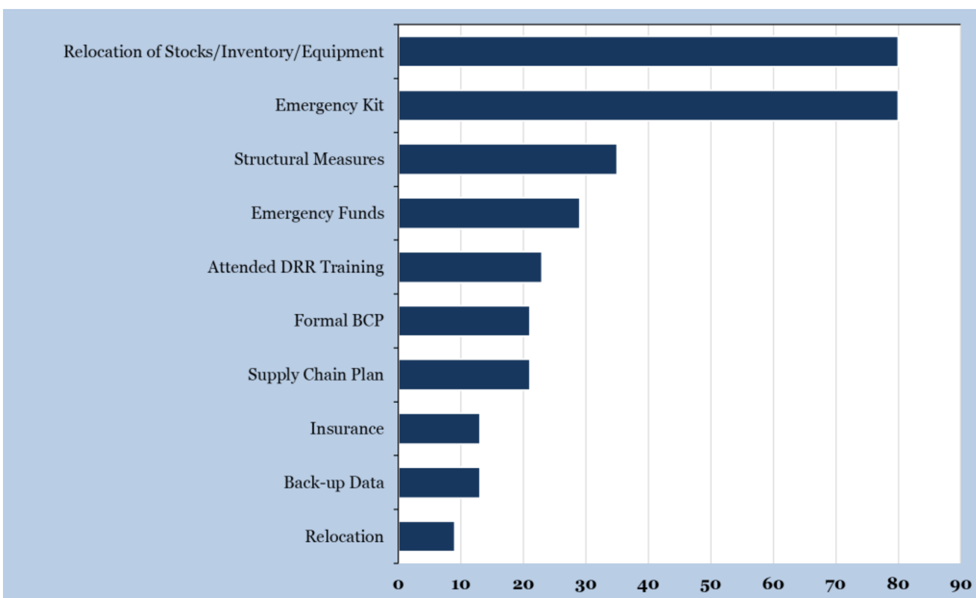
Figure 2.8. Coping Strategies During and After Flooding



Source: 2018 MSME Survey

Another way to cope with the effects of flooding is to transfer the costs to consumers. However, most of the respondents chose not to raise their prices following the disaster since they deemed it unnecessary. Some fear that their consumers will shift to other establishments while a few found it unfair. For those that answered that they increased their prices, majority revealed that their suppliers raised the prices of the inputs, so they have no choice but to follow suit or else face further losses. Only one enterprise reduced its prices, asserting the urgency to sell of the products. Although not conclusive given the small sample, this follows the study by Cavallo et al. (2014) regarding the lack of erratic movement of prices following natural disasters.

Figure 2.9. DRR Measures



Source: 2018 MSME Survey

The most utilized DRR measures among the MSMEs interviewed were the relocation of stocks, products, and equipment, and keeping an emergency kit/go bag, as shown in **Figure 2.9**. An emergency kit is a bag of essential products that can last at least 72 hours.

This includes food and water, matches, emergency lamps/flashlights, hygiene kit, first-aid kit, radio, blankets, documents, and other important items. This is followed by structural measures such as flood defenses, securing roofs, and strengthening walls, although only 35 enterprises adopted these.

Twenty-one (10.5 percent) enterprises have a written BCP, a "documented procedure that guides organizations to respond, recover, resume, and restore to a pre-defined level of operation following a disruption" (ISO 22301:2012). This details what an enterprise and its employees do to continue operating, recover, and minimize damage and losses in the event they are hit with emergencies like natural disasters, terrorism attacks, and diseases, among others. The primary reason for not having a BCP is the thinking that it is impractical. Others also reported that crafting a BCP is not the priority. Given these reasons, only 37 respondents or 21 percent of those that have no BCP, answered that they plan to create a BCP in the future.

For insurance, which includes property insurance, business interruption insurance, and microinsurance, a mere 13 enterprises (6.5 percent) responded that they have adopted this. The information from the survey is consistent with other disaster studies that MSMEs do not have sufficient disaster risk reduction or mitigation measures.

Chapter 3. Costs and Causes: Assessing the Impacts of Floods on Micro, Small, and Medium Enterprises in Marikina City, Philippines

1. Introduction

Flooding adversely impacts the lives and livelihoods of people, particularly in the case of low- and middle-income countries. And cities are especially exposed to natural hazards like flooding because of how close they are to rivers and coasts. This vulnerability is further exacerbated by climate change, as the intensity and frequency of hydro-meteorological events have risen and will further worsen if the temperature rises to 1.5 or 2.0 degrees Celsius (Stocker et al., 2014). In addition, a growing urban population, with people moving away from the rural areas to urban spaces, and a lack of proper urban planning and governance further contributes (Kahn, 2009). Governments all over the world, therefore, must prepare sustainable flood risk management plans that prepare households and businesses, prevent further flooding, and minimize the impacts.

The aggregate number of deaths resulting from floods has considerably declined since the 1990s. Meanwhile, the damages incurred per decade continued to increase (EM-DAT[7]: International Disaster Database, January 30, 2020), along with the number of flooding events. The decline in the number of deaths suggests that flood risk management mechanisms implemented by various countries have successfully protected the lives of people. However, due to continuing urban expansion; stronger typhoons; and heavier rains, the likelihood of damage to infrastructure, particularly to supply chains, transportation systems, markets, and

[7] For a disaster to be included in the EM-DAT database, at least one of the following criteria must be met: more than ten people reported killed; 100 or more people reported affected; declaration of a state of emergency; and appeal issued for international assistance.

the number of people injured, affected, or left homeless, will remain high. Moreover, since total damage only reflects the direct impacts of flooding events, the figures are underestimated. Disaster studies usually collect data on direct effects for their analyses. Meanwhile, indirect and long-term effects of flooding, such as loss of livelihood, decline in sales, and coping with everyday flooding, although acknowledged in the literature, attract little research attention.

MSMEs, together with the poor and climate-sensitive sectors, are vulnerable to these events (Wedawatta & Ingirige, 2012; UNDP, 2013; Ballesteros & Domingo, 2015). However, before determining how to reduce MSME vulnerability, it is vital to provide a flood damage assessment—quantifying and examining the impacts of different flooding scenarios and assess the sources of risks faced by MSMEs. This chapter, therefore, aimed to answer the following questions:

1. How does flooding affect MSMEs?
2. How do flood exposure and DRR measures affect structural damage, equipment and inventory damage, and sales loss?

Since data on MSMEs, flooding impacts, and adoption of disaster preparedness and risk reduction mechanisms are limited, primary data was gathered through an interview-assisted survey of enterprises in Marikina City. Data were then examined and analyzed through Tobit and Double-Hurdle estimation. To address the endogeneity issues inherent in the models, instrumental variables (IV), namely gender, distance to the nearest construction firm, and distance to the nearest hardware supply store, were tested.

Results from the regression models show, not surprisingly, that direct effects of flooding—in this case, damage to premises and damage to and loss of contents like inventory and equipment—were primarily due to intrusion of floodwaters into the stores and facilities. To some extent, the location, elevation, and distance from the Marikina River—represented by the five-year flood hazard map—was also a significant factor on inventory and equipment damage.

Meanwhile, results from the indirect impact models illustrated that enterprises are interconnected with the community they are operating in and are reliant on the community members. One crucial reason for business disruption and sales loss, aside from damages to stocks and equipment and flood experience, is the reduction of customers. Consumers were affected by floods due to the inaccessibility of roads and business facilities. This chapter emphasized the importance of considering indirect impacts and not just direct damages and losses of MSMEs.

For the IV Tobit model, the Wald Test of Exogeneity displayed that using instrumental variables may not be necessary. And upon further testing using the Anderson-Rubin test showed that gender and the distance variables were, unfortunately, weak.

The following section discusses recent research on flood damage and its influencing factors and the possible contributions of this chapter. Section 3 provides information on the research design, data collection, and the Tobit and Double-Hurdle estimation models. Next, data from the survey and the results from the regression models were analyzed and discussed in Section 4. Lastly, Section 5 offers the discussion and concluding statements.

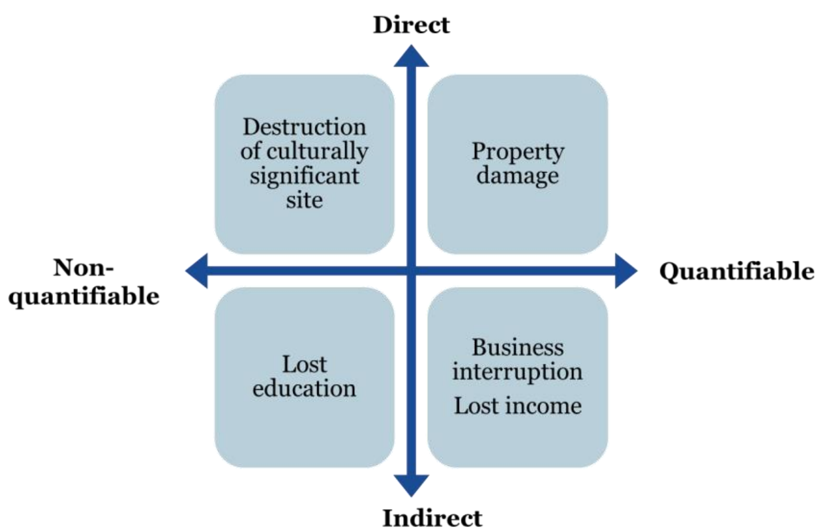
2. Review of Related Literature

How exactly are enterprises affected by flooding? This section summarizes the types of damages and losses an enterprise can experience and reviewed the relationship between flood exposure indicators and damages and losses.

2.1. Types of flood damage

There are two types of damage caused by flooding disasters. The first is direct damages and losses, the second quadrant in **Figure 3.1**, caused by the physical contact of floodwater to people, property, and other objects (Thieken, Müller, Kreibich, & Merz, 2005; Thieken et al., 2009; Meyer et al., 2013; Molinari, Ballio, Handmer, & Menoni, 2014). These refer to quantifiable losses such as the number of people killed; structural and non-structural damage to buildings, business facilities, and infrastructure including utilities; damage to or loss of equipment, inventories, business records; and destruction of natural resources.

Figure 3.1. Direct and Indirect Effects of Disasters



Source: United Nations Office for Disaster Risk Reduction

Meanwhile, indirect damages, the fourth quadrant in the figure, refer to "downstream" or second-order impacts caused by direct flooding events (Tierney, 2009). They can occur inside or outside the inundated areas and frequently with a time delay (Meyer et al., 2013). Classified under this category is the disruption of the flow of traffic and goods and services due to the impairment of critical infrastructure such as roads and bridges; income losses of individuals and households; and economic losses because of temporary business closures.

For businesses, the interruption or stoppage may be due to direct physical damage to the premises, equipment, and inventory, as well as destruction of power, telecommunication, and transportation infrastructure, or even government-initiated responses such as sealing off of roads or spaces that were heavily damaged by floods (Tierney, 2009). This means that indirect damages and losses cover a wider area than those directly flooded. Despite remaining undamaged during a flooding event, businesses may be forced to postpone their operations or make do with a reduced consumer base, thereby shrinking their productivity and sales (Pelling, Özerdem, & Barakat, 2002; Messner & Meyer, 2005; Sydnor, Niehm, Lee, Marshall, & Schrank, 2017).

For instance, during the 1993 floods in Des Moines, Iowa in the United States, several establishments were forced to close, not because they were flooded, but since lifeline services were wiped out (Tierney, 2009). In Corey and Deitch's (2011) study of the effects of Hurricane Katrina, business operations were most affected by the direct damage from the storm and the displacement of the population, thereby losing consumers and workers. This has implications for the local economic system (Pelling et al., 2002).

These two types can be further categorized as tangible or intangible damage, the first and third quadrants, based on how easily they can be quantified or assessed in monetary terms (Merz, Kreibich, Schwarze, & Thieken, 2010; Meyer et al., 2013). Tangible can be readily measured, such as damage to buildings and contents like equipment and stocks. Meanwhile, the intangible is tricky to monetize since they are not traded on the market (Merz et al., 2010; Meyer et al., 2013). Examples of this are the loss of life, physical and psychological health impacts, and the effects on the environment. Given the challenges of estimating damages, most studies acknowledge and assess only direct and tangible ones. Not taking into account all direct, indirect, and intangible damages and losses suggests that the economic costs of disasters are greatly underestimated and are much higher in actuality.

2.2. Flood damage models

Studies have utilized stage-damage functions to estimate the damage caused by floods. These link the damages to specific factors such as social, economic, or ecological variables to flood characteristics like flood depth, duration, velocity, and contamination. Thieken et al. (2005) referred to these as resistance and impact factors, respectively. The information is usually obtained either through empirical methods or synthetic approaches. The former typically uses surveys of households, agricultural workers, businesses, and insurance companies, among others, and analysis of historical flood events. Meanwhile, the synthetic approaches utilize laboratory experiments and "what-if" scenarios and questions

(Dutta, Herath, & Musiake, 2003; Merz et al., 2010; Cammerer, Thieken, & Lammel, 2013). The analysis of flood damages is usually done in two steps. The first phase is to ascertain the flood characteristics and exposure of the area and then placing a monetary value on the damages sustained due to inundation (Messner & Meyer, 2005; Jonkman, Bočkarjova, Kok, & Bernardini, 2008).

Most damage models continue to use flood depth as the primary impact factor, based on the review article by Merz et al. (2010) (see Jonkman et al. (2008)). However, models have since been developed to include more parameters. For instance, Middelmann-Fernandes (2010) argued that, when using flood depth or velocity in isolation, the losses incurred by the residential sector in the Swan River system in Perth, Western Australia, were underestimated.

Some studies have incorporated the length of time the area was inundated. For example, Shrestha et al. (2016) conducted a flood damage assessment of the agriculture and residential sectors in Pampanga, Philippines, using flood depth and duration, which were then computed using the rainfall runoff inundation model socio-economic factors. Dutta et al. (2003) simulated flood inundation effects by employing the main physical activities in a Japanese river basin and linking this with a stage-damage relationship between flood parameters such as depth and duration to estimate economic losses. The study also included the timing of the flooding and different land-use elements like urban or rural, residential or non-residential, and infrastructure.

For Wijayanti et al. (2017), the model they used to estimate the flood damage in Jakarta, Indonesia incorporated depth, duration, the distance of housing or buildings to a river, area of housing or building, and socioeconomic factors. Win et al.'s (2018) study utilized building type/materials, the height of the floodwater, height of the floor from the ground, and landslide for the residential and agricultural sectors in Myanmar.

In terms of the type of damage and loss, Thieken et al. (2005), Kreibich and Thieken (2008), Middelmann-Fernandes (2010), Merz et al. (2013) estimated only direct damages to households, while Shrestha et al. (2016) and Win et al. (2018) examined physical damages for the residential and the agriculture sectors. Corey and Deitch (2011) and Sydnor et al. (2017) focused on the indirect effects of disasters, specifically looking at business performance after Hurricane Katrina and how disaster impact factors, business characteristics, and owner demographics affect firm operations.

Chang and Falit-Baiamonte (2002) and Xiao and Peacock (2014) both looked at the influence of having disaster mitigation and preparedness plans but came to different conclusions. Xiao and Peacock (2014) reported that having an emergency response/disaster plan is significant for reducing physical damage. According to the study, physical damage to the businesses' buildings, machinery/equipment, and inventories were considerably reduced because of disaster planning (Xiao & Peacock, 2014). However, for Chang and Falit-Baiamonte (2002), disaster mitigation and preparedness were not associated with reductions in business loss. Instead, this is explained better by vulnerability factors as well as neighborhood effects.

2.3. Research gap and contributions

Businesses are essential players in the local economy and community. This chapter attempted to address the research gaps relating to businesses, specifically MSMEs, flooding, and DRR and preparedness. Disaster studies generally highlight the number of people and households affected, the climate-sensitive sectors like agriculture and fisheries, the large enterprises, local government, and national government agencies, often discounting the experiences of MSMEs. In addition, the discussion is usually lumped together with large enterprises. However, the experiences and responses of large enterprises are generally inapplicable or unsuitable for smaller enterprises.

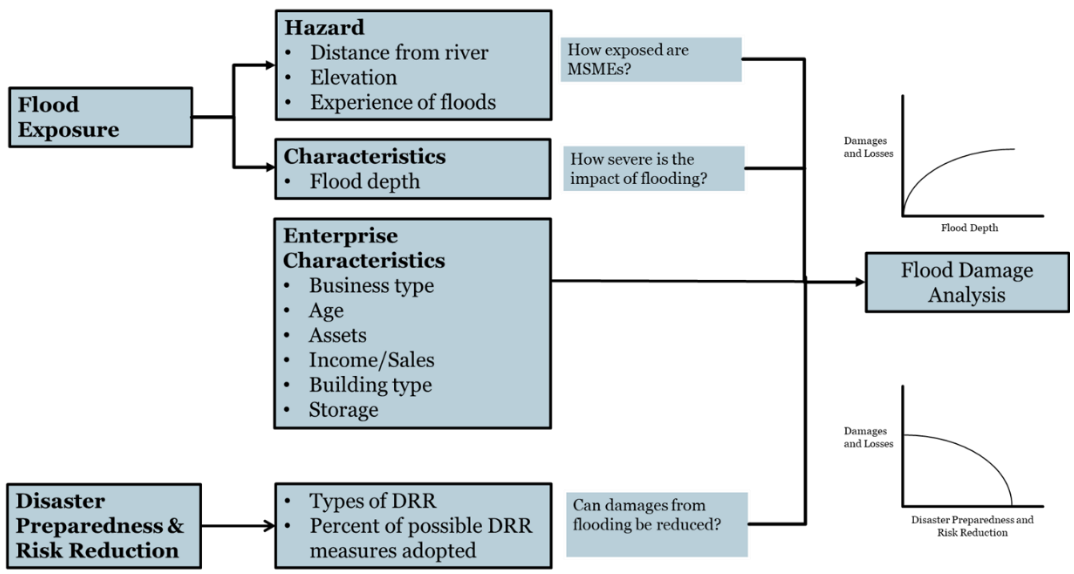
Additionally, most research is concerned with extreme weather events but not on the more frequently occurring flood events. The insights from the research questions will provide information regarding the impacts of floods on business structures, equipment, and stocks. And to address the other type of damage, this chapter also examined enterprise performance after the disaster, looking at MSMEs that were not just directly inundated but also those in areas that received little to no flooding.

2.4. Conceptual Framework

Following the literature, this chapter estimated tangible damages of floods—direct damages to premises and damages to and loss of equipment and inventory, and indirect impacts like effects on business sales. As pointed out by previous studies, businesses can be interrupted because of disruption of essential services even if they were not directly inundated.

This chapter adapted and updated Messner and Meyer's (2005) flood vulnerability framework, as shown in **Figure 3.2**. The main hypothesis here are: (1) as the flood level rises, the cost of direct damages and losses also increase, (2) the cost of indirect damages and losses rise when its consumers, suppliers, and employees are affected, not just because of flooding itself; and (3) disaster preparedness and risk reduction measures reduce flood damages and losses.

Figure 3.2. Conceptual Framework on Flood Damage Analysis



Note: Adapted from Messner & Meyer (2005)

However, one of the limitations of the framework is that it overlooks the cyclical path of flood damage analysis. Specifically, that flood damage impacts can affect the adoption of disaster preparedness and risk reduction measures. Another limitation is that the framework illustrates a rise in damages and losses but at a decreasing rate, that it smoothens out when it reaches a certain flood depth, however, due to data constraints, it proved challenging to show.

3. Data and Methodology

3.1. Variables

This chapter explored the effects of flood exposure of MSMEs and their DRR and preparedness measures on tangible damages of floods—direct damages to premises and damages to and loss of equipment and inventory, and indirect impacts, particularly on business sales.

The damages and losses came from the following questions: What is the estimated value of the damage to premises/building during the last moderate/major flooding? What is the estimated value of the damage, spoil, or loss of inventory/stock during the last moderate or major flooding? How much did the enterprise lose during the last moderate or major flooding? If the respondent gained sales, their responses were coded as zero. The cost of damages and losses and sales loss variables were then transformed into log variables to address skewed data. Some constraints with this type of data are the lack of verification of the actual damages and losses and subject to how the respondents want them to be identified. Although subjective as well, perception on the damages and losses incurred, and if consumers, suppliers, and employees were affected were also used as outcome variables.

Flood exposure of the enterprise included the five-year return period flood hazard, which represents elevation and distance from Marikina River. The map was sourced from the Phil-LiDAR discussed in the previous chapter. In addition, the flood height that entered the establishments' premises was employed.

For the DRR mechanisms, dummy variables were created for structural measures—whether the enterprise strengthened roofs and walls and installed flood defenses, and on whether the enterprise has relocated its stocks/inventory/equipment. Moreover, a percent of possible DRR measures adopted—encompassing ten mechanisms, specifically having a BCP insurance, an emergency fund, a supply chain plan, relocated its stock/equipment, has back-up of data, and has emergency kit—was used. One is the highest value, which means all DRR measures were implemented, while zero is the lowest with no DRR measures pursued.

There is an issue on the endogeneity of DRR measures, however. Although the question on DRR was if the respondent had the measures before the flooding event and that most answered that the recent flooding they experienced was August 2018, a month before the survey, there still remains the uncertainty if they remember correctly if the measures were adopted before or after their most recent flooding.

Other control variables used were the enterprise indicators, namely, if the MSME is in the wholesale and retail trade sector or the services sector, the enterprise is home-based, and the business has its own storage space. The age of the enterprise, (log) average income, and (log) assets were also used. **Table 3.1** describes the variables used in the regression models.

Table 3.1. Description of Variables

	Type	Definition and Measurement
Dependent Variables		
(Log) Cost of Damages to Premises	Continuous	(Log) Amount of damages to enterprise's building
(Log) Cost of Damages to and Loss of Contents	Continuous	(Log) Amount of damages and losses to enterprise's content/inventory
(Log) Sales Loss	Continuous	(Log) Amount of sales lost from flooding
Flood Exposure		
Flood hazard (five-year return period)	Category	Five-year flood hazard of enterprise's location 1 = No flooding, 4 = High flood hazard
Flood height inside premises	Category	Height of flood water that reached inside the enterprise's premises 1 = No flood waters, 4 = Higher than waist
For sales loss model		
Has flood experience	Binary	1 = Experienced minor and/or moderate/major flooding
Consumers were affected by last flooding	Binary	1 = Consumers had difficulty traveling to your establishment during the last moderate/major flooding
Suppliers were affected by last flooding	Binary	1 = Contracts/orders from suppliers were cancelled during the last moderate/major flooding
Employees were affected by last flooding	Binary	1 = Workers were unable to go to work during the last moderate/major flooding
Number of days without operations	Continuous	Number of days enterprise stopped operations during the last moderate/major flooding
Percent damage to utilities	Continuous	Extent of damage of utilities like electricity and water during the last moderate/major flooding
Enterprise Characteristics		
Enterprise is Wholesale and Retail Trade	Binary	1 = Enterprise is in the wholesale/retail trade
Enterprise is Services	Binary	1 = Enterprise is in the services sector
Age of enterprise	Continuous	Enterprise's years in operation
(Log) Asset size	Continuous	(Log) Asset size in PhP
(Log) Average Income of Enterprise	Continuous	(Log) Three-year average income in PhP
(Log) Average Annual Sales	Continuous	(Log) Sales in PhP
Enterprise is home-based	Binary	1 = Enterprise is located in respondent's home
Enterprise has storage space	Binary	1 = Enterprise has storage space
Disaster Preparedness and Risk Reduction		
Structural measures	Binary	1 = Enterprise implemented structural measures
Enterprise has relocated stocks/inventory/equipment	Binary	1 = Enterprise has relocated stocks/inventory/equipment
Percent of possible DRR measures adopted	Continuous	Number of DRR measures adopted over total

For the sales loss model, flood exposure characteristics contain experience of minor and/or moderate/major floods, number of days without operations, the experience of damage to utilities, and dummy variables on whether consumers, suppliers, and employees were affected by the last moderate/major flooding.

3.2. Estimation Models

Tobit and Double-Hurdle models were used to examine the relationship between flooding exposure and the effects on MSMEs. The distribution of damages and losses of MSMEs, the outcome variable, is right-skewed due to a substantial number of responses with zero value. The damage and sales loss amounts may not be reported for some respondents because the figures may be too small and would simply be reported as zero. An Ordinary Least Squares estimation would not be appropriate in this case since estimates may be biased and inefficient.

Developed by James Tobin, the Tobit model is based on the assumption that there is a latent (i.e. unobservable) outcome variable $Damages_i^*$ for enterprise i. This variable linearly depends on the variables of interest, in this case the flood exposure ($FloodExposure_i$), and a vector of control variables—enterprise characteristics and disaster preparedness and risk reduction indicators, via a parameter (vector) which determines the relationship between the explanatory variables and the latent variable $Damages_i^*$. In addition, the model includes a normally distributed error term ε_i to capture random influences on this relationship. The observable variable $Damages_i$ is defined to be equal to the latent variable whenever the latent variable is above a specific damage level, c, and zero otherwise. The model looks as follows:

$$Damages_i = \begin{cases} Damages_i^* \; if \; Damages_i^* > c \\ 0 \; if \; Damages_i^* \leq c \end{cases} \tag{3.1}$$

$$Damages_i^* = \beta_0 + \beta_1 Flood\ Exposure_i + \beta_2 Enterprise\ Characteristics_i + \beta_3 DRR_i + \varepsilon_i \tag{3.2}$$

The assumption for the Tobit model is that the process for generating the censored values is the same process that determines the observations on the outcome variable. In this chapter, flood exposure, enterprise characteristics, and DRR mechanisms are all factors and provide the same contributions to whether the respondent reported any damage or not and the amount of damages and losses they incurred.

The Double-Hurdle model, first introduced by Cragg (1971), is an alternative to the Tobit model. Tobit is useful to manage a rightly-skewed distribution of a dependent variable that is due to a large number of observations with the value of zero. However, unlike the Tobit model that determines the probability of a positive value and the actual value by using the same parameter, the Double-Hurdle model provides a more flexible alternative as the outcomes are determined through a separate two-stage model: a probit model in the first tier and a truncated normal in the second tier (Burke, 2008).

Following Burke (2009), the first-tier model was estimated using a probit regression and modelled as follows:

$$Damaged_i = \begin{cases} 1 \; if \; Damaged_i^* > 0 \\ 0 \; if \; otherwise \end{cases} \tag{3.3}$$

$$Damaged_i^* = \beta_0 + \beta_1 Flood\ Exposure_i + \beta_2 Enterprise\ Characteristics_i + \beta_3 DRR_i + \varepsilon_i \tag{3.4}$$

Where $Damaged_i$ is the probability that an enterprise incurs damages and losses. β_i represents the coefficients of the explanatory variables—flood exposure, adaptive capacity, and susceptibility indicators, and ε_i is the error term.

The second-tier model, which illustrates the amount of damages the enterprises suffered, was estimated using a regression truncated at zero.

$$Damages_i = \begin{cases} Damages_i^* \ if \ Damages_i^* > 1 \\ 0 \ if \ otherwise \end{cases} \qquad (3.5)$$

$$Damages_i^* = \beta_0 + \beta_1 Flood\ Exposure_i + \beta_2 Enterprise\ Characteristics_i + \beta_3 DRR_i + \varepsilon_i \ (3.6)$$

Where $Damages_i^*$ is the observed response on how much the damage is.

The estimates in the models, however, fail to address the issue of simultaneity bias. Enterprises may have chosen to pursue DRR measures because of the impacts of previous disasters. To control for endogeneity, this chapter used instrumental variables: respondent is female, distance to the nearest construction firm, and distance to the nearest hardware supply store. The IV Tobit estimation model is as follows:

$$Damages_i^* = \beta_0 + \beta_1 Flood\ Exposure_i + \beta_2 Enterprise\ Characteristics_i + \beta_3 DRR_i + \varepsilon_i \ (3.7)$$

$$DRR_i = \pi_0 + \pi_1 Flood\ Exposure_i + \pi_2 Enterprise\ Characteristics + \pi_3 Z_i + v_i \ (3.8)$$

where $Damages_i^*$ is the latent outcome variable, the cost of damages and losses, Z_i is the instrumental variable—the gender variable and distance variables, namely, and π_1, π_2, π_3 are the matrices of reduced-form parameters.

4. Results

4.1. Summary of Variables

4.1.1. Direct Effects

More than half of the surveyed enterprises suffered from flooding, as shown in **Table 3.2**. Most of them had their premises flooded, with the worst exceeding the waist height. Only five of these enterprises answered that floodwaters did not infiltrate their place of business.

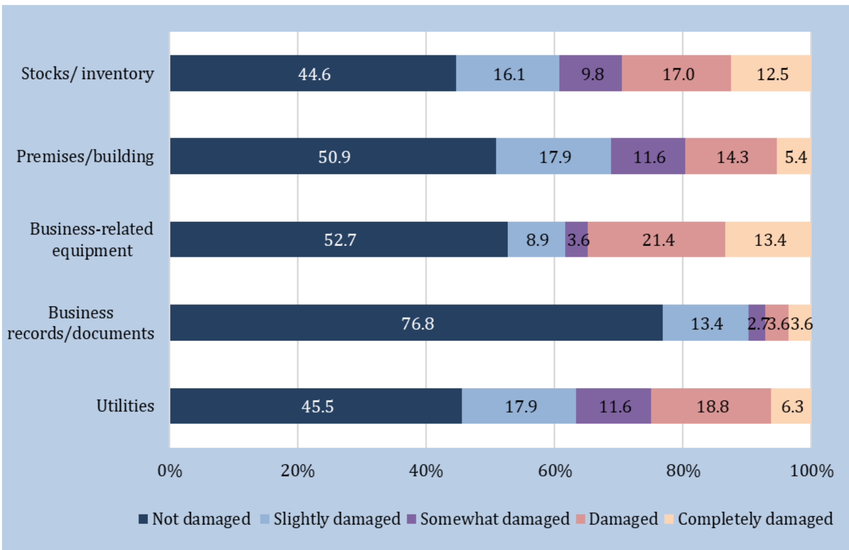
Table 3.2. Summary of Variables

	Obs	Mean	SD	Min	Max
Dependent Variables					
(Log) Cost of Damages to Premises	200	2.41	4.13	0	12.21
(Log) Cost of Damages to and Loss of Contents	200	3.57	4.93	0	14.51
(Log) Sales loss	200	5.22	4.59	0	14.91
Flood Exposure					
Flood hazard (five-year return period)	200	1.30	1.28	0	3
Flood height inside premises	200	1.04	1.34	0	3
For sales loss model					
Has flood experience	200	0.56	0.50	0	1
Consumers were affected by last flooding	200	0.73	0.45	0	1
Suppliers were affected by last flooding	200	0.58	0.50	0	1
Employees were affected by last flooding	200	0.47	0.50	0	1
Number of days without operations	200	6.7	15.56	0	120
Percent damage to utilities	200	0.17	0.30	0	1
Disaster Preparedness and Risk Reduction					
Structural measures	200	0.07	0.16	0	1
Enterprise has relocated stocks/inventory/equipment	200	0.40	0.49	0	1
Percent of possible DRR measures adopted	200	0.19	0.13	0	0.50

Damages to the enterprises brought about by the entry of flood included the destruction of assets such as the business premises, business-related equipment, and stocks/inventory of raw materials and/or products, as shown in **Figure 3.3**. Utilities like water, electricity, and telephone used by the enterprises were also affected by the floods. For business records and documents, majority reported that they were not destroyed.

These 112 establishments suffered broad variations in damages and losses with more than half responding that they had zero or insignificant amount of physical damages while some recounted total destruction in utilities (seven MSMEs), documents (four), equipment (15), stocks (14), and premises (six). Most of those with damages and losses are located in the medium and high flood hazard areas and endured high flood level intrusion.

Figure 3.3. Direct Effects of Flooding on MSMEs



Source: 2018 Marikina MSME Survey

Breaking down by sector, twelve are in the production business and only one did not have any type of damage. Out of this nine, eight experienced damages to their premises and eight had damages to and lost equipment and stocks. Eighty-one are wholesalers or retailers with 30 reporting zero or insignificant overall damages while 44 damaged or lost the contents of the establishment with 11 of this facing complete destruction of stocks and equipment. Nineteen are in the services sector with 12 receiving damages to their building and 13 for content.

Looking only at those that provided damage amounts, direct damages and losses to stocks or inventory dominated the total costs, with this type accounting for 46 percent of the total costs, followed by damages and losses to equipment at 39 percent, and the rest coming from damages to premises. Utilities and business records and documents in this study were not quantified but instead were measured with a five-point Likert scale on how severe the damage was.

Average flood damage to and loss of content amounted to PhP92,127 and a median of PhP15,000. More than half had flood damage less than this average, 14 MSMEs had damages between PhP100,000 to PhP500,000, while two exceeded Ph500,000. Although the high average value of the overall damage to the MSMEs comes from the non-normal distribution of the data and the presence of outliers. For damage to premises, average was at PhP16,108, with 65 enterprises having less than the average. Median amount of damage to premises was PhP3,000, 14 MSMEs had damages between PhP20,000 and PhP70,000, and four with more than PhP100,000.

Considering the income and asset size of the businesses, damages to and loss of contents varied across the income groups while those without building damage were mostly from the first and second quartiles. Overall damage over the average annual income, majority were less than 50 percent, ten had greater than 50 percent, and 16 exceeded 100 percent of their income for their entire year. For asset size, larger enterprises incurred higher amounts of flood damages and losses. Comparing the value of direct damage to asset size by computing for the damage ratio (damage divided by the assets), majority has less than 50 percent, five exceeds 50 percent with three of these having greater than 100 percent.

Enterprises that are located in houses or buildings that have accessible top floors or storage space could relocate and store their assets to reduce losses. Out of the 83 establishments directly affected by the flood, 61 had available higher floors and/or storage facilities. However, 46 of these MSMEs still suffered from damages. Sixty-four enterprises did not have any sort of structural measure to fortify their houses or shops; 17 have only one defense while the rest had two or three measures. For the DRR mechanisms, nine enterprises had zero out of the ten possible preparedness and risk reduction measures available, 64 businesses had between one to three measures, while only two had half of the total DRR measures presented.

To differentiate whether there are differences in the means between the categories in the flood exposure variables, Analysis of Variance (ANOVA) was used. However, since the homogeneity of variances assumption was violated, ANOVA with Welch Test was then utilized. As shown in **Table A.3.1**, the significant p-values in both the five-year flood hazard and the flood entry variables indicate that the four means are not all equal.

Since the Welch test only shows the overall difference between the groups and does not indicate which pairs of groups are significantly different, a post hoc test was used, as shown in **Table A.3.2**. For the flood hazard variable and damages to premises, there is sufficient evidence at the 0.05 level of significance that the means are different between these groups: no flood hazard and medium/high flood hazard areas; and the low and high flood hazard areas. Meanwhile for the contents, except for the medium and high group, all comparison groups had different means. For the flood entry variable and damages to premises, there is a statistically significant difference between the no flood entry and low, medium, and high flood entry only. Unfortunately, this means that as long as the enterprise gets flooded, it incurs damages, no matter the level of water.

4.1.2. Indirect Damages and Losses

As indicated by previous studies, however, enterprises function not in isolation but rely on the community they are operating in. Flooding does not have to hit an enterprise directly for it to be affected. A question regarding the impacts of community flooding, or inundation in their community or barangay, was then raised in the survey to address this scenario. To be more specific, in this case, the enterprise itself was not flooded but the community or barangay where the enterprise was operating in was inundated. All the enterprises responded that they were affected by community flooding—for most, this occurred in August 2018—through their clients, suppliers, and/or employees.

Apart from the direct damages and losses, the enterprises in the survey also suffered from temporary closures of their establishments, thereby causing a decrease in their sales. Of the 200 establishments, 120 reported losses with 31 of this never having faced minor or moderate/major flooding. For those that never had any direct experience of floods but incurred losses, most answered that their suppliers and consumers were affected by flooding.

It implies that business disruption and changes in sales are not just caused by the flooding event itself but also other factors such as damage to stocks, equipment, and utilities or inaccessibility of roads and business facilities.

For those that experienced flooding, sales dropped, in part, because of temporary closures of their establishments, which, for more than half, lasted for up to a week. The worst affected (seven MSMEs), meanwhile, halted operations for more than a month. Only 18 reported continuous work while 14 resumed their business a few hours or a day later. Another reason for the decline in sales is the interruption in delivering goods and services as 38 enterprises responded that they had to cancel orders from their clients. Additionally, consumers found it challenging to travel to the location of the establishment, according to a large majority of the MSMEs. This persisted for more than three days for most of the MSMEs affected. Businesses also experienced delays in the delivery of raw materials and inputs from suppliers, lasting for less than a day for the majority to, at most, two months for three enterprises. Eighty-eight enterprises answered that they had employees that were unable to go to work with the longest lasting up to almost a month for two establishments.

Fourteen MSMEs experienced an increase in their sales despite the flooding. Four of these never faced any type of flooding while the rest faced minor flooding and moderate/major flooding. Six were located in the no flood areas, three from low, four from medium, and one from the high flood hazard areas. The rise in sales indicated that they profited despite the flooding owing to their relatively accessible location and because consumers flocked to them since they remained open.

Breaking down by location, 51 enterprises that suffered from a reduction in sales due to flooding were found in none to low flood hazard zones, 25 were located in the medium, and 44 were in high flood hazard areas. In terms of sector, 12 businesses were from the manufacturing, 87 were from the wholesale and retail trade, while the rest were from services.

In terms of DRR measures adopted, out of the 61 that did not suffer from sales loss, 14 MSMEs (23 percent) had no DRR mechanisms in place. Meanwhile, the others had at least one DRR measure. For those that experienced a reduction in their sales, 83 percent implemented one or more. And those that never experienced flooding before, more than half pursued DRR measures. Comparing the value of sales lost to total annual sales, a large majority had a ratio of less than 50 percent. Only seven exceeded 50 percent and four MSMEs had 100 percent or greater.

4.2. Regression Results

4.2.1. Direct Damages and Losses

Table 3.3 presents the Tobit estimation results and **Table 3.4** shows the first and second tier of the Double-Hurdle estimation for all observations. Both display the models for damage to premises and damage to and loss of contents, which is made up of inventory and equipment damage. For each of the dependent variable, there are two models—Models 1 and 3 were estimated with the structural measures with model 3 having an additional dummy variable on relocation of stock/inventory, while Models 2 and 4 were estimated with the variable on the percent of possible disaster preparedness and risk reduction measures pursued by each business establishment. Average marginal effects for the Tobit models were also calculated and this is presented in **Table A.3.3**.

For both the Tobit and the tier 1 (probit) models, entry of flood waters has a significant positive association with damage to premises and contents. Enterprises that had flood intrusion to their houses or place of business, as opposed to MSMEs that had no flood entry, were more likely to incur damages. Location, elevation, and distance from the Marikina River, or collectively the flood hazard, was also an important factor, specifically the medium flood hazard, on inventory and equipment damage, and high flood hazard on damage to premises. The reference group in this case are the MSMEs that are in an area with no flooding.

For the enterprise (control) characteristics used in the Tobit and the tier 1 models, they were consistently insignificant, which may indicate there were no significant disparities in the damages sustained among MSMEs of different sizes and types. Except for the MSMEs having their own storage space, which has a statistically significant relationship with damages and losses of stocks and equipment. It indicates that those enterprises that can move their content to a safe storage area, are less likely to incur damages. In the tier 2 (truncated) of the Double-Hurdle model, results showed that the higher the income and if MSME is involved in the wholesale and retail trade sector, the lower the damages to the premises sustained.

Table 3.3. Tobit Model: (Log) Cost of Damages and Losses

	Damage to Premises		Damage to and Loss of Contents	
	(1)	(2)	(3)	(4)
Exposure				
Flood entry into premises				
Low	14.063***	15.731***	16.769***	16.928***
	(3.78)	(4.16)	(2.91)	(2.78)
Medium	15.134***	16.096***	14.813***	14.991***
	(2.75)	(2.87)	(1.82)	(1.78)
High	12.854***	13.018***	15.358***	15.270***
	(2.78)	(2.94)	(1.81)	(1.84)
Flood hazard (five-year return period)				
Low	-0.839	-1.202	0.922	0.624
	(3.28)	(3.44)	(2.05)	(2.07)
Medium	4.456	4.795	5.625**	5.390**
	(3.01)	(3.24)	(1.88)	(1.83)
High	7.660*	7.022*	3.564	3.217
	(3.22)	(3.41)	(2.15)	(2.10)
Enterprise characteristics				
MSME is wholesale and retail trade = 1	-1.641	-1.726	-2.774	-2.601
	(2.19)	(2.29)	(1.59)	(1.64)
MSME is services = 1	2.401	2.022	-2.415	-2.451
	(2.56)	(2.65)	(1.77)	(1.83)
Years in operation	0.099	0.106	0.024	0.034
	(0.09)	(0.09)	(0.06)	(0.06)
(Log) Asset size	1.014	1.087	-0.058	0.029
	(0.63)	(0.70)	(0.54)	(0.55)
(Log) Average Income	-0.945	-1.042	-0.757	-0.832
	(0.64)	(0.67)	(0.46)	(0.47)
Home-based = 1	0.911	1.556	1.188	0.99
	(2.63)	(2.76)	(1.99)	(1.98)
Has own storage space = 1			-2.956**	-2.728**
			(1.02)	(1.00)
DRR Measures				
Structural measures	12.721**		2.137	
	(4.73)		(3.18)	
Has relocated stocks/inventory/equipment = 1			-0.44	

			(1.14)	
Percent of possible DRR measures adopted		7.658		4.54
		(5.96)		(4.17)
Constant	-15.196	-16.814	2.433	1.147
	(9.46)	(9.87)	(5.93)	(6.32)
var(e.(Log) Cost of Damages to Premises)	47.049***	51.737***		
	(9.06)	(10.40)		
var(e.(Log) Cost of Damages to and Loss of Contents)			23.868***	23.859***
			(5.61)	(5.57)
Pseudo R^2	0.236	0.222	0.31	0.311
N	192	192	192	192
Left-censored observations	142	142	142	142
Uncensored observations	50	50	50	50

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 3.4. Double-Hurdle Model: (Log) Cost of Damages and Losses

	Damage to Premises				Damage to and Loss of Contents			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Probit / Tier 1		**Truncated / Tier 2**		**Probit / Tier 1**		**Truncated**	
Exposure								
Flood entry into premises								
Low	2.520**	2.197**	0.142	-0.152	3.950***	3.990***	2.296*	2.390*
	(0.87)	(0.72)	(0.94)	(0.93)	(1.14)	(1.15)	(1.15)	(1.19)
Medium	2.667***	2.411***	0.261	0.159	3.282***	3.271***	1.521	1.617
	(0.56)	(0.49)	(0.74)	(0.71)	(0.74)	(0.72)	(0.88)	(0.91)
High	2.011***	1.753***	0.352	0.216	3.464***	3.404***	1.473	1.31
	(0.46)	(0.40)	(0.71)	(0.68)	(0.70)	(0.66)	(0.87)	(0.90)
Flood hazard (five-year return period)								
Low	-0.396	-0.381	0.859	0.965	-0.037	-0.138	-0.063	0.007
	(0.64)	(0.62)	(1.03)	(1.01)	(0.67)	(0.67)	(0.97)	(1.01)
Medium	0.637	0.611	0.845	0.956	1.373*	1.246*	0.568	0.636
	(0.53)	(0.49)	(0.78)	(0.76)	(0.58)	(0.57)	(0.84)	(0.87)
High	1.304*	1.011*	0.686	0.711	0.689	0.641	0.277	0.189
	(0.54)	(0.48)	(0.71)	(0.69)	(0.55)	(0.54)	(0.79)	(0.82)
Enterprise characteristics								
MSME is wholesale and retail trade = 1	-0.369	-0.219	-1.181*	-1.296*	-1.029	-1.008	-1.521*	-1.430*
	(0.54)	(0.50)	(0.52)	(0.51)	(0.83)	(0.81)	(0.63)	(0.65)
MSME is services = 1	0.577	0.364	-0.02	-0.046	-0.877	-0.886	-1.119	-1.181
	(0.58)	(0.54)	(0.73)	(0.70)	(0.84)	(0.82)	(0.76)	(0.79)
Years in operation	0.028	0.022	-0.012	-0.015	0.007	0.009	0.037	0.048*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
(Log) Asset size	0.184	0.166	0.245	0.232	-0.193	-0.16	0.213	0.208
	(0.17)	(0.15)	(0.19)	(0.19)	(0.26)	(0.26)	(0.23)	(0.24)
(Log) Average Income	-0.21	-0.158	-0.470**	-0.491**	-0.135	-0.157	-0.253	-0.229
	(0.14)	(0.12)	(0.18)	(0.17)	(0.15)	(0.15)	(0.18)	(0.19)
Home-based = 1	0.212	0.264	-0.387	-0.342	0.58	0.589	-0.16	-0.398
	(0.44)	(0.41)	(0.54)	(0.52)	(0.53)	(0.52)	(0.62)	(0.63)
Has own storage space = 1					-1.418*	-1.294*	0.243	0.272
					(0.65)	(0.63)	(0.43)	(0.45)
DRR Measures								
Structural measures	3.853***		0.209		0.929		-0.389	
	(1.16)		(0.80)		(1.07)		(1.04)	

Has relocated stocks/inventory/equipment = 1					0.06		-0.962*	
					(0.35)		(0.39)	
Percent of possible DRR measures adopted		1.684		-2.039		1.691		-1.364
		(1.19)		(1.24)		(1.35)		(1.56)
Constant	-3.38	-3.485	11.627***	12.706***	2.549	2.074	9.681**	9.271**
	(2.42)	(2.25)	(2.83)	(2.81)	(3.64)	(3.54)	(3.37)	(3.54)
Sigma			1.071***	1.044***			1.416***	1.469***
			(0.11)	(0.10)			(0.12)	(0.13)
N	192	192	192	192	192	192	192	192

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Among the DRR measures used, only the structural measures variable was significant in the Tobit and tier 1 models. MSMEs that reinforced their roofs, supported their walls, and/or mounted flood defenses seem to suffer from damages to their building, which contradicts literature that say DRR measures help in avoiding damages and losses. The change in the sign of the structural measures variable is maybe one potential consequence caused by endogeneity.

To check for robustness, damage ratios **(Table A.3.4)**, that is the cost of damages over assets, and damage severity categories **(Table A.3.5)** were also examined. Both models were mostly consistent with the results of the Tobit and Double-Hurdle models. For the damage ratios in **Table A.3.4,** models show that flood entry into the premises at all levels increases the cost of damages in relation to the MSMEs' assets compared with those that had no flood intrusion. Being in high flood hazard areas also raises this ratio for the damage to premises.

The ordered probit models for damage severity categories in **Table A.3.6** demonstrate that flood entering the premises will more likely worsen the damages and losses to premises, equipment, and stocks of the MSMEs compared to those that had no flood intrusion. Having your enterprise in a site that has medium and high flood hazard also exacerbates damages to premises and stocks compared to MSMEs located in areas with no flood hazard. But for damages to and loss of equipment, only the medium flood hazard was statistically significant. Other factors that can potentially worsen damages in the premises is if the MSME is involved in manufacturing or services and damages to and loss of equipment will be higher if the

MSME is in the manufacturing sector. Moreover, as income rises, moving from a severer damage category to a relatively better one is more likely.

To control for the endogeneity of DRR measures, the study used instrumental variables such as gender and distance from nearest construction firm or hardware/construction retail stores. The Wald Test of Exogeneity, as seen in the bottom rows of Panel A in both **Tables A.3.7. and A.3.8.,** show insignificant results, which can indicate the lack of evidence to reject the null hypothesis of no endogeneity. However, there remains the possibility of simultaneity bias in the model. To confirm whether the variables chosen meet the conditions to be a good candidate for IV, the Anderson-Rubin test was applied. The values, however, demonstrate that the IVs were weak. This is one limitation of the chapter.

4.2.2. Indirect Damages and Losses

Table 3.5 shows the Tobit estimation results with Model 4 displaying the enterprises that had never experienced flooding before, Models 5 for those with flood experience whether minor or moderate/major flooding or both, and Models 1, 2, 3, and 6 presenting all observations. Model 1 and 2 uses cost of damages to premises and content as well as damage to utilities while Models 3 and 6 includes number of days the enterprise stopped operations. Except for Model 1, the models employ the dummy variables on whether the consumers, suppliers, and employees of the MSME were affected by the last flooding. All models were estimated with the percent of possible DRR measures adopted by each of the enterprises. Average marginal effects are presented in **Table A.3.9**.

Table 3.6 presents the Double-Hurdle estimation results of all observations. Models 1 and 5 in the Double-Hurdle model are compared with Model 1 of the Tobit model, Models 2 and 6 for Model 2, Models 3 and 7 for Model 3, and Models 4 and 8 for Model 6.

The performance of the enterprise after a flooding event is represented by the change in sales due to the disaster. Based on the Tobit models and tier 1—which models the likelihood of the enterprise suffering from a deduction on sales—of the Double-Hurdle models, MSME performance can be explained primarily by the reduction of customers, the damage to and loss of equipment and stocks/inventory, as well as number of days without operating and experience of previous flood events. For those with flood experience, Model 5 of **Table 3.5,** content damages and losses and shrinking consumer base accounted for the higher sales loss. The adoption of disaster preparedness and risk reduction measures did not have any significant relationship with change in sales. Meanwhile, MSMEs that had no flood experiences, as shown in Model 4 of **Table 3.5,** are more likely to suffer from higher loss in sales if their consumers found their business facilities inaccessible.

For the truncated model in **Table 3.6**, sustaining damages to stocks and equipment, experiencing flood, and length of business closure have a statistically significant relationship with amount of sales loss. An increase in the amount of damages to contents of the enterprise, the more likely the MSMEs will have a poorer performance after the flooding. An MSME that has experienced flood before will have a greater probability of incurring higher losses. And as the number of days without business operations, the greater the sales losses. Operating in wholesale and retail trade and services also indicates lower sales loss compared with the manufacturing sector.

Table 3.5. Tobit Model: (Log) Sales Loss

	Sales Loss					
	(1)	(2)	(3)	(4)	(5)	(6)
	Complete	**Complete**	**Complete**	**No Flood Experience**	**With Flood Experience**	**Complete**
Exposure						
(Log) Cost of Damages to Premises	0.098	0.107				
	(0.10)	(0.09)				
(Log) Cost of Damages and Losses of Content	0.627***	0.391***				
	(0.11)	(0.11)				
Damage to utilities	2.395*	1.196				
	(1.13)	(1.01)				
Number of days without operating			0.066**		0.033	0.040*
			(0.02)		(0.02)	(0.02)
Has flood experience = 1						3.994***
						(0.98)
Consumers were affected by last flooding = 1		6.790***	8.137***	8.705***	6.461**	7.034***
		(1.24)	(1.36)	(1.84)	(2.14)	(1.33)
Suppliers were affected by last flooding = 1		0.94	1.691	0.308	1.02	1.083
		(0.97)	(1.09)	(1.81)	(1.14)	(0.93)
Employees were affected by last flooding = 1		0.442	1.118	3.156*	-0.902	0.496
		(0.72)	(0.81)	(1.54)	(0.87)	(0.77)
Enterprise characteristics						
MSME is wholesale and retail trade = 1	-1.842	-2.369	-3.575*	-5.488	-3.926*	-2.878*
	(1.53)	(1.35)	(1.41)	(4.38)	(1.52)	(1.38)
MSME is services = 1	-3.44	-3.582*	-4.443**	-6.979	-3.064	-3.258*
	(1.78)	(1.49)	(1.49)	(4.37)	(1.59)	(1.47)
Years in operation	-0.01	-0.035	-0.026	-0.06	-0.049	-0.045
	(0.05)	(0.04)	(0.05)	(0.09)	(0.06)	(0.04)
(Log) Asset size	0.082	0.002	-0.252	-0.054	-0.031	0.096
	(0.38)	(0.36)	(0.39)	(0.57)	(0.60)	(0.38)
(Log) Average Annual Sales	-0.024	-0.055	-0.145	0.191	-0.289	-0.159
	(0.34)	(0.35)	(0.38)	(0.66)	(0.42)	(0.37)
Home-based = 1	-0.786	-1.143	-0.204	-0.78	-0.023	-0.454
	(1.10)	(1.06)	(1.19)	(1.84)	(1.66)	(1.13)
Has own storage space = 1	-0.161	-0.724	-0.813	0.588	-0.732	-0.459
	(0.88)	(0.75)	(0.82)	(1.53)	(0.90)	(0.75)

DRR Measures						
Percent of possible DRR measures adopted	-0.197	1.797	4.901	3.822	-1.731	1.063
	(3.23)	(3.04)	(3.15)	(7.13)	(3.86)	(3.34)
constant	3.064	0.787	4.632	-3.061	9.662	-0.429
	(5.55)	(4.92)	(5.37)	(8.39)	(8.97)	(5.48)
var(e.(Log) Sales Loss)	25.728***	18.501***	23.447***	25.589***	17.897***	20.645***
	(3.41)	(2.96)	(3.75)	(6.90)	(4.02)	(3.70)
Pseudo R^2	0.096	0.162	0.129	0.149	0.057	0.147
N	192	192	192	84	108	192
Left-censored observations	74	74	74	53	21	74
Uncensored observations	118	118	118	31	87	118

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 3.6. Double-Hurdle Model: (Log) Sales Loss

	Sales Loss							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Probit / Tier 1				Truncated / Tier 2			
Exposure								
(Log) Cost of Damages to Premises	-0.025	-0.004			0.075	0.079*		
	(0.06)	(0.07)			(0.04)	(0.04)		
(Log) Cost of Damages and Losses of Content	0.131**	0.077			0.216***	0.202***		
	(0.04)	(0.05)			(0.04)	(0.04)		
Damage to utilities	0.614*	0.535			-0.053	-0.086		
	(0.30)	(0.31)			(0.13)	(0.13)		
Number of days without operating			0.043*	0.033			0.029***	0.013*
			(0.02)	(0.02)			(0.01)	(0.01)
Has flood experience = 1				0.306				3.222***
				(0.30)				(0.29)
Consumers were affected by last flooding = 1		1.454***	1.537***	1.502***		0.196	0.433	0.144
		(0.32)	(0.30)	(0.31)		(0.54)	(0.67)	(0.47)
Suppliers were affected by last flooding = 1		0.103	0.188	0.153		0.658*	0.950*	0.574*
		(0.29)	(0.27)	(0.28)		(0.32)	(0.39)	(0.27)
Employees were affected by last flooding = 1		0.135	0.199	0.151		0.006	0.276	0.097
		(0.26)	(0.25)	(0.25)		(0.27)	(0.34)	(0.24)
Enterprise characteristics								
MSME is wholesale and retail trade = 1	-0.293	-0.572	-0.517	-0.48	-1.826***	-1.822***	-2.388***	-1.599***
	(0.47)	(0.54)	(0.51)	(0.51)	(0.46)	(0.46)	(0.56)	(0.40)
MSME is services = 1	-0.723	-0.957	-0.833	-0.75	-1.950***	-1.918***	-2.327***	-1.316**
	(0.49)	(0.56)	(0.53)	(0.54)	(0.51)	(0.50)	(0.61)	(0.44)
Years in operation	-0.003	-0.012	-0.009	-0.01	-0.001	-0.005	0.003	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)
(Log) Asset size	0.05	0.022	-0.039	-0.013	-0.086	-0.102	-0.219	0.118
	(0.09)	(0.09)	(0.09)	(0.09)	(0.12)	(0.12)	(0.14)	(0.10)
(Log) Average Annual Sales	-0.091	-0.109	-0.097	-0.099	0.470***	0.478***	0.418**	0.398***
	(0.09)	(0.09)	(0.09)	(0.09)	(0.11)	(0.11)	(0.14)	(0.10)
Home-based = 1	-0.184	-0.232	-0.125	-0.116	-0.413	-0.446	-0.027	-0.381
	(0.27)	(0.29)	(0.28)	(0.28)	(0.34)	(0.34)	(0.41)	(0.29)
Has own storage space = 1	0.027	-0.087	-0.065	-0.037	-0.148	-0.22	-0.322	-0.09
	(0.24)	(0.27)	(0.25)	(0.26)	(0.28)	(0.27)	(0.33)	(0.24)
Susceptibility								

Percent of possible DRR measures adopted	-0.185	0.354	1.119	0.797	-0.123	-0.249	1.424	-1.167
	(0.85)	(0.96)	(0.89)	(0.95)	(1.03)	(1.04)	(1.26)	(0.92)
constant	0.176	0.23	1.154	0.788	4.762**	4.488*	6.945**	1.183
	(1.32)	(1.46)	(1.36)	(1.41)	(1.78)	(1.77)	(2.14)	(1.59)
Sigma					1.356***	1.326***	1.635***	1.150***
					(0.09)	(0.09)	(0.11)	(0.07)
N	192	192	192	192	192	192	192	192

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

To see if the results are robust across other specifications, **Table A.3.10** makes use of sales loss over total sales (in percent). Damages to and loss of equipment and stock as well as consumers affected by flooding seem to be the variables that consistently aggravates the performance of the MSME. There are also lower sales for those that had no direct experience to flooding if and employees were affected by the last flooding. And for all models, DRR measures had no statistically significant relationship with the sales of MSMEs during the last flooding. Number of days without business operations in these models were not significant unlike in the main models, **Tables 3.5 and 3.6**. For **Table A.3.10**, another difference in the results is suppliers were affected has statistically significant negative relationship with sales loss as percent of total sales and asset size and relocation of content have positive relationship.

Table A.3.12 and **Table A.3.13** provides a look at other direct and indirect impacts of flooding. The number of days a business can temporarily stop its operations is mostly likely affected by the location of the enterprise **(Table A.3.12)**. Specifically, if they are located in the high flood hazard areas compared to areas with no flooding, the higher the likelihood that they will close down longer. Experience of floods and incurring damages to and loss of equipment and inventory also have a positive relationship with length of stoppage. Including flood entry into the business premises variable, intrusion of flood waters forces enterprises to cease their operations for a period of time compared to those that did not.

Looking at other outcome variables, **Table A.3.13** shows that consumers would likely find it more difficult to travel to the business establishment if the enterprise was located in a high flood hazard area and if it experienced flooding. These same variables also affect orders from suppliers and whether employees can go to work or not. However, consumer and supplier location variables were not statistically significant. To see the relationship between two categorical variables, **Table A.3.14** shows the Chi-Square statistics of the consumer location and supplier location dummy variables. There is no ample evidence to say that there is a relationship between location and if consumer or supplier is affected.

5. Discussion and Conclusion

For this chapter, the goals were to examine how MSMEs are directly and indirectly affected by flooding and how exposure to flooding as well as DRR measures affect the damages and losses the MSMEs experienced. To address these, a flood damage analysis was used as a framework indicating that as the flood level inside the premises increase, the cost of direct damages and losses also rise. The framework also worked on the hypothesis that there are indirect losses when its consumers, suppliers, and employees are affected, regardless if the enterprises were directly flooded or not. Moreover, that disaster preparedness and risk reduction measures reduces flood damages and losses.

Flooding results in considerable economic losses for a country, especially to the local economy, owing to physical damages on infrastructure and assets and interruption of business operations. Based on the results of this study, MSMEs typically suffer from damages because of the physical impact of flood on the premises and business facilities and on content, like inventory and equipment, found in the establishments. From the Tobit and Double-Hurdle estimation models, if flood waters enter the enterprise’s premises, it is likely that there will be damages to the structure and MSMEs' inventory and equipment. This is consistent with Thieken et al. (2005) and Wijayanti et al. (2017) as the authors showed that flood characteristics like depth and contamination were among the variables that had the most effect on building and content damages. The association between the five-year flood hazard, which accounts for the site, elevation, and distance from the Marikina River, and damages and losses was statistically significant, particularly the medium flood hazard, on content damages and losses, and high flood hazard on damage to premises.

Results generally follow the existing literature. However, on the implementation of structural measures, the more MSMEs protect the structure of their establishments, the more likely for damages to the premises to be high. One possible explanation for this is that improvements made for the business premises increased the value of their assets, thereby, overestimating the value of damages. Another reason could be because the issue of simultaneity was not addressed, hence, affecting the signs. The general hypothesis on disaster preparedness and risk reduction is that implementation should reduce the damages incurred from flooding but this was contradicted by the results of the Tobit and Double-Hurdle models. However, having a storage space for the MSMEs' inventory and equipment was a factor in decreasing the damages and losses incurred for content.

Businesses, however, can remain untouched by flood waters yet still feel the impact of the disaster by affecting its market—its consumers, suppliers, as well as its employees. For this study, consumers were one of the primary reasons why the enterprise experienced dwindling sales. This was seen in other studies as well (Pelling et al., 2002; Messner &

Meyer, 2005; Sydnor et al., 2017). For those that did experience flooding, sales loss may be due in part to the damage in the structure, equipment, stock, and utilities as well as inaccessibility of roads, thereby prohibiting consumers, suppliers, and employers from travelling to the MSME (Tierney, 2009; Corey & Deitch, 2011). DRR measure had no statistically significant relationship with sales loss. Chang and Falit-Baiamonte (2002), did argue, however, that DRR mechanisms did not have an association with reductions in business loss. As an alternative, they suggest that vulnerability factors as well as neighborhood effects can explain change in sales better. This means that government awareness campaigns should not merely focus on the population directly affected by floods. Households and businesses outside the flood hazard areas need to prepare themselves as well for the consequences of flooding.

6. Appendices

Table A.3.1. ANOVA with Welch Test: (Log) Cost of Damages and Losses

		Summary of (Log) Cost of Damages to Premises		Summary of (Log) Cost of Damages to and Loss of Contents	
	Obs	**Mean**	**SD**	**Mean**	**SD**
Flood Exposure					
Flood hazard (five-year return period)					
No	85	0.29	1.52	0.44	2.00
Low	27	1.91	4.11	2.99	4.84
Medium	32	3.79	4.69	6.21	5.36
High	56	5.08	4.74	7.10	4.77
		Welch Stat	p-value	Welch Stat	p-value
ANOVA with Welch Test		22.92	0.00	41.86	0.00
Flood height inside premises					
No	121	0.22	1.41	0.28	1.54
Low	5	5.61	5.12	8.15	4.71
Medium	19	6.84	4.34	8.68	4.15
High	55	5.40	4.76	8.64	3.95
		Welch Stat	p-value	Welch Stat	p-value
ANOVA with Welch Test		33.33	0.00	94.76	0.00

Table A.3.2. Post Hoc Test: (Log) Cost of Damages and Losses

	(Log) Cost of Damages to Premises	(Log) Cost of Damages to and Loss of Contents
Flood Exposure		
Flood hazard (five-year return period)		
No vs Low	1.63	2.55***
	(0.80)	(0.88)
No vs Medium	3.50***	5.77***
	(0.75)	(0.83)
No vs High	4.79***	6.66***
	(0.62)	(0.68)
Low vs Medium	1.87	3.22***
	(0.94)	(1.04)
Low vs High	3.17***	4.11***
	(0.84)	(0.93)
Medium vs High	1.30	0.90
	(0.80)	(0.88)
Flood height inside premises		
No vs Low	5.39***	7.87***
	(1.42)	(1.27)
No vs Medium	6.61***	8.40***
	(0.77)	(0.69)
No vs High	5.18***	8.36***
	(0.51)	(0.45)
Low vs Medium	1.23	0.54
	(1.57)	(1.40)
Low vs High	-0.21	0.49
	(1.46)	(1.30)
Medium vs High	-1.43	-0.05
	(0.83)	(0.74)

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.3.3. Tobit Model: (Log) Cost of Damages and Losses, Average Marginal Effects

	Damage to Premises		Damage to and Loss of Contents	
	(1)	(2)	(3)	(4)
Exposure				
Flood entry into premises				
Low	3.789***	4.217***	6.638***	6.701***
	(1.00)	(1.11)	(1.14)	(1.09)
Medium	4.077***	4.315***	5.864***	5.934***
	(0.73)	(0.75)	(0.72)	(0.71)
High	3.463***	3.490***	6.080***	6.045***
	(0.76)	(0.80)	(0.71)	(0.72)
Flood hazard (five-year return period)				
Low	-0.226	-0.322	0.365	0.247
	(0.88)	(0.92)	(0.82)	(0.82)
Medium	1.201	1.285	2.227**	2.134**
	(0.82)	(0.88)	(0.73)	(0.71)
High	2.064*	1.882*	1.411	1.274
	(0.87)	(0.92)	(0.85)	(0.83)
Enterprise characteristics				
MSME is wholesale and retail trade = 1	-0.442	-0.463	-1.098	-1.03
	(0.59)	(0.61)	(0.61)	(0.63)
MSME is services = 1	0.647	0.542	-0.956	-0.97
	(0.69)	(0.71)	(0.69)	(0.71)
Years in operation	0.027	0.028	0.01	0.013
	(0.02)	(0.02)	(0.023)	(0.022)
(Log) Asset size	0.273	0.291	-0.023	0.012
	(0.17)	(0.19)	(0.21)	(0.22)
(Log) Average Income	-0.255	-0.279	-0.3	-0.329
	(0.17)	(0.18)	(0.18)	(0.18)
Home-based = 1	0.245	0.417	0.47	0.392
	(0.71)	(0.74)	(0.78)	(0.78)
Has own storage space = 1			-1.170**	-1.080**
			(0.37)	(0.37)
DRR Measures				
Structural measures	3.427**		0.846	
	(1.24)		(1.26)	
Has relocated stocks/inventory/equipment = 1		2.053		1.796
		(1.58)		(1.63)
Percent of possible DRR measures adopted		1.964		1.79
		(1.60)		(1.58)
Constant	-15.196	-16.814	2.433	1.147
	(9.46)	(9.87)	(5.93)	(6.32)
Pseudo R^2	0.236	0.222	0.31	0.311
N	192	192	192	192
Left-censored observations	142	142	142	142
Uncensored observations	50	50	50	50

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.3.4. Tobit Model: Damage Ratios

Damage Ratio	Damage to Premises (1)	(2)	Damage to and Loss of Contents (3)	(4)
Exposure				
Flood entry into premises				
Low	0.100*	0.106*	0.924*	0.941*
	(0.04)	(0.04)	(0.36)	(0.37)
Medium	0.124**	0.125**	0.914*	0.916*
	(0.05)	(0.04)	(0.36)	(0.36)
High	0.110*	0.108*	1.024*	0.997*
	(0.05)	(0.04)	(0.42)	(0.41)
Flood hazard (five-year return period)				
Low	0.015	0.014	0.392	0.385
	(0.03)	(0.03)	(0.28)	(0.29)
Medium	0.035	0.039	0.295*	0.296*
	(0.02)	(0.02)	(0.15)	(0.14)
High	0.057*	0.054*	0.295	0.276
	(0.03)	(0.03)	(0.16)	(0.15)
Enterprise characteristics				
MSME is wholesale and retail trade = 1	-0.044	-0.046	-0.167	-0.151
	(0.04)	(0.04)	(0.12)	(0.13)
MSME is services = 1	-0.013	-0.015	-0.034	-0.019
	(0.04)	(0.04)	(0.18)	(0.19)
Years in operation	0.001	0.001	0.006	0.007
	0.00	0.00	(0.01)	(0.01)
(Log) Asset size	-0.01	-0.01	-0.064	-0.066
	(0.01)	(0.01)	(0.05)	(0.05)
(Log) Average Income	-0.023	-0.017	0.017	-0.022
	(0.03)	(0.03)	(0.13)	(0.14)
Has own storage space = 1			-0.145	-0.139
			(0.08)	(0.08)
DRR Measures				
Structural measures	0.068		-0.092	
	(0.04)		(0.21)	
Has relocated stocks/inventory/equipment = 1			-0.169	
			(0.12)	
Percent of possible DRR measures adopted		-0.006		-0.212
		(0.05)		(0.33)
Constant	0.002	0.01	-0.195	-0.208
	(0.08)	(0.08)	(0.36)	(0.37)
var(e.(Log) Cost of Damages to Premises)	0.004	0.004		
	0.00	0.00		
var(e.(Log) Cost of Damages to and Loss of Contents)			0.25	0.25
			(0.17)	(0.18)
Pseudo R^2	11.666	11.295	0.443	0.434
N	192	192	192	192
Left-censored observations	142	142	142	142
Uncensored observations	50	50	50	50

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.3.5. Tobit Model: Damage Ratios, Average Marginal Effects

Damage Ratio	Damage to Premises		Damage to and Loss of Contents	
	(1)	(2)	(3)	(4)
Exposure				
Flood entry into premises				
Low	0.021*	0.022**	0.212*	0.216*
	(0.01)	(0.01)	(0.08)	(0.08)
Medium	0.026**	0.026**	0.210*	0.210*
	(0.01)	(0.01)	(0.08)	(0.08)
High	0.023*	0.023*	0.236*	0.228*
	(0.01)	(0.01)	(0.10)	(0.09)
Flood hazard (five-year return period)				
Low	0.003	0.003	0.09	0.088
	(0.01)	(0.01)	(0.07)	(0.07)
Medium	0.007	0.008	0.068*	0.068*
	(0.01)	(0.01)	(0.03)	(0.03)
High	0.012*	0.011*	0.068	0.063
	(0.01)	(0.01)	(0.04)	(0.04)
Enterprise characteristics				
MSME is wholesale and retail trade = 1	-0.009	-0.01	-0.039	-0.035
	(0.01)	(0.01)	(0.03)	(0.03)
MSME is services = 1	-0.003	-0.003	-0.008	-0.004
	(0.01)	(0.01)	(0.04)	(0.04)
Years in operation	0.0001	0.0001	0.001	0.002
	(0.0001)	(0.0001)	(0.002)	(0.002)
(Log) Average Income	-0.002	-0.002	-0.015	-0.015
	(0.001)	(0.001)	(0.01)	(0.01)
Home-based = 1	-0.005	-0.004	0.004	-0.005
	(0.01)	(0.01)	(0.03)	(0.03)
Has own storage space = 1			-0.093	-0.091
			(0.07)	(0.07)
DRR Measures				
Structural measures	0.068		-0.069	
	(0.04)		(0.10)	
Has relocated stocks/inventory/equipment = 1			-0.099	
			(0.07)	
Percent of possible DRR measures adopted		-0.006		-0.116
		(0.05)		(0.18)
Constant	0.002	0.01	-0.059	-0.069
	(0.08)	(0.08)	(0.27)	(0.28)
var(e.(Log) Cost of Damages to Premises)	0.004	0.004		
	0.00	0.00		
var(e.(Log) Cost of Damages to and Loss of Contents)			0.061*	0.064*
			(0.03)	(0.03)
Pseudo R^2	11.362	11.028	0.692	0.676
N	192	192	192	192
Left-censored observations	142	142	142	142
Uncensored observations	50	50	50	50

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.3.6. Ordered Probit: Damage Categories

	Damages (Categories)					
	Damage to Premises		Damage to and Loss of Stocks		Damage to and Loss of Equipment	
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure						
Flood entry into premises						
Low	2.022**	2.171**	2.179***	2.193***	3.218***	3.271***
	(0.70)	(0.69)	(0.61)	(0.63)	(0.88)	(0.86)
Medium	2.111***	2.160***	2.076***	2.091***	2.678***	2.724***
	(0.45)	(0.46)	(0.46)	(0.46)	(0.49)	(0.47)
High	1.780***	1.757***	2.300***	2.239***	3.049***	3.021***
	(0.43)	(0.46)	(0.42)	(0.43)	(0.51)	(0.49)
Flood hazard (five-year return period)						
Low	0.344	0.276	0.675	0.625	-0.04	-0.108
	(0.48)	(0.49)	(0.42)	(0.45)	(0.52)	(0.54)
Medium	0.882*	0.877*	1.697***	1.631***	0.835*	0.801*
	(0.41)	(0.43)	(0.47)	(0.48)	(0.35)	(0.35)
High	1.213**	1.092*	1.258**	1.175*	0.016	-0.064
	(0.43)	(0.46)	(0.47)	(0.48)	(0.38)	(0.38)
Enterprise characteristics						
Enterprise is Wholesale/Retail Trade	-0.623*	-0.625*	0.216	0.265	-0.983**	-0.940**
	(0.29)	(0.29)	(0.46)	(0.47)	(0.33)	(0.32)
Enterprise is Services	-0.445	-0.487	0.162	0.149	-1.188**	-1.170**
	(0.38)	(0.36)	(0.51)	(0.52)	(0.40)	(0.40)
Age	0.003	0.004	0	0.003	0.017	0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
(Log) Assets	0.089	0.098	0.026	0.048	0.087	0.104
	(0.10)	(0.10)	(0.14)	(0.14)	(0.10)	(0.10)
(Log) Average Income	-0.208*	-0.216*	-0.249*	-0.257*	-0.347***	-0.362***
	(0.10)	(0.10)	(0.11)	(0.11)	(0.10)	(0.10)
Enterprise is home-based	-0.316	-0.244	0.168	0.072	0.006	-0.069
	(0.34)	(0.35)	(0.42)	(0.41)	(0.42)	(0.40)
Enterprise has own storage space			-0.313	-0.26	-0.1	-0.056
			(0.29)	(0.29)	(0.26)	(0.26)
DRR Measures						
Structural measures	1.419*		0.165		0.299	
	(0.61)		(0.64)		(0.59)	

Enterprise has relocated stocks/inventory/equipment			-0.243		-0.212	
			(0.25)		(0.27)	
Percent of possible DRR measures adopted		0.859		0.63		0.60
		(0.71)		(0.89)		(0.89)
cut1	0.58	0.66	0.21	0.59	-1.081	-0.84
	(1.45)	(1.47)	(1.68)	(1.67)	(1.41)	(1.44)
cut2	1.22	1.27	0.77	1.15	-0.727	-0.49
	(1.44)	(1.46)	(1.68)	(1.67)	(1.42)	(1.45)
cut3	1.65	1.69	1.08	1.45	-0.578	-0.341
	(1.43)	(1.44)	(1.69)	(1.68)	(1.42)	(1.45)
cut4	2.49	2.54	1.85	2.22	0.408	0.645
	(1.41)	(1.43)	(1.67)	(1.66)	(1.42)	(1.46)
chi^2	68.91**	43.51	43.63	55.59	59.34	60.92*
p-value	0.00	0.28	0.49	0.06	0.07	0.03
Pseudo R^2	0.318	0.307	0.346	0.344	0.375	0.373
N	192	192	192	192	192	192

Note: chi^2 is the approximate likelihood-ratio test of proportionality of odds across response categories
Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.3.7. IV Tobit: (Log) Damage to Premises

	Panel A: Second-Stage Results (Damage to Premises)					
	IV for Structural Measures				IV for Percent DRR Measures Used	
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure						
Flood entry into premises						
Low	17.686*	26.556	18.030*	9.849	18.065**	18.373**
	(7.03)	(39.93)	(7.58)	(7.45)	(5.98)	(7.01)
Medium	18.031***	24.622	18.295***	11.946**	16.325***	16.355***
	(4.42)	(27.22)	(4.70)	(4.38)	(4.31)	(4.62)
High	13.275***	14.330*	13.319***	12.169***	13.961***	14.081***
	(3.31)	(6.97)	(3.42)	(3.03)	(3.68)	(3.97)
Flood hazard (five-year return period)						
Low	0.292	1.89	0.346	-1.497	0.234	0.403
	(3.82)	(11.39)	(3.90)	(3.96)	(4.54)	(4.86)
Medium	6.838	11.454	6.941	2.086	10.155	10.78
	(4.49)	(21.73)	(4.58)	(3.44)	(7.56)	(8.63)
High	6.705	3.864	6.557	8.837**	11.541	12.098
	(3.96)	(10.83)	(4.13)	(3.29)	(6.23)	(7.12)
Enterprise characteristics						
MSME is wholesale and retail trade = 1	-1.647	-0.693	-1.603	-1.543	-1.787	-1.747
	(2.92)	(7.37)	(3.02)	(2.84)	(3.35)	(3.59)
MSME is services = 1	2.896	4.465	2.922	2.043	3.605	3.82
	(3.42)	(10.48)	(3.52)	(3.62)	(4.14)	(4.51)
Years in operation	0.084	0.054	0.083	0.119	0.101	0.1
	(0.11)	(0.26)	(0.12)	(0.13)	(0.13)	(0.14)
(Log) Asset size	1.163	1.416	1.165	0.711	1.445	1.485
	(0.83)	(2.26)	(0.86)	(0.84)	(1.00)	(1.07)
(Log) Average Income	-0.665	0.01	-0.647	-1.21	0.077	0.223
	(0.83)	(2.81)	(0.86)	(0.70)	(1.56)	(1.83)
Home-based = 1	3.011	7.525	3.071	-1.486	1.023	0.85
	(3.56)	(18.83)	(3.57)	(3.06)	(3.45)	(3.74)
DRR Measures						
Structural measures	-36.652	-148.482	-40.98	64.467		
	(38.93)	(420.66)	(43.32)	(33.95)		

	(1)	(2)	(3)	(4)	(5)	(6)
Percent of possible DRR measures adopted					-70.95	-81.67
					(86.73)	(108.18)
Constant	-24.614*	-33.86	-24.636*	-14.00	-27.14	-27.62
	(11.90)	(47.65)	(12.07)	(12.09)	(14.89)	(15.87)
Instruments	distance from construction firm	distance from construction/hardware supply retailer	distance from construction firm and distance from construction/hardware supply retailer	female	distance from construction firm	distance from construction firm and distance from construction/hardware supply retailer
N	192	192	192	192	192	192
Wald Test of Exogeneity	2.6	0.62	2.67	4.21*	1.58	1.45
p-value	0.11	0.43	0.1	0.04	0.21	0.23
Anderson-Rubin Test	1.45	0.68	1.95	3.41	1.42	1.85
p-value	0.23	0.41	0.38	0.06	0.23	0.40

Panel B. First-Stage Results

	Structural Measures				Percent DRR Measures Used	
	(1)	(2)	(3)	(4)	(5)	(6)
Instrumental Variables						
Distance from construction firm (in meters)	0.0002*		0.0002*		0.0002*	0.0002*
	(0.00)		(0.00)		(0.00)	(0.00)
Distance from construction/hardware supply retailer (in meters)		0.00001	0.00002			0.00001
		(0.00)	(0.00)			(0.00)
Female				-0.056*		
				(0.02)		
Flood Experience						
Flood entry into premises						
Low	0.074	0.081	0.078	0.083	0.029	0.031
	(0.11)	(0.12)	(0.11)	(0.12)	(0.08)	(0.08)
Medium	0.053	0.06	0.054	0.072	-0.0003	0.0004
	(0.06)	(0.06)	(0.06)	(0.06)	(0.04)	(0.04)
High	0.004	0.009	0.004	0.015	0.01	0.009

	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Flood hazard						
Low	0.003	0.018	0.005	0.024	0.009	0.01
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)
Medium	0.045	0.048	0.048	0.049	0.067*	0.069*
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)
High	-0.025	-0.022	-0.024	-0.018	0.055*	0.056*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Enterprise characteristics						
MSME is wholesale and retail trade = 1	0.011	0.008	0.013	-0.012	0.005	0.006
	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.03)
MSME is services = 1	0.017	0.016	0.02	0.011	0.024	0.025
	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)
Years in operation	-0.0005	-0.0003	-0.0004	-0.001	-0.0002	-0.0001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
(Log) Asset size	0.002	0.002	0.001	0.0001	0.004	0.004
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
(Log) Average Income	0.007	0.006	0.007	0.004	0.015*	0.015*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Home-based = 1	0.038	0.04	0.035	0.048*	-0.01	-0.012
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)
Constant					-0.096	-0.099
					(0.13)	(0.13)
N	192	192	192	192	192	192

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.3.8. IV Tobit: (Log) Damages to and Loss of Content

	Panel A: Second-Stage Results (Damage to Content)						
	IV for Structural Measures				IV for Percent DRR Measures Used		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Exposure							
Flood entry into premises							
Low	17.041***	17.682	17.046***	15.264**	17.089***	15.258	17.095***
	(3.09)	(10.23)	(3.10)	(4.88)	(2.97)	(27.30)	(2.95)
Medium	14.994***	15.485*	14.998***	13.675***	15.013***	14.702**	15.015***
	(2.12)	(7.66)	(2.12)	(2.13)	(1.79)	(5.35)	(1.79)
High	15.311***	15.370***	15.311***	15.064***	15.359***	14.281	15.364***
	(1.83)	(2.13)	(1.83)	(1.80)	(2.03)	(16.35)	(2.02)
Flood hazard (five-year return period)							
Low	0.907	1.05	0.908	0.788	0.709	-0.195	0.711
	(2.14)	(3.04)	(2.15)	(2.17)	(2.22)	(13.31)	(2.22)
Medium	5.718**	6.084	5.721**	4.856*	5.704	2.423	5.717
	(2.22)	(6.18)	(2.21)	(2.13)	(2.93)	(47.11)	(2.94)
High	3.434	3.216	3.432	4.036	3.502	0.645	3.514
	(2.16)	(3.76)	(2.16)	(2.06)	(2.84)	(41.08)	(2.85)
Enterprise characteristics							
MSME is wholesale and retail trade = 1	-2.703	-2.634	-2.703	-2.72	-2.622	-2.521	-2.623
	(1.62)	(2.03)	(1.62)	(1.70)	(1.61)	(2.46)	(1.61)
MSME is services = 1	-2.325	-2.216	-2.325	-2.555	-2.367	-3.275	-2.362
	(1.81)	(2.54)	(1.81)	(2.10)	(1.82)	(13.96)	(1.81)
Years in operation	0.027	0.025	0.027	0.032	0.033	0.045	0.033
	(0.06)	(0.06)	(0.06)	(0.07)	(0.06)	(0.18)	(0.06)
(Log) Asset size	-0.029	-0.011	-0.029	-0.157	0.052	-0.191	0.053
	(0.54)	(0.67)	(0.54)	(0.61)	(0.60)	(3.70)	(0.60)
(Log) Average Income	-0.76	-0.715	-0.76	-0.856	-0.755	-1.597	-0.752
	(0.48)	(0.79)	(0.48)	(0.47)	(0.73)	(12.17)	(0.73)
Home-based = 1	1.187	1.525	1.188	0.26	0.945	1.4	0.948
	(2.05)	(5.05)	(2.04)	(2.14)	(2.06)	(7.05)	(2.04)
Has own storage space = 1	-2.894**	-2.803	-2.893**	-3.107**	-2.887	-1.141	-2.893
	(1.00)	(1.69)	(1.00)	(1.11)	(1.69)	(25.32)	(1.69)
DRR Measures							

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Structural measures	-0.566 (20.46)	-8.971 (126.73)	-0.642 (20.56)	20.968 (20.61)			
Percent of possible DRR measures adopted					-0.25 (32.78)	51.578 (750.05)	-0.42 (32.57)
Constant	1.92 (6.64)	1.24 (13.17)	1.92 (6.63)	4.43 (7.30)	0.82 (7.28)	4.54 (56.43)	0.79 (7.30)
Instruments	distance from construction firm	distance from construction/hardware supply retailer	distance from construction firm and distance from construction/hardware supply retailer	female	distance from construction firm	distance from construction/hardware supply retailer	distance from construction firm and distance from constructio n/hardware supply retailer
N	192	192	192	192	192	192	192
Wald Test of Exogeneity	0.02	0.01	0.02	0.98	0.02	0.01	0.02
p-value	0.89	0.93	0.89	0.32	0.89	0.93	0.88
Anderson-Rubin Test	0.00	0.01	0.01	0.74	0.00	0.00	0.00
p-value	0.98	0.94	0.99	0.65	0.99	0.95	0.99

Panel B: First-Stage Results

	Structural Measures				**Percent DRR Measures Used**		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Instrumental Variables							
Distance from construction firm (in meters)	0.0003* (0.00)		0.0003* (0.00)		0.0002 (0.00)		0.0002 (0.00)
Distance from construction/hardware		0.00003	0.000008			0.000006	-0.00001

supply retailer (in meters)							
		(0.00)	(0.00)			(0.00)	(0.00)
Female				-0.055*			
				(0.02)			
Flood Experience							
Flood entry into premises							
Low	0.074	0.08	0.074	0.082	0.034	0.036	0.033
	(0.11)	(0.11)	(0.11)	(0.12)	(0.08)	(0.08)	(0.08)
Medium	0.053	0.059	0.053	0.071	0.003	0.006	0.003
	(0.06)	(0.06)	(0.06)	(0.06)	(0.04)	(0.04)	(0.04)
High	0.004	0.006	0.003	0.013	0.019	0.021	0.02
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Flood hazard							
Low	0.003	0.018	0.004	0.024	0.009	0.018	0.008
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)
Medium	0.045	0.05	0.046	0.05	0.063*	0.064	0.061
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)
High	-0.025	-0.021	-0.025	-0.017	0.053*	0.055*	0.053*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Enterprise characteristics							
MSME is wholesale and retail trade = 1	0.011	0.01	0.012	-0.011	0.001	-0.001	-0.0001
	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)
MSME is services = 1	0.018	0.018	0.018	0.012	0.02	0.018	0.019
	(0.04)	(0.04)	(0.04)	(0.05)	(0.03)	(0.04)	(0.04)
Years in operation	-0.0005	-0.0002	-0.0004	-0.0005	-0.0002	-0.0002	-0.0004
	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(Log) Asset size	0.002	0.002	0.002	0.0001	0.004	0.005	0.004
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
(Log) Average Income	0.007	0.006	0.007	0.004	0.017*	0.016*	0.017*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Home-based = 1	0.038	0.04	0.037	0.048*	-0.012	-0.009	-0.011
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Has own storage space = 1	0.003	0.011	0.003	0.008	-0.038	-0.034	-0.039*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
Constant	-0.127	-0.1	-0.129	0.007	-0.1	-0.08	-0.09
	(0.12)	(0.13)	(0.12)	(0.13)	(0.13)	(0.13)	(0.13)

N	192	192	192	192	192	192	192

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.3.9. Tobit Model: (Log) Sales Loss, Average Marginal Effects

	Sales Loss					
	(1)	(2)	(3)	(3)	(4)	(5)
	Complete	Complete	Complete	No Flood Experience	With Flood Experience	Complete
Exposure						
(Log) Cost of Damages to Premises	0.055	0.065				
	(0.06)	(0.05)				
(Log) Cost of Damages and Losses of Content	0.353***	0.236***				
	(0.06)	(0.07)				
Damage to utilities	1.347*	0.722				
	(0.61)	(0.60)				
Number of days without operating			0.038**		0.026*	0.024*
			(0.01)		(0.01)	(0.01)
Has flood experience = 1						2.381***
						(0.62)
Consumers were affected by last flooding = 1		4.097***	4.716***	2.986***	5.204**	4.193***
		(0.78)	(0.83)	(0.70)	(1.72)	(0.81)
Suppliers were affected by last flooding = 1		0.567	0.98	0.106	0.821	0.646
		(0.59)	(0.63)	(0.62)	(0.92)	(0.56)
Employees were affected by last flooding = 1		0.267	0.648	1.083*	-0.727	0.296
		(0.44)	(0.47)	(0.51)	(0.70)	(0.46)
Enterprise characteristics						
MSME is wholesale and retail trade = 1	-1.036	-1.429	-2.072*	-1.883	-3.162**	-1.716*
	(0.86)	(0.82)	(0.82)	(1.49)	(1.19)	(0.82)
MSME is services = 1	-1.934	-2.161*	-2.575**	-2.394	-2.468	-1.942*
	(1.00)	(0.89)	(0.87)	(1.48)	(1.26)	(0.87)
Years in operation	-0.005	-0.021	-0.015	-0.02	-0.039	-0.027
	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.03)
(Log) Asset size	0.046	0.001	-0.146	-0.019	-0.025	0.057
	(0.22)	(0.22)	(0.23)	(0.20)	(0.48)	(0.23)
(Log) Average Annual Sales	-0.014	-0.033	-0.084	0.066	-0.233	-0.095
	(0.19)	(0.21)	(0.22)	(0.23)	(0.34)	(0.22)
Home-based = 1	-0.442	-0.69	-0.118	-0.268	-0.019	-0.27
	(0.62)	(0.64)	(0.69)	(0.63)	(1.34)	(0.68)
Has own storage space = 1	-0.091	-0.437	-0.471	0.202	-0.589	-0.274
	(0.50)	(0.45)	(0.48)	(0.53)	(0.73)	(0.45)

DRR Measures						
Percent of possible DRR measures adopted	-0.111	1.084	2.841	1.311	-1.394	0.634
	(1.82)	(1.84)	(1.83)	(2.46)	(3.11)	(1.99)
constant	3.064	0.787	4.632	-3.061	9.662	-0.429
	(5.55)	(4.92)	(5.37)	(8.39)	(8.97)	(5.48)
var(e.ln_sales_loss)	25.728***	18.501***	23.447***	25.589***	17.897***	20.645***
	(3.41)	(2.96)	(3.75)	(6.90)	(4.02)	(3.70)
Pseudo R^2	0.096	0.162	0.129	0.149	0.057	0.147
N	192	192	192	84	108	192
Left-censored observations	74	74	74	53	21	74
Uncensored observations	118	118	118	31	87	118

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.3.10. Tobit Model: Sales Loss over Annual Sales (in percent)

	Sales Loss/Total Sales					
	(1)	(2)	(3)	(4)	(4)	(5)
	Complete	**Complete**	**Complete**	**No Flood Experience**	**With Flood Experience**	**Complete**
Exposure						
(Log) Cost of Damages to Premises	0.011	0.011				
	(0.01)	(0.01)				
(Log) Cost of Damages and Losses of Content	0.034***	0.025**				
	(0.01)	(0.01)				
Damage to utilities	0.037	0.025				
	(0.04)	(0.04)				
Number of days without operating			0.002		0.0005	0.001
			0.00		(0.001)	0.00
Has flood experience = 1						0.206*
						(0.08)
Consumers were affected by last flooding = 1		0.276**	0.380**	0.005***	0.304*	0.332**
		(0.09)	(0.12)	(0.002)	(0.15)	(0.11)
Suppliers were affected by last flooding = 1		0.086	0.162*	0.0002	0.144*	0.133*
		(0.04)	(0.06)	(0.001)	(0.07)	(0.05)
Employees were affected by last flooding = 1		0.019	0.058	0.002*	-0.029	0.03
		(0.06)	(0.07)	(0.001)	(0.09)	(0.07)
Enterprise characteristics						
MSME is wholesale and retail trade = 1	-0.12	-0.139	-0.244	-0.007	-0.284	-0.206
	(0.11)	(0.12)	(0.13)	(0.003)	(0.15)	(0.13)
MSME is services = 1	-0.249*	-0.259*	-0.333*	-0.008*	-0.320*	-0.274*
	(0.11)	(0.11)	(0.14)	(0.003)	(0.16)	(0.14)
Years in operation	0.002	-0.001	0.00005	-0.0001	-0.0002	-0.001
	(0.003)	(0.002)	(0.003)	(0.0001)	(0.003)	(0.002)
(Log) Asset size	-0.016	-0.021	-0.049*	-0.0003	-0.069	-0.031
	(0.02)	(0.02)	(0.02)	(0.003)	(0.04)	(0.02)
(Log) Average Annual Sales	-0.061	-0.083	-0.006	-0.001	0.005	-0.02
	(0.06)	(0.07)	(0.07)	(0.001)	(0.11)	(0.07)
Home-based = 1	0.074	0.051	0.036	-0.001	0.049	0.054
	(0.06)	(0.05)	(0.05)	(0.001)	(0.06)	(0.05)

Has own storage space = 1	-0.161	-0.724	-0.813	0.588	-0.732	-0.459
	(0.88)	(0.75)	(0.82)	(1.53)	(0.90)	(0.75)
DRR Measures						
Percent of possible DRR measures adopted	-0.268	-0.225	0.02	0.002	-0.464	-0.176
	(0.23)	(0.23)	(0.18)	(0.004)	(0.33)	(0.22)
constant	0.132	0.017	0.396	0.008	0.984	0.114
	(0.31)	(0.31)	(0.32)	(0.01)	(0.66)	(0.33)
var(e.Sales Loss over Annual Sales)	0.13	0.129	0.153	0.000**	0.198	0.148
	(0.07)	(0.07)	(0.09)	(0.005)	(0.12)	(0.09)
Pseudo R^2	0.303	0.37	0.252	-0.201	0.109	0.277
N	192	192	192	84	108	192
Left-censored observations	74	74	74	53	21	74
Uncensored observations	118	118	118	31	87	118

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.3.11. Independent t-Tests: (Log) Sales Loss

	(Log) Sales Loss					
	Yes	**N**	**No**	**N**	**t**	**p-value**
Flood Experience						
Consumers were affected by last flooding	7.65	129	1.12	52	-13.27	0.00
Suppliers were affected by last flooding	7.93	102	2.98	79	-8.73	0.00
Employees were affected by last flooding	7.60	83	4.23	98	-5.47	0.00
Temporarily stopped operations	9.40	88	2.34	93	-17.35	0.00

Table A.3.12. Tobit Model: Length of Business Stoppage

	Length of Business Stoppage			
	(1)	(2)	(3)	(4)
	Coefficient	**Marginal Effects**	**Coefficient**	**Marginal Effects**
Exposure				
Flood hazard (five-year return period)	15.972***	5.991***	11.875**	4.440**
Low	(4.12)	(1.50)	(4.17)	(1.54)
	15.462***	5.800***	13.636***	5.098***
Medium	(3.97)	(1.43)	(3.81)	(1.37)
	16.363***	6.138***	12.879**	4.815***
High	(3.80)	(1.34)	(3.88)	(1.40)
Flood entry into premises				
Low	1.405	0.527	5.156	1.928
	(5.70)	(2.14)	(5.61)	(2.09)
Medium	7.066	2.651	9.615*	3.595*
	(4.33)	(1.61)	(4.86)	(1.80)
High	7.668*	2.877*	8.575*	3.206*
	(3.62)	(1.34)	(3.81)	(1.40)
(Log) Cost of Damages to Premises	0.22	0.08	0.34	0.13
	(0.34)	(0.13)	(0.34)	(0.13)
(Log) Cost of Damages and Losses of Content	1.064**	0.399**	0.66	0.245*
	(0.35)	(0.13)	(0.33)	(0.13)
Utility Damage	2.139*	0.802*	1.88	0.70
	(1.05)	(0.39)	(1.01)	(0.37)
Consumers were affected by last flooding = 1			8.159*	3.051*
			(3.97)	(1.44)
Suppliers were affected by last flooding = 1			8.077*	3.020*
			(3.29)	(1.21)
Employees were affected by last flooding = 1			-1.827	-0.683
			(2.93)	(1.09)
Enterprise characteristics				
MSME is wholesale and retail trade = 1	-3.814	-1.431	-3.195	-1.195
	(5.78)	(2.17)	(5.95)	(2.23)
MSME is services = 1	-5.851	-2.195	-4.899	-1.832
	(5.76)	(2.16)	(5.69)	(2.13)
Years in operation	0.14	0.052	0.094	0.035
	(0.16)	(0.06)	(0.15)	(0.06)
(Log) Asset size	-1.189	-0.446	-1.278	-0.478
	(1.27)	(0.47)	(1.24)	(0.46)
(Log) Average Annual Sales	0.599	0.225	0.683	0.255
	(1.04)	(0.39)	(1.07)	(0.40)
Home-based = 1	-1.481	-0.555	-3.302	-1.235
	(4.59)	(1.72)	(4.86)	(1.81)
Has own storage space = 1	-3.697	-1.387	-4.723	-1.766
	(3.49)	(1.31)	(3.51)	(1.31)
DRR Measures				
Percent of possible DRR measures adopted	-3.215	-1.206	-3.657	-1.367
	(10.19)	(3.83)	(10.57)	(3.96)
constant	-8.973		-14.55	
	(17.36)		(17.39)	

var(e.Length of Business Stoppage)	172.074***		163.702***	
	(49.94)		(46.11)	
Pseudo R^2	0.172		0.184	
N	192	192	192	192
Left-censored observations	74	74	74	74
Uncensored observations	118	118	118	118

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.3.13. Probit Models: Consumers, Suppliers, and Employees Affected

	Consumers Affected (1)	Suppliers Affected (2)	Employees Affected (3)
Exposure			
Flood hazard (five-year return period)			
Low	0.503	0.657	-0.444
	(0.40)	(0.35)	(0.37)
Medium	0.393	0.459	-0.031
	(0.38)	(0.37)	(0.36)
High	1.303**	0.985**	0.657*
	(0.42)	(0.35)	(0.33)
Experienced flooding	1.194**	0.829**	0.758*
	(0.38)	(0.30)	(0.30)
Enterprise characteristics			
MSME is wholesale and retail trade = 1	0.534	0.057	-0.035
	(0.42)	(0.43)	(0.37)
MSME is services = 1	0.656	-0.234	0.565
	(0.46)	(0.45)	(0.40)
Years in operation	0.022	0.031*	-0.006
	(0.01)	(0.01)	(0.01)
(Log) Asset Size	0.12	0.06	0.18
	(0.10)	(0.12)	(0.09)
(Log) Average Annual Sales	0.00	(0.15)	0.12
	(0.09)	(0.10)	(0.08)
Home-based = 1	0.248	0.448	0.139
	(0.29)	(0.27)	(0.25)
Has own storage space = 1	0.374	0.543*	0.134
	(0.25)	(0.24)	(0.22)
Number of Employees			-0.0002
			(0.01)
Consumer Location			
In the same barangay = 1	0.487		
	(0.27)		
In different barangay = 1	-0.062		
	(0.26)		
Outside Marikina City = 1	-0.145		
	(0.35)		
Supplier Location			
In the same barangay = 1		-0.332	
		(0.24)	
In different barangay = 1		-0.215	
		(0.27)	
Outside Marikina City = 1		0.397	
		(0.31)	
Outside Metro Manila = 1		0.745	
		(0.55)	
DRR Measures			
Percent of possible DRR measures adopted	-2.024*	0.623	-0.946
	(0.96)	(0.85)	(0.79)
constant	-3.036*	-0.837	-4.646***
	(1.42)	(1.50)	(1.40)

Pseudo R^2	0.274	0.283	0.153
N	192	192	192

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.3.14. Chi-Square Tests: (Log) Sales Loss

		Consumers Affected			
		Yes	No	χ^2	p-value
Flood Exposure					
Flood Hazard (five-year return period)	None	45	40		
	Low	22	5	31.68	0.00
	Medium	25	7		
	High	53	3		
Consumer Location					
In the same barangay	Yes	115	40	0.99	0.32
	No	30	15		
In different barangay	Yes	44	23	2.36	0.13
	No	101	32		
Outside Marikina City	Yes	22	12	1.25	0.26
	No	123	43		
Enterprise Characteristics					
Type	Wholesale/Retail Trade	105	36		
	Services	28	15	1.50	0.47
	Manufacturing	12	4		

		Suppliers Affected			
		Yes	No	χ^2	p-value
Flood Exposure					
Flood Hazard (five-year return period)	None	29	56		
	Low	19	8	37.18	0.00
	Medium	20	12		
	High	47	9		
Supplier Location					
In the same barangay	Yes	34	29	0.47	0.49
	No	81	56		
In different barangay	Yes	42	24	2.36	0.13
	No	73	61		
Outside Marikina City	Yes	86	29	1.43	0.23
	No	107	8		
Outside Metro Manila	Yes	3	82	1.10	0.29
	No	107	8		
Enterprise Characteristics					
Type	Wholesale/Retail Trade	84	57		
	Services	20	23	3.20	0.20
	Manufacturing	11	5		

		Employees Affected			
		Yes	No	χ^2	p-value
Flood Exposure					
Flood Hazard (five-year return period)	None	29	56		
	Low	10	17	18.38	0.00
	Medium	16	16		
	High	39	17		
Enterprise Characteristics					
Type	Wholesale/Retail Trade	61	80		
	Services	23	20	3.07	0.22
	Manufacturing	10	6		
Employment Size		94	106	21.91	0.08

Chapter 4. Living with Floods: Examining the Protection Motivation of Micro, Small, and Medium Enterprises in Marikina City, Philippines

1. Introduction

Disasters are a product of society's—individuals, communities, businesses, and the governments—decisions and policies, actions and inactions. A changing climate further exacerbates risks against disasters. Along with unsound land use plans, environmental programs, and infrastructure development, as well as low individual protection. The responsibilities fall on each stakeholder, but they must also be shared to prevent or minimize the risks.

MSMEs are essential players in the growth and development of the local economy. They are crucial in accelerating the restoration of the community following a disaster and bolstering local resilience since they are the primary providers of goods and services, local employment, and revenue to the community. However, they are greatly at risk when natural hazards strike, especially since most belong to the informal sector. Despite their role, however, are MSMEs actively searching for and implementing measures to reduce their risks against disasters? Are disaster risk management and climate adaptation mechanisms, which contribute to MSMEs' recovery and survival, high on their agenda?

With the enormous costs brought by disasters and the possible benefits of adequate preparation, it should follow that disaster risk reduction and management (DRRM) measures must be undertaken. However, according to the literature, it is not always the case (Bubeck, Botzen, & Aerts, 2012). According to an Asia-Pacific Economic Cooperation (APEC) (2014) study, more than half (67 percent) of the enterprises asked in 17 APEC economies did not have any knowledge about Business Continuity Plans (BCP). The survey covered all enterprises, including the large ones. Focusing on MSMEs, that figure rose to 83 percent. This story is reiterated in a study conducted by the ADPC (2016). Even with information about climate hazards and disaster risks and suffering damages and loss, there is a lack of understanding of formal coping mechanisms like BCPs and insurance. More than three-fourths of the respondents stated that they had not adopted BCPs ADPC (2016). In a rapid survey conducted by UNIDO (2020)**,** enterprises that did not have any BCP cited the following barriers: no or inadequate knowledge about the plan, doubts against its usefulness, or the inability to craft one. And for those that have BCP, some were no longer effective because their BCPs were not updated or were merely created to meet requirements. For insurance, not even a quarter of the respondents answered that they have existing natural catastrophe insurance and a mere four percent responded that they bought insurance to reduce potential losses (ADPC, 2016).

This chapter aims to identify the disaster preparedness and risk reduction measures implemented by MSMEs in Marikina City and determine the factors that affect DRR decisions.

With these objectives in mind, this chapter intends explicitly to answer the following questions:

1. What drives MSME's adoption of DRRM measures? What is the role of flood experience, social capital, risk perception, and perceived preparedness on intention to implement DRR?
2. Do past flood experience and social capital affect risk perception and perceived preparedness of enterprises?
3. Do risk perception and perceived level of preparedness act as mediating factors between individual experiences/characteristics and intent?

Since data on MSMEs, flooding impacts, and intention to adopt disaster preparedness and risk reduction mechanisms are limited, primary data was gathered through a survey of 200 enterprises in Marikina City. These were then examined and analyzed mainly through SEM.

Based on the survey data and available literature, this chapter argues that flood experience alone does not prompt or trigger adjustments in behavior towards risk reduction. Decisions on adopting DRR are made on the basis of several interconnected factors like the experience of direct and indirect floods, damages and losses incurred due to floods, the social network the enterprise is part of, the perception on the frequency and intensity of future floods, and the perceived ability to protect themselves. Following a growing number of research that drew on socio-psychological theories to explain protective behavior, the relationships among the variables were examined using the PMT as the primary framework.

Findings from this study echoed some of the results of available surveys. Specifically, it showed how inadequately prepared enterprises are against flooding events. A large majority of enterprises, especially micro and small enterprises, have no existing BCPs and/or insurance plans, even though it has been argued that these are essential components in alleviating the risks encountered by MSMEs and speeding the recovery from a disaster.

Results from the SEM showed that flood experience—the frequency of suffering from inundation and incurred damages and losses—does have a statistically significant effect on willingness to insure (WTI) and willingness-to-pay for insurance (WTP). However, risk perception, which is a latent variable shaped by perceived frequency of future flooding, perceived severity of the subsequent flooding in the enterprise's area, and worry about flooding threats on the enterprise, does not statistically significant relationship with WTI and WTP for insurance. An enterprise's perception of its level of preparedness, on the other hand, is a significant positive factor.

For the social capital indicators, if MSMEs received information about flooding and insurance from their social networks, they may be more inclined to answer that they plan to buy insurance or provide a higher amount they are willing to pay. These findings are the direct associations. Although results from the estimation show indirect paths from flood experience, social capital, and respondent and enterprise characteristics to risk perception and perceived preparedness to WTI and WTP for insurance, they were not statistically significant. It means there was insufficient evidence to prove that risk perception and perceived preparedness act as mediating variables.

Some methodological limitations in this paper should be acknowledged. Attempts to test a causal model of DRR behavioral intention and addressing possible endogeneity issues were made, for instance, by asking the respondents about the intention to adopt DRR measures instead of using actual DRR behavior to ensure temporal precedence. Additionally, the flood experience of respondents occurred before the survey was conducted. Meanwhile, the questions regarding their perception of the risks of flooding and their level of preparedness as well as their intention to purchase insurance or pursue DRR mechanisms reflect their present thoughts and beliefs. Thus, it guarantees that simultaneity, or the mediating and outcome variables drive the independent variables, was evaded.

Section 2 discusses recent research on disaster risk reduction and management behavior and its influencing factors as well as the possible contributions of this paper. Information on the research design, data collection, and the SEM models are provided in Section 3. Section 4 assesses the data from the survey and examines the results from the models. Lastly, section 5 offers a summary of the findings.

2. Review of Related Literature

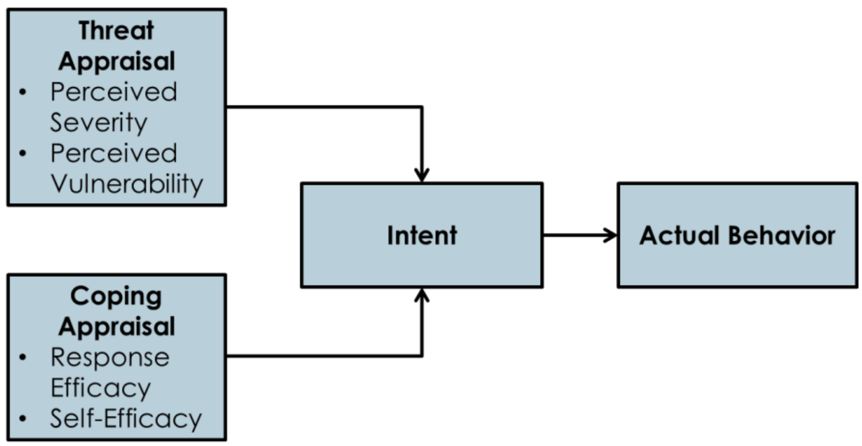
This paper adopts the PMT initially developed by Rogers (1975) and further revised by Rogers and Prentice-Dunn (1997). The theory provides an elaborate explanation on addressing fear and how and why individuals protect themselves against various threats. It is made up of two phases (Rogers, 1983). One is threat appraisal. It comprises individuals' own beliefs and perceptions about the likelihood and severity of risks and worry or fear that future disasters will affect them. The other is coping appraisal, which is made up of self-efficacy or their ability to cope, response-efficacy or perception on the effectiveness of the protective behavior, and response cost.

PMT was, in the beginning, utilized primarily in health risk discussions. Though it has been expanding to other fields, particularly in disaster preparedness literature (Grothmann & Patt, 2005; Grothmann & Reusswig, 2006; Zaalberg, Midden, Meijnders, & McCalley, 2009; Meyer et al., 2013), in recent years. Another advantage of this framework is that it can be utilized in pointing out possible policy programs that can push or communicate better disaster protective measures (Oakley, Himmelweit, Leinster, & Casado, 2020).

Studies have demonstrated that the relationship between high disaster risk perception and decisions to prepare and reduce the effects of disasters remains substantial (Lindell & Hwang, 2008; Thistlethwaite, Henstra, Brown, & Scott, 2018; Martins, Nigg, Louis-Charles, & Kendra, 2019). The same goes for intention to adopt DRR measures as well (Warner et al., 2009; Botzen & van den Bergh, 2012). However, based on growing research, as reviewed by Bubeck, Botzen, and Aerts (2012) and summarized in **Table 4.1**, risk perception alone is not enough because the relationship between risk perception and the adoption of flood reduction measures was shown to be weak or not statistically significant.

Recent findings from literature claim that it is crucial to consider both threat appraisal or risk perception and coping appraisal to prompt a change in protection behavior as espoused by the PMT (Grothmann & Reusswig, 2006; Zaalberg et al., 2009; Bubeck et al., 2012; Mishra & Suar, 2012; Reynaud, Aubert, & Nguyen, 2013; Poussin, Botzen, & Aerts, 2014; Bamberg, Masson, Brewitt, & Nemetschek, 2017). For people to make and carry out decisions, they not merely rely on their feelings of risk but also depend on how confident they can take action against different risks (Bubeck, Botzen, Kreibich, & Aerts, 2013; Babcicky & Seebauer, 2019). As illustrated in Figure 4.1, PMT suggests that an individual's risk reduction decisions are driven jointly by threat appraisal and coping appraisal.

Figure 4.1. Protection Motivation Theory



Note: Adopted from Rogers & Prentice-Dunn (1997)

However, both threat appraisal and coping appraisal are influenced by the personality, characteristics, and past experiences of a person. Therefore, these two appraisal factors can be viewed as intervening or mediating variables (Grothmann & Reusswig, 2006; Budhathoki, Paton, A. Lassa, & Zander, 2020). In a mediation relationship, there is a direct link between an independent variable and a dependent variable. There are also indirect associations between an independent and a mediator variable and between a mediator variable and a dependent variable (Kline, 2011).

Being struck by natural hazards and suffering from the consequences significantly alter people's awareness and perception of risks and are, therefore, more likely to adopt various preparedness and risk reduction measures (Grothmann & Reusswig, 2006; Lindell &

Hwang, 2008; H. Kreibich et al., 2011; Poussin et al., 2014; Brown, Daigneault, Tjernström, & Zou, 2018). For Bamberg et al. (2017), however, using meta-analytical structural equation modeling, past flood experience was only an indirect factor in influencing protective behaviors and suggested further use of flood-related emotions and trust in government institutions as supplement factors.

More studies, as shown in **Table 4.1.B**, have also been incorporating social networks, human capital, values, perceptions, awareness, and culture to determine the factors affecting risk perception and disaster preparedness, and climate adaptation (Adger, et al., 2009; Preston, Yuen, & Westaway, 2011; Aldrich & Meyer, 2015). Disasters are experiences shared by the community, and disaster preparedness and recovery are attached to that network (Adger, 2003; Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008; Martins et al., 2019), however, social capital—that is forming strong connections with friends, neighbors, the community—has not been fully utilized in building community resilience (Aldrich & Meyer, 2015). This is despite demonstrating that it can positively affect adaptation and disaster mitigation behavior (Norris et al., 2008; Yaméogo, Fonta, & Wünscher, 2018; Martins et al., 2019; Raza et al., 2019) as social networks can offer several both financial and non-financial resources and support before, during, and after disasters (Aldrich & Meyer, 2015).

Strong social ties, however, can backfire. According to Wolf et al. (2010), individuals with stronger connections perceive themselves as having lower risk than those with weaker social ties. This finding is especially true if the network believes that they are resilient for surviving previous disasters, hence getting less encouraged to adopt mitigation programs (Wolf et al., 2010). But Babcicky and Seebauer (2017) illustrated that social capital could have both positive and negative effects on risk perception and coping ability of households. Thus, on the one hand, social capital can raise self-efficacy, but on the other hand, it can lower the perception of flood risks.

This chapter endeavors to address the research gaps relating to MSMEs, flooding, risk perception, social capital, and DRRM, as well as the use of PMT as the main lens for MSME protection behavior. One limitation of the framework is that it does not address the cyclical nature of disasters and threat and coping appraisal and DRR behavior. Although there have been studies that explained enterprise protection behavior using this framework, the topics were mostly focused on cyber security and information technology (see Ifinedo, 2012) and not natural hazards. Some studies like Han and Nigg (2011)'s examination of businesses affected by an earthquake used risk perception only and excluding coping appraisal or any of its indicators to determine their disaster preparedness.

Additionally, literature seems to lean towards households (Zaalberg et al., 2009; Mercado, 2016; Lee, 2018; Huang, Cao, Wang, & Wang, 2020) and farmers (Luu et al., 2019; Raza et al., 2019; Budhathoki et al., 2020) as the unit of analysis. Related studies were summarized in **Table 4.1.** However, MSMEs, especially microenterprises, act similarly with households because most of them are operated within their own homes. They are also parallel farmers or fishermen since the respondents' enterprise is the primary source of income for the household.

Table 4.1. Summary of Related Literature

Authors and Year	Country Studied	Disaster Type	Framework	Method	Main Results
			A: Flood Experience		
Brown et al., 2018	Fiji	Flooding		Linear Regression Model	“Experiencing extreme event substantially changes individuals’ risk perceptions.”, p. 1
Han & Nigg, 2011	United States	Earthquake	Disaster Preparedness	Linear Regression Model Tobit Model	“Disaster experience and risk perception of businesses have a positive effect on disaster preparedness activities.”, p. 22
Lee, 2018	Taiwan	Flooding	Disaster Preparedness	Structural Equation Model	“More vulnerable townships show no significant positive relationship between attitudes to and knowledge of climate change, place attachment, and their adaptation behavioral intentions in the face of disaster risk perceptions.”, p. 1
Takao et al., 2004	Japan	Flooding	Disaster Preparedness	Chi-squared test	“Degree of preparedness of households for floods was determined by the level of fear of floods and the amount of damage sustained. Preparedness did not depend on their anticipation of floods.”, p. 775
			B: Social Capital		
Babcicky & Seebauer, 2017	Austria	Flooding	Protection Motivation Theory	Multiple Linear Regression	“Social capital increases perceived self-efficacy and provides critical support during and after flood events but it can also reduce flood risk perceptions of private households.”, p. 1017
Cai et al., 2015	China		Social Network Effect	Randomized experiment,	Disseminating information about insurance within farmers’ social network is more effective in influencing DRR behavior compared to government promotions.
Martins et al., 2019	United States	Flooding	Disaster Preparedness	Factor Analysis Path Analysis	Social capital and risk perception had positive impacts on the preparedness efforts developed by New York City households.
Wolf et al., 2010	United Kingdom	Heat Wave	Social Network Analysis	Case Study	“Strong bonding networks could potentially exacerbate rather than reduce the vulnerability of elderly people to the effects of heat waves.”, p. 44

Yaméogo et al., 2018	Burkina Faso	Climate change-related hazards	Social Capital	Generalized Poisson Regression Multivariate Probit Model	“Farmers’ cognitive social capital was significantly and positively related to their choice of soil and water conservation techniques, and techniques such as agroforestry and irrigation. Structural social capital, on the other hand, was positively associated with the adoption of new varieties and conservation tillage strategies and negatively associated with the use of a crop-diversification strategy.”, p. 1
			C: Threat Appraisal and Coping Appraisal		
Babcicky & Seebauer, 2019	Austria	Flooding	Protection Motivation Theory	Structural Equation Model	“Two separate routes leading to two different response types: A protective route from coping appraisal to protective behavior, and a non-protective route from threat appraisal to non-protective responses.”, p. 1503
Bamberg et al., 2017	various countries	Flooding		Meta Analysis	Threat appraisal and coping appraisal are both significantly associated with flood preventive intentions/behaviors. “Flood-related emotions and trust in public institutions as additional predictors, whereas past flood experiences qualify only as an indirect predictor.”, p. 116
Bubeck et al., 2012	various countries	Flooding	Protection Motivation Theory	Meta Analysis	Weak relationship between flood risk perception and mitigation. It needs to be accompanied by coping appraisal to result in a protective response.
Bubeck et al., 2013	Germany	Flooding	Protection Motivation Theory	Logistic Regression	Coping appraisal is an important variable in influencing household precautionary behavior.
Budhathoki et al., 2020	Nepal	Climate change-related hazards	Protection Motivation Theory	Structural Equation Model	“Risk perception has significant mediation effects in the flood model, but not on heatwave or cold spells for farmers.”, p. 1
Grothmann & Reusswig, 2006	Germany	Flooding	Protection Motivation Theory	Correlation, Binary Logistic Regression	“Perceptual factors such as perceptions of risk and coping abilities are better than socio-economic factors at predicting household flood adaptation.”, p. 117

Huang et al., 2020	China	Flooding	Protection Motivation Theory	Structural Equation Model	“Socio-demographic factors and flood risk perception do not have impacts on protective coping behaviors directly but are mediated by flood risk knowledge and flood risk attitude.”, p. 1
Ifinedo, 2012		Cyber Security	Theory of Planned Behavior Protection Motivation Theory	Structural Equation Model	“Self-efficacy, attitude toward compliance, subjective norms, response efficacy and perceived vulnerability positively influence information systems security policy behavioral compliance intentions of employees.”, p. 83
Le Dang et al., 2014	Vietnam	Climate change-related hazards	Protection Motivation Theory	Structural Equation Model	“Farmers are more likely to have an adaptation intention when they perceive higher risks of climate change and greater effectiveness of adaptive measures.”, p. 11
Lindell & Hwang, 2008	United States	Flooding Hurricane Toxic Chemical Release	Protective Action Decision Model	Mediation Analysis	“There is a causal chain from hazard proximity through hazard experience and perceived personal risk to expectations of continued residence in the home and adoption of household hazard adjustments”, p. 539
Luu et al., 2019	Vietnam	Flooding	Protection Motivation Theory	Structural Equation Model	“Farmers show a higher adaptation intention when they perceive higher climate risks threatening their physical health, finances, production, social relationships, and psychology.”, p. 1
Mercado, 2016	Philippines	Disasters	Heuristics Cognitive Cultural Theory	Structural Equation Model	Strong awareness of climate change and disaster risks positively impacts self-efficacy, distress, risk perception, and other cognitive and cultural measures.
Miceli et al., 2008	Italy	Flooding	Protection Motivation Theory	Correlation, Stepwise Linear Regression	“Household disaster preparedness was positively associated with risk perception. No significant relationship between likelihood judgments and adoption of protective behaviors, while feelings of worry were associated with disaster preparedness.” p. 164

Mishra & Suar, 2012	India	Flooding, Heat Wave	Trait Anxiety and Disaster Preparedness	Multiple Linear Regression	“Trait anxiety decreased flood and heat-wave preparedness. Disaster education and resources are mediators between anxiety and flood, heat-wave preparedness.”, p. 1069
Papagiannaki et al., 2019	Greece	Flooding	Flood- Risk Precautionary Behavior Protection Motivation Theory	Structural Equation Model	“Risk perception and worry are significant drivers of preparedness intention. And act as mediating variables, explaining how flood experience, access to more risk information, vulnerability awareness, and trust in authorities affect citizens’ intention to invest in precautionary measures.”, p. 1329
Poussin et al., 2014	France	Flooding	Protection Motivation Theory	Multiple Linear Regression	“Threat appraisals have a small effect on mitigation behavior, while coping appraisals have a more important influence.
Raza et al., 2019	India	Crop Residue Burning	Protection Motivation Theory	Structural Equation Model	Farmers with high risk perception and awareness are more likely to adopt sustainable crop residue management practices.”, p. 1
Reynaud et al., 2013	Vietnam	Flooding		Choice Experiment Multiple Linear Regression	“Some flood protective behaviors of households are driven by the perception of flood risks.”, p. 547
Richert et al., 2017	France	Flooding	Protection Motivation Theory	Logistic Regression	“PMT is a relevant framework to describe the mechanisms of private flood mitigation for French households, particularly the importance of threat appraisal and previous experience of floods.”, p. 342
Terpstra, 2011	Netherlands	Flooding		Structural Equation Model	“Higher level of trust reduces citizens’ perceptions of flood likelihood and dread, which then impedes intention to prepare.”, p. 1,658
Thistlethwaite et al., 2018	Canada	Flooding		Chi-squared Test	“WTP and contractor visits, which measure intention instead of adoption, had strong relationships with risk perception, but risk perception had a very weak relationship with actual adoption of property level flood protection.”, p. 205

Apart from flood experience, perception, beliefs, and social networks play major roles in the enterprise's DRR intent and behavior. By identifying these factors, the study adds to the current literature on the decision-making of MSMEs and contributes to how to communicate risks and the available protection options better.

However, there are limitations to this study. Due to the complex interconnections of the framework, the cross-sectional nature of the data, as well as the lack of experimentation, tackling the omitted variable bias remains a challenge, therefore, complicated to deduce causality. Additionally, the PMT framework has several possible feedback loops between flood experience, risk perception, and DRR behavior. Existing literature, however, can assist in establishing the relationships. The language for the interpretation used, however, may be similar to that of establishing a cause-and-effect relationship.

3. Data and Methodology

Previous chapters discussed the details on site selection and data collection. Relevant to this chapter is the data on risk perception, perceived level of disaster preparedness, how willing enterprises are to pay for flood insurance, and social capital.

4.1. Variables

The dependent variables, where the arrows point to in **Figure 4.2**, used in this chapter are the intention to pursue DRR measures, specifically, if the respondent is willing to insure and by how much. Instead of the actual DRR mechanisms the enterprises have adopted, these variables were used to avoid a possible circular path to flood experience, risk perception, and perceived preparedness.

The contingent valuation method was used for the willing to insure (WTI) and willingness-to-pay for insurance (WTP) variables. This scenario was presented to the respondents: "There is a 20 percent probability of a flood with 5-year return period, like that of the 2014 Habagat or the 2018 flooding, occurring in a single year. The impact of this flood for Parang (Malanday) is low (high). Suppose that it is possible to obtain insurance to protect the enterprise's assets against flooding. For a premium of Php1,200 per year, assets can be insured for Php100,000 for a year of coverage. Once insurance policy is obtained, the enterprise can file a claim when a flood damages its assets by submitting photos as well as a list of all the damages, an estimate of repairs to compare with adjuster's estimates, and receipts for emergency repairs done on the enterprise within 60 days of the flood." The premium amount used for this scenario is based on what the insurance companies and government-supported microinsurance provide.

The respondents were then asked that if they could get insurance that protects the enterprise's assets from flood, would the enterprise be willing to pay for it? And if yes, what is the maximum amount the enterprise is willing to pay for this type of insurance per month? They were presented with a list of amounts, ranging from Php50 to Php3,000, to choose from.

The mediating variables include flood risk perception, which represents the threat appraisal part of the PMT, and the perceived preparedness, which acts as the indicator for coping appraisal. These variables are considered endogenous because they are affected by flood experience, social capital, individual characteristics, and other factors. In a mediation relationship, there is a direct link between an independent variable and a dependent variable.

There are also indirect associations between an independent and a mediator variable, and between a mediator variable and a dependent variable (Kline, 2011).

The flood risk perception is composed of the respondent's perceived frequency of future flooding in the enterprise's area and perceived intensity of future flooding in enterprise's area. Moreover, affective factors like fear or worry, and in the case of this study if the respondent is worried about the possible threat of moderate/major flooding in their business, was also added based on the reviews of Bubeck et al. (2012). The answers were chosen from a five-point Likert scale.

For perceived preparedness, the proxy indicator for self-efficacy, the respondent was asked how prepared they think their enterprise is if a moderate/major flood occurs in their area. Although the survey questionnaire included a question about response cost, which would have been a good variable to include for coping appraisal, it was excluded in the analysis because seven percent of total respondents answered with "do not know". The codes are summarized in **Table 4.2**.

Table 4.2. Description of Variables

	Type	Definition and Measurement
Dependent Variables		
Willing to insure	Binary	Enterprise is willing to insure = 1
(Log) Willingness-to-pay for insurance	Continuous	(Log) Amount enterprise is willing to pay for insurance
Mediating Variables		
Perceived frequency of future flooding	Category	How much more frequent would flooding in the enterprise's area be in the future compared to recent years? 1 = Much less frequent, 5 = Much more frequent
Perceived intensity of future flooding	Category	How severe would flooding in the enterprise's area be in the future compared to recent years? 1 = Not severe, 5 = Very much severe
Worry over the next flooding	Category	I am worried about the possible threat of major flooding to my business. 1 = Strongly disagree, 5 = Strongly agree
Perceived preparedness	Category	Overall, how prepared is your enterprise if a moderate/major flood occurs in your area? 1 = Not prepared, 5 = Extremely prepared
Flood Experience		
Frequency of minor flooding per year	Continuous	Minor flooding enterprise experiences per year
Frequency of moderate/major flooding per year	Continuous	Moderate/major flooding enterprise experiences per year
(Log) Building damage	Continuous	(Log) Amount of damages to enterprise's building
(Log) Content damage and loss	Continuous	(Log) Amount of damages and losses to enterprise's content/inventory
(Log) Sales loss	Continuous	(Log) Amount of sales lost from flooding
Social Capital		
Number of social organizations respondent is member of	Continuous	Number of social organizations respondent is member of
Attends government meetings	Binary	1 = Attends government meetings
Receives information about flooding from social network	Binary	1 = Receives information about flooding from social network
Receives information about flooding from government	Binary	1 = Receives information about flooding from government
Receives information/advice about insurance from social network	Binary	1 = Receives information/advice about insurance from social network
Receives information/advice about insurance from government	Binary	1 = Receives information/advice about insurance from government
Receives information/advice about BCP from social network	Binary	1 = Receives information/advice about BCP from social network
Respondent Characteristics		
Owner	Binary	1 = Respondent is owner of enterprise
Female	Binary	1 = Respondent is female
Age	Continuous	Respondent's age in years
Years of education	Continuous	Respondent's education in years

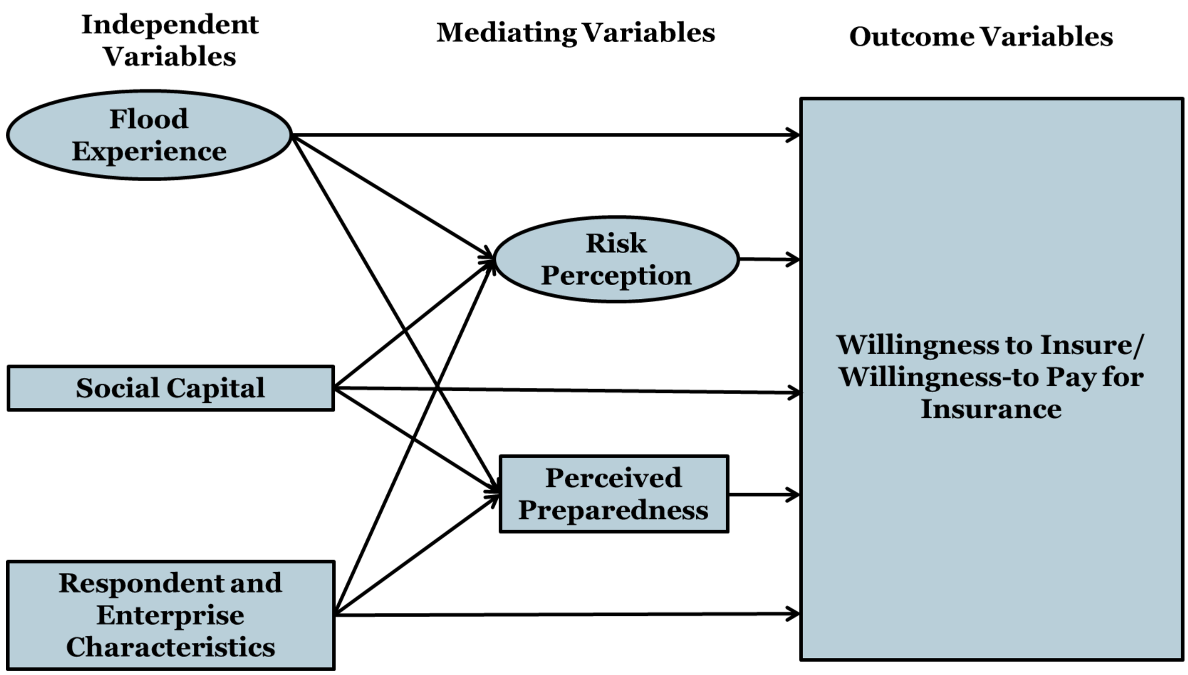
Household includes minor and/or senior citizens	Binary	1 = Respondent’s household includes minors and/or senior citizens
Enterprise Characteristics		
Enterprise is Wholesale and Retail Trade	Binary	1 = Enterprise is in wholesale/retail trade
Enterprise is Services	Binary	1 = Enterprise is in services sector
Age of enterprise	Continuous	Enterprise’s years in operation
(Log) Assets	Continuous	(Log) Asset size in PhP
Total number of employees	Continuous	Number of full-time and part-time employees
Enterprise is home-based	Binary	1 = Enterprise is located in respondent’s home

Source: 2018 MSME Survey

The independent variables, the variables in the model that have no arrows pointing at them in **Figure 4.2,** for this chapter include flood experiences, specifically, the questions were how often the enterprises experience different types of flooding, and how much damages and losses on building and content the enterprise incurred because of flooding. The cost of damages and losses were transformed into log variables to address skewed data. Risk perceptions, support for climate-related policies, and the public’s response to climate change are driven by experience, which includes affect, imagery, and values, and psychological and sociocultural variables (Leiserowitz, 2006).

For the social capital variables, the respondents were asked about the number of social organizations they are a member of, if they participated in government meetings like barangay assembles. Regarding information about the frequency and severity of flooding, and insurance, these were elicited by asking respondents their source of information or advice. The choices include family, friends, fellow members in social organizations, traditional media, social media, government, and others. Specifically, the social network used here includes only family, friends, and social organizations. Information from the government was separated. Norris et al. (2008) and Cai et al. (2015) argued that if the information is coming from reliable and trusted sources, the higher the likelihood that DRR measures will be pursued as opposed to merely relying on usual government awareness promotions.

Figure 4.2. Factors Affecting Behavioral Intention



Note: Modified Protection Motivation Theory

The model also controlled for variables such as respondent and enterprise characteristics. These include whether the respondent owns the business or not, gender, age, years of education, and if their household includes vulnerable population like minors and/or senior citizens. The enterprise indicators consist of dummy variables for operating in the wholesale and retail trade sector or the services sector, and if the enterprise is home-based. The age of the enterprise, (log) asset size, and the number of full-time and part-time employees were also used.

The hypothesis for this study are: (1) flood experience and receiving information about flooding and DRR from social networks have direct paths to the willingness to adopt DRR measures; (2) risk perception and perceived preparedness positively influence intention to pursue DRR; and (3) following the PMT, risk perception, together with perceived preparedness, act as mediating factors between individual experiences/characteristics and disaster risk mitigation behavior. **Figure 4.2** provides a summary of the directionality of the variables.

4.2. Structural Equation Model

To examine the relationships within the PMT framework and following the literature (Zaalberg et al., 2009; Mercado, 2016; Luu et al., 2019; Raza et al., 2019; Budhathoki et al., 2020; Huang et al., 2020), the Structural Equation Model (SEM) was used. It is a statistical analysis model that assesses the complex interrelationships and direct and indirect effects between and among various factors (Kline, 2011). The model allows for understanding how individual experiences and characteristics influence the intention of an enterprise to adopt DRR measures (direct effect) and if these same variables have an indirect effect, mediated through risk perception and perceived preparedness, as seen in **Figure 4.3**.

Another important aspect of SEM is that it can deal with latent or unobserved variables generated from observed indicators (referred to as the measurement model) through factor analysis (Kline, 2011). Ovals denote latent variables while the observed variables are in rectangles. In this chapter, there are two latent variables. One is the respondent's risk perception, shaped using perception on the frequency and severity of future flooding in the enterprise's area and worry over the impacts of the next flooding on the business. The second is flood experience formed by utilizing damages from flooding, sales loss, and minor and moderate/major flooding frequency. Latent variables were used for this study to aggregate observable variables and decrease the dimensionality of data.

As shown in **Figure 4.3**, the arrows move from the latent variables to the observed ones since the latent variables predict the measured variables (also referred to as a reflective model). The implication is that, for instance, risk perception (higher risk perception) drives, or creates, higher perception on the frequency of floods, higher perception of the severity of floods in the enterprise's area, and more worry about future flooding. The SEM also comprises a structural model, which tests all the associations or dependencies based on the path analysis (Kline, 2011). This figure also displays the direction and signs of the variables based on the current literature available.

Due to the generalized responses of the variables, this chapter employed both the SEM and the Generalized SEM (GSEM) estimated through quasi-maximum likelihood to relax the conditional normality assumptions (Acock, 2013). Specifically, the risk perception indicators are categorical, the WTI is a binary variable, and the WTP is right-skewed due to a number of respondents answering with zero value. The statistical software Stata was used for descriptive data analysis, SEM, and GSEM. In addition, the model fit indices for SEM such as the model χ^2, the Root Mean Squared Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Standardized Root Mean Square Residual (SRMR) were reported.

Although SEM can confirm the association among factors, SEM is not entirely a causal model. The study ensured that the chosen variables followed time-ordering rules to establish that the independent variables cause the mediating and outcome variables. For example, the flood experience occurred in the past; meanwhile, the variables for risk perception, perceived preparedness, and intention to pursue DRR measures were answered based on their thoughts at the time of the survey. This also ensures that simultaneity, that the mediating and outcome variables causes the independent variables, was avoided. However, due to data constraints, the small sample size, and lack of experimentation, this paper was unable to address omitted variable bias. For instance, the income variable was removed from the model because of convergence issues. As such, the goal does not include establishing causality between enterprise experiences or characteristics and intention to adopt DRR mechanisms and instead emphasizes on the association and path direction of the variables.

Figure 4.3. Proposed Structural Equation Model

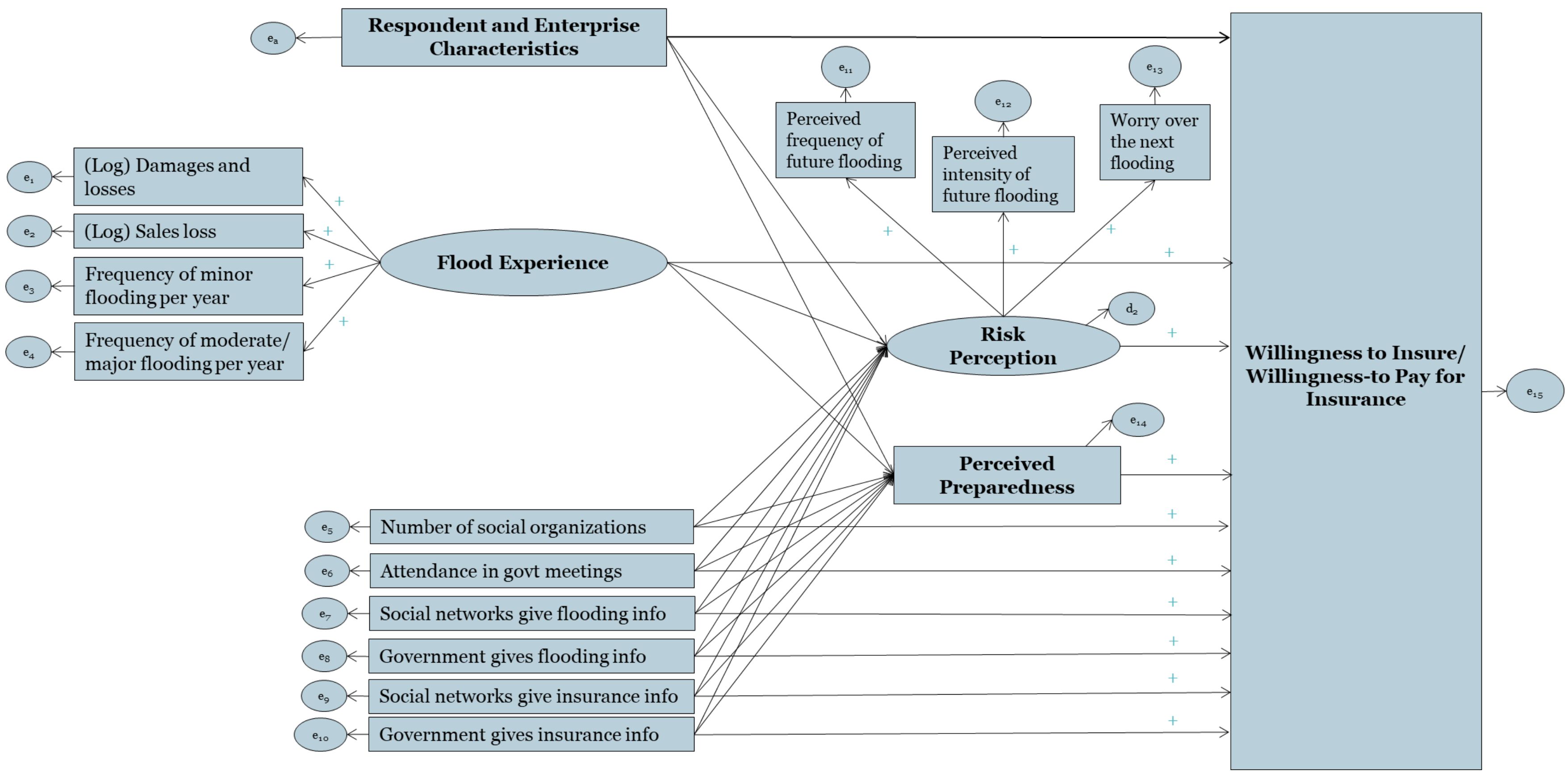
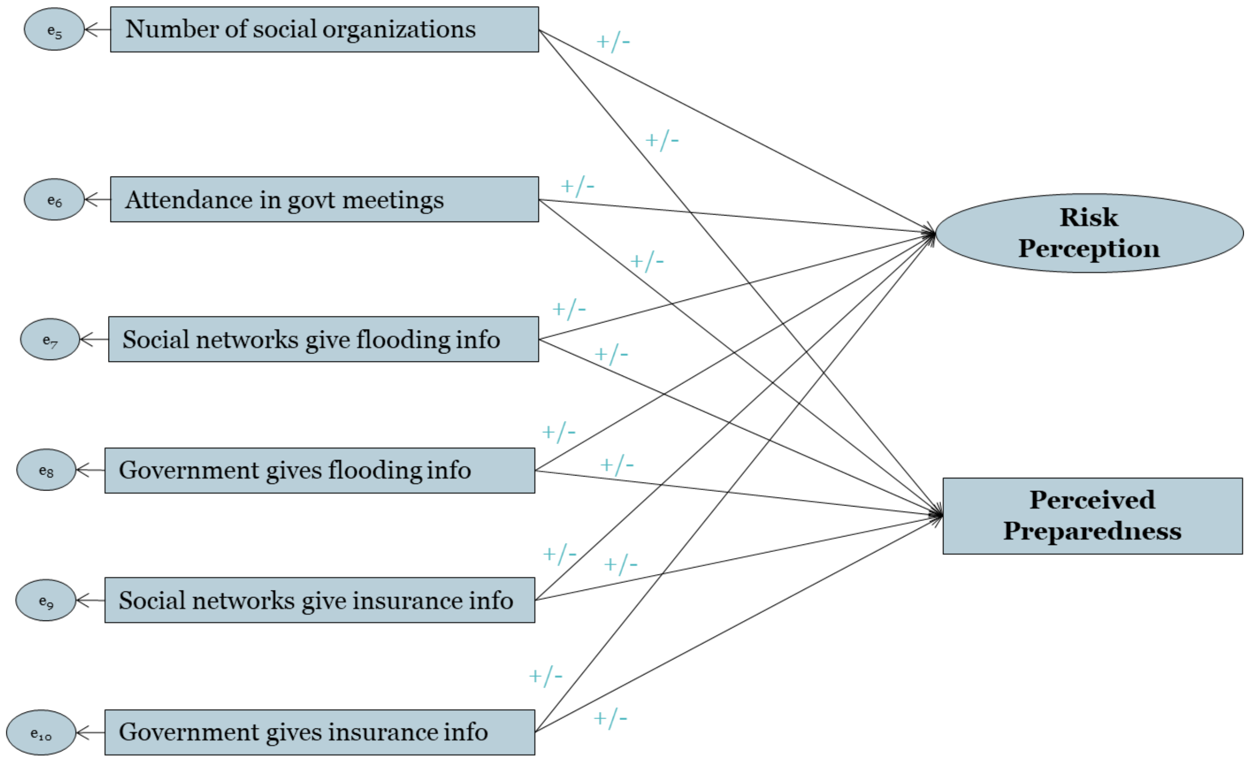


Figure 4.4. Detailed View of Relationship between Social Capital and Mediating Variables



4. Results

4.1. *Summary of Variables*

4.1.1. *Willingness to Adopt Disaster Risk Reduction Measures*

Since there is low adoption of insurance and BCP, this study asked questions on intention—willingness to pay for insurance and if respondent plans to create a BCP. Descriptive statistics on these variables are summarized in **Table 4.3.**

More than half of the respondents answered that they are willing to insure. For those that are willing to pay, the lowest amount chosen was Php50. Eighty-five responded that they are willing to pay less than the premium of Php1,200. Fourteen answered that they can pay Php1,200, while 11 said they are willing to pay more than Php1,200.

Looking at the test of proportions, the willingness to insure (WTI) between barangays Parang and Malanday were not significantly different. However, comparing enterprises that suffered from flooding and those that did not, there was a statistically significant difference ($z = -2.85$, $p = 0.00$). Examining the (log) willingness-to-pay (WTP) for insurance, the mean WTP for those that were flooded was significantly different from the mean WTP of enterprises that did not experience flooding ($t = -2.39$, $p = 0.00$), while there was no sufficient evidence that the mean WTP of Malanday and Parang are different.

Table 4.3. Summary of Variables

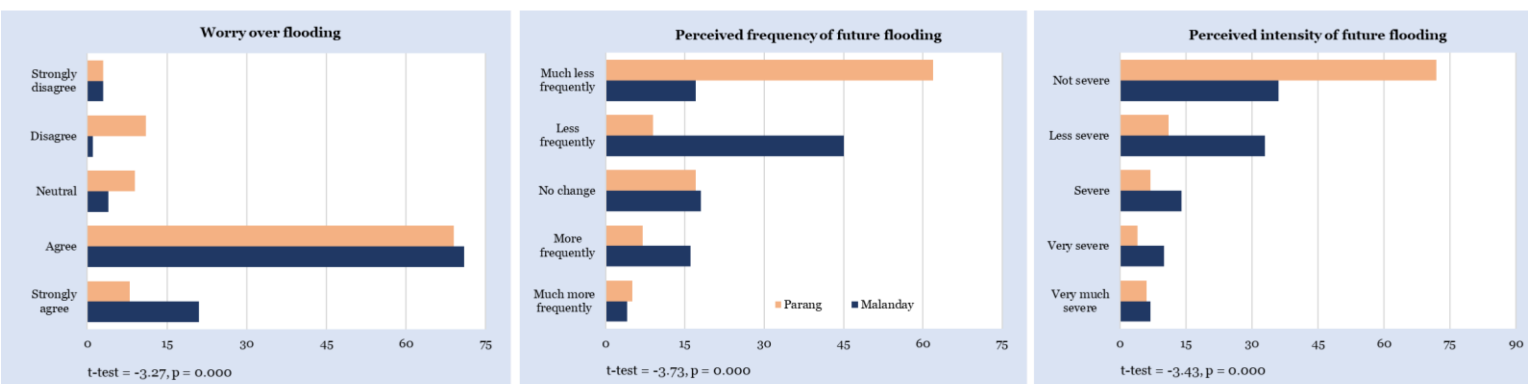
	Type	Obs	Mean	SD	Min	Max
Dependent Variables						
Willingness to insure	Binary	200	0.55	0.50	0	1
Willingness-to-pay for insurance	Continuous	200	423.75	760.27	0	4,000
(Log) Willingness-to-pay for insurance	Continuous	200	3.31	3.13	0	8.29
Mediating Variables						
Perceived frequency of future flooding	Category	200	2.15	1.19	1	5
Perceived intensity of future flooding	Category	200	1.90	1.23	1	5
Worry over the next flooding	Category	200	3.87	0.84	1	5
Perceived preparedness	Category	200	3.53	1.11	1	5
Flood Experience						
Frequency of minor flooding per year	Continuous	200	0.51	0.91	0	5
Frequency of moderate/major flooding per year	Continuous	200	0.40	0.75	0	3
(Log) Building damage	Continuous	200	2.41	4.13	0	12.21
(Log) Content damage and loss	Continuous	200	3.57	4.94	0	14.51
(Log) Sales loss	Continuous	200	5.22	4.59	0	14.91
Social Capital						
Number of social organizations respondent is member of	Continuous	200	0.39	0.90	0	6
Attends government meetings	Binary	200	0.35	0.48	0	1
Receives information about flooding from social network	Binary	200	0.34	0.47	0	1
Receives information about flooding from government	Binary	200	0.20	0.40	0	1
Receives information/advice about insurance from social network	Binary	200	0.57	0.50	0	1
Receives information/advice about insurance from government	Binary	200	0.05	0.22	0	1
Receives information/advice about BCP from social network	Binary	200	0.48	0.50	0	1
Respondent Characteristics						
Owner	Binary	200	0.68	0.48	0	1
Female	Binary	200	0.66	0.47	0	1
Age	Continuous	200	47.09	14.01	18	82
Years of education	Continuous	200	11.98	2.79	3	15
Household includes minor and/or senior citizens	Binary	200	0.72	0.45	0	1
Enterprise Characteristics						
Enterprise is Wholesale and Retail Trade	Binary	200	0.71	0.46	0	1
Enterprise is Services	Binary	200	0.22	0.41	0	1
Age of enterprise	Continuous	200	12.44	8.94	3	31
(Log) Assets	Continuous	200	13.94	1.52	13	18
Total number of employees	Continuous	200	7.66	18.95	1	174
Enterprise is home-based	Binary	200	0.73	0.45	0	1

Source: 2018 MSME Survey

4.1.2. Perceived Risk and Preparedness

Examining the perception about future flooding, 133 enterprises or 66.5 percent, responded that they think moderate/major flooding will occur “less/much less frequently” compared to recent years. Breaking it down by barangay, as shown in **Figure 4.5**, there were more enterprises located in Parang (62 enterprises) that answered with “much less frequently” than in Malanday (17 enterprises). Test of means show that there was a statistically significant difference in the perceived frequency of the next flooding between the two barangays. There was also a difference in the means between those that experienced flooding and those that did not, which is consistent with available literature.

Figure 4.5. Perception on Future Flooding



Source: 2018 MSME Survey

In terms of intensity of the next flooding, more than half (152 enterprises) answered that they perceive that future flooding will not be or will be less severe relative to recent years. Out of this 152, 54.6 percent (83 enterprises) were from Parang and almost half (75 enterprises) never experienced any type of flooding. T-test results show that there was a statistically significant difference in the mean perception of intensity between the two barangays as well as those with flood experience versus no flood experience.

Although it has been established in the scientific community that a changing climate has a high probability of intensifying rains, hence, adding to the worsening inundation, respondents had more positive perceptions about the frequency and severity of future flooding in the areas where their enterprises are located. From the data collected, around 80 percent of those that answered that there will be less frequent flooding or less severe flooding cited the role of government infrastructure projects such as flood defense/flood control projects, river dredging, and sewerage improvements, among others, for this view. This can indicate that respondents believe that current and future government infrastructures can assist in reducing the occurrence of flooding events.

Availability heuristic, or availability bias, coined by Tversky and Kahneman in their series of chapters beginning with Judgment under Uncertainty (1974), may also play a role. This type of bias explains that when an individual assesses the probability of risks, if the disaster comes to their memory easily, the risk is familiar, or the events are more prominent in the news, the more likely they will overestimate the frequency or severity of the risks (Thaler & Sunstein, 2009). They may also seem to be too used to flooding and are more adjusted (Porio, 2011). Another possible reason is wishful thinking or attempting to remain positive under the circumstances, yet still feel worried about the future and the uncertainties they may face. Despite the majority feeling that the next flooding events will occur less frequently and will not be severe, 169 enterprises (84.5 percent) agreed/strongly agreed with the statement that they are worried about the possible threat of major flooding to their business. Test of means show that there is a statistically significant difference between

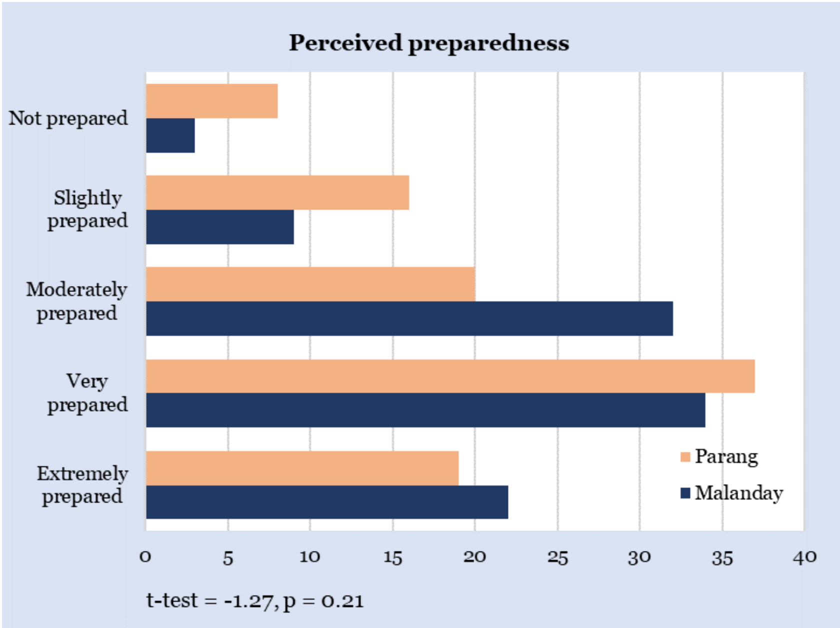
Malanday and Parang. Same results for those that suffered from flooding and those that did not.

Examining the data further, those that experienced flooding, especially moderate/major flooding, their business premises were inundated, hence have damages to their building, stocks and equipment, and documents. Utilities were also damaged. Loss of sales was brought about by cancelled orders from consumers and contracts from suppliers. For those that were not inundated, the effects were not direct but have also suffered from a reduction in their sales since most of their consumers and suppliers were affected by flooding owing to inaccessibility of roads and business facilities. These consumers and suppliers may also have incurred their own damages and losses.

Looking at the frequency of past flooding, 169 enterprises were worried about the possible threat of flooding to their business even though 93 of which, or about 60 percent, have never experienced moderate/major flooding before. The 44 enterprises that answered they were worried experienced one to three moderate/major flooding events every year.

On the question if the respondent thinks how prepared the enterprise is for a moderate/major flooding, 56 percent, or 112 respondents, answered that they are very prepared or extremely prepared, as seen in **Figure 4.6**. Only 11 answered that they were not ready in the event of a moderate/major flooding. Looking at whether there is a difference in perception between those located in Malanday and those in Parang, t-test shows that there is no statistically significant difference between the barangays. There is also no difference for those that experienced flooding versus those that did not.

Figure 4.6. Perception on Level of Preparedness



Source: 2018 MSME Survey

Comparing these responses with actual DRR measures implemented, 39 respondents answered that they did not adopt any of the ten DRR measures enumerated to them. However, there is no statistically significant relationship between the perceived preparedness and actual number of DRR measures implemented (chi-square with 20 degrees of freedom = 20.38, p = 0.44).

4.2. Structural Equation Model

Figures 4.7 and **4.8** (path form of Models 1-4 in Table 4.4) and **Table 4.4** present the results from the estimation of GSEM and SEM. Model 1 is the GSEM model with Model 3 using the binary WTI as the outcome variable, the censored WTP for Model 4, while Model 7 utilized SEM and a continuous WTP as the dependent variable. As mentioned earlier, the model does not aim to determine a causal relationship among the variables but instead ascertain an association and confirm path direction.

SEM was used to verify the results from the GSEM. However, since SEM requires responses to be continuous and assumes multivariate normality, risk perception was treated as continuous instead of ordinal. The WTP is continuous but is nonnormal. Hence, the use of the Satorra-Bentler standard errors to deal with nonnormality. Apart from the model χ^2, the hypothesized model has a generally acceptable fit as seen in **Table 4.4**.

The findings presented in **Table 4.4** show that risk perception does not significantly influence WTI and WTP. The risk perception variable, considered a latent variable in these models, was computed through factor analysis using the perceived frequency of future flooding, perceived severity of the next flooding, and worry about the impacts of flooding on one's business. As seen in **Table A.4.1**, risk perception was constrained at one for the frequency of flooding indicator. Intensity has the most influence on risk perception, followed by frequency, and lastly, by worry. The Cronbach alpha, a test for the validity of the variables set as measures of the latent variable, was 0.57. Although this value is still acceptable, it is within the low range. When the worry variable was removed and separated, the Cronbach alpha rises to 0.7. The results from that model are shown in **Table A.4.2,** which shows that neither risk perception nor worry have significant associations with WTI and WTP.

Figure 4.7. Generalized Structural Equation Model: Willingness to Insure (from Models 1-3 of Table 4.4)

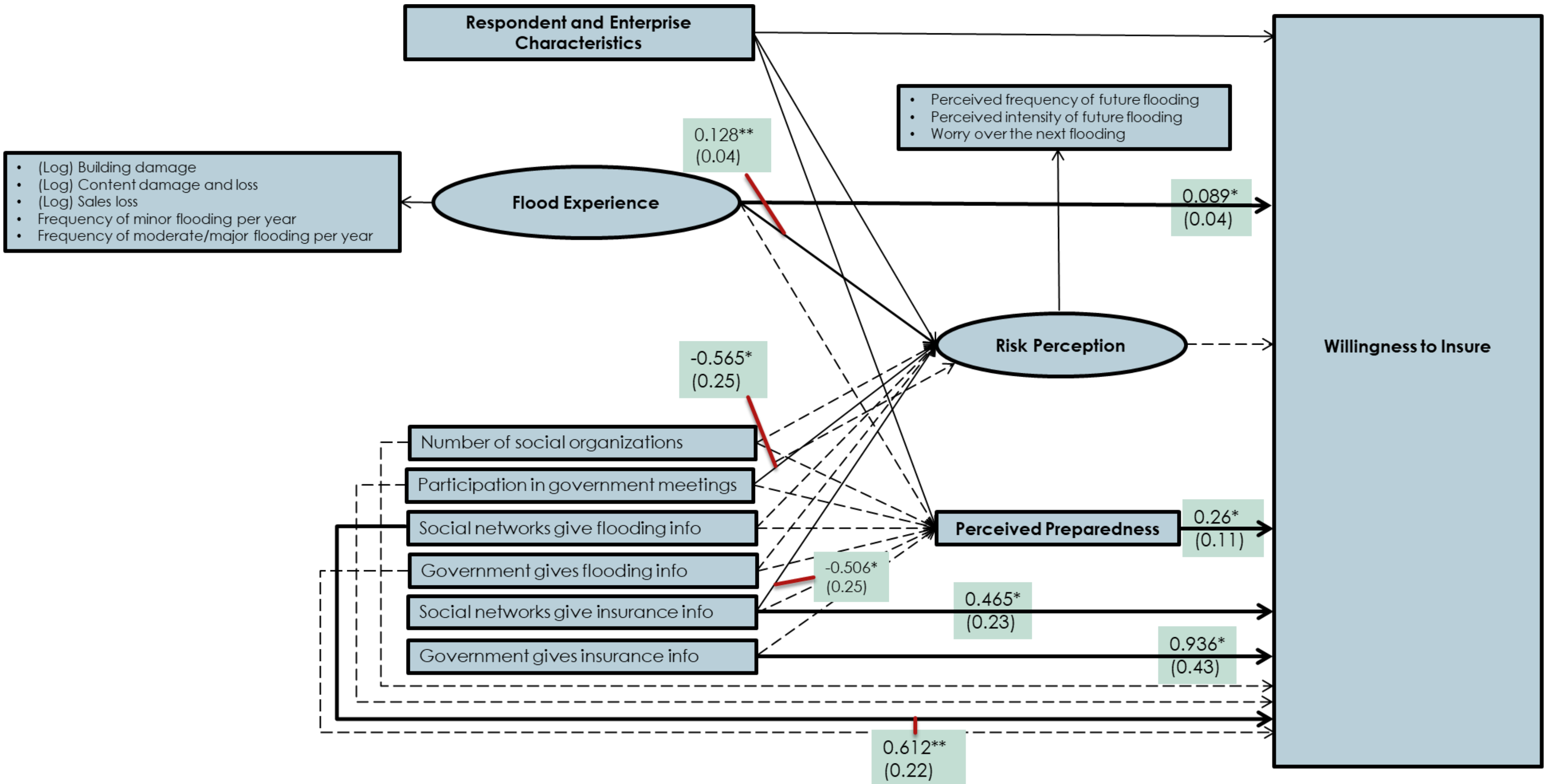


Figure 4.8. Generalized Structural Equation Model: Willingness-to-Pay for Insurance (from Model 4 of Table 4.4)

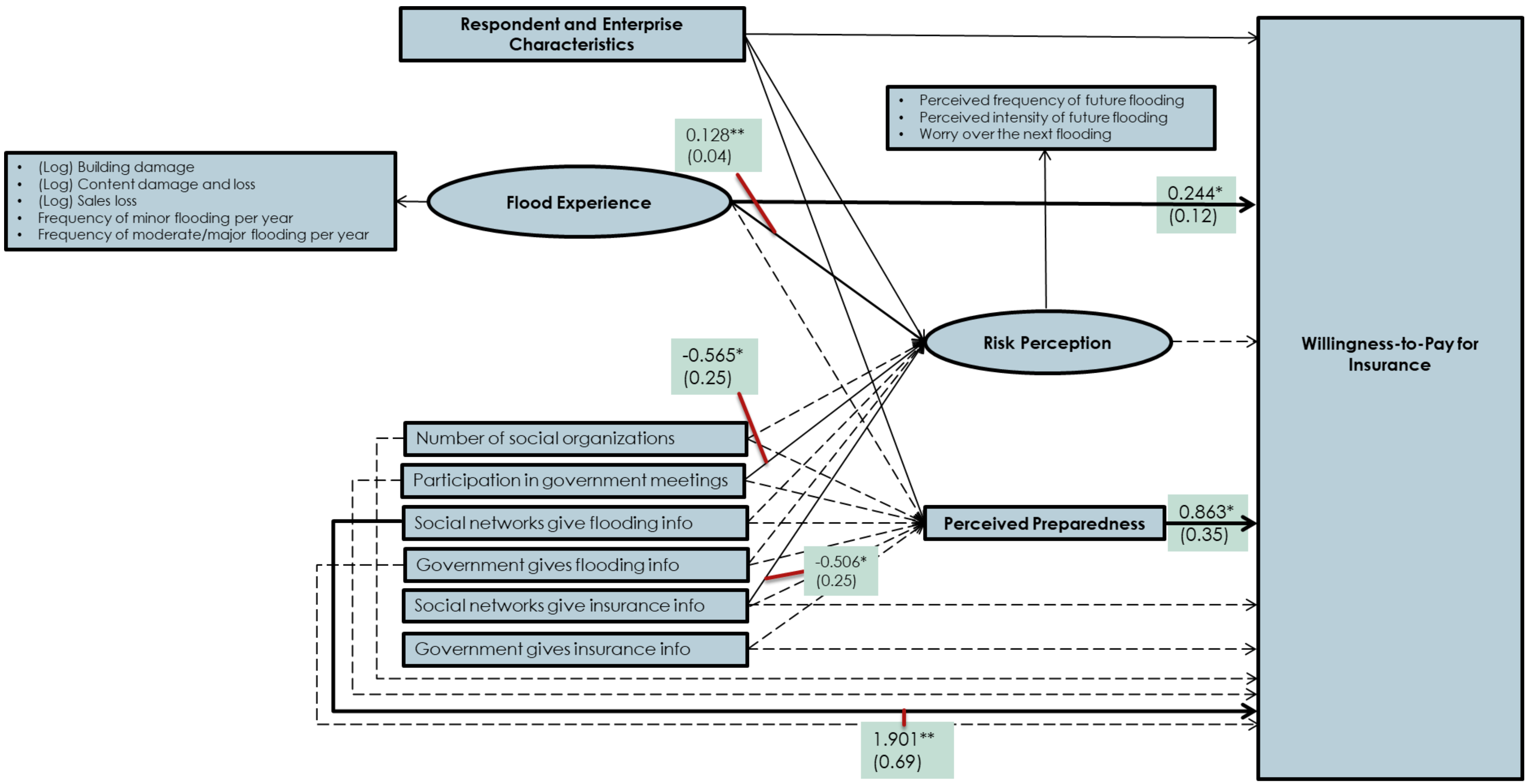


Table 4.4. Structural Equation Models: Willingness to Insure and Willingness-to-Pay for Insurance

	Risk Perception (categories)	Perceived Preparedness	WTI	WTP	Risk Perception (continuous)	Perceived Preparedness	WTP
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	GSEM				SEM		
Risk Perception			0.021	0.168			0.063
			(0.13)	(0.43)			(0.31)
Perceived Preparedness			0.260*	0.863*			0.468**
			(0.11)	(0.35)			(0.18)
Flood experience	0.128**	0.016	0.089*	0.244*	0.080***	0.016	0.138*
	(0.04)	(0.02)	(0.04)	(0.12)	(0.02)	(0.02)	(0.06)
Social capital							
Number of social organizations respondent is member of	0.056	0.048	0.03	0.076	0.034	0.047	0.04
	(0.04)	(0.03)	(0.040)	(0.12)	(0.03)	(0.04)	(0.08)
Attends government meetings = 1	-0.565*	0.086	0.49	1.44	-0.380**	0.093	0.698
	(0.25)	(0.18)	(0.26)	(0.77)	(0.14)	(0.18)	(0.45)
Receives information about flooding from social network = 1	-0.052	0.112	0.612**	1.901**	-0.078	0.111	1.071**
	(0.22)	(0.15)	(0.22)	(0.69)	(0.14)	(0.14)	(0.41)
Receives information about flooding from government = 1	0.049	0.214	0.30	0.789	0.037	0.206	0.465
	(0.22)	(0.20)	(0.270)	(0.83)	(0.14)	(0.21)	(0.50)
Receives information/advice about insurance from social network = 1	-0.506*	0.203	0.465*	1.41	-0.308*	0.208	0.69
	(0.25)	-0.16	(0.23)	(0.73)	(0.15)	-0.15	(0.38)
Receives information/advice about insurance from government = 1	0.288	0.469	0.936*	1.69	0.132	0.476	0.87
	(0.47)	-0.45	(0.43)	(1.31)	(0.33)	-0.41	(0.74)
Individual Characteristics							
Owner = 1	0.089	-0.035	-0.263	-0.793	0.054	-0.04	-0.615
	(0.28)	(0.18)	(0.27)	(0.80)	(0.14)	(0.18)	(0.46)
Female = 1	0.048	0.206	-0.313	-0.901	-0.098	0.2	-0.514
	(0.26)	(0.17)	(0.25)	(0.79)	(0.15)	(0.16)	(0.45)

Age (in years)	-0.009	-0.002	-0.030***	-0.099***	-0.006	-0.002	-0.053***
	(0.010)	(0.010)	(0.01)	(0.03)	(0.01)	(0.000)	(0.01)
Years of Education	0.084	-0.094**	-0.014	-0.018	0.047	-0.093**	0.022
	(0.05)	(0.03)	(0.05)	(0.15)	(0.03)	(0.03)	(0.08)
HH has minor or senior members = 1	-0.114	-0.252	0.597*	1.508	-0.061	-0.253	0.864
	(0.23)	(0.15)	(0.24)	(0.82)	(0.14)	(0.15)	(0.45)
Enterprise Characteristics							
MSME is wholesale and retail trade = 1	-1.148**	0.163	-0.882	-2.306	-0.717*	0.178	-1.434
	(0.44)	(0.30)	(0.48)	(1.29)	(0.31)	(0.30)	(0.77)
MSME is services = 1	-1.112*	0.217	0.214	0.908	-0.724*	0.233	0.395
	(0.46)	(0.32)	(0.52)	(1.40)	(0.31)	(0.31)	(0.87)
Years in operation	-0.001	0.001	-0.011	-0.051	-0.004	0.001	-0.031
	(0.01)	(0.01)	(0.01)	(0.04)	(0.01)	(0.01)	(0.02)
(log) Asset size	0.017	0.069	0.15	0.662*	-0.006	0.069	0.419**
	(0.09)	(0.07)	(0.09)	(0.26)	(0.05)	(0.06)	(0.15)
Total number of employees	-0.014	0.001	-0.006	-0.018	-0.007*	0.001	-0.012
	(0.01)	0.00	(0.01)	(0.03)	(0.003)	(0.004)	(0.01)
Home-based = 1	0.44	-0.208	0.412	1.181	0.279	-0.213	0.667
	(0.27)	(0.21)	(0.28)	(0.88)	(0.17)	(0.21)	(0.50)
constant	0.44	3.546***	-1.59	-6.548		3.539***	-2.011
	(0.27)	(1.00)	(1.50)	(4.49)		(0.94)	(2.61)
N	200	200	200	200	200	200	200
AIC		5,416.33				16,107.29	
BIC		5,699.98				16,991.24	
model χ^2 (rule: close to 0 & p>0.5)						model χ^2 (109): 147.404***	
RMSEA (rule: close to 0)						0.042	
RMSEA_SB						0.047	
CFI (rule: close to 1)						0.92	
CFI_SB						0.907	
SRMR (rule: close to 0)						0.036	
CD (rule: close to 1)						0.917	

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

For perceived preparedness, there is a statistically significant relationship with WTI and WTP. The more the enterprises think that they are prepared for moderate/major flooding, the more they are willing to decide to buy insurance. With a higher level of perceived preparedness, WTP for insurance will likely rise by 86.3 percent, all other variables held constant. The more the respondent perceives that their enterprise is prepared for a major flooding, the higher the amount they are willing to pay for insurance.

Flood experience, another latent variable, is also associated with WTI and WTP. A one percent increase in flood experience of the enterprise may likely raise the WTP for insurance by 24.4 percent, holding other control variables constant. This is a direct path to WTI and WTP. Examining the factor loadings, total damages was constrained at one. Total amount of damages had the most influence in the flood experience variable, followed by sales loss, frequency of moderate/major flood experience per year, and frequency of minor flooding experience per year. The Cronbach alpha for flood experience was at 0.64.

However, it can be argued that since flood experience can be affected by the control factors used in this chapter, such as the enterprise characteristics, the variables for flood experience can be seen as endogenous. As such, the five-year flood hazard and a dummy variable for past flood experience were used instead in **Table A.4.4**. Results show that perceived preparedness remains to have a significant positive association with WTI and WTP. In addition, having experienced flooding was significant as well. Meanwhile, the five-year flood hazard variables are not, which could indicate that the extent of the damage affects WTI and WTP more. Meanwhile the location, elevation, and distance to the Marikina River, as embodied by the flood hazard, show there was insufficient evidence to show that flood hazard and WTI or WTP have a relationship.

Among the social capital variables for the models, the “receives information about flooding from social network” is statistically significant in Models 3, 4, and 7. Thus, if enterprises obtained information about flooding from their social networks—family, friends, fellow members in social organizations—they are more likely to buy insurance. Respondents with a government or a social network that relays what they know about insurance will be more willing to insure. However, as shown in Models 4 and 7, this variable loses its significance when talking about the amount respondents are willing to pay. Participation in social organizations does not seem to have a statistically significant relationship with WTP.

For the respondent characteristics, age seems to have a statistically significant relationship with WTI and WTP. The younger the respondent is, the more willing they are to buy insurance and the higher their willingness to pay. The composition of the household also has a significant association with WTI. If the respondent’s household has vulnerable members, they are more likely to answer that they are willing to buy insurance. Whether the respondent is the owner, a female, and is more educated are not statistically significant.

For the enterprise characteristics, the sector, years in operation, total number of employees, and whether the enterprise is home-based were not statistically significant. The asset size, however, does have a positive relationship with WTP.

The results enumerated above are the direct associations. Although results from the estimation show indirect paths from flood experience, social capital, and respondent and enterprise characteristics to risk perception and perceived preparedness to WTI and WTP, as seen in **Table A.4.3.** they were not statistically significant. It means there was insufficient evidence to prove the third hypothesis—that risk perception and perceived preparedness act as mediating variables.

In Models 1 and 5 of **Table 4.4,** flood experience has a statistically significant relationship with risk perception. If respondents experienced worse inundation, the perception of future flood risks rises. Attendance in government meetings and getting information about insurance from their social network also show an association with risk perception. For perceived preparedness (Models 2 and 6), only years of education was significant.

To show if the results are robust, different specifications were used to run the SEM and GSEM. Results are shown in **Table A.4.4** to **A.4.8**. As seen from these other models, perceived preparedness, flood experience, and receives information about flooding from social network, were mostly consistent with having a statistically significant relationship with WTI and WTP. For risk perception, the significant variables were also similar.

Regarding the relationship with risk perception, flood experience is a statistically significant factor in all models. However, looking at the individual risk perception variables, suffering from damages and losses does not seem to have any relation with perceived frequency and severity of the next flooding and worry over future flooding **(Table A.4.9)**.

5. Discussion and Conclusion

This chapter sought to answer why people, despite suffering from disasters, fail to act or have inadequate preparation against these events to reduce their risks. To address this issue, the chapter built on the PMT as the main framework and studied not just respondents' flood experience but also the influence of their social network, how they perceive the risks of future flooding to their area and business, and how they see themselves as sufficiently prepared for flooding or not, and how these factors influence their intent to pursue various DRR measures like insurance.

Decisions are made based on several interconnected factors. But from the GSEM and SEM and other regression models, the consistently significant finding across all models is that flood experience, perceived preparedness, and information about flooding events from the respondents' social networks have a positive association with WTP. The same goes for WTI but add the receives information about insurance from the government and social network.

5.1. Risk Perception and Perceived Preparedness

Regression results between risk perception and WTP for insurance were not statistically significant. Examining the risk perception variables more closely using Tobit models **(Models 3-6** in **Table A.4.8)**, perceived frequency and intensity of future flooding and worry over the next flooding were also not statistically significant factors on whether respondent will buy insurance or not. The lack of statistical significance or weak relationship seems to be a consistent finding in disaster and risk literature as summarized by Bubeck, Botzen, & Aerts (2012).

Although some studies have shown that a high perception of disaster risks is still usually related with decisions to prepare and reduce the effects of disasters (Lindell & Hwang, 2008; Martins et al., 2019) as well as intention to adopt DRR measures (Warner et al., 2009; Botzen & van den Bergh, 2012), more research points to the necessity of taking into account coping appraisal, together with threat appraisal or risk perception, to trigger protective behavior, as advocated by the PMT (Grothmann & Reusswig, 2006; Zaalberg et al., 2009; Bubeck et al., 2012; Mishra & Suar, 2012; Reynaud et al., 2013; Poussin et al., 2014).

Results from this study show that how respondents see their level of preparedness has a significant association with WTI and WTP for insurance. The more prepared for disasters they perceive themselves, or the more confident they are in their ability to prepare and manage risks, regardless if it is consistent with their actual disaster preparedness, the higher the likelihood that the enterprise will pursue DRR measures such as buying insurance (see Grothmann & Patt, 2005; Ung, Luginaah, Chuenpagdee, & Campbell, 2016). On its own, without the risk perception variables, it remains to have a significant association with intention and WTP.

Perceived preparedness was used as an indicator for coping appraisal and a proxy to self-efficacy to see whether the respondents think how capable they are of protecting their business against disaster. Self-efficacy is considered to be the strongest predictor of DRR behavior among the coping appraisal factors (Grothmann & Reusswig, 2006; Poussin et al., 2014).

5.2. Flood experience

Suffering from flooding events raises the likelihood that the respondent will be more aware and perceptive, and will be more willing to adopt DRR measures (Grothmann & Reusswig, 2006; Lindell & Hwang, 2008; Zaalberg et al., 2009; H. Kreibich et al., 2011; Poussin et al., 2014). Hence, the use of flood experience in this chapter despite the endogeneity issues arising from its relationship with other control variables. In all the models, there is a direct relationship between flood experience and WTI and WTP contradictory to the meta-analysis Bamberg et al. (2017).

For the Tobit models **(Table A.4.8)**, the influence of damages to building is statistically significant, however, other flood experience variables are not. One possible explanation of this is that respondents are getting so much used to floods that they find they can survive even without or with little preparations. Despite this, flood experience remains an important component in the models since facing flooding events is and will remain a part of the life of most respondents and enterprises.

As shown in **Table 4.5,** the expected value of flood damages was computed by multiplying the probability of a five-year flood hazard to occur and the flood damage incurred per enterprise. The average flood damage per year, including the zeroes, is at Php3,884.32. Excluding those that were not damaged or did not suffer any losses, average per year is Php9,359.81.

Table 4.5 Willingness-to-Pay for Insurance and Expected Value of Damages

in Philippine peso (Php)		**Flood with 5-year return period**
WTI	(% respondents)	0.55
WTP	(Php per year)	423.75
CWTP	(Php per year)	770.45
Expected value of flood damages		3,884.32
Expected value of flood damages	(excluding zeroes)	9,359.81

Fifty-five percent of the respondents are willing to pay a positive amount of insurance (WTI). The mean WTP or the average of WTP for flood insurance of all respondents is Php423.75. The Mean WTP conditional on wanting insurance (CWTP), that is, the mean WTP of respondents who are willing to pay a positive amount for flood insurance is Php770.45. This is considerably lower than the expected value of the flood risk they experience.

In terms of its relationship with risk perception, flood experience remains to be an important factor based on the results of this study and consistent with studies like Lindell & Hwang (2008), Zaalberg et al. (2009), Brown et al. (2018).

5.3. Social capital

As social beings, our decisions are shaped not just by experience but also through the behavior of other people and the community we belong to. Disasters are usually shared experiences and disaster preparedness and recovery is tied to community network (Adger, 2003; Norris et al., 2008; Martins et al., 2019).

Social capital was seen to have a positive relationship with adaptation and disaster mitigation behavior (Norris et al., 2008; Yaméogo et al., 2018; Martins et al., 2019). Norris et al. (2008) showed that if information about risks is shared by trusted sources, DRR mechanisms are more likely to be implemented compared to the typical government awareness campaigns. Martins et al., (2019) argued that households with strong ties with their communities, are more participative in political activities, and are more active in community work have a higher likelihood of pursuing disaster preparedness measures. And for Cai et al. (2015), rather than the actual purchase of insurance itself of household's social network, they found that circulating information about insurance within their social network is more effective in influencing this DRR behavior.

Both Norris et al. (2008) and Cai et al. (2015) contended that if the information is coming from reliable and trusted sources, the higher the likelihood that DRR measures will be pursued as opposed to merely relying on usual government awareness promotions. In this study, findings show that receiving information or advice about flooding events and insurance from social networks like family, friends, other members of social organizations, among others, may increase the chance that enterprises will plan to insure.

Estimation results, however, showed the other side of social capital. Attendance in government meetings and receiving information on insurance from social network show a negative relationship with risk perception. That if the respondent joins meetings conducted by the government and if respondent gets information about insurance from family, friends, or co-members in social organizations, they may assess future flooding to be less frequent, less severe, and not be as worried. Wolf et al. (2010) explained in their study that those with stronger ties see themselves as more resilient, hence, lower risk. Babcicky and Seebauer,

(2017) supported this as social capital, although assists in response and recovery, because there is an expectation that their own networks will provide help, the risk is toned down. This shows that the relationship between social capital and risk perception as well as DRR behavior is more complex and merits further investigation.

6. Appendices.

Table A.4.1. Structural Equation Models, Factor Loadings for the Latent Variables in Table 4.4

	WTI	**WTP**	**WTP**
	(1)	(2)	(3)
	GSEM		**SEM**
Risk Perception			
Perceived frequency of future flooding	1.00	1.00	1.00
	(constrained)	(constrained)	(constrained)
Perceived intensity of future flooding	1.317*	1.313*	1.085***
	(0.65)	-0.64	(0.16)
Worry over the next flooding	0.233**	0.234**	0.218**
	(0.09)	-0.09	(0.07)
Flood Experience			
Frequency of minor flooding per year	0.100***	0.100***	0.097***
	(0.02)	(0.02)	(0.02)
Frequency of moderate/major flooding per year	0.109***	0.108***	0.108***
	(0.02)	(0.02)	(0.02)
(Log) Total Cost of Damages	1.00	1.00	1.00
	(constrained)	(constrained)	(constrained)
(Log) Sales loss	0.780***	0.780***	0.763***
	(0.06)	(0.06)	(0.06)

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.4.2. Structural Equation Models (separate Worry over Future Flooding)

	Risk Perception (ordinal)	Worry over Future Flooding	Perceived Preparedness	WTI	Risk Perception (continuous)	Worry over Future Flooding	Perceived Preparedness	WTP
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	GSEM				SEM			
Risk Perception				0.022				0.035
				(0.14)				(0.31)
Worry over Future Flooding				0.134				0.145
				(0.15)				(0.25)
Perceived Preparedness				0.250*				0.445*
				(0.11)				(0.18)
Flood experience	0.109	0.059***	0.019	0.084*	0.075***	0.062***	0.02	0.134*
	(0.06)	(0.02)	(0.02)	-0.04	(0.02)	(0.02)	(0.02)	(0.07)
Social capital								
Number of social organizations respondent is member of	0.057	-0.022	0.047	0.030	0.037	-0.024	0.047	0.049
	(0.04)	(0.02)	(0.03)	(0.04)	(0.03)	(0.02)	(0.04)	(0.08)
Attends government meetings = 1	-0.525*	0.021	0.09	0.486	-0.383**	0.044	0.098	0.685
	(0.27)	(0.13)	(0.18)	(0.26)	(0.14)	(0.13)	(0.18)	(0.45)
Receives information about flooding from social network = 1	-0.048	0.064	0.111	0.599**	-0.084	0.058	0.109	1.061**
	(0.20)	(0.11)	(0.15)	(0.22)	(0.14)	(0.11)	(0.15)	(0.41)
Receives information about flooding from government = 1	0.06	-0.291	0.209	0.342	0.057	-0.318	0.2	0.512
	(0.22)	(0.16)	(0.20)	(0.28)	(0.14)	(0.16)	(0.21)	(0.51)
Receives information/advice about insurance from social network = 1	-0.441	-0.167	0.206	0.495*	-0.295*	-0.15	0.212	0.707
	(0.25)	(0.12)	(0.16)	(0.23)	(0.15)	(0.12)	(0.16)	(0.38)
Receives information/advice about insurance from government = 1	0.192	0.331	0.474	0.913*	0.104	0.357	0.482	0.836
	(0.47)	(0.28)	(0.45)	(0.43)	(0.36)	(0.28)	(0.43)	(0.76)
Individual Characteristics								
Owner = 1	0.024	-0.003	-0.038	-0.272	0.037	-0.025	-0.045	-0.613
	(0.29)	(0.13)	(0.18)	(0.27)	(0.14)	(0.13)	(0.17)	(0.46)
Female = 1	-0.002	0.299*	0.202	-0.348	-0.124	0.277*	0.194	-0.556

	(0.22)	(0.13)	(0.17)	(0.25)	(0.15)	(0.13)	(0.17)	(0.45)
Age (in years)	-0.007	-0.005	-0.002	-0.029***	-0.005	-0.005	-0.002	-0.053***
	(0.010)	0.000	(0.010)	(0.01)	(0.01)	0.00	(0.010)	(0.01)
Years of Education	0.073	0.024	-0.093**	-0.018	0.043	0.025	-0.093**	0.018
	(0.05)	(0.02)	(0.03)	(0.05)	(0.03)	(0.02)	(0.03)	(0.08)
HH has minor or senior members = 1	-0.094	0.003	-0.253	0.592*	-0.06	-0.004	-0.256	0.854
	(0.22)	(0.11)	(0.15)	(0.24)	(0.14)	(0.11)	(0.15)	(0.45)
Enterprise Characteristics								
MSME is wholesale and retail trade = 1	-1.101*	-0.045	0.173	-0.879	-0.732*	0.007	0.191	-1.443
	(0.44)	(0.18)	(0.31)	(0.49)	(0.31)	(0.20)	(0.31)	(0.78)
MSME is services = 1	-1.078*	0.026	0.228	0.226	-0.739*	0.086	0.249	0.381
	(0.48)	(0.19)	(0.32)	(0.53)	(0.31)	(0.20)	(0.31)	(0.87)
Years in operation	-0.001	-0.003	0.001	-0.011	-0.003	-0.004	0.001	-0.031
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
(log) Asset size	0.04	-0.065	0.069	0.166	0.003	-0.064	0.069	0.430**
	(0.08)	(0.06)	(0.07)	(0.09)	(0.05)	(0.05)	(0.06)	(0.15)
Total number of employees	-0.016*	0.006*	0.001	-0.007	-0.008*	0.006*	0.001	-0.013
	(0.01)	0.00	0.00	(0.01)	0.00	0.00	0.00	(0.01)
Home-based = 1	0.442	0.001	-0.211	0.43	0.289	-0.015	-0.216	0.672
	(0.24)	(0.17)	(0.21)	(0.27)	(0.17)	(0.17)	(0.21)	(0.50)
constant		4.696***	3.538***	-2.308		4.666***	3.528***	-2.637
		(0.79)	(1.00)	(1.72)		(0.77)	(0.99)	(2.84)
N	200	200	200	200	200		200	200
AIC	5,526.18				16,114.95			
BIC	5,862.61				17,058.27			
model χ^2 (rule: close to 0 & p>0.5)					model χ^2 (91): 119.064***			
RMSEA (rule: close to 0)					0.039			
RMSEA_SB					0.044			
CFI (rule: close to 1)					0.941			
CFI_SB					0.93			
SRMR (rule: close to 0)					0.029			
CD (rule: close to 1)					0.924			

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.4.3. Structural Equation Models, Indirect Effects

Independent Variables (IDV)	IDV → Preparedness → WTI	IDV → Risk Perception → WTI	IDV → Preparedness → WTP	IDV → Risk Perception → WTP
	(1)	(2)	(3)	(4)
		GSEM		
Flood experience	0.004	0.003	0.014	0.021
	(0.01)	(0.01)	(0.02)	0.02
Social capital				
Number of social organizations respondent is member of	0.012	-0.012	0.041	0.009
	(0.01)	(0.01)	(0.04)	(0.25)
Attends government meetings = 1	0.022	-0.001	0.074	-0.095
	(0.05)	(0.07)	(0.15)	(0.04)
Receives information about flooding from social network = 1	0.029	0.001	0.097	-0.009
	(0.04)	(0.01)	(0.13)	(0.04)
Receives information about flooding from government = 1	0.055	-0.011	0.184	0.009
	(0.06)	(0.01)	(0.19)	(0.22)
Receives information/advice about insurance from social network = 1	0.053	0.006	0.175	-0.085
	(0.04)	(0.06)	(0.14)	(0.14)
Receives information/advice about insurance from government = 1	0.122	0.002	0.404	0.048
	(0.12)	(0.04)	(0.40)	(0.06)
Individual Characteristics				
Owner = 1	-0.009	0.001	-0.030	0.015
	(0.05)	(0.01)	(0.16)	(0.05)
Female = 1	0.053	0.000	0.177	0.008
	(0.05)	(0.01)	(0.15)	(0.00)
Age (in years)	-0.001	0.002	-0.002	-0.001
	(0.00)	(0.00)	(0.00)	(0.04)
Years of Education	-0.024	-0.002	-0.081	0.014
	(0.01)	(0.01)	(0.05)	(0.06)
HH has minor or senior members = 1	-0.065	-0.024	-0.217	-0.019
	(0.04)	(0.01)	(0.15)	(0.50)

Enterprise Characteristics				
MSME is wholesale and retail trade = 1	0.042	-0.023	0.141	-0.192
	(0.08)	(0.15)	(0.28)	(0.48)
MSME is services = 1	0.056	0.000	0.187	-0.186
	(0.09)	(0.14)	(0.30)	(0.00)
Years in operation	0.000	0.000	0.001	0.000
	(0.00)	(0.00)	(0.01)	(0.02)
(log) Asset size	0.018	0.000	0.059	0.003
	(0.02)	(0.00)	(0.06)	(0.01)
Total number of employees	0.0002	0.0093	0.0005	-0.0024
	(0.001)	(0.002)	(0.004)	(0.193)
Home-based = 1	-0.054	0.003	-0.180	0.073
	(0.06)	(0.06)	(0.19)	(0.05)

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.4.4. Structural Equation Models (Five-year Flood Hazard)

	Risk Perception (categories)	Perceived Preparedness	WTI	WTP	Risk Perception (continuous)	Perceived Preparedness	WTP
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		GSEM				SEM	
Risk Perception			0.081	0.032			0.138
			(0.13)	(0.12)			(0.30)
Perceived Preparedness			0.272*	0.861*			0.489**
			(0.11)	(0.34)			(0.18)
Has flood experience = 1	0.615	-0.01	1.033**	3.021**	0.420*	-0.01	1.821**
	(0.41)	(0.23)	(0.34)	(1.09)	(0.20)	(0.23)	(0.60)
Five-year Flood Hazard							
Low	0.289	0.273	-0.154	-0.54	0.06	0.273	-0.371
	(0.41)	(0.25)	(0.39)	(1.17)	(0.26)	(0.25)	(0.63)
Medium	-0.009	0.107	-0.355	-1.035	(0.10)	0.107	-0.647
	(0.19)	(0.13)	(0.19)	(0.60)	(0.11)	(0.13)	(0.34)
High	0.260*	0.101	-0.172	-0.485	0.14	0.101	-0.317
	(0.11)	(0.09)	(0.14)	(0.38)	(0.07)	(0.09)	(0.21)
Social capital							
Number of social organizations respondent is member of	0.053	0.047	0.021	0.054	0.034	0.047	0.032
	(0.04)	(0.03)	(0.04)	(0.12)	(0.03)	(0.04)	(0.08)
Attends government meetings = 1	-0.592*	0.091	0.521*	1.508	-0.442**	0.091	0.658
	(0.25)	(0.17)	(0.26)	(0.78)	(0.15)	(0.17)	(0.45)
Receives information about flooding from social network = 1	-0.016	0.105	0.576*	1.874**	-0.038	0.105	1.054*
	(0.21)	(0.15)	(0.23)	(0.68)	(0.14)	(0.15)	(0.41)
Receives information about flooding from government = 1	-0.072	0.192	0.162	0.258	-0.014	0.192	0.255
	(0.21)	(0.20)	(0.28)	(0.82)	(0.14)	(0.20)	(0.47)
Receives information/advice about insurance from social network = 1	-0.421	0.236	0.451*	1.361	-0.293	0.236	0.602

	(0.24)	(0.16)	(0.22)	(0.71)	(0.15)	(0.15)	(0.38)
Receives information/advice about insurance from government = 1	-0.111	0.428	0.649	0.657	-0.132	0.428	0.28
	(0.49)	(0.44)	(0.39)	(1.25)	(0.34)	(0.40)	(0.71)
Individual Characteristics							
Owner = 1	-0.015	-0.059	-0.234	-0.652	0.027	-0.059	-0.502
	(0.27)	(0.18)	(0.27)	(0.83)	(0.15)	(0.18)	(0.47)
Female = 1	-0.025	0.174	-0.383	-1.101	-0.114	0.174	-0.575
	(0.24)	(0.17)	(0.25)	(0.79)	(0.15)	(0.16)	(0.44)
Age (in years)	-0.001	-0.001	-0.029***	-0.098***	-0.001	-0.001	-0.053***
	(0.010)	(0.010)	(0.01)	(0.03)	(0.01)	(0.010)	(0.02)
Years of Education	0.082	-0.091**	-0.021	-0.024	0.046	-0.091**	0.02
	(0.05)	(0.03)	(0.05)	(0.15)	(0.03)	(0.03)	(0.08)
HH has minor or senior members = 1	-0.135	-0.252	0.608*	1.506	-0.072	-0.245	0.883*
	(0.23)	(0.15)	(0.24)	(0.81)	(0.15)	(0.15)	(0.44)
Enterprise Characteristics							
MSME is wholesale and retail trade = 1	-1.169**	0.196	-1.204*	-2.647*	-0.847**	0.196	-1.765*
	(0.42)	(0.30)	(0.49)	(1.28)	(0.31)	(0.30)	(0.77)
MSME is services = 1	-0.956*	0.25	-0.036	0.91	-0.733*	0.25	0.255
	(0.43)	(0.33)	(0.55)	(1.45)	(0.32)	(0.33)	(0.90)
Years in operation	-0.002	-0.0001	-0.016	-0.067	-0.003	-0.0001	-0.039
	(0.01)	(0.01)	(0.01)	(0.04)	(0.01)	(0.01)	(0.02)
(log) Asset size	0.061	0.071	0.138	0.624*	0.02	0.071	0.399**
	(0.08)	(0.07)	(0.09)	(0.26)	(0.05)	(0.07)	(0.15)
Total number of employees	-0.015*	0.001	-0.008	-0.021	-0.009*	0.001	-0.015
	(0.01)	0.00	(0.01)	(0.02)	0.00	0.00	(0.01)
Home-based = 1	0.423	-0.239	0.358	1.171	0.315	-0.239	0.719
	-0.26	(0.21)	-0.27	(0.90)	-0.17	-0.21	-0.51
constant		3.293**	-1.317	-6.471		3.293**	-1.869
		(1.12)	(1.55)	(4.60)		(1.10)	(2.64)
N	200	200	200	200	200	200	200
AIC		2,247.11		2,800.14		14,339.45	
BIC		2,520.88		3,077.20		15,427.89	
model χ^2 (rule: close to 0 & p>0.5)						model χ^2 (47): 54.605	
RMSEA (rule: close to 0)						0.029	
RMSEA_SB						0.036	

CFI (rule: close to 1)	0.962
CFI_SB	0.944
SRMR (rule: close to 0)	0.024
CD (rule: close to 1)	0.595

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A 4.5. Structural Equation Models (No Perceived Level of Preparedness)

	Risk Perception (ordinal)	WTI	WTP	Risk Perception (continuous)	WTP
	(1)	(2)	(3)	(4)	(5)
		GSEM			SEM
Risk Perception		-0.019	0.081		-0.012
		(0.12)	(0.42)		(0.31)
Flood experience	0.129**	0.094*	0.271*	0.081***	0.153*
	(0.04)	-0.04	(0.12)	(0.02)	(0.06)
Social capital					
Number of social organizations respondent is member of	0.056	0.047	0.115	0.03	0.07
	(0.04)	(0.04)	(0.13)	(0.03)	(0.08)
Attends government meetings = 1	-0.565*	0.46	1.525	-0.379**	0.714
	(0.25)	(0.25)	(0.78)	(0.14)	(0.46)
Receives information about flooding from social network = 1	-0.052	0.624**	1.967**	(0.08)	1.117**
	(0.22)	(0.22)	(0.69)	(0.14)	(0.41)
Receives information about flooding from government = 1	0.048	0.289	0.942	0.04	0.562
	(0.22)	(0.27)	(0.82)	(0.14)	(0.50)
Receives information/advice about insurance from social network = 1	-0.508*	0.472*	1.527*	-0.308*	0.762*
	(0.25)	(0.22)	(0.74)	(0.15)	(0.38)
Receives information/advice about insurance from government = 1	0.291	0.984*	2.17	0.13	1.10
	(0.47)	(0.48)	(1.48)	(0.33)	(0.85)
Individual Characteristics					
Owner = 1	0.087	-0.253	-0.818	0.054	-0.631
	(0.28)	(0.27)	(0.82)	(0.14)	(0.46)
Female = 1	0.046	-0.23	-0.71	-0.099	-0.429
	(0.26)	(0.24)	(0.80)	(0.15)	(0.45)
Age (in years)	-0.009	-0.030***	-0.101***	-0.006	-0.055***
	(0.010)	(0.01)	(0.03)	(0.01)	(0.01)
Years of Education	0.084	-0.031	-0.074	0.047	-0.018

	(0.05)	(0.05)	(0.16)	(0.03)	(0.08)
HH has minor or senior members = 1	-0.114	0.506*	1.327	-0.061	0.741
	(0.23)	(0.23)	(0.84)	(0.14)	(0.45)
Enterprise Characteristics					
MSME is wholesale and retail trade = 1	-1.149**	-0.809	-2.283	-0.715*	-1.4
	(0.45)	(0.53)	(1.35)	(0.31)	(0.82)
MSME is services = 1	-1.111*	0.288	0.964	-0.723*	0.455
	(0.46)	(0.56)	(1.46)	(0.31)	(0.91)
Years in operation	-0.001	-0.011	-0.051	-0.004	-0.031
	(0.01)	(0.01)	(0.04)	(0.01)	(0.02)
(log) Asset size	0.016	0.152	0.723**	-0.006	0.451**
	(0.09)	(0.08)	(0.26)	(0.05)	(0.15)
Total number of employees	-0.014	-0.006	-0.019	-0.007*	-0.012
	(0.01)	(0.01)	(0.03)	0.00	(0.01)
Home-based = 1	0.443	0.395	1.051	0.278	0.587
	(0.27)	(0.27)	(0.90)	(0.17)	(0.50)
constant		-0.573	-3.737		-0.358
		(1.37)	(4.47)		(2.52)
N	200	200	200	200	200
AIC	4,798.32			15,489.75	
BIC	5,012.71			16,304.44	
model χ^2 (rule: close to 0 & p>0.5)				model χ^2 (103): 139.081***	
RMSEA (rule: close to 0)				0.042	
RMSEA_SB				0.047	
CFI (rule: close to 1)				0.922	
CFI_SB				0.909	
SRMR (rule: close to 0)				0.036	
CD (rule: close to 1)				0.907	

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.4.6. Structural Equation Models (no Risk Perception)

	Perceived Preparedness (1)	WTI (2)	WTP (3)	Perceived Preparedness (4)	WTP (5)
		GSEM		SEM	
Perceived Preparedness		0.253*	0.843*		0.460*
		(0.11)	(0.35)		(0.18)
Flood experience	0.019	0.093**	0.269**	0.02	0.146**
	(0.02)	-0.03	(0.10)	(0.02)	(0.05)
Social capital					
Number of social organizations respondent is member of	0.047	0.030	0.085	0.05	0.05
	(0.03)	(0.04)	(0.12)	(0.04)	(0.07)
Attends government meetings = 1	0.09	0.48	1.348	0.097	0.676
	(0.18)	(0.25)	(0.73)	(0.18)	(0.44)
Receives information about flooding from social network = 1	0.111	0.616**	1.886**	0.11	1.065**
	(0.15)	(0.23)	(0.69)	(0.15)	(0.41)
Receives information about flooding from government = 1	0.21	0.297	0.803	0.201	0.466
	(0.20)	(0.27)	(0.83)	(0.21)	(0.50)
Receives information/advice about insurance from social network = 1	0.206	0.450*	1.33	0.21	0.67
	(0.16)	(0.22)	(0.74)	(0.16)	(0.39)
Receives information/advice about insurance from government = 1	0.473	0.950*	1.75	0.48	0.88
	(0.45)	(0.42)	(1.29)	(0.44)	(0.73)
Individual Characteristics					
Owner = 1	-0.038	-0.258	-0.789	-0.044	-0.615
	(0.18)	(0.27)	(0.81)	(0.18)	(0.46)
Female = 1	0.202	-0.311	-0.901	0.196	-0.523
	(0.17)	(0.25)	(0.80)	(0.17)	(0.45)
Age (in years)	-0.002	-0.030***	-0.099***	-0.002	-0.053***
	(0.010)	(0.01)	(0.03)	(0.01)	(0.01)
Years of Education	-0.093**	-0.013	-0.006	-0.093**	0.025
	(0.03)	(0.05)	(0.15)	(0.03)	(0.08)
HH has minor or senior members = 1	-0.253	0.589*	1.487	-0.255	0.855
	(0.15)	(0.24)	(0.83)	(0.15)	(0.45)

Enterprise Characteristics					
MSME is wholesale and retail trade = 1	0.172	-0.898	-2.504*	0.188	-1.472*
	(0.30)	(0.46)	(1.17)	(0.31)	(0.74)
MSME is services = 1	0.228	0.209	0.713	0.246	0.362
	(0.32)	(0.50)	(1.24)	(0.32)	(0.81)
Years in operation	0.001	-0.011	-0.051	0.001	-0.032
	(0.01)	(0.01)	(0.04)	(0.01)	(0.02)
(log) Asset size	0.069	0.149	0.668**	0.069	0.420**
	(0.07)	(0.08)	(0.26)	(0.06)	(0.15)
Total number of employees	0.001	-0.007	-0.02	0.001	-0.012
	0.00	(0.01)	(0.03)	0.00	(0.01)
Home-based = 1	-0.211	0.425	1.269	-0.216	0.684
	(0.21)	(0.27)	(0.86)	(0.21)	(0.50)
constant	3.539***	-1.567	-6.506	3.529***	-2.013
	(1.00)	(1.49)	(4.49)	(0.97)	(2.62)
N	200	200	200	200	200
Left-censored observations			90		
Uncensored observations			110		
AIC	4,035.44		4,589.09	14,419.31	
BIC	4,206.95		4,763.90	15,204.31	
model χ^2 (rule: close to 0 & p>0.5)				model χ^2 (59): 93.241***	
RMSEA (rule: close to 0)				0.054	
RMSEA_SB				0.058	
CFI (rule: close to 1)				0.901	
CFI_SB				0.892	
SRMR (rule: close to 0)				0.028	
CD (rule: close to 1)				0.894	

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.4.7. Structural Equation Models (Risk Perception as a continuous variable)

	Risk Perception (continuous)	Perceived Preparedness	WTI	WTP
	(1)	(2)	(3)	(4)
		GSEM		
Risk Perception			0.011	0.142
			(0.17)	(0.58)
Perceived Preparedness			0.257*	0.856*
			(0.11)	(0.35)
Flood experience	0.077***	0.017	0.091*	0.254*
	(0.02)	(0.02)	(0.04)	(0.11)
Social capital				
Number of social organizations respondent is member of	0.037	0.048	0.03	0.080
	(0.03)	(0.03)	(0.04)	(0.12)
Attends government meetings = 1	-0.408**	0.087	0.483	1.407
	(0.14)	(0.18)	(0.26)	(0.78)
Receives information about flooding from social network = 1	-0.071	0.112	0.612**	1.900**
	(0.14)	(0.15)	(0.22)	(0.69)
Receives information about flooding from government = 1	0.07	0.213	0.30	0.794
	(0.15)	(0.20)	(0.27)	(0.83)
Receives information/advice about insurance from social network = 1	-0.329*	0.204	0.456*	1.37
	(0.15)	-0.16	(0.23)	(0.72)
Receives information/advice about insurance from government = 1	0.1	0.469	0.942*	1.72
	(0.34)	-0.45	(0.42)	(1.30)
Individual Characteristics				
Owner = 1	0.080	-0.035	-0.261	-0.793
	(0.17)	(0.18)	(0.27)	(0.81)
Female = 1	-0.072	0.205	-0.31	-0.883
	(0.16)	(0.17)	(0.25)	(0.80)
Age (in years)	-0.005	-0.002	-0.030***	-0.099***
	(0.010)	(0.010)	(0.01)	(0.03)
Years of Education	0.045	-0.093**	-0.013	-0.012
	(0.03)	(0.03)	(0.05)	(0.15)
HH has minor or senior members = 1	-0.052	-0.252	0.594*	1.498
	(0.15)	(0.15)	(0.24)	(0.83)

Enterprise Characteristics				
MSME is wholesale and retail trade = 1	-0.782*	0.165	-0.895	-2.391
	(0.32)	(0.30)	(0.48)	(1.28)
MSME is services = 1	-0.797*	0.219	0.203	0.829
	(0.32)	(0.32)	(0.52)	(1.41)
Years in operation	-0.003	0.001	-0.011	-0.05
	(0.01)	(0.01)	(0.01)	(0.04)
(log) Asset size	-0.007	0.069	0.149	0.666**
	(0.05)	(0.07)	(0.08)	(0.26)
Total number of employees	-0.007*	0.001	-0.007	-0.019
	0.00	(0.00)	(0.01)	(0.03)
Home-based = 1	0.3	-0.209	0.419	1.218
	(0.17)	(0.21)	(0.27)	(0.87)
constant		3.546***	-1.572	-6.511
		(1.00)	(1.50)	(4.49)
N	200	200	200	200
AIC		5,725.20		6,278.70
BIC		5,989.06		6,545.86

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.4.8. Probit and Tobit Models: Willingness to Insure and (Log) Willingness-to-Pay for Insurance

	WTI		**WTP**			
	(1)	(2)	(3)	(4)	(5)	(6)
			Coefficient	**Marginal Effects**	**Coefficient**	**Marginal Effects**
	Probit		**Tobit**			
Flood perception						
Perceived frequency of future flooding	-0.064	-0.06	-0.16	-0.08	-0.06	-0.03
	(0.11)	(0.11)	(0.35)	(0.17)	(0.35)	(0.17)
Perceived intensity of future flooding	0.103	0.072	0.24	0.12	0.12	0.06
	(0.10)	(0.11)	(0.32)	(0.15)	(0.33)	(0.16)
Worry over the next flooding	0.204	0.163	0.45	0.22	0.41	0.20
	(0.15)	(0.14)	(0.47)	(0.23)	(0.47)	(0.23)
Perceived Preparedness	0.265*	0.218*	0.826*	0.399*	0.747*	0.362*
	(0.11)	(0.10)	(0.34)	(0.16)	(0.33)	(0.16)
Flood experience						
Has flood experience = 1	1.077**		3.144**	1.520**		
	(0.34)		(1.11)	(0.53)		
Frequency of minor flooding per year		0.111			0.225	0.109
		(0.14)			(0.42)	(0.20)
Frequency of moderate/major flooding per year		0.32			0.698	0.338
		(0.17)			(0.44)	(0.21)
(Log) Cost of Damages to Premises		0.088*			0.244*	0.118*
		(0.04)			(0.11)	(0.05)
(Log) Cost of Damages to and Loss of Contents		-0.053			-0.144	-0.07
		(0.04)			(0.12)	(0.06)
(Log) Sales loss		0.025			0.091	0.044
		(0.03)			(0.09)	(0.04)
Five-year Flood Hazard						
Low	-0.185		-0.617	-0.298		
	(0.38)		(1.15)	(0.55)		
Medium	-0.391*		-1.088	-0.526		
	(0.19)		(0.62)	(0.30)		
High	-0.198		-0.496	-0.24		
	(0.13)		(0.38)	(0.18)		

Social capital						
Number of social organizations respondent is member of	0.037	0.014	0.213	0.103	0.194	0.094
	(0.14)	(0.14)	(0.43)	(0.21)	(0.42)	(0.21)
Attends government meetings = 1	0.520*	0.528*	1.435*	0.694*	1.393	0.674
	(0.24)	(0.24)	(0.73)	(0.35)	(0.72)	(0.35)
Receives information about flooding from social network = 1	0.563*	0.586*	1.820**	0.880**	1.737*	0.840*
	(0.23)	(0.23)	(0.69)	(0.33)	(0.71)	(0.34)
Receives information about flooding from government = 1	0.232	0.348	0.435	0.21	0.915	0.443
	(0.28)	(0.28)	(0.84)	(0.41)	(0.84)	(0.40)
Receives information/advice about insurance from social network = 1	0.489*	0.532*	1.364	0.659	1.473*	0.713*
	(0.22)	(0.23)	(0.71)	(0.34)	(0.71)	(0.34)
Receives information/advice about insurance from government = 1	0.625	0.975*	0.528	0.255	1.694	0.82
	(0.41)	(0.47)	(1.29)	(0.62)	(1.37)	(0.66)
Individual Characteristics						
Owner = 1	-0.203	-0.23	-0.542	-0.262	-0.624	-0.302
	(0.27)	(0.28)	(0.84)	(0.41)	(0.82)	(0.40)
Female = 1	-0.419	-0.263	-1.183	-0.572	-0.815	-0.394
	(0.26)	(0.25)	(0.80)	(0.39)	(0.79)	(0.38)
Age (in years)	-0.028***	-0.025**	-0.098***	-0.047***	-0.090**	-0.044**
	(0.01)	(0.01)	(0.03)	(0.01)	(0.03)	(0.01)
Years of Education	-0.02	-0.013	-0.031	-0.015	-0.023	-0.011
	(0.05)	(0.05)	(0.16)	(0.08)	(0.16)	(0.08)
HH has minor or senior members = 1	0.593*	0.568*	1.428	0.69	1.47	0.711
	(0.23)	(0.24)	(0.81)	(0.39)	(0.81)	(0.39)
Enterprise Characteristics						
MSME is wholesale and retail trade = 1	-1.189*	-0.957*	-2.741*	-1.325*	-2.371*	-1.148*
	(0.49)	(0.44)	(1.20)	(0.57)	(1.19)	(0.57)
MSME is services = 1	-0.038	0.115	0.69	0.333	0.692	0.335
	(0.54)	(0.49)	(1.40)	(0.68)	(1.31)	(0.63)
Years in operation	-0.016	-0.013	-0.067	-0.032	-0.053	-0.026
	(0.01)	(0.01)	(0.04)	(0.02)	(0.04)	(0.02)
(log) Asset size	0.157	0.193*	0.641*	0.310*	0.707**	0.342**
	(0.09)	(0.09)	(0.26)	(0.13)	(0.26)	(0.12)
Total number of employees	-0.01	-0.008	-0.026	-0.012	-0.02	-0.01
	(0.01)	(0.01)	(0.02)	(0.01)	(0.03)	(0.01)

Home-based = 1	0.388	0.408	1.222	0.591	1.223	0.592
	(0.27)	(0.27)	(0.89)	(0.43)	(0.88)	(0.42)
constant	-2.393	-3.201	-7.983		-9.821*	
	(1.79)	(1.81)	(4.92)		(4.93)	
Pseudo R2	0.308	0.316	0.1		0.101	
N	200	200	200		200	

Robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table A.4.9. Ordered Probit: Risk Perception and Perceived Preparedness

	Perceived Frequency of Future Flooding		Perceived Intensity of Future Flooding		Worry over Future Flooding		Perceived Preparedness	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Flood experience								
Has flood experience = 1	0.837*		0.289		0.431		-0.049	
	(0.33)		(0.31)		(0.26)		(0.23)	
Frequency of minor flooding per year		0.025		-0.027		0.1		0.115
		(0.12)		(0.14)		(0.11)		(0.09)
Frequency of moderate/major flooding per year		-0.076		-0.088		0.204		0.073
		(0.16)		(0.14)		(0.15)		(0.11)
(Log) Cost of Damages to Premises		0.019		0.051		0.014		0.032
		(0.03)		(0.03)		(0.03)		(0.03)
(Log) Cost of Damages to and Loss of Contents		0.041		0.015		0.019		-0.025
		(0.03)		(0.03)		(0.03)		(0.04)
(Log) Sales loss		0.013		0.018		0.026		-0.004
		(0.03)		(0.03)		(0.03)		(0.02)
Five-year Flood Hazard								
Low	-0.464		0.035		0.345		0.251	
	(0.40)		(0.36)		(0.34)		(0.27)	
Medium	-0.546*		-0.13		0.058		0.112	
	(0.22)		(0.18)		(0.12)		(0.13)	
High	-0.09		0.139		0.191*		0.104	
	(0.12)		(0.11)		(0.09)		(0.09)	
Social capital								
Number of social organizations respondent is member of	0.0002	0.022	0.232	0.235	-0.006	-0.001	0.188	0.185
	(0.11)	(0.11)	(0.13)	(0.13)	(0.08)	(0.08)	(0.10)	(0.10)
Attends government meetings = 1	-0.430*	-0.404	-0.698**	-0.704**	-0.039	-0.012	0.111	0.087
	(0.22)	(0.21)	(0.24)	(0.24)	(0.18)	(0.19)	(0.18)	(0.19)
Receives information about flooding from social network = 1	-0.067	-0.09	-0.29	-0.38	0.031	0.008	0.054	0.036
	(0.22)	(0.21)	(0.22)	(0.22)	(0.19)	(0.18)	(0.16)	(0.15)

Receives information about flooding from government = 1	-0.038	0.106	-0.053	0.065	-0.573*	-0.48	0.247	0.254
	(0.24)	(0.24)	(0.25)	(0.25)	(0.25)	(0.25)	(0.21)	(0.21)
Receives information/advice about insurance from social network = 1	-0.203	-0.23	-0.427*	-0.523*	-0.262	-0.286	0.273	0.255
	(0.20)	(0.20)	(0.21)	(0.21)	(0.19)	(0.18)	(0.16)	(0.16)
Receives information/advice about insurance from government = 1	-0.06	0.194	-0.296	-0.105	0.443	0.7	0.485	0.5
	(0.46)	(0.45)	(0.58)	(0.57)	(0.50)	(0.49)	(0.52)	(0.53)
Individual Characteristics								
Owner = 1	0.39	0.354	-0.175	-0.068	-0.028	-0.013	-0.002	-0.006
	(0.23)	(0.24)	(0.27)	(0.26)	(0.19)	(0.20)	(0.18)	(0.19)
Female = 1	-0.234	-0.194	-0.299	-0.223	0.346	0.409*	0.192	0.217
	(0.23)	(0.22)	(0.23)	(0.23)	(0.19)	(0.20)	(0.17)	(0.17)
Age (in years)	-0.001	-0.005	-0.003	-0.011	-0.004	-0.007	-0.001	-0.001
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Years of Education	0.092*	0.077	0.045	0.032	0.041	0.042	-0.105**	-0.105**
	(0.04)	(0.04)	(0.05)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)
HH has minor or senior members = 1	0.089	0.124	-0.036	0.049	0.165	0.147	-0.245	-0.253
	(0.22)	(0.22)	(0.22)	(0.22)	(0.18)	(0.17)	(0.16)	(0.17)
Enterprise Characteristics								
MSME is wholesale and retail trade = 1	-0.49	-0.372	-1.131*	-1.098*	-0.198	-0.17	0.192	0.1
	(0.37)	(0.39)	(0.47)	(0.47)	(0.30)	(0.33)	(0.31)	(0.31)
MSME is services = 1	-0.456	-0.564	-1.208*	-1.395**	0.025	0.001	0.176	0.098
	(0.42)	(0.44)	(0.51)	(0.52)	(0.33)	(0.35)	(0.34)	(0.32)
Years in operation	-0.002	-0.002	-0.015	-0.017	-0.007	-0.006	-0.001	-0.001
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
(log) Asset size	-0.013	-0.045	-0.02	-0.074	-0.082	-0.082	0.069	0.08
	(0.08)	(0.08)	(0.09)	(0.09)	(0.09)	(0.09)	(0.07)	(0.07)
Total number of employees	-0.004	-0.001	-0.033	-0.035	0.007*	0.007	0.001	0.001
	(0.01)	(0.01)	(0.02)	(0.02)	(0.004)	(0.004)	(0.005)	(0.005)
Home-based = 1	0.381	0.342	0.615*	0.597*	0.1	0.146	-0.244	-0.197
	(0.27)	(0.27)	(0.29)	(0.29)	(0.22)	(0.23)	(0.22)	(0.23)
cut1	1.293	0.643	-0.78	-1.958	-2.524	-2.611	-1.702	-1.685
	(1.40)	(1.39)	(1.46)	(1.48)	(1.40)	(1.34)	(1.15)	(1.06)
cut2	1.846	1.189	-0.188	-1.359	-1.929	-2.001	-0.918	-0.892
	(1.41)	(1.40)	(1.46)	(1.48)	(1.39)	(1.33)	(1.16)	(1.07)

cut3					-1.555	-1.634	-0.096	-0.065
					(1.39)	(1.33)	(1.16)	(1.08)
cut4					0.836	0.732	0.966	0.998
					(1.35)	(1.31)	(1.15)	(1.07)
chi2	29.87	24.82	24.2	30.46	87.31*	92.03*	75.99	76.62
p-value	0.09	0.31	0.28	0.11	0.02	0.02	0.13	0.17
Pseudo R2	0.101	0.09	0.14	0.15	0.10	0.10	0.05	0.05
N	200	200	200	200	200	200	200	200

Note: chi^2 is the approximate likelihood-ratio test of proportionality of odds across response categories

Robust standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Chapter 5. Conclusion

1. Summary of Major Findings

Flooding results in considerable economic losses for a country, especially to the local economy, owing to physical damages on infrastructure and assets and interruption of business operations. Based on the results of Chapter 3, MSMEs typically suffer from damages because of the physical impact of flood on the premises and business facilities and on content, like inventory and equipment, found in the establishments. Businesses, however, can remain untouched by flood waters yet still feel the impact of the disaster by affecting its market—its consumers, suppliers, as well as its employees. For this study, consumers were one of the primary reasons why the enterprise experienced dwindling sales. This means that government awareness campaigns should not merely focus on the population directly affected by floods. Households and businesses outside the flood hazard areas need to prepare themselves as well for the consequences of flooding.

Despite the impacts, however, findings from this study as well as other surveys, show how inadequately prepared enterprises are against the effects of flooding events. A large majority of enterprises, especially the micro and small, have no existing BCPs and/or insurance plans. Although argued as an important component in alleviating the risks encountered by MSMEs and speeding the recovery from a disaster (Alharbi & Coates, 2018; APDC, 2016; Chatterjee & Wehrhahn, 2015; APEC, 2014; Warner, et al., 2009; Runyan, 2006), insurance remains to be inaccessible.

For the 2018 MSME Marikina Survey, there were only 13 respondents, a measly 6.5 percent, that stated that they have any type of insurance. When asked if the respondents are willing to pay for insurance, majority answered in the affirmative. However, 85 out of the 110 respondents chose a payment of less than Php1,200, the premium provided in the hypothetical scenario mentioned in Section 4.3.

For those that answered that they were unwilling to buy insurance, 41 out of the 90, or 45.6 percent, indicated that insurance purchase is not the priority of the enterprise. Some answered that they find it impractical or not necessary and that the enterprise has inadequate finances. BCP is also considered impractical and not a priority. As such, only 21 percent of enterprises that have no existing BCP, stated that they plan to create a BCP. Additionally, because of the number of flooding events experienced by most of the respondents, they may have simply endured living with floods and that whatever the effectiveness of disaster mitigation measures no longer matter.

A stated intent, however, is different from actual behavior. Although most of the respondents replied that they are willing to insure, moving from intent to action will be difficult if the reasons for inaction are not addressed. Having the capacity to adapt or indicating intention to implement DRR measures does not mean that households, enterprises, or a system will actually choose that behavior (Poussin et al., 2014). For instance, Liverani (2009) argues that despite having sufficient knowledge about climate change, this does not automatically mean that they will engage in adaptation behaviors. In the ADPC MSME Survey (2016), surveyed firms had a high awareness of climate hazards and disaster risks as well as experience of damages and losses, however, understanding of formal coping mechanisms like BCPs and insurance remains low.

2. Policy Implications and Recommendations

5.1. Current laws and regulations

Policy interventions on climate-related activities have been initiated in the Philippines as early as 1992, in accordance with the United Nations Conference of Environment and Development (UNCED) or the Rio Earth Summit, starting with the Philippine Agenda 21. This is a program of action pushing forth sustainable development (Environmental Management Bureau, 1992).

Following this are the Philippine Clean Air Act of 1997 and the Presidential Task Force on Climate Change in 2007. The latter was institutionalized and replaced, and in 2009, Republic Act No. 9729 or the Climate Change Act was approved and signed into law. This is the primary law tackling climate change issues, aiming to mainstream climate change adaptation into national, sector, and local government policy formulations; formulate and develop a framework strategy and program on climate change; and create the Climate Change Commission (Republic Act No. 9729, 2009). With this mandate, a National Climate Change Action Plan (NCCAP) for 2011 to 2028 was prepared, highlighting food security, water sufficiency, ecological and environmental stability, human security, climate-smart industries and services, and knowledge and capacity development (Climate Change Commission, 2011).

Acknowledging the relationship between climate change and natural disasters, the Climate Change Act also decrees that disaster risk reduction and management (DRRM) be integrated into climate change policies and programs (Republic Act No. 9729, 2009). Although there have already been existing policies relating to disasters since 1978, it was only in 2010 that Republic Act No. 10121, also known as the Philippine Disaster Risk Reduction and Management Act, was enacted. The law "strengthens the Philippine disaster risk reduction and management system, providing for the national disaster risk reduction and management framework and institutionalizing the National Disaster Risk Reduction and Management Plan, and appropriating funds" (Republic Act 10121, 2010). It emphasizes adopting DRRM policies that will reduce the effect of disasters including climate change impacts as well as highlighting the need for local governments at the regional, provincial, city and municipal, barangay to establish their own Disaster Risk Reduction and Management Councils, duplicating the NDRRMC's responsibilities (Republic Act 10121, 2010). Work on this area so far covers hazards, vulnerability, and risk assessments; early warning systems and evacuations; risk transfer mechanisms; capacity building for disaster preparedness; response and relief operations; and rehabilitation, recovery, and reconstruction. These issues are also underscored in the government's medium-term (Philippine Development Plan 2017-2022) and long-term plans (Ambisyon Natin 2040).

For enterprises, the Magna Carta for Micro, Small, and Medium Enterprises—R.A. No. 6977 and amended by R.A. No. 8289—details the current national policy to promote, support, strengthen, and encourage the growth and development of MSMEs. The Barangay Micro Business Enterprises (BMBE) Act of 2002, or R.A. No. 9178, supports the creation and development of barangay micro business enterprises through the streamlining of various bureaucratic processes and the active granting of incentives and benefits to boost employment and ease poverty.

5.2. Limitations of current laws and regulations

On paper, policies to reduce, mitigate, and manage disaster as espoused by the Philippine Disaster Reduction and Management Act seem satisfactory, even being extolled by various international organizations like the United Nations International Strategy for Disaster Reduction as well as non-government organizations. Moreover, it serves as a model for other governments, civil society organizations, and local communities in other countries. However, the story proves to be more challenging on the ground as implementation remains difficult for both the government and the private sector.

Ballesteros and Domingo (2015) reported that there are no sound policy and interventions by the national and local government to support MSMEs before, during, and after disasters as resources are usually used on search and rescue, evacuation, relief operations, and providing necessities in temporary shelters. As seen from the data in this study, as well as other survey data, MSMEs used their personal savings or borrowed money from their own social circle or informal lenders to cope with disasters with only a few indicating that they had assistance from the government. Furthermore, a mere 13 MSMEs answered that they have any type of insurance, and 21 enterprises crafted a written BCP.

An integration of microenterprise programs and policies, especially financial and non-financial support, with local development, climate change adaptation, and disaster risk reduction management policies is, therefore, necessary. Examples of this assistance can include tax holidays, deferring payments of loans, and accessible credit facilities. It is also vital for policy makers to incorporate dealing with multiple disaster simultaneously and consecutively because the frequency and severity of climatic hazards are likely to increase. The COVID-19 pandemic and the recent disasters demonstrated how MSMEs remain unprepared.

This study also recognizes the role of the community and its members including MSMEs, and stresses community-based disaster risk management along with the usual top-down approaches.

5.3. Risk Assessment

Gathering and analyzing the effects of disasters from enterprises would allow the government, as well as other sectors like the academe and non-government organizations, to quantitatively assess the vulnerabilities and economic losses of businesses, especially the smaller ones. As shown in Chapter 3, enterprises do not need to be physically affected by flooding but still feel the effects of the disaster through its consumers, suppliers, and employees, hence, data should include not just direct but indirect impacts as well.

The data collection can be done through community mapping, wherein members of the community will gather data from the field. Following the collection of data, maps can be generated, using OpenStreetMap, to easily examine where the highest damages and losses are located, assess what the needs of these MSMEs are for them to recover sooner, as well as assist them in crafting their own disaster preparedness and risk reduction measures.

The initiative from the APDC iPrepare Business Team in partnership with DTI and ADB to conduct the Philippine MSME Survey (Asian Disaster Preparedness Center and Department of Trade and Industry, 2016)—which examined MSME's perception of risk, experience of disasters, preparedness measures, and BCPs—on September 2015 is a good development but not enough.

Moreover, hazards maps of different cities and municipalities in the Philippines has been accessible in recent years. A list of establishments in each local government is also available. LGUs may not have all the resources to integrate them together since inputting addresses requires payment even if there are free mapping software available, nor conduct comprehensive studies, national government agencies can step up and provide these resources to them and partnerships between LGUs, scientific and technical experts, the academe, the community itself can be established.

5.4. Communicating Risks and DRR Measures

Since the assessment in Chapter 3 was that the effects of flooding extend to those not physically affected, government awareness campaigns about risks should not merely focus on the population directly affected by floods.

In terms of DRR, although most of the respondents answered that they were willing to purchase insurance, shifting from intent to actual behavior will continue to be a challenge if the reasons for inaction are not tackled. For instance, the main reason for not crafting a BCP is that MSMEs believe they are impractical or not their priority. It remains essential to properly communicate the role and importance of BCPs, insurance, and other DRR mechanisms in protecting a business.

As seen in Chapter 4, there is a relationship between the intention to insure and some social capital factors like receiving information about flooding and insurance from family and friends. Actual behavior may differ, however, there may be merit in strengthening social networks and utilizing trusted members of a community or sector in advocating for enterprise protection. This should be considered by local governments and policymakers.

All that said about the importance of MSMEs having their individual preparedness measures, the onus should not only be on individuals and the private sector. Calls for personal responsibility become useless if there is weak infrastructure—both physical and financial to assist ailing MSMEs that suffer not just from the consequences of flooding but also other disasters. And especially since the Philippines is located in a disaster-prone area, the pandemic highlighted the necessity of planning for multiple disasters and ensure that risks will be minimized. However, it costs time and money, resources that MSMEs lack, to be prepared, hence, the government should step in.

3. Future Research

As mentioned in the first chapter, this study was confronted with some constraints owing to the type of dataset, the small sample size mainly due to budgetary restrictions, and lack of experiments. As such, there is considerable room for future research like collecting more data on direct and indirect damages and losses and even the intangible effects; different cognitive and behavioral factors, specifically related to disasters such as fear, loss aversion, and optimism bias; as well as government-related factors like trust in government, perception on government policies and projects should be done. Adding coping appraisal variables like response efficacy and response cost would also be useful in determining protection motivation and other decision-making processes.

A social network analysis of MSMEs can also offer insights on how enterprises are influenced by their family and community and how the three types of social capital, namely bonding, bridging, and linking social capital varies in helping sway DRR decisions and behavior.

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Appendix A. Survey Questionnaire and Guidelines