COPING WITH DISASTER RISK MANAGEMENT IN NORTHEAST ASIA

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COPING WITH DISASTER RISK MANAGEMENT IN NORTHEAST ASIA: ECONOMIC AND FINANCIAL PREPAREDNESS IN CHINA, TAIWAN, JAPAN AND SOUTH KOREA

BY

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List of Abbreviations

AADMER	ASEAN Agreement on Disaster Management and Emergency Response
ADB	Asian Development Bank
ADRFI	ASEAN Disaster Risks Financing and Insurance Programme
ARC	African Risk Capacity
ARF	ASEAN Regional Forum
ARF DiREx	ASEAN Regional Forum Disaster Relief Exercise
ART	Alternative Risk Transfer
ASEAN	Association of Southeast Asian Nations
BAU	Business-As-Usual
CCFVI	Coastal City Flood Vulnerability Index
CCP	Chinese Communist Party
CCR	Caisse Centrale de Réassurance (France)
CCRIF	Caribbean Catastrophe Risk Insurance Facility
CDSCHQ	Central Disaster and Safety Countermeasures Headquarters (South Korea)
CEA	California Earthquake Authority
CIRC	China Insurance Regulatory Commission
CRED	Centre for Research on the Epidemiology of Disasters
CREIP	China Residential Earthquake Insurance Pool
DMZ	Korean Demilitarized Zone
DPP	Democratic Progressive Party (Taiwan)
DPRK	Democratic People's Republic of Korea
DSCHQ	Disaster and Safety Countermeasures Headquarters (South Korea)
ECFA	Economic Cooperation Framework Agreement
ECLAC	Economic Commission for Latin America and the Caribbean (United Nations)
EEW	Earthquake Early Warning (Japan)
EEWS	Earthquake Early Warning System (Taiwan)
EM-DAT	Emergency Events Database
EQC	Earthquake Commission (New Zealand)
ESCAP	Economic and Social Commission for Asia and the Pacific (United Nations)

FAO	Food and Agriculture Organization (United Nations)
FARD	Frequency Analysis Rainfall Data (South Korea)
FEMA	Federal Emergency Management Agency (United States)
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Geographic Information System
HA/DR	Humanitarian Assistance/Disaster Relief (activities)
IDNDR	International Decade for Natural Disaster Reduction (United Nations)
IFRC	International Federation of Red Cross/Red Crescent Societies
ILS	Insurance-Linked Securities
IMF	International Monetary Fund
INES	International Nuclear and Radiological Event Scale
IPCC	Intergovernmental Panel for Climate Change
JER	Japan Earthquake Reinsurance
JMA	Japan Meteorological Agency
JP¥	Japanese Yen
KACCC	Korean Adaptation Center for Climate Change
KIRI	Korea Insurance Research Institute
KMT	Kuomintang (Taiwan)
KRW	South Korean Won
METI	Ministry of Economy, Trade and Industry (Japan)
MEXT	Ministry of Education, Culture, Sports, Science and Technology (Japan)
MOOTW	Military Operations Other Than War
MoU	Memorandum of Understanding
NCDR	National Committee for Disaster Reduction (China)
NCREE	National Center for Research on Earthquake Engineering (Taiwan)
NDMI	National Disaster Management Research Institute (South Korea)
NDRC	National Development and Reform Committee (China)
NEMA	National Emergency Management Agency (South Korea)
NGO	Non-Governmental Organization
NHK	Nippon Hoso Kyokai
NHMP	National Hazard Mitigation Program (Taiwan)
NHRA	Natural Hazards Risk Atlas
NT$	New Taiwan Dollar
NZ$	New Zealand Dollar
OECD	Organization for Economic Cooperation and Development
P&C	Property and Casualty
PCRAFI	Pacific Catastrophe Risk Assessment and Financing Initiative
PCRIC	Pacific Catastrophe Risk Insurance Company
PICC	People's Insurance Company of China

PLA	People's Liberation Army
PPP	Public–Private Partnership
PRC	People's Republic of China
RCSC	Red Cross Society of China
RMB	Renminbi (China)
RMS	Risk Management Solutions
ROC	Republic of China
ROK	Republic of Korea
SDF	Self-Defence Forces (Japan)
SEADRIF	Southeast Asia Disaster Risk Insurance Facility
SPNDA	Standard Procedure for Natural Disaster Assistance (Taiwan)
SPV	Special-Purpose Vehicle
TAPEX	Taiwan Cooperative Precipitation Ensemble Forecast Experiment
TCIP	Turkish Catastrophe Insurance Pool
TDRS	Tsunami Disaster Response System (South Korea)
TELES	Taiwan Earthquake Loss Estimation System
TEPCO	Tokyo Electric Power Company
TREIF	Taiwan Residential Earthquake Insurance Fund
TRY	Turkish Lira
TTFRI	Taiwan Typhoon and Flood Research Institute
UNDHA	United Nations Department of Humanitarian Affairs
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
UNISDR	United Nations Office for Disaster Risk Reduction
USDA	United States Department of Agriculture
WEF	World Economic Forum

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Chapter 1

Introduction

Natural disasters have affected mankind since its very beginnings. They have influenced, shaped, and modified human behavior, changing the way people live with and respond to the environment around them. They are a global phenomenon that know no borders and can devastate entire countries overnight, leaving behind dramatic scenes of desolation and suffering. Images of wrecked bridges, half-submerged streets, and last-minute rescues of children trapped in collapsed houses have made their way to local media, as well as international headlines, and come to dominate the news cycle. Natural disasters have become part and parcel of our daily lives, requiring special actions and policies to reduce the severity of their negative effects.

Complex and diverse by their very nature, such disasters are extremely hard to predict and impossible to stop. Taking many different forms, their duration can range from an hourly disruption to months or years of ongoing destruction. Earthquakes, tsunamis, typhoons, floods, landslides, avalanches, extreme cold and heat waves, wildfires, and volcanic eruptions are usually categorized as rapid-onset disasters. The warning time for these can range from seconds, or at best a few minutes in the case of earthquakes and landslides, to several days in the case of most typhoons and floods. The physical impacts are immediate and high intensity. Slow-onset disasters, on the other hand, emerge gradually over time, often based on a confluence of different circumstances. Drought, desertification and deforestation, disease epidemics, and sea-level rise are common examples of slow-onset disasters. Their impact may not be felt for decades, although they are likely to create deep economic and social crises. The public view of natural disasters is that they are short-term occurrences. Real-time delivery and extensive coverage, for a relatively brief period, tend to reinforce the perception of a limited extent in time and space. Unlike sudden-onset emergencies, slowly unfolding events are recognized as disasters that can be mitigated by an appropriate response. If anticipation, early warning, and precautionary measures are fully functioning and operating, the longer lead time should allow local and national authorities to

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step in early enough to minimize loss of life and material damage. Unfortunately, the response to most slow-onset disasters resembles the response to rapid-onset disasters: a large influx of resources released without any budgeting plans.

Whether it is rapid-onset disasters or slow-onset disasters, there is no question that Asia has it all. The Asian continent has a long history of natural disasters that have devastated its populations, cities, and heritage. Recent events have only emphasized this vulnerability. The 2008 Sichuan earthquake, the 2009 Morakot typhoon, the 2011 Tohoku earthquake and tsunami, the 2011 Thailand floods, the 2013 Haiyan typhoon, and the 2015 Nepal earthquake are just a few examples among many. When compared to other regions of the world, people in Asia are four times more likely to be affected by natural disasters than those in Africa, and 25 times more vulnerable than those in Europe and North America. The United Nations Office for Disaster Risk Reduction (UNISDR) and the Belgian-based Centre for Research on the Epidemiology of Disasters (CRED) estimated that, from 1950 to 2011, 9 out of 10 people affected by natural disasters worldwide lived in Asia. The northeast part of the continent is among the most exposed areas. China, Taiwan, Japan, and South Korea have suffered, and continue to suffer from repeated disasters, requiring the implementation of a comprehensive strategy dedicated to the management of risks posed by the occurrence of such events. The question that needs to be asked is whether the governments of these countries will be able to cope with the impacts of future disasters, especially when it comes to financial preparedness and the handling of costs associated with restoring livelihoods and rebuilding social and economic infrastructures.

1.1. Addressing the Threat of Natural Disasters

Natural disasters annually cause tens of thousands of deaths and tens of billions of (US) dollars worth of losses.[1] The figures available from international agencies such as the International Federation of Red Cross/Red Crescent Societies (IFRC, World Disaster Report, Geneva, annual) and from major transnational insurance and reinsurance corporations meeting in Davos (Switzerland) every year under the World Economic Forum (WEF, annual reports on global risk) show that mortality has been fairly consistent, while the number of catastrophic events, and even more, the size of economic losses, have rapidly increased. In the 1980s, inflation-adjusted costs were on average about US$25 billion – a number which increased to US$95 billion per year in the 1990s. In the last 10 years, economic damage reached an annual average of US$130 billion (Swiss Re, 2013).

The substantial rise in economic losses is primarily due to economic development and population growth, a higher concentration of assets in exposed areas and increasingly climate change. However, the figures disguise the gap between the actual economic losses and the insured losses. A large part of the economic

[1]US dollars are the reference currency used in this book. When primary sources only provide information in local currency, the author has decided not to transfer local currency into US dollars to preserve accuracy. However, in order to help the reader, a standard exchange rate is provided for each case study.

costs of natural disasters is not insured. For instance, the global reinsurer Swiss Re evaluated that of the estimated US$131 billion losses due to catastrophes in 2013, which was a regular year for catastrophe losses, only some US$37 billion were covered by insurance. In 2012, a much heavier year of losses, Swiss Re estimated natural catastrophe-related losses at US$188 billion, of which US$75 billion were insured, making 2012 the fourth most costly year on record (Swiss Re, 2014).[2] In 2014 and 2015, economic losses were down to US$104 billion and US$80 billion, respectively – below the average of the previous 10 years – with insurance losses of US$28 billion for each year (Swiss Re, 2016). In 2016, economic losses resumed their ascent, with losses estimated at US$170 billion, of which US$48 were insured. In 2017, an active hurricane season in the North Atlantic and widespread flooding in South Asia pushed global catastrophe losses to their highest level ever recorded in a single year: total economic losses were US$330 billion and insured losses were US$138 billion (Swiss Re, 2018).

Total damage estimates may differ from one source to another, mainly due to divergent definitions of the notion of "catastrophe," but all sources come to the same inevitable conclusion: (i) economic losses have increased in recent history and (ii) this upward trend will continue into the future. Economic losses vary by country and by category of disaster. Over the past two decades, about 20–40% of losses were covered by insurance. Measured in premiums as a percentage of gross domestic product (GDP), average insurance penetration rates in the non-life sector reach only 2.9% in developing countries, far below the 8.1% seen in industrialized countries (Swiss Re, 2016). This means that the majority of economic losses fall back on governments, enterprises, and private households.

Natural disasters place a huge burden on the public sector, which not only shoulders the cost of relief and recovery efforts such as administering first aid, providing emergency supplies and clearing roads, but is also responsible for rebuilding damaged infrastructures. Since individuals and businesses are generally underinsured, the government is often expected to support private rebuilding efforts by providing transfer payments as well. Traditionally, most governments rely on so-called national disaster management policies and planning, which include or should consider post-disaster financing. This may include in the short run or in the medium term increasing national or local taxes, reallocating public funding from other budget items, or negotiating additional loans borrowed from the general public (special treasury bills) or from domestic and/or international financial institutions. This approach may raise several major problems: (i) it can divert funds from key development projects, (ii) it can be costly to raise new domestic debt in speculative capital markets, and (iii) it can further weaken fragile economies, especially in the developing world. There is substantial value in shifting to a post-disaster management approach that would accumulate preventive funds and implement positive actions for disaster vulnerability reduction before the next catastrophe occurs, particularly in disaster-prone countries.

[2]Although 2012 recorded the most economic losses after 2017, it still has competition from the years 2011 and 2005. In 2011, the insured catastrophe losses were about US$110 billion, while, in 2005, the trio of hurricanes Katrina, Wilma, and Rita caused more than US$120 billion in insurance losses.

The resilience of a country, or its ability to rebound from a natural disaster, not only depends on the severity of the catastrophe but also on available funding for relief, recovery, and reconstruction – which have different spatial and time spans. The faster a country can return to its normal state of affairs, the smaller the long-term impacts of the catastrophe. In many countries, however, total available funds are simply not enough to cover all the potential economic costs of natural disasters. Based on an estimate of country-wide risk for the 70+ countries most exposed to extreme events, the World Bank has identified a number of countries that are highly financially vulnerable and experience a resource gap, which means that net disaster losses exceed all available financing sources. Many of these disaster-prone countries already run into a financing problem for small- to medium-sized events (World Bank, 2010). In such cases, governments need to increase their efforts to alleviate the financial burden on the public sector and consider pre-disaster financing tools as an important component of disaster risk management. Prevention and mitigation are critical steps to dealing with natural disasters, but preparing for the financial aspects of catastrophe losses is a key element of any disaster-prone country or region.

1.2. Disaster Risk Governance

Large and more complex natural disasters demand the intervention of more participants. The effective reduction and financing of catastrophe risks compel a collaborative response involving the whole of society – from individuals, communities, businesses, and emergency management and support agencies to all levels of government. As frequency and costs rise, single players can no longer meet these challenges alone. No government can fully prevent damage from every imaginable event. The objective of reducing risks and controlling economic losses calls for adaptive governance.

The literature has embraced a range of novel concepts on the subject, including collaborative governance (Freeman, 1998), multilevel governance (Hooghe & Marks, 2003), collaborative ecosystem governance (Karkkainen, 2001), and new environmental governance (Holley, Gunningham, & Shearing, 2011), to name a few. Although divergent in their pedigree, these concepts are bound together through an engagement with forms of disaster policy that favor less rigid, less uniform, less prescriptive, and less hierarchical approaches to governing and incorporate more collective, decentralized decision-making approaches that devolve control to multistakeholder groups, envelop flexibility and multilevel arrangements, and pursue explicitly adaptive and arguably more adequate means of addressing catastrophe risks.[3] Participation and collaboration favorably influence the capacity to design disaster preparedness and adaptation strategies.

[3]For more details on the need for flexible organizations, policies, and institutions in managing catastrophe risks, see Bull-Kamanga et al. (2003), Klein, Nicholls, and Thomalla (2003), King (2007), Warner (2008), and Holley (2010).

The pooling of knowledge, resources, and competencies from multiple actors can allow for valuable processes and better outcomes.

Global adaptive governance has made great progress since the UN International Decade for Natural Disaster Reduction (IDNDR) raised international community awareness on the need to move from reaction measures toward a more integrated disaster risk management.[4] The importance of non-state actors and the notion of cooperation are now the defining features of the international agenda. However, the formation of international mechanisms on how to deal with these imperatives remains elusive. The lack of involvement from financial institutions and the persistent division between developed and developing countries have to be taken into account to comprehend the current absence of international regulation. Despite global financial assistance provided by the UNISDR, the International Monetary Fund (IMF), major development banks (e.g., ADB and the World Bank), non-governmental organizations (NGOs), and private market actors, there are still no international rules and procedures on how to move from disaster risk reduction to disaster risk transfer and from national risk governance to global adaptive risk governance. The fact is that national governments continue to play a leading role in disaster risk governance. As attractive as the rhetoric of integrated disaster risk management might be, the problem of financing the effects of natural disasters remains vested in national governments. This statement is especially true in Asia, where governments hold supreme authority and act as the central institution, determining, issuing, and enforcing regulations from the top down, in a strict hierarchical order.

Governments are of crucial importance to take measures for the prevention and mitigation of natural disasters, and the preparedness and capacity building for dealing with threatening disaster situations. Governments have the political and legal power to set framework conditions that facilitate adaptive responses. They are the ones that can implement codes and procedures that enhance the resilience of structures, delimit intelligent zoning to lessen perils in disaster-prone areas, and introduce compulsory insurance schemes. Governments also exercise tight control over the capital planning and resource allocation process. They are the ones that can reduce exposure to disasters (pre-disaster measures) and stimulate relief and reconstruction progress (post-disaster measures) by the means of national economic and fiscal policies. Governments are always at the forefront of efforts to manage the economic impacts of natural disasters, and citizens' trust in government is directly affected by how efficiently governments address the issue. Governments have a responsibility to uphold their citizens' rights, including the right to be safe from the devastating economic repercussions of natural disasters. For all of these reasons, this book is essentially carried out within the scope of government actions. It analyzes the diversity of national disaster risk governance across Northeast Asia from the comparative perspective of the national disaster management plans implemented by the governments of China, Taiwan, Japan, and South Korea to handle the rising costs of natural disasters. It aims to provide the necessary information

[4]The decade was inaugurated in 1989 by the General Assembly with the purpose of mitigating the effects of natural disasters (Resolution 44/232).

on hazards, exposures, and vulnerabilities to assist policy development to increase governmental preparedness for catastrophe risks. In the absence of international rules and procedures, governments in disaster-prone countries or regions have every reason to build on previous successes.

1.3. Hazard, Risk, and Disaster

The study of natural disasters is the subject of intense research and discussion. The potential for ambiguity may be growing. Defining natural disasters is not as easy as it looks. Depending on the academic discipline or the purpose of the user (e.g., insurance industry, emergency management), it may have different connotations and meanings. Porfiriev (1995) of the International Foundation for Science, Culture and Education states that:

> despite many years of intensive research, there still exists a wide gamut of interpretations of the basic question of 'what is a disaster', and the need for clarification of its conceptualization and definition repeatedly emphasized by a few respected scholars, remains an acute problem. (p. 287)

Some researchers choose to define natural disasters according to their characteristics such as the length of forewarning, the magnitude of impact, the geographical scope of impact, the duration of impact, and the speed of onset (Kreps, 1995; Pearce, 2000; Tierney, Lindell, & Perry, 2001). The CRED groups natural disasters into different categories such as geophysical (e.g., earthquakes, tsunamis, volcanic eruptions) and meteorological (e.g., extreme temperatures and typhoons), hydrological (e.g., floods, landslides, avalanches, and sea-level rise) and climatological (e.g., drought, desertification, deforestation, and wildfires), biological (e.g., disease epidemics and insect infestations), and extraterrestrial (e.g., airburst, energetic particles, and geomagnetic storms).

The US Federal Emergency Management Agency (FEMA, 1990) describes natural disasters as "an occurrence that has resulted in property damage, deaths, and/or injuries to a community" (Instruction 5000.2). According to FEMA, the basic requirement for an event to be viewed as a disaster would be: (i) an occurrence (or event) transpires, (ii) damage to property or people takes place, and (iii) a community scale – as opposed to an individual scale – applies. The UN considers natural disasters as "a serious disruption of the functioning of society, causing widespread human, material, or environmental losses which exceed the ability of affected society to cope using only its own resources" (UNDHA, 1992, p. 93/36). This definition adds an additional criteria and an expansion of loss,that is, the event must exceed the ability of a society to respond, and environmental values are explicitly added to human and property values. Pearce (2000) argues that, in general, researchers agree that a disaster affects people and often is cataloged in terms of the number of people dead or injured, indicating that others, however, include losses to population and physical structures that disrupt the social structure and essential functioning of a society (Dynes, 1970; Fritz, 1961; Gilbert, 1995).

Notwithstanding the term "natural," the concept of natural disasters always implies an element of human involvement. A physical event such as a volcanic eruption that does not impact human beings is a natural phenomenon. A natural phenomenon that takes place in a populated area is a hazardous event. A hazardous event that causes an unacceptably large number of fatalities or overwhelming property damage is a natural disaster. Therefore, a disaster can exist only where people and their possessions exist. The concept of risk is sometimes taken as being synonymous with hazard, but it has the additional implication of the statistical chance of a particular hazard actually occurring. Hazard is defined as a naturally occurring event with the potential to create loss. Risk is the actual exposure of something of human value to a hazard and is measured as the product of probability and loss (Smith, 2009). In other words, hazard is the cause, and risk is the likely consequence. Unlike hazard and risk, disaster is an actual happening, rather than a potential threat. Disaster is the realization of hazard (the actual consequence).

1.4. Tragedy or Opportunity

The analysis of the economic impacts of natural disasters is a fairly recent branch of economic research (Okuyama, 2007; Pelling, Ozerdem, & Barakat, 2002). Much research in both the social and technical sciences has been devoted to the possibility to predict disasters and prepare for them. The first systematic disaster research is generally acknowledged to be Prince's (1920) study of the 1917 Halifax explosion (Scanlon, 1988). This study was so influential that it served as the basis of disaster research tradition that evolved following the publication of his pioneering work (Dynes & Quarantelli, 1992). Subsequent studies conducted by Carr (1932) and Sorokin (1942) questioned the influence of catastrophes on social patterns. The publication of *Economics of Natural Disasters: Implications for Federal Policy* by Dacy and Kunreuther (1969) is regarded as the first work of economic research. Following the 1964 Alaska earthquake, Dacy and Kunreuther (1969) claimed "to formulate a clear-cut case for the development of a comprehensive system of disaster insurance as an alternative to the current paternalistic Federal policy" (p. ix). More recent events such as the 1992 hurricane Andrew, the 1994 Northbridge earthquake, the 1995 Kobe earthquake, the 2004 Indian Ocean tsunami, the 2005 hurricane Katrina, the 2011 Tohoku earthquake, and tsunami received worldwide media coverage and increased the general public's awareness about the destructive nature of such disasters. As a result, the literature on the economic impacts of these events has grown substantially over the past two decades (Raschky, 2008).

Most scholars of disasters classify disaster impacts into direct and indirect impacts. Direct impacts have been described as the physical destruction from a catastrophe, and indirect impacts are considered the consequences of that destruction (National Research Council, 1999). In this way, direct damages refer to damage to structures, their contents, and infrastructures that occur as a direct result of a catastrophe. Indirect damages refer to lost economic activity such as business interruption, increased costs of production, loss of expected income,

and other welfare losses. The approach of dividing disaster impacts into direct and indirect damages, and summing them, appears to be a theoretically straightforward accounting method for estimating the total economic impacts of a natural disaster; however, the difficulty of doing this in practice has led much of the literature to focus instead on the impacts of disasters on macroeconomic variables (Kousky, 2012). The assumption is that direct and indirect effects would be reflected in macroeconomic accounts if a catastrophe was significant. Almost all existing researches focus on GDP (Cavallo & Noy, 2010). Other economic indicators such as consumption and fiscal costs have been under-investigated. For instance, the impacts of disasters on tax and other public revenue sources have seldom been evaluated. The focus on macroeconomic variables is due to the fact that good data are easily available, facilitating cross-country comparison and multiple-event analysis.

On the question of the economic repercussions of natural disasters, two contrasting positions prevail in the literature. The first emphasizes the negative effects of natural disasters on economic performance, while the second considers natural disasters as leaving economic perspectives largely unaffected.

The body of literature subscribing to the first position examines short-term and medium-term macroeconomic effects, and considers natural disasters a barrier to longer term development. The main empirical studies are Otero and Marti (1995), Benson (1997a, 1997b, 1997c, 1998), Benson and Clay (1998, 2000, 2004), ECLAC (1985, 1988, 1999, 2003), Murlidharan and Shah (2001), Crowards (2000), Charveriat (2000), Mechler (2004), Rasmussen (2004), Raddatz (2006), Hochrainer (2006, 2009), Stephens (2007), Hallegatte and Dumas (2009), Noy and Nualsri (2007), Noy (2009), and Fomby, Ikeda, and Loayza (2009). ECLAC has been conducting numerous case studies on the impacts of disaster in Latin American countries since 1972. Otero and Marti (1995) summarize the results observed and find significant short-term impacts as national income decreases, an increase in fiscal deficit as tax revenue falls, and an increase in trade deficit as exports fall and imports increase. Benson (1997) and Benson and Clay (1998, 2000, 2004) studied countries such as Fiji, Vietnam, the Philippines, and the Dominican Republic. The timeframe of their research was one year after a particular catastrophe. They detect serious negative economic effects, with agriculture being hit most strongly, an exacerbation of inequalities and the reinforcement of poverty. Crowards (2000) observed the impacts of 22 hurricanes in borrowing member countries of the Caribbean Development Bank and found that GDP growth slowed by 3% on average post-event. Charveriat (2000) for most cases in her disaster sample finds a typical pattern of GDP with a decrease in the year of the event and a recuperation in the following two years due to high investments. She identifies the scale of short-term impacts to depend on the loss-to-GDP ratio and whether the event is localized or countrywide. Murlidharan and Shah (2001), by means of a regression analysis, examined a sample of 52 catastrophes in 32 countries with a short-term focus. They find catastrophes for all country income groups affect short-term growth very significantly. In the medium term, the repercussions on growth are still significant. Another study, by Rasmussen (2004), is in accordance with the above results and, for a cross-country sample, identifies a

median reduction of the growth rate by 2.2% in the year of the event. Raddatz (2006) analyzed the impacts of natural disasters on the output of 40 low-income countries between 1965 and 1997. He used the Emergency Events Database (EM-DAT) maintained by the CRED and a panel vector autoregression model, assuming that disaster occurrence is exogenous. His results indicate that natural disasters generate declines in real per capita GDP of 2% one year after the event. Noy (2009) also used the EM-DAT data for a sample of 109 countries between 1970 and 2003. He finds that in developing countries, the amount of property damage caused by a disaster negatively influences GDP growth. Hochrainer (2009) examined data from both EM-DAT and Munich Re NatCat Service for 225 disasters between 1960 and 2005. He used an autoregressive integrated moving average model to forecast GDP in a hypothetical no-disaster world and finds negative effects on GDP for up to five years.

In contrast to the studies cited, some scholars arrive at different conclusions. Not all studies have discovered adverse effects. When analyzing macroeconomic variables, these scholars find small or no positive impacts of natural disasters. Albala-Bertrand (1993) examined a sample of 28 disasters in 26 countries between 1960 and 1979 with a short-term focus. Based on before/after statistical analysis, he concludes that disasters do not impact GDP and may have a slight positive impact on GDP growth (0.4%). He finds no impact on rates of inflation. Skidmore and Toya (2002) was the first major research to look at the long-term impacts of natural disasters. Using a cross-sectional regression, they discover a robust correlation between the frequency of disasters and longrun economic growth. They explain their findings by suggesting that natural disasters may be speeding up the Schumpeterian "creative destruction" process that is at the heart of the development of market economies. Skidmore and Toya argue that the physical capital destroyed during a catastrophe is generally replaced with more productive capital during the reconstruction.[5] Cunado and Ferreira (2011) analyzed the impact of floods on the growth rate of real per capita GDP for a panel of 118 countries between 1985 and 2008. Using vector autoregressions with country-fixed effects, they find that floods have a positive impact on GDP growth. This positive impact is found not in the year of the event, but in the year after the event, and peaks two years after the event. Caselli and Malhotra (2004) examined the losses in relation to country growth after disaster events using a sample of 172 countries between 1975 and 1996. They find that natural disasters do not reduce GDP, fiscal deficits, or inflation in either the short or medium term. Fatalities and damage appear to depend on the stage of a country's development, not the catastrophes per se.

Research on the impacts of natural disasters has provided contradictory results. There is as yet no agreement in the literature on whether natural disasters are important from a macroeconomic perspective. Most of the studies find no or small negative effects on macroeconomic variables from disaster occurrences,

[5]The Shumpeterian "creative destruction" process was critically examined by Cuaresma, Hlouskova, and Obersteiner (2008) and Hallegatte and Dumas (2009). They establish that natural disasters are never positive economic events and find that large catastrophes that overwhelm reconstruction capacity lead to poverty traps.

although there are mixed results with some finding a small, positive effect on GDP or GDP growth. Research suggests that impacts are worse, the more severe the event. Economic repercussions are more negative when examining smaller geographic areas, whether it is small countries or localities within countries. The studies also show that most communities have a lot of resiliency and rebound quickly, with most studies finding that effects disappear within a few years. That said, repercussions are worse and more persistent in developing countries, while disasters can usually be absorbed by larger developed economies. Countries with more advanced institutions are better prepared to respond to a catastrophe. One possible explanation is that stable and established institutions can invest in pre-disaster planning and preparedness, which results in less damage when disasters occur (Kousky, 2012). Kahn (2005) was the first to consider the role of institutions in mitigating natural disasters. His findings imply that more democratic countries experience better disaster prevention and lower death counts. Other variables such as governance, openness, and education have also been found to influence natural disaster damages.

1.5. About this Book

When it comes to addressing the challenges associated with natural disasters, not all countries are equal. Some invest more resources and find themselves in a better position to deal with the economic impacts of natural disasters. This book offers the unique opportunity to take a deeper look at some of the most exposed countries in the world and compare the strengths and weaknesses of their national disaster management plans. China, Taiwan, Japan, and South Korea have experienced their fair share of disasters, and remain constantly under the threat of future catastrophes. With their increasing economic activity, spatial population distribution, and potential vulnerability to climate change, these countries face enormous financial risks. The concentration of people and economic assets reveals the prospect of considerable economic losses in the event of a catastrophe. That specific danger requires the governments of these countries to adopt a constructive approach that not only focuses on the prevention and mitigation of natural disasters, but also considers appropriate measures to guarantee sufficient funding for relief, recovery, and reconstruction. While this book touches upon these different dimensions, it concentrates on the capacity of governments to mobilize the requisite financing for adaptation. The chapters in this book cover the disaster management practices and financial solutions implemented in China, Taiwan, Japan, and South Korea. They are organized as follows:

Chapter 2 serves as a foundation and theoretical framework, introducing the various components of what constitutes a comprehensive disaster risk management strategy. As one of those components, financial protection ensures that governments, enterprises, and private households will be able to meet their post-disaster funding needs as they arrive. Unfortunately, financial protection is not regarded as a top priority and is often neglected in favor of the other components. This chapter stresses the combination of a broader distribution of risk and the implementation of *ex ante* financing instruments as the most effective way

to achieve coherent financial protection. It insists on the importance of moving away from traditional emergency cash distribution models, and promotes instead the adoption of a more diversified and planned financing mix that would include securing the establishment of reserve funds (calamity funds), budget contingencies and contingent debt facility, as well as the participation of the insurance industry and capital markets.

Chapter 3 evaluates China's catastrophe risks, summarizes the key adjustments of integrated natural disaster risk governance, and examines large-scale response cases. It argues that natural disaster management policies and planning were not considered by the Chinese Communist Party (CCP) as a major concern until the reform era. However, the multiplication of catastrophes and the growing cost associated with these events forced the central government to address the effects of natural disasters on the country's social and economic development. Recognizing the need to reduce the burden on public budgets, Chinese authorities elaborated a series of pilot projects to improve the country's financial protection mechanisms. This chapter discusses the investments made by the municipal government of Shanghai as an example of the new approach developed to enhance disaster preparedness. The last section of this chapter is devoted to the role and functions played by the CCP in the field of disaster risk management. The omnipresent position of the CCP, combined with the restrictions imposed on NGOs and other private initiatives led by Chinese citizens on the Internet, represents an obstacle to any meaningful change in disaster policy.

Chapter 4 focuses on Taiwan and the natural disasters that the island has had to cope with since 1960. Special attention is paid to the 921 earthquake (also known as the Chichi earthquake). Considered the deadliest catastrophe since the disastrous Hsinchu-Taichung earthquake of 1935, the 921 earthquake proved to be a major wake-up call in the management of natural disasters in Taiwan. Prior to the catastrophe, the government and local population underestimated the potential losses that could be caused by such a dramatic event. The 921 earthquake prompted public authorities to improve building standards with seismic design requirements, as well as to set up an earthquake insurance pool system aimed at increasing earthquake insurance coverage. This chapter also investigates the measures and actions embraced by the government to reduce the impact of typhoons. Typhoons hit the island more often than any other type of natural disaster, but unlike residential earthquake insurance, there is very limited financial protection against typhoon-related catastrophes. This lack of private protection forces the government to step in and compensate for underinsured individuals and businesses.

Chapter 5 reviews the evolution of disaster risk management in Japan, with a focus on the implementation of financial protection provided by the Japan Earthquake Reinsurance (JER) and cooperative mutual insurers such JA Kyosai and Zenrosai. It also discusses the devastating repercussions of two of the worst catastrophes in Japan's modern history, namely the 1995 Kobe earthquake and the 2011 Tohoku earthquake and tsunami (also known as the Great East Japan earthquake). The analysis of these two events reveals that, if the preventive measures and actions adopted by the government have helped save tens of thousands

of people, they did not prevent the government from paying *in fine* a hefty price for relief and recovery efforts and rebuilding damaged infrastructures, driving up the already outstanding national public debt.

Chapter 6 examines the modernization strategy undertaken by South Korea to move away from the traditional post-disaster management approach to an approach that anticipates future catastrophes and estimates their potential impacts. It also provides an overview of the financing practices developed by the government to support the establishment of special disaster insurance schemes. Various targeted insurance programs which offer protection to residential properties, agriculture, and the fisheries industry are studied, highlighting the specific roles allotted to the public and private sectors. Since the turn of the century, the government has come to the conclusion that, in terms of the economic impacts of natural disasters, budgeting for disaster risk reduction should not be considered as a simple cost, but as an investment in the public interest. This chapter illustrates the challenges faced by the government to impose new disaster management policies and planning, and the difficulty to promote effective risk awareness within the local population.

Chapter 7 presents a number of innovative initiatives taken both at national and regional levels to increase disaster risk assessment and financial capacity. In view of the high costs incurred by many economies due to natural disasters in the recent past, as well as the growing risk exposures going forward, strengthening financial protection has appeared to many governments across the world as the right thing to do. This chapter identifies the concrete ways in which relevant actions can be taken to secure adequate financial resources and strengthen budgetary discipline. It goes beyond the territorial confines of Northeast Asia to include successful experiences implemented in California, New Zealand, and Turkey. It also discusses the creation of regional initiatives such as the Caribbean Catastrophe Risk Insurance Facility(CCRIF), the Pacific Catastrophe Risk Insurance Company (PCRIC), and the African Risk Capacity (ARC), as examples of advanced mechanisms that allow clients to pool and transfer catastrophe risks.

This book draws attention to the negative effects of natural disasters and how these are handled in Northeast Asia. Comparative in its scope, it examines the national disaster management plans implemented in China, Taiwan, Japan, and South Korea. The originality of this book is that it investigates the efforts deployed by the governments of these countries to reduce catastrophe risks and respond to crisis situations, but also focuses on the need for these governments to reform their financial involvement. Many studies have looked into the economic impacts of natural disasters, but very few have examined the financial repercussions of these tragic events. This deficit of information comes from the general perception that whatever the catastrophe, the government will pay for it. This book intends to raise awareness about the need to change this perception, build substantial financial capabilities, and reconsider traditional post-disaster financing models. Written in an accessible and comprehensible manner, this book targets a large audience, but is of special interest to policymakers, public officials, insurance managers, and students eager to learn more about financing disaster risk management.

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