

ERIA Discussion Paper Series**Disaster Management in ASEAN**

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Abstract: While the Asian countries have been successful in achieving economic growth and poverty reduction, the region cannot avoid exposure to a variety of disasters. Indeed, Asia, particularly the area of the ASEAN Member States (AMSs), is the most prone region to disasters in the world. The paper examines the experience of ASEAN and other countries and regions in the world on disaster management, and looks at the research literature, in order to provide insights, lessons and recommendations for the way forward for strengthened disaster management in AMSs and ASEAN beyond 2015. Particularly, we will summarize different approaches towards effective disaster risk coping strategy and regional cooperation on disaster management. By doing so, we aim at providing a clue to answer the question of how we should protect ourselves and the people of the region and the entire world from catastrophes.

Keywords: Natural disasters; Manmade Disasters; Disaster Management; Insurance; Risk Sharing; ASEAN; East Asia

JEL Classification: F6, H53, G01, H84, Q54

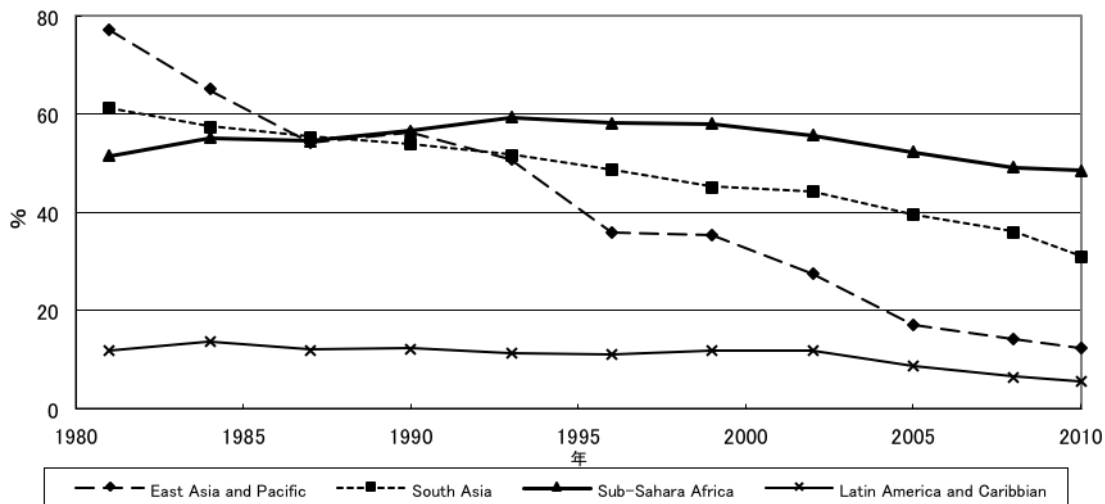
1. Introduction

Natural disasters, whether they occur in advanced or developing nations, can destroy people's livelihoods. Extreme natural and man-made events have recently hit both developed and developing countries. We see vividly the ongoing 2011 devastating earthquake, tsunami, and nuclear radiation crisis in Japan that has killed tens of thousands of people and resulted in damages of around US\$200 to 300 billion (Cabinet Office, 2011). Hundreds of thousands of lives were lost in the Indian Ocean tsunami, Hurricane Katrina, and the earthquakes in central Chile, Haiti, the Sichuan province of China, northern Pakistan, and the Hanshin area of Japan. Disasters are created not only by nature but also by humans. The tsunami disaster in Tohoku was accompanied by a serious technological disaster involving a nuclear power plant's leaking radioactive matter. Global economies are still being impaired by the global financial crisis triggered by the 2008 Lehman Shock. Nations in Africa are still at war and involved in conflicts, and terrorist attacks are having serious impacts even on advanced nations. Natural and man-made disasters show distinct trends across the globe: Natural and technological disasters have been increasing more rapidly in frequency in terms of the average occurrence of disaster per country per year than financial crises and violence-related disasters (Cavallo and Noy, 2009; Kellenberg and Mobarak, 2011; Strömberg, 2007).

While the Asian countries have been successful in achieving economic growth and poverty reduction (Figure 1), the region cannot avoid exposure to a variety of disasters. Indeed, Asia, particularly the area of the ASEAN Member States (AMSs), is the most prone region to disasters in the world (Sawada and Oum, 2012). According to Table 1, during the past decade Asia experienced more than 150 times of natural disasters (40% of world total) annually that affected more than 200 million people annually (about 90%); and caused more than 41.6 billion USD in annual damage (39%). Munich Re's 2010 NatCatSERVICE data reports that only 9% of the total property losses due to natural disasters in Asia was covered by private insurance, compared with about USD 9 billion of the USD 12 billion (75%) in total property losses that was covered by private insurance in the case of recent Christchurch, New

Zealand earthquake.

Figure 1: The Incidence of Poverty in the World (% , poverty line = 1.25 USD per person per day)



Data source: Regional aggregation using 2005 PPP and \$1.25/day poverty line, Data last updated: April 18, 2013, Povcal Net, World Bank.

Table 1: Natural Disaster Occurrence and Impacts: Regional Figures (Average from 2001 until 2010)

	(1) Number of Natural Disasters per Year					
	Africa	Americas	Asia	Europe	Oceania	Global
Climatological	9	12	11	17	1	50
Geophysical	3	7	21	2	2	35
Hydrological	44	39	82	24	6	195
Meteorological	9	34	40	14	7	104
Total	65	92	153	58	16	384

Data: Annual Disaster Statistical Review 2011, CRED, IRSS & UCL, 2012.

	(2) Number of Victims per Year (in millions)					
	Africa	Americas	Asia	Europe	Oceania	Global
Climatological	12.29	1.22	63.45	0.27	0.00	77.23
Geophysical	0.08	1.02	7.77	0.01	0.04	8.92
Hydrological	2.18	3.31	100.82	0.35	0.04	106.70
Meteorological	0.35	2.72	35.88	0.11	0.04	39.10
Total	14.91	8.27	207.92	0.74	0.12	231.95

Data: Annual Disaster Statistical Review 2011, CRED, IRSS & UCL, 2012.

	(3) Damages (in USD Billions)					
	Africa	Americas	Asia	Europe	Oceania	Global
Climatological	0.04	1.90	3.45	3.23	0.48	9.10
Geophysical	0.69	4.75	17.38	0.57	0.69	24.08
Hydrological	0.28	3.15	11.15	5.57	1.24	21.39
Meteorological	0.08	40.47	9.62	4.03	0.56	54.77
Total	1.10	50.27	41.61	13.40	2.97	109.35

Data: Annual Disaster Statistical Review 2011, CRED, IRSS & UCL, 2012.

Obviously, the costs of disasters would pose threats to both short and longer term development in the region, by disrupting production and flows of goods and services, worsening the balance of payments and government budgets, derailing economic growth, income distribution, and poverty reduction. Disasters also pose negative effects on social structures and the environment. Having said this, disaster risks are beyond human controls by nature. There is no preventing the occurrence of natural disasters, whether earthquakes, tsunamis, or typhoons. However, it is possible to prevent or at least mitigate damage arising from disasters, both in terms of the number of human casualties and economic impacts, and preparedness is what makes a key difference. As we continue our ceaseless efforts to recover from different disasters in the Asian region and the world, we are rediscovering the importance of advance preparations, such as drawing up emergency plans, disseminating and teaching emergency knowledge, conducting evacuation drills, constructing early warning systems, and investing in infrastructure.

Indeed, at the recent high-level forums in East Asia such as 4th East Asia Summit (EAS) in Cha-am Hua Hin, Thailand, held on 25 October 2009, the Fifth EAS on 30 October 2010 in Hanoi, Viet Nam, the Sixth EAS in Bali, Indonesia, on November, 2011, and the Seventh EAS in Phnom Penh, Cambodia, on November 2012, the leaders noted and reiterated the need to enhance disaster management

cooperation for the region. The Special ASEAN-Japan Ministerial Meeting in April 2011 also emphasize the need to strengthen such cooperation through sharing of exercises and lessons-learned as well as conducting training and capacity building programs for disaster preparedness, emergency response, relief, and reconstruction efforts. The Chair's statement at the 18th ASEAN Summit held in Jakarta, Indonesia 7 - 8 May 2011, noted the potential trans-boundary impact of accidents at nuclear plants in the aftermath of the Fukushima incident. They agreed that ASEAN should engage as appropriate in information-sharing and promote transparency on relevant nuclear related issues in the region and to achieve goal of building disaster-resilient societies and towards a safer community by the year 2015. The 4th ERIA Governing Board Statement on June 3, 2011 also recognized that knowledge sharing and exchange of technologies on disaster risk management on a regional basis is essential.

The paper examines the experience of ASEAN and other countries and regions in the world on disaster management, and looks at the research literature, in order to provide insights, lessons and recommendations for the way forward for strengthened disaster management in AMSs and ASEAN beyond 2015. Particularly, we will summarize different approaches towards effective disaster risk coping strategy and regional cooperation on disaster management. By doing so, we aim at providing a clue to answer the question of how we should protect ourselves and the people of the region and the entire world from catastrophes.

This Chapter is organized as follows. In Section 1, we provide a brief background of the paper, then in Section 2 we set conceptual framework of disaster risk management and coping mechanisms/strategies. Section 3 presents analytical review on current efforts including regional cooperation. The paper will be closed

by policy recommendation in Section 4.

2. Conceptual Framework and Literature Review

2.1. A Taxonomy of Disasters

In general, disasters can be classified into four major groups (Sawada, 2007). The first type is natural disasters which consist of hydrological disasters (floods), meteorological disasters (storms or typhoons), climatological disasters (droughts), geophysical disasters (earthquakes, tsunamis and volcanic eruptions), and biological disasters (epidemics and insect infestations). The second type of disasters is technological disasters, i.e., industrial accidents (chemical spills, collapses of industrial infrastructures) and transport accidents (by air, rail, road or water means of transport). The final two disasters are manmade which include economic crises (hyperinflation, banking crisis, and currency crisis) and violence (terrorism, civil strife, riots, and war).

The Center for Research on the Epidemiology of Disasters (CRED) in Belgium organizes detailed, long-term time series data on natural disasters per country. The Center also disseminates data on technological disasters. As for economic crises disasters resulting from the violence of war, Professors C. Reinhart of the University of Maryland and K. Rogoff of Harvard University (both in the U.S.) produce cross-country panel data.

According to the average occurrence of each of the four types of disaster per country per year shown by Sawada and Oum (2012), while natural and technological disasters are increasing rapidly, financial crises and war are maintaining stable

patterns. Even so, they are not showing any trends toward reducing in frequency. These disaster trends indicate the importance of careful preparations in reducing damage arising from disasters.

2.2. Household-Level Risk Management and Coping Strategies

In response to the wide variety of shocks caused by natural and manmade disasters, households have developed and employ formal and informal mechanisms. We classify such uses of insurance mechanisms into ex ante risk management and ex post risk-coping behaviors. First, household risk management strategies are defined as activities for mitigating risk and reducing income instability before the resolution of uncertainties. These strategies include investments in earthquake-proof house, insurance contract subscription, and access to the early-warning system. It has been known that these ex ante management strategies are cost effective instruments to mitigate losses due to disasters (UN, and World Bank, 2010). This is driven mainly by the significance of welfare costs of disaster risks. Using the framework of the Arrow-Pratt risk premium, we can capture the negative welfare costs of risks by calculating how much money households would be willing to pay to completely eliminate income variability. This framework indicates that approximately, the fraction of average income that a household would be willing to give up can be calculated as half of the coefficient of relative risk aversion multiplied by the square of the coefficient of variation of income. Sawada (2007) shows the estimated welfare costs of risks in India and Pakistan. These results indicate that the welfare cost of risks is at least 10% and can be 30-50% of household income. Since natural and manmade disasters generate larger income volatilities than these income fluctuations, the welfare costs estimated here may be regarded as lower-bound

estimates of the negative welfare impacts of natural or manmade disasters.

These figures indicate the importance of ex ante risk management mechanisms and strategies to reduce welfare costs of disasters. However, it is often difficult by nature to elaborate such mechanisms and strategies because they are typically rare events, and sometimes even worse, they are unforeseen. Also, these disaster risks are correlated in nature which could not be diversified away within a region or country. Thus, the aggregated macro welfare cost can be non-negligible. Indeed, Barro (2009) found that macro welfare loss due to disasters can be as large as 20% of welfare. The significance of potential risk management implies two important issues. First, it will be indispensable for government to strengthen national and regional level market and non-market insurance mechanisms against natural disasters. Second, risk coping strategies will become important because even if households, communities, and governments adopted a variety of risk management strategies, a disaster can happen unexpectedly, causing serious negative impacts on household welfare.

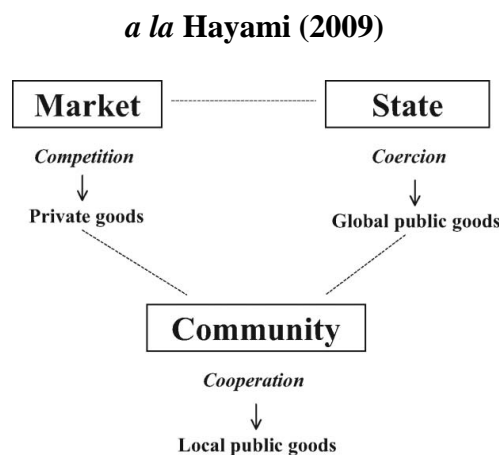
Accordingly, against these unexpected natural disasters, it is indispensable for people to adopt ex post risk-coping strategies which are defined as ex post strategies to reduce consumption fluctuations and to maintain desirable level of livelihood. In general, the existing literature identified the following different ways of risk-coping mechanisms. First, households can employ different market mechanisms such as credit markets to reallocate future resources to today's consumption, insurance market transactions to eliminate losses from disasters, and ex post labor market participation to utilize market returns to human capital. Second, people can adopt self-insurance mechanisms such as consumption reallocation by cutting back luxury expenses while maintaining total calorie intakes and dissaving of financial and

physical assets, i.e., utilization of precautionary saving. Finally, households can adopt non-market insurance mechanisms such as public transfers from the government and informal private aids from networks based on extended family, relatives, and communities. Against unexpected natural disasters, ex post risk-coping will be indispensable

2.3. “The Market, State, and Community Trinity” in Disaster Management and Coping

General risk management and coping strategies mentioned above imply divided roles of market, state, and community as elaborated by Hayami (2009). As is shown in Figure 2, the economy system is composed of three domains, i.e., market, state, and community, interacting each other.

Figure 2: The Community, the Market, and the State in the Economic System



Source: Hayami (2009).

According to Hayami (2009), the market is the mechanism that coordinates profit-seeking individuals and firms through competition under the price signals. Naturally, the market has an advantage in matching demand and supply of private tradable goods. The state is the mechanism that forces people to adjust their

resource allocations by the command or legal enforcement of the government. Typically, the state plays an important role in supplying global or pure public goods. In contrast, the community is the mechanism that guides community members to voluntary cooperation based on intensive social interactions, facilitating supply of the local public goods such as the provision of reciprocal social safety nets, the conservation of commons, and the enforcement of informal transactions.

To address the roles of the market, the state, and the community in facilitating disaster management and coping, it will be useful to classify two different types of risks by the level at which they occur, i.e., idiosyncratic and aggregate risks. Idiosyncratic risks affect specific individuals and/or firms while aggregate shocks affect groups of households, an entire community and region, or a country as a whole. This distinction is important because the geographic level at which risks arise determines the effectiveness of market and non-market institutions against risk.

On one hand, a risk that affects a specific individual can be traded with other people in the same insurance network through informal mutual insurance as well as a well-functioning formal insurance or credit market. In the last two decades, micro-development economists have shown that households have developed formal and informal risk coping mechanisms against a wide variety of idiosyncratic risks to some extent (Townsend, 1994). The community-based mutual insurance mechanism, one of the important components of “social capital,” can be effective, provided that all the members contribute due informal insurance premiums according to the principle of reciprocity dictated by customs and norms (Hayami, 2009). The community can enforce the collection of due contributions from community members by means of the reputation/opprobrium/ostracism mechanism. In short, community can play an important role in weathering losses caused by natural disasters if such losses are largely idiosyncratic.

The role of social capital is not necessarily confined to the community-based mutual insurance mechanism. Aldrich (2012) investigates the mechanisms through which social capital and networks assist with disaster management, including modifying the responses of exit and voice, overcoming barriers to collective action, and providing informal insurance and mutual aid. Through examples such as the

1923 Tokyo earthquake, the 1995 Kobe earthquake, the 2004 Indian Ocean tsunami, and the 2011 compounded disaster in Tohoku, Japan, this piece seeks to underscore a potentially efficient and cost effective response to crises. Aldrich (2012) has suggested a new paradigm for thinking about disaster recovery and for designing emergency management responses. Moving beyond “brick and mortar” approaches to recovery, it has stressed that the ties between residents may serve as a critical engine during what may be a long and difficult recovery process. Rather than merely responding to disasters as they occur in the future, visionary decision makers in these and other countries should move to embrace a social-capital based approach to policy making. Bringing residents to the forefront and increasing community based planning will ensure a strong future for these important countries.

While community can play an important role beyond the informal mutual insurance mechanism, according to the NatCatService data of Munich Re, the proportion of market-insured losses out of overall losses caused by disasters in the world is quite limited, around 20% on average.¹ Currently, formal insurance mechanisms against natural disasters are quite limited. Indeed, studies based on micro-data show the overall ineffectiveness of formal and informal insurance mechanisms against natural disasters (Kohara, *et al.*, 2006, Sawada and Shimizutani, 2007, 2008).

On the other hand, a risk that affects an entire region cannot be insured within the region and thus community mechanisms can function imperfectly. Natural, technological and manmade disasters are likely to fall into this category of aggregate or covariate risks. As we have seen, efficient risk sharing are likely to be absent

¹ In the formal insurance market, the insurers need international reinsurance markets to pool disaster risks. Yet, it is known that reinsurance markets and trades of catastrophe (CAT) bonds are still thin.

especially for natural disasters as a rare, covariate event. In fact, the extent to which a risk is idiosyncratic or correlated depends considerably on the underlying causes. These risks should be covered by well-designed formal market or similar arrangements backed by the public enforcement mechanisms in which region-specific risks are diversified away across regions. If these mechanisms cannot work properly or are difficult to be set, households are forced to insure themselves against shocks by using self-insurance measures. For example, by analyzing a 1998 survey of areas affected by Hurricane Mitch, Morduch (2004) found that for 21% of households, the main response to the hurricane was not to use savings, nor to borrow money; the main response was a drastic reduction in consumption. This suggests that these households are constrained from borrowing against the shocks. By investigating how victims of the Great Hanshin-Awaji (Kobe) earthquake in 1995 coped with their unexpected losses, Sawada and Shimizutani (2005) found that households without borrowing constraints can borrow and/or dissave to respond to damages caused by the earthquake, while those under a constraint are unable to cope with housing losses effectively.

2.4. The Effectiveness of Overall Insurance Mechanisms against Disasters in East and Southeast Asia

In the last fifteen years, there has been remarkable progress in formulating and testing full consumption risk sharing (Mace, 1991; Cochrane, 1991; Townsend, 1994; Hayashi, *et al.* 1996; Ligon, 1998; Ogaki and Zhang, 2001; Dubois, *et al.* 2008; Kinnan, 2010). The canonical model of consumption risk sharing shows that under complete markets, idiosyncratic income changes should be absorbed by all other members in the same insurance network. As a result, after controlling for aggregate

shocks, idiosyncratic income shocks should not affect consumption when risk sharing is efficient. Sawada (2011) employs this testable implication to evaluate the overall effectiveness of the insurance network in East and Southeast Asian countries. More concretely, we will regress per capita consumption growth rates (or changes) in per capita growth rates (or changes) in gross domestic product (GDP) as their idiosyncratic shock variables to test the full consumption risk-sharing hypothesis.

The test of full consumption risk sharing can be interpreted as a test of overall insurance mechanisms, which consist of formal market mechanisms, informal or nonmarket mechanisms, and self-insurance mechanisms. The first market mechanism includes credit markets to reallocate future resources to today's consumption, formal insurance market transactions involving *ex ante* insurance contracts, and *ex post* labor market participation to use returns to human capital. The second mechanism (i.e., informal or nonmarket mechanisms) includes public and private transfers. The third and final mechanism (i.e., self-insurance mechanisms) is meant to reduce consumption expenditure by maintaining total calorie intakes or to use accumulated financial and physical assets (i.e., precautionary saving).

To investigate the implications of complete consumption risk sharing (or insurance), Sawada (2011) solves a benevolent social planner's problem by maximizing the weighted sum of people's lifetime utilities given social resource constraints (Mace, 1991; Cochrane, 1991; Townsend, 2004) and, in addition follows, the approach of Lewis (1996) who incorporated consumption of nontradables to test the international consumption risk-sharing hypothesis.

Sawada (2011) used the dataset covering the period 1980 to 2007. Twelve countries were used for natural disasters (Cambodia, China, Indonesia, Japan, Korea,

Laos, Malaysia, Mongolia, the Philippines, Taiwan, Thailand, and Viet Nam) and eight for economic disasters (China, Indonesia, Japan, Korea, Malaysia, the Philippines, Taiwan, and Thailand). Table 2 shows the time series data of incidence of disasters. While we can verify that after there have been only a few occurrences of economic disasters after the Asian financial crises, natural disasters have occurred continuously in the region.

Table 2: Incidence of Disasters in East and Southeast Asia

	Currency	Inflation	banking	Geophysical	Meteorological	hydrological	climatological	biological
# of countries	8	8	8	12	12	12	12	12
Year								
1980	1	1	1	7	0	0	6	4
1981	0	1	2	6	8	7	4	3
1982	0	0	2	8	9	9	6	5
1983	2	0	4	8	9	0	6	5
1984	3	1	3	6	6	9	3	3
1985	0	1	4	8	0	9	5	5
1986	1	0	4	5	8	9	5	3
1987	0	0	4	4	7	6	7	3
1988	0	0	2	8	6	8	5	4
1989	1	0	0	7	0	7	3	3
1990	1	0	0	6	1	9	6	6
1991	0	0	0	4	9	8	5	3
1992	0	0	3	6	0	8	5	5
1993	0	0	2	6	9	9	4	1
1994	1	1	3	4	7	8	3	1
1995	0	0	3	6	6	7	3	2
1996	0	0	3	6	7	0	2	5
1997	5	0	8	5	7	6	5	5
1998	2	1	7	3	6	6	4	7
1999	0	1	7	5	6	0	6	5
2000	3	0	6	5	9	0	2	6
2001	0	0	6	4	8	1	0	2
2002	0	0	2	6	9	8	4	9
2003	0	0	0	6	0	0	3	1
2004	0	0	0	8	1	1	5	8
2005	0	0	0	5	9	2	7	8
2006	0	0	0	6	7	2	4	6
2007	0	0	0	8	7	0	5	6

Note: Twelve countries were covered for natural disasters (Cambodia, China, Indonesia, Japan, Korea, Laos, Malaysia, Mongolia, the Philippines, Taiwan, Thailand, and Viet Nam) and

eight for economic disasters (China, Indonesia, Japan, Korea, Malaysia, the Philippines, Taiwan, and Thailand).

Sawada (2011) found that per capita consumption growth rates of East and Southeast Asian countries are affected positively by country-specific idiosyncratic changes of per capita GDP and that the full consumption risk-sharing model is strongly rejected. These results suggest that overall insurance mechanisms within East and Southeast Asian countries are imperfect. Table 3 shows the estimated degree of imperfection of overall insurance mechanisms based on the test of full consumption risk-sharing hypothesis. The specification (A) and (B) indicate that the degree of insurance imperfections are 0.426 and 0.897, respectively. Hence, in specification (A), 57 percent of country-specific income shocks caused by natural and economic disasters are diversified among eight middle- or high-income countries in the region. On the other hand, only 10 percent of country-specific income shocks from natural disasters are shared in the wider set of countries within the region. Sawada (2011) also found that inflation and climatological disasters cause serious income shocks. These results indicate that market and nonmarket insurance mechanisms within the region are far from complete, especially against extreme shocks caused by changes in commodity prices and climate. Additional econometric analyses of Sawada (2011) reveal that a currency crisis may generate serious, adverse impacts on consumption change in addition to inflation and climatological disasters.

In addition to the estimation results reported in Sawada (2011), estimated coefficients on time dummies show that there was a dip in per capita consumption growth rates in 1997 or 1998. This means that the average consumption level within the region declined temporarily in either of these two years. This decrease may have been caused either by the financial crisis or the El Niño phenomenon. Indeed, according to the Food and Agriculture Organization's (FAO) World Food Prices Index presented in figure 2, there was a sharp worldwide increase in food prices in 1997 and 1998 due to El Niño-caused droughts. This price increase might have led to the dip in per capita consumption. Using household survey data for 1998, Datt and Hoogeveen (2003) found that in terms of its impact on poverty, the 1998 economic crisis in the Philippines was more of an El Niño phenomenon than a financial crisis. While our data did not cover the year 2008 when the global food crisis occurred, a future study with updated data may uncover the reasons behind the lack of insurance

mechanisms against inflation and climatological disasters. In sum, these results clearly show the incomplete consumption risk sharing within East and Southeast Asian countries.

Table 3: Degree of Imperfection of Overall Insurance Mechanisms Based on the Test of Full Consumption Risk-Sharing Hypothesis Dependent Variable: Per capita consumption growth rate

	(A)	(B)
Per capita GDP growth rate	0.426*** (0.093)	0.897*** (0.090)
Disasters considered	Currency crises; Inflation crises; Banking crises; Geophysical disasters; Meteorological disasters; Hydrological disasters; Climatological disasters; and Biological disasters	Geophysical disasters; Meteorological disasters; Hydrological disasters; Climatological disasters; and Biological disasters
Countries covered for the analysis	China, Indonesia, Japan, Korea, Malaysia, the Philippines, Taiwan, and Thailand	Cambodia, China, Indonesia, Japan, Korea, Laos, Malaysia, Mongolia, the Philippines, Taiwan, Thailand, and Viet Nam

Source: Sawada (2011).

3. Towards Effective Disaster Risk Coping and Regional Cooperation on Disaster Management

To facilitate more effective disaster management by strengthening complementarities among the market functioning under the price signals, the state enforcement mechanisms, and the community informal insurance mechanisms, we can learn insights from previous empirical studies. According to Kahn (2005), natural disasters occur in advanced and developing nations alike, but when a nation

is democratized and has better governance, the number of casualties is drastically reduced owing to disaster risk information that is communicated and shared, early warning systems that are developed, and infrastructure and other risk management mechanisms that are well developed to prevent or mitigate the impact of disasters. Since insurance market for natural disasters is far from complete, the government plays an important role in disaster management and rehabilitation. For example, a report by World Bank and United Nations (2010) describes Bangladesh, where frequent cyclones have affected several hundred thousand people, has significantly reduced the number of casualties by investing in emergency infrastructure such as improving its early warning system, which operates via radio, and building numerous cyclone shelters. Having noticed this, Yang (2008) used data on the world's storms of the past 30-plus years to show that the economic damage has been enormous. That tells us that we should balance emergency information systems and infrastructure that prevent damage to people with market-based insurance systems that prevent economic damage to prepare ourselves for natural disasters. In a study on the Chuetsu Earthquake, Ichimura, *et al.*, (2006) found that earthquake insurance and public transfers had functioned quite well.

3.1. Current Regional Effort in Disaster Management

Given disaster-prone condition of majority ASEAN member states, ASEAN has been raising its collective efforts to cope with the challenges. Since its inception back in 1976, ASEAN has been recognising and adopting disaster management as one of its eight principles and objectives. The declaration stated that *“natural disasters and other major calamities can retard the pace of development of member states, therefore they shall extend, within their capabilities, assistance for relief of member*

states in distress.”

One of early cooperation is done through ASEAN Expert (AEGDM). The 11th AEGDM Meeting in Chiang Rai in August 2000 considered the elevation of AEGDM to an ASEAN Committee or a Senior Officials Meeting on Disaster Management that would report to the ASEAN Standing Committee or to the ASEAN Ministerial Meeting on Disaster Management. Within this form, ASEAN Member Countries could regularly meet to monitor the programs and projects they adopt. The idea then was put as recommendation in the 12th AEGDM Meeting to establish the ASEAN Committee on Disaster Management (ACDM). The ACDM was established in 2003 reporting to ASEAN Standing Committee (ASC). It consists of heads of national agencies responsible for disaster management of ASEAN Member Countries. The ACDM assumes overall responsibility for coordinating and implementing the regional activities.

ACDM has vision of a region of disaster-resilient nations, mutually assisting and complementing one another, sharing a common bond in minimizing adverse effects of disasters in pursuit of safer communities and sustainable development. And, its mission is to enhance cooperation in all aspects of disaster management, including prevention, mitigation, preparedness, response, and recovery through mutual collaborative activities (ASEAN DRR Portal, 2013).

In 2004, ASEAN Ministerial Meeting on Disaster Management (AMMDC) was set up aimed at reviewing and enhancing regional cooperation on disaster management. At the same year, the ASEAN Regional Program on Disaster Management (ARPDMD) was also established. It aims to create cooperation among member countries, capacity building, sharing of information and resources. It also creates engagement external partnerships and public education, awareness and

advocacy.

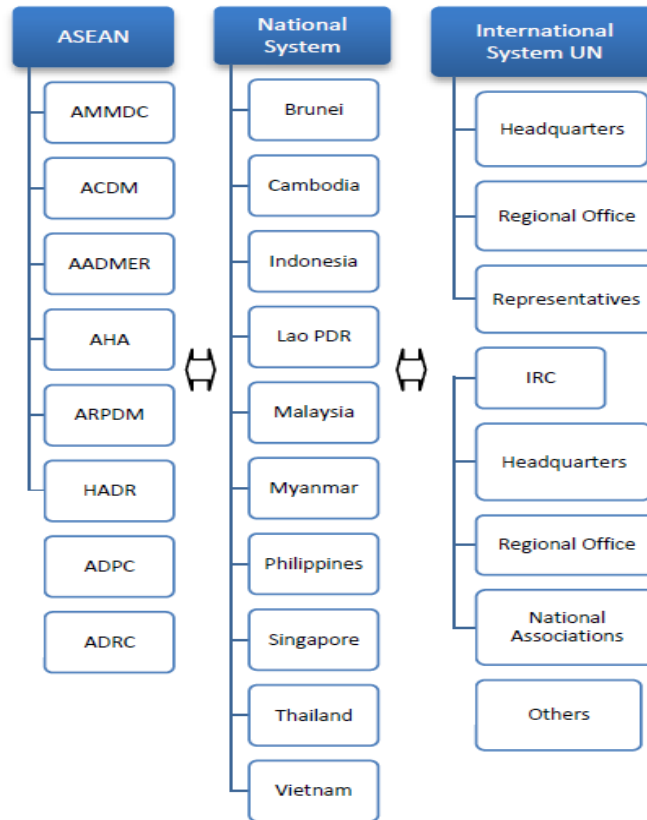
The coordinating unit responsible for the tasks is ASEAN Agreement on Disaster Management and Emergency Response (AADMER) established in 2005 and put on effect since 2009. It is the first Hyogo Framework for Action (HFA)-related binding instrument in the world. Operational Coordination Body and Engine of AADMER is ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management (AHA Centre) headquartered in Jakarta.

Given its young age, AHA Centre currently is still developing its programs, thus the scope is limited to logistics and rapid assessment in preparedness and response, technical support for early warning, risk assessment and monitoring, and capacity building. The AHA Centre shall work on the basis that the Party will act first to manage and respond to disasters. In the event that the Party requires assistance to cope with such situation, in addition to direct request to any Assisting Entity, it may seek assistance from the AHA centre to facilitate such request (AADMER article 20.2).

Apart from ASEAN context, cooperation in Disaster Risk Reduction (DRR) is also performed by other international entities, including UN, International Red Cross, and APEC. Asian Disaster Preparedness Center (ADPC) was setup in Bangkok in 1986 as follow up of a feasibility study conducted jointly by two agencies of the United Nations, the Office of the United Nations Disaster Relief Coordinator (current the UN Office for the Coordination of Humanitarian Affairs) and the World Meteorological Organization. Now, ADPC is one of significant entities working on DRR in Asia (not only ASEAN region). In 2005, APEC established the APEC Task Force of Emergency Preparedness (TFEP) to coordinate and promote responses to emergencies and disasters, which in 2010, it became the Emergency Preparedness

Working Group (EPWG).

Figure 4: Interplay between Different Actors at Different Tiers

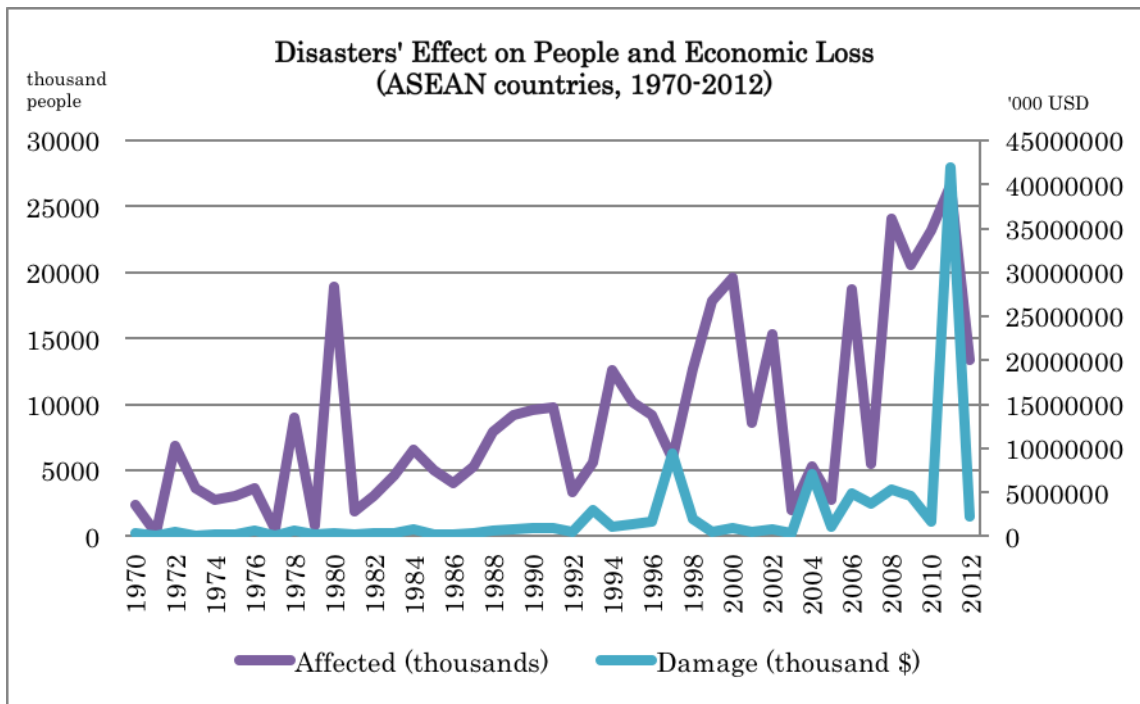


Source: Lai, et al., 2009.

At the national level, each country has a national body responsible for managing disaster risk reduction that also acts as national focal point for regional cooperation. Most works are devoted on technical and logistics aspects, from the stage of preparedness, response, to reconstruction. The financing aspect is a bit lagged behind; it is focused on financing the logistics to respond the emergency situation, and to some extent on reconstruction.

Various efforts have been made to manage the natural disasters in South East Asia region as discussed earlier. Yet, the amount of damages and the number of affected people remain high, some caused by exogenous variables such as scale of disaster.

Figure 5: Effect of Natural Disasters on People and Total Economic Loss in ASEAN Countries, 1970-2012



Note: Disasters data cover drought, seismic earthquake, flood, mass movement, storm, volcano, and wildfire.

Source: Emergency Events Database, CRED.

3.2. Challenges

As in many other emerging economies, insurance for natural disasters is not common in ASEAN countries. Estimated annual loss is higher in low income countries such as Cambodia, Lao PDR, Vietnam, and Myanmar which made up to 0.7% of GDP (GFDRR, 2012). Large portion of disaster risk financing is shouldered by government, following the perception that disaster risk management is public good. Even though market mechanism will fail to address the whole system, parts of the disaster management can be undertaken by private sector.

The insurance system works on the basis of law of large numbers, therefore it requires sufficient numbers of subscribers to function the insurance. Yet, for natural disasters, characterized by rare events, the law of large numbers is unlikely to work especially at individual household level. Indeed, some of problems causing underdeveloped markets for disaster insurance in the region are low participation –because of poor households–, lacking reliable and sufficiently data series to estimate

the risks –especially damage-, and for some regions the frequency of occurrence is high thus unattractive for insurance scheme.

Impact estimation is complex and costly, hence not sufficiently touched. It is central for government, people and insurance companies to carefully assess the potential impact in order to determine appropriate efforts. The vulnerable countries in ASEAN, unfortunately are the least developed ones such as CLMV plus some middle income economies including Indonesia, Philippines, and Thailand. This will affect the governments' ability and interest to join the insurance for natural disasters in their countries.

Distribution of impact is uneven, the poor most likely suffer in the longer time compared to the rich. Infrastructures belong to both private and public, hence imposing insurance should address different issues: fiscal burden vs regulatory burden.

There is also trade off between efficiency and equity: between reducing aggregate loss and helping small loss on larger population. Natural disaster typically affects the rich at larger monetized loss but the impact is more severe on the poor. Fortunately, the rich have larger options to protect themselves; calling more government's role on addressing the problems for the poor. However, heavy government intervention in developing disaster-linked market (insurance, credits, etc.) can have opposite effect, such as crowding out private sector participation and less transparent system.

3.3. New Innovative Ideas

There are a few emerging innovative ideas to strengthen the complementarities among the market, the state, and the community in the context of disaster management and coping. Here, we discuss microcredit and micro-insurance.

3.3.1. Microcredit

While it has been rather long known that the remarkable performance of microcredit programs is based on community enforcement mechanisms, multiple roles of microcredit have been identified in the recent literature. Poor households are not just struggling entrepreneurs using microcredit programs for business facilitation. They are complicated households seeking to manage expenses

(consumption credit), cope with emergencies (disaster protection), and seize opportunities. Potentially, microcredit programs can play a role of disaster insurance: For example, most micro-finance institutions in Bangladesh introduced a flexible repayment system in 2002, which permits members to reschedule instalment payments during disasters.

3.3.2. Microinsurance

Another innovative idea is to use a new micro-insurance program called “index insurance or parametric insurance contracts” which are written against specific aggregate events such as drought or flood defined and recorded at a regional level (Hazell, 2003; Morduch, 2004; Lilleor, Gine, Townsend, Vickery, 2008; Skees, Varangis, Larson and Siegel, 2006). This type of insurance pays out on storms that exceed a pre-designated speed, rainfall that falls short of a threshold level, and earthquakes that exceed a certain seismic intensity. It is an excellent system that alleviates the time and costs required by conventional indemnity-based insurance systems to assess damage.

As such, index insurance involves a number of positive aspects; they can cover the aggregate correlated events; they are affordable and accessible even to the poor; they are easy to implement and privately managed; and they are free from moral hazard, adverse selection, and high transaction costs that have plagued traditional agricultural insurance contracts such as crop insurance schemes. The World Bank and other institutions have been piloting weather-based index insurance contracts in Morocco, Mongolia, Peru, Vietnam, Ethiopia, Guatemala, India, Mexico, Nicaragua, Romania, and Tunisia. However, the market for microinsurance is still underdeveloped in South East Asia region. For disaster linked micro-insurance, only Indonesia, Philippines, Thailand, and Vietnam, that have developed small-scale or pilot projects, hence the coverage areas are still limited and the programs are at early stage of development.

Since natural disasters are typically an aggregate event, index insurance is thought to be an appropriate instrument to combat them. Yet, there are three major constraints to design index type insurance against natural disasters. First, natural disasters are often characterized by a rare event which makes it difficult to design actuarially fair insurance. Since obtaining historical data on natural disasters

pattern is hard, it is almost impossible to set appropriate premiums for insurance.

Secondly, related to the first issue, even if appropriate premiums are set, the poor who potentially should demand insurance against natural disasters may find it difficult to recognize the value of index type insurance against natural disasters. This may be an inevitable consequence because natural disasters are often characterized by unforeseen contingencies by nature and because the poor often are often myopic with high time discount rates. Indeed, human beings tend to ignore rare bad events (Camerer and Kunreuther, 1989). Moreover, the existence of the “basis risk” with which an individual could incur damage but cannot be compensated enough, will also deter demand for index insurance. This problem has been identified as an inevitable drawback of index insurance because index contracts essentially trade off basis risk for transaction costs (Morduch, 2004; Hazell, 2003).

In these lines, Nakata (2012) identifies the issues that would be central in designing a possible regional insurance scheme or mechanism for East Asia. The main focus is on the risk sharing mechanism for catastrophe risks households in the region and to provide a consistent explanation for the apparent anomalies concerning the demand for catastrophe insurance within the subjective expected utility framework. The key finding is that the number of observations would be inevitably insufficient to warrant a robust probability estimate for a rare event. The inherent lack of a robust probability estimate leads to diverse probability beliefs. Nakata (2012) concludes that a desirable index insurance scheme is the one that eliminates any personal catastrophe state, given the possible moral hazard issues inherent to indemnity insurance. Moreover, since voluntary subscriptions likely lead to insufficient level of insurance, an insurance scheme with subscriptions by local governments in conjunction with *ex post* payments/compensations to the affected households would be more desirable. However, the underwriting costs for index insurance may well not be low, whether the index insurance will be supplied and priced by insurance suppliers or traded on the capital market.

3.3.3. Feasibility of Micro Insurance in Asia

How can we evaluate feasibility of index type micro insurance products in the AMSs? There are two important studies in this aspect. First, focusing on Thailand, Chantararat, *et al.* (2012) explores innovations in index-based insurance products or

index-based risk transfer products (IBRTPs) as a means to address important insurance market imperfections that have precluded the emergence and sustainability of formal insurance markets in developing countries, where uninsured natural disaster risk remains a leading impediment of economic development. Chantarat, *et al.* (2012) provides analytical framework and empirical illustrations how to design nationwide and scalable IBRTP contracts, to analyse hedging effectiveness and welfare impacts at the micro level and to explore cost effective risk-financing options. Thai rice production is used in the analysis with the goal to extend the methodology and implications to enhance development of national and regional disaster risk management in Asia. Using household level data in estimating basis risk and so in simulating contracts' hedging effectiveness, Chantarat, *et al.* (2012) found that the optimal provincial contract based on basis risk minimising combination of moving dry spell and moving excessive rain spell indices could result in up to 25% reduction in the variations of household's income available for consumption. The return to scale in term of cost effective portfolio pricing can be achieved as part of nationwide, multi-seasonal coverage insurance program. The transparency of these weather indices and control measures in fact could further promote the possibility of cost effective risk transfers in the international market. The potential impacts on household welfare, agricultural loan portfolio and government of this nationwide program under various market arrangements. The purely market driven program was found to result in more than 50% reductions in probabilities that household consumption collapsing to zero, in means and variations of five-year accumulated debt and annual loan default rates. Properly layering insurable nationwide risk, they further found public financing of tailed risk beyond the 20-30% capped to insurer's payout rates to result in substantial reduction in market premium rates. These in turn resulted in up to twice the impacts of the purely market-driven program, though with substantial smaller budget exposures to the government relative to the current government program. There could thus be a strong case for public financing of tailed risk in enhancing development values and market viability of Thailand's nationwide index insurance program.

Secondly, on Vietnam, Nakata, *et al.* (2009) utilize a unique survey data collected jointly by the Research Institute of Economy, Trade and Industry (RIETI)

of Japan and the Center for Agricultural Policy in Vietnam (CAP), which they call the RIETI-CAP survey. The data set is a resurvey of subsamples of the Vietnam Household Living Standards Survey (VHLSS) 2006 households. They employ hypothetical questions on AI, flood (FL), and drought index insurance in Vietnam. According to their analysis of this unique data set, a past experience dramatically increases probability assessment of the event (10 and 100 times for AI and FL) and WTP for the insurance (30% and 50% for AI and FL). A first loss experience tends to have a large impact on the subjective loss probability, and consequently on the willingness-to-pay for insurance, especially for flooding insurance (both index and indemnity-based insurance). This indicates that it would be less likely for a household with no past loss experience to purchase flooding insurance even if the insurance premium is actuarially fair in accord with the loss probability model of the insurance supplier. Meanwhile, they have found that agents may not behave in accord with the subjective expected utility framework as far as AI insurance is concerned. In other words, it is less clear if it is the subjective loss probability that drives the behavior of the agents concerning AI insurance. This is not very surprising, since AI involves mutations of viruses, and so, there are possible unforeseen contingencies. This makes it harder to have some agreement on the terms and conditions of insurance.

3.3.4. Index Insurance as a Mitigation Device of Human-Made Disasters

Miguel, *et al.*, (2004) use data from 41 countries in Africa in 1981–99 to find a robust causality from drought, i.e., a type of natural disasters to income decline and conflicts, i.e., a type of human made disasters. This signifies that preventative action taken against natural disasters could also prevent conflicts and wars. Today, we are capable of issuing early warnings of drought risks based on rainfall

measurements and vegetation indices obtained from satellite images. Accordingly, Miguel (2009) proposes a new type of foreign aid—Rapid Conflict Prevention Support (RCPS), which would reduce the risk of conflicts by using this information to estimate droughts and natural disasters, and by transferring aid immediately. Foreign aid provisions will be targeted to drought or other disaster vulnerable countries beforehand. Indeed, Botswana, Africa’s economic superstar for the past 40 years, has been implementing Drought Relief Program (DRP). It would be safely said that the drought insurance played an important role in its success (Miguel, 2009).

3.3.5. Regional Insurance Mechanisms

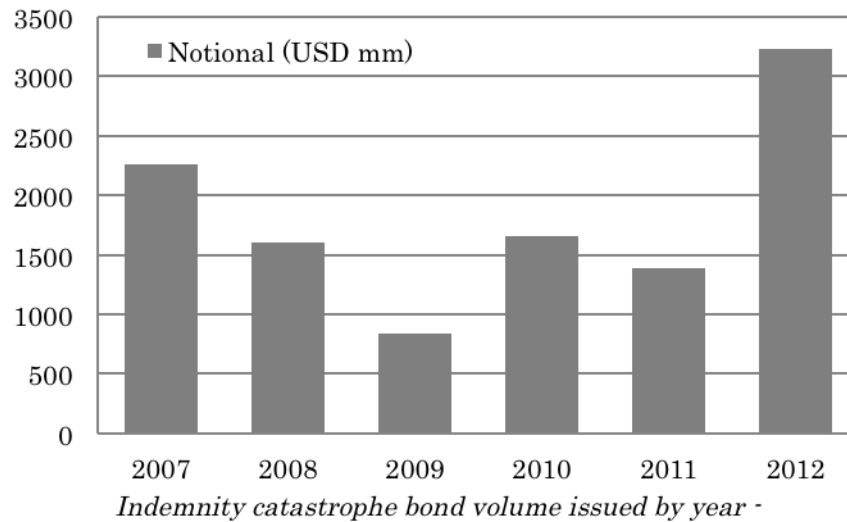
Sawada (2011) showed that the full consumption risk-sharing model was significantly rejected, showing that 57 percent of country-specific income shocks caused by natural and economic disasters are diversified among the eight middle- or high-income countries in the East and Southeast Asian region; and only 10 percent of country-specific income shocks from natural disasters were shared among the wider set of countries in the region. Also, inflation and climatological disasters cause the most serious and significant income shocks, implying that overall insurance mechanisms against agricultural-commodity price jumps within the region are rather incomplete. These results highlight the necessity of developing more regional cooperation mechanisms in disaster management. To respond to this necessity, there are two potential policy directions.

First, as Noy (2012) concludes, we need to identify needed future policy changes to construct better and more robust early-warning systems by incentivizing disaster risk reduction (DRR) policy is through a dedicated fund, a Global Fund for DRR, that will support this work. Noy (2012) proposes that countries will be constantly

evaluated for their DRR plans, and given ‘Seals of Approval.’ The evaluation process would allow a ‘grading’ of DRR policy and the allocation of the contingent ‘seal of approval’ for these policies. The positive externality from such fund with its associated monitoring and evaluation functions, would be enabling countries who receive this DRR ‘seal of approval’ to more easily insure themselves explicitly (with re-insurers) or implicitly by issuing Catastrophic Bonds (CAT bonds) and further enable multi-year insurance. All three developments (re-insurance, CAT bonds and multi-year) will be made easier by having a ‘seal of approval’ since that seal will alleviate investors/insurers concerns regarding the moral hazard generated by the disaster-contingent financial support.

Recently, CAT bonds gain popularity as investor fear of instability of financial market (increasing demand) and increasing number of disasters as well as valuable assets built by modern developers (increasing supply). The following graph shows increasing sales of CAT bonds. Yet, the overall scale of CAT bond market is still very small if we compare it with the overall damages caused by natural disasters which were more than 350 billion USD in 2011 according to Munich Re’s database.

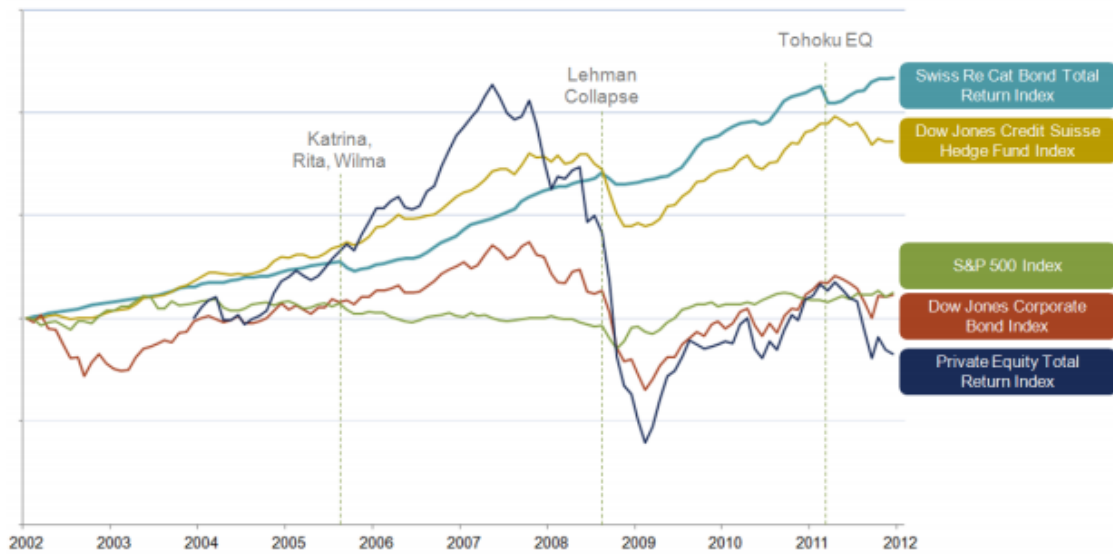
Figure 6: CAT bonds issued



Source: Swiss Re Capital Markets (As of Dec 31 2012).

Potential investors attracted to CAT bond are typically long-term funds, with more than half of the capital in catastrophe-linked assets come from pension funds, endowments and sovereign wealth funds. The bond serves well as option for portfolio diversification with high yield. The return is typically in the range of 5-15 % above LIBOR (RMS, 2012) as shown in the following figure.

Figure 7: Performance of the Swiss Re Cat Bond Total Return Index Compared to Other Asset Classes



Source: RMS, CAT Bonds Demystified, 2012.

Second, index insurance or parametric insurance can be designed for disaster risk pooling at regional level. One example is the Caribbean Catastrophe Risk Insurance Facility (CCRIF), which is a parametric, multinational hazard insurance fund for hurricanes and earthquakes that works with the international reinsurance market and was established as the first of its kind in the world. Haiti was a member of the Facility, and after the Haiti Earthquake in January 2010, the government received 7.75 million dollars in earthquake insurance—around twenty times its premium—as soon as two weeks after the quake. This is evidence of the importance of preparing a new insurance system such as CCRIF.

Another example is the Pacific Disaster Risk Financing and Insurance Program which builds on the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) through a joint initiative between the Secretariat of the Pacific Community (SPC/SOPAC) started in 2007, the World Bank, and the Asian Development Bank, with financial support from the Government of Japan and the Global Facility for Disaster Reduction and Recovery (GFDRR). PCRAFI aims to enhance the disaster risk management and to reduce the financial vulnerability of the Pacific Island Countries (PICs) against natural disasters by improving their financial

response capacity while protecting their long term fiscal balance.

The PDRFI Program provides the PICs with tailor-made advisory services for disaster risk modeling and assessment tools and financial instruments for national disaster risk financing and insurance strategies and catastrophe risk insurance market development.² There are three project components: The first component is institutional capacity building on disaster risk financing through setting national disaster risk financing strategy and technical assistance to design and implement their integrated financial strategy against natural disasters; The second component is Pacific disaster risk insurance market development, aiming to offer technical assistance to improve disaster risk insurance solutions in the Pacific; and the final component is the Pacific Disaster Risk Financing and Insurance (PDRFI) Pilot Program which is pilot natural disaster derivatives aimed at serving as support measures for disaster prevention and disaster mitigation through a Public-Private Partnership (PPP). The Pacific Disaster Risk Financing and Insurance Program is the first of a series of applications of PCRAFI to be developed on disaster risk management and urban/infrastructure planning.

As part of Japan's international cooperation in disaster prevention, the Japanese government announced it would "establish an insurance system as natural disaster support in Pacific island countries" at the 6th Pacific Islands Leaders Meeting (PALM) held in May 2012. Accordingly, this program was established in collaboration with Pacific island countries (governments) and the World Bank and private-sector insurance companies. PDRFI Pilot program is a 2 year pilot program launched in November 2012.

Let us also touch upon preparations for economic crises. The Group of Twenty nations/regions (G20) and other meetings are discussing the installation of an early warning system that predicts and helps to counter the currency and financial crises that have occurred frequently since 1990. But as Rose and Spiegel (2011) points out, current research has not yet developed an early warning system that is sufficiently

² Countries receiving technical assistance on disaster risk financing and insurance through the PDRFI Program include Papua New Guinea (PNG), Fiji, Solomon Islands, Vanuatu, Samoa, Federal States of Micronesia (FSM), Tonga, Kiribati, Republic of Marshall Island, Palau, Cook Islands, Tuvalu, Nauru, Niue; and Timor-Leste. The Pacific catastrophe risk insurance pilot is launching in November 2012 with Vanuatu, Tonga, Marshall Islands, Solomon Islands, and Samoa.

reliable. On the other hand, preparations for economic crises have been enhanced. In 2009, for example, the International Monetary Fund (IMF) established a new prevention facility against economic crises. In the East Asia region, the Chiang Mai Initiative (CMI), a bilateral currency swap agreement to be implemented in times of a currency crisis, expanded to a multilateral framework (CMIM) in 2010.

4. Policy Implications

In general, advanced nations can deal with a major disaster by managing their own domestic financial resources. But developing nations, which carry diverse risks of major disasters, have weak fiscal groundwork and are less tolerant of such risks. Different disasters come in combination, as was the case with the Great East Japan Earthquake and conflicts in Africa. AMSs are mixture of high, middle, and low income countries, facing a wide variety of natural and manmade disasters. What are the lessons and recommendations for the way forward for strengthened disaster management in AMSs and ASEAN beyond 2015?

First, it is imperative to develop formal mechanisms to diversify aggregate disaster risks at national and regional levels (Figure 3). We may need to elaborate on multi-country risk pooling schemes, i.e., regional fund, to cover sovereign disaster risk. Against natural disasters, regional level index insurance such as CCRIF and PDRFI can function effectively to support the disaster affected country with immediate liquidity in the aftermath of a catastrophic disaster by using the insurance mechanism in addition to microcredit and microinsurance schemes to enhance disaster resilience of individual households and firms. While the regional index insurance schemes are based on PPP, the microcredit and insurance programs are supported by informal community enforcement mechanisms. Hence, complementarities among the market, the state, and the community will be the key.

As to the economic disasters, Chiang Mai Initiative (CMI) has been and will be playing an important role. CMI is a bilateral or multilateral currency swap arrangement by pooling a foreign exchange reserves and was designed as an ex post coping mechanism against a financial crisis. Further development of Asian bond

markets will also be indispensable because bond markets are composed of a large number of individual bond holders, idiosyncratic risks can be diversified away effectively and it is generally considered that bond markets have effective risk-sharing mechanisms. In order to diversify the shocks caused by disasters, developed bond markets can potentially play an important role.

As is shown by Figure 3, to further improve national and regional risk management capabilities, a global system of pooling the risks of the four types of disasters would be effective for both developing and advanced nations to diversify the risks of disasters. In other words, we should also work on the securities and reinsurance markets to develop a global disaster insurance system that would encompass various regional frameworks such as CCRIF, PDRFI, and CMIM beyond disaster types.

Disaster resiliency is an important core component of sustainability for ASEAN because ASEAN and East Asia experienced various crises and disasters during the past two decades, and those shocks were utilized to improve resiliency in the region. Not to mention, strengthening regional cooperation in the fields of financial, trade, energy security, food security, and disaster management will pave the way for smooth development in the region. The region has experienced diverse forms of disasters, including floods, typhoons, earthquakes, epidemics, and the financial crises of the late '90s, which necessitates better regional organization for quick action. This is the very reason why there is a need for more effective insurance mechanisms against various kinds of disasters. When we consider the actual form of such insurance mechanisms, there are numerous issues involved, such as whether it would be an institutionalized system such as a disaster fund, or something more flexible such as a coordination forum. It is worth pursuing reforms that undertake comprehensive preparations against the risks of a variety of disasters in Asia.

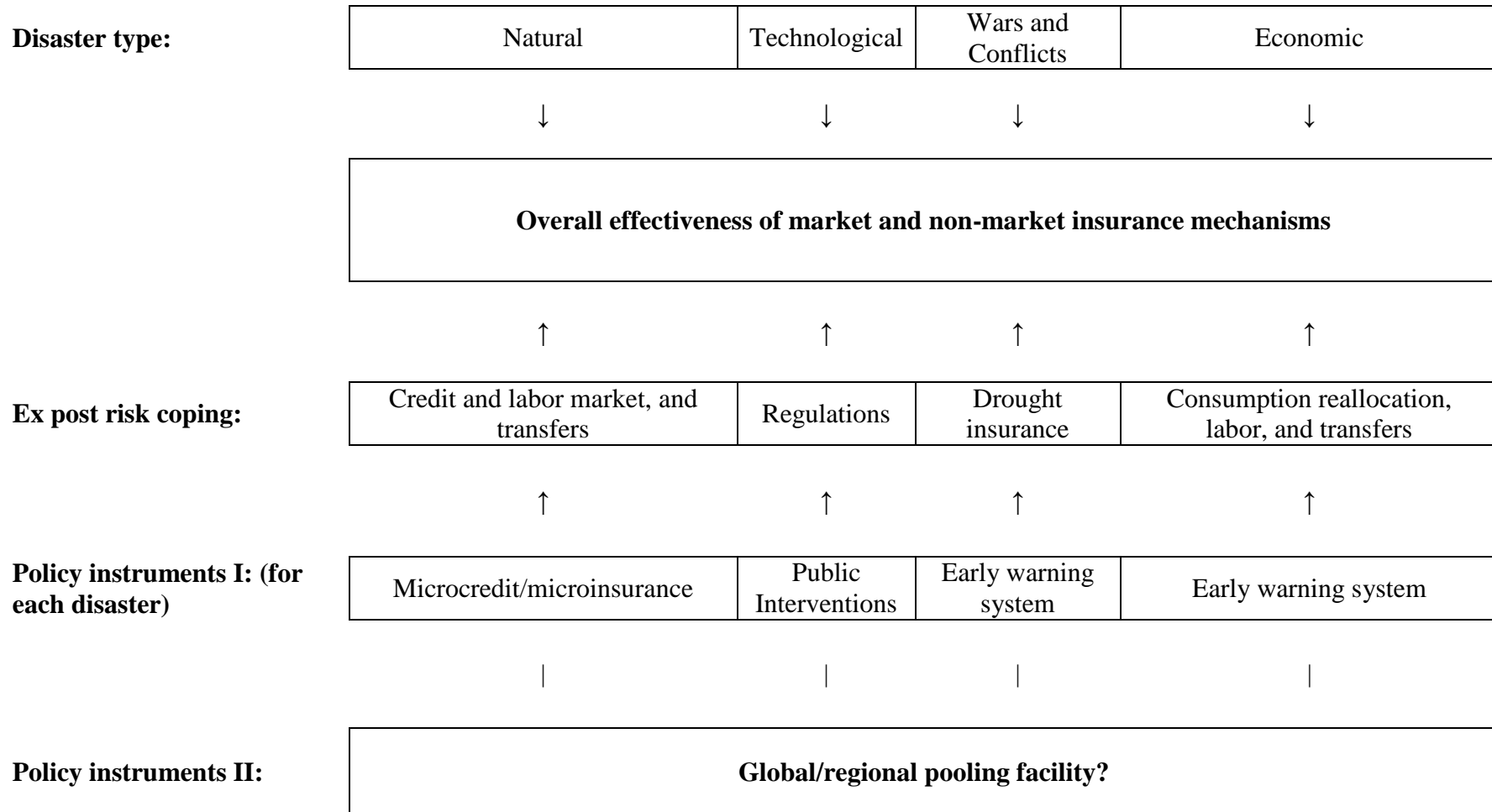
On the regional cooperation, the existing schemes shall be improved to cover better system of financing and transfer. In developing countries, cost of preparation – response – post disaster is typically following a bell-shaped graph and also reflects cycle-related fiscal needs. Government and individuals spend small portion on preparation efforts therefore when the disaster occurs they are burdened by large financial consequence, some obligations usually filled by donors out of humanitarian

considerations, and at later stage, reconstruction may face delayed and under-budgeted program. With appropriate design, the bell-shaped financing burden can be changed into upside down curve –even though not completely. The situation can be changed if there is sufficient fiscal allocation for preparation in pre-disaster, thus in the occurrence of disaster claims will close large part of fiscal needs, and can be used for the later stage as well.

Given the financial constraints of many developing economies in the regions, development partners can contribute to assist the programs. The participation rate for disaster-linked insurance can be increased by contribution from the government for paying the premium. Once the coverage is sufficient in terms of fair calculation of premium, insurance company can sell CAT bond. Apart from government contribution, international development partners can take the role to provide soft loan for the government or grants. The contribution can have positive impact on the institution itself; it can be a way to enforce some constructive liabilities, for examples: safe standard for building in the covered areas, obligation to build sufficient mitigation system, capacity building, etc. The donors also can expect declining costs of contribution in the events of disaster and decreasing fatalities and damages.

Another policy to consider is to support the acquiring and publicly providing hazard map and data. Rashcky and Chantararat (2013) suggested that regional cooperation develops a regional centre for disaster risk data, modelling and insurance. Reliable spatiotemporal rich data on exposures and disaster losses are largely unavailable in ASEAN countries. These necessary risk data and modeling are critical in enhancing risk-based pricing and supervision, in stimulating development of new insurance products and in helping the governments to identify appropriate risk financing strategies for effective and timely disaster responses. The centre shall have the objectives to enhance development of regional risk market infrastructure and to promote cross-border knowledge exchange and capacity building on natural disaster risk financing and transfer practices.

Figure 3: Towards Effective Disaster Risk Coping Strategy and Regional Cooperation: A Summary



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