Chapter 1

Disaster Risks, Social Preferences, and Policy Effects: Field Experiments in Selected ASEAN and East Asian Countries

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CHAPTER 1
Disaster Risks, Social Preferences, and Policy Effects: Field Experiments in Selected ASEAN and East Asian Countries

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1. Introduction

Recently, a number of major natural disasters have hit both developed and developing countries. Disasters can have serious negative effects, not only in terms of loss of lives, but also on the livelihoods of survivors in the aftermath of the disaster. In Asia, a series of recent devastating disasters include the 2013 Typhoon Haiyan (Yolanda) in the Philippines, the 3/11 compound disasters in Tohoku, Japan in 2011, the 2008 Sichuan earthquake in China, and the massive floods in Thailand in 2011. The tsunami disaster in Tohoku was accompanied by a serious technological disaster involving the leaking of radioactive matter from a nuclear power plant. Global economies have been impaired by global financial crises such as the Latin American debt crisis in the 1980s, the Asian financial crisis of the late 1990s and 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. These natural and manmade 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).

Disasters can be subdivided into four major groups (Sawada, 2007). Natural disasters comprise the first category, which includes 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 disaster revolves around technological disasters, i.e., industrial accidents (chemical and oil spills, nuclear power plant meltdowns, industrial infrastructure collapse) and transport accidents (air, rail, road or water transport). The final two disaster types involve manmade disasters, which include economic crises (hyperinflation, banking crises and currency crises) and violence-related disasters (terrorism, civil strife, riots, and civil and external wars). As Aldrich, Sawada and Oum (2014) showed, while natural and technological disasters have been rapidly increasing, the occurrence of financial crises and war have maintained stable patterns over time.

While the Asian countries have been successful in achieving economic growth and poverty reduction, the region cannot avoid being greatly exposed to a variety of disasters. Indeed, Asia, particularly the area of the Association of Southeast Asian Nations (ASEAN) Member States (AMSs), is the region most prone to disasters in the world (Sawada and Zen, 2014). Natural disasters in particular have been increasing in Asia.

2. Market, State, and Community Insurance Mechanisms

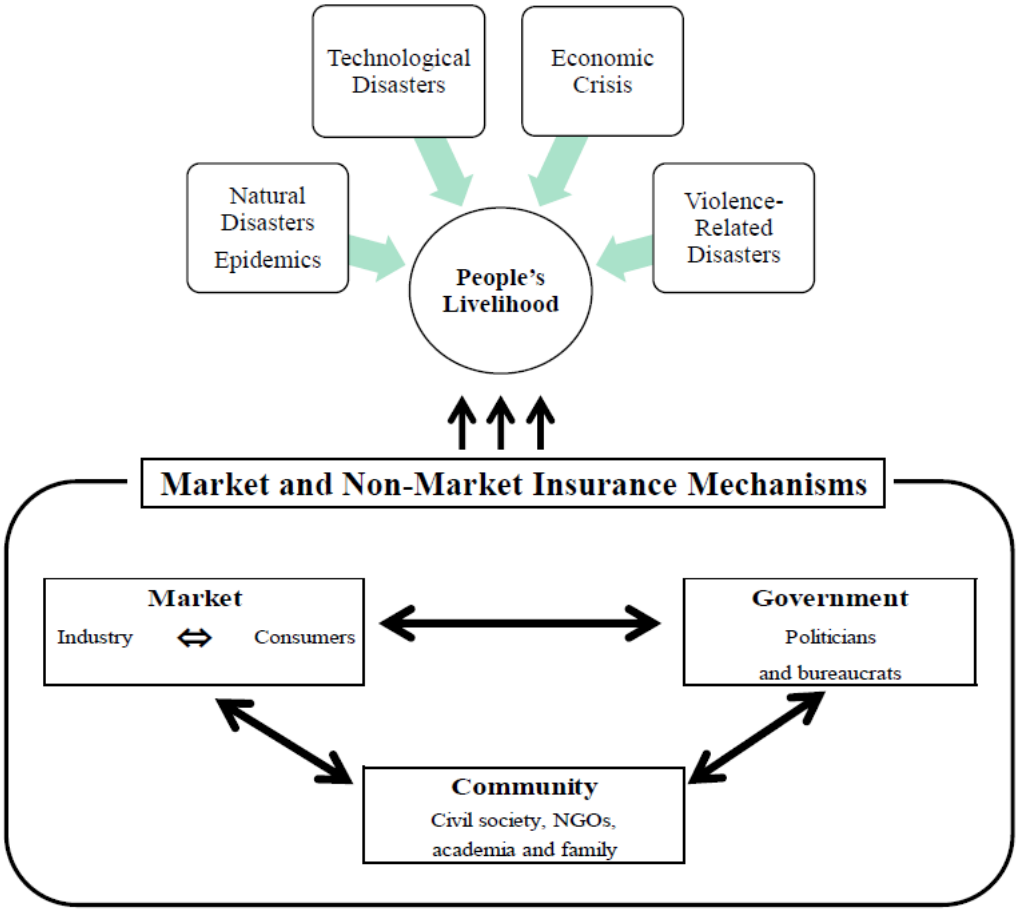
To prepare for disasters and their aftermath, a variety of market and non-market mechanisms are indispensable for minimising loss of life when disaster strikes and for people to maintain their livelihood in the aftermath of a disaster. To illustrate such mechanisms, we adopt the framework of community, market, and state in the economic system of Hayami (2009), as seen below in Figure 1.1 (Aldrich, *et al.*, 2014).

The market serves as the mechanism that coordinates profit-seeking individuals

and firms through competition using price signals. Naturally, the market has an advantage in matching the demand and supply of private tradable goods. Potentially, risks can be traded in credit and insurance markets, but it is often difficult to trade risks of disasters that are characterised by rare and unforeseen events. Hence, insurance market mechanisms are incomplete at best in trading disaster risks. This is a typical case of market failure. When markets fail, the government works as the institution that forces people to adjust their resource allocations by regulation or fiat so that resource misallocation due to market failure can be corrected. Typically, the government plays an important role in supplying global or pure public goods that private firms may be reluctant to provide. A public insurance mechanism for disasters is an example of such public goods. Disaster risks can be diversified away through governmental tax and expenditure mechanisms as well as other intertemporal resource smoothing mechanisms through the government's budget. In sum, market and government mechanisms play mutually complementary roles when markets are not functioning well against disasters. Yet, the government may also fail due to misbehaviour of selfish politicians and bureaucrats who seek to maximise their own benefits. To fill the gap in resource misallocation arising from market and government failures, community enforcement mechanisms based on social capital also play an indispensable role. A local community guides residents and members to work voluntarily and collectively based on historical social interactions and norms. The community facilitates the supply of local public goods, enforces informal transactions, and preserves reciprocal social safety nets. In the aftermath of a disaster, the community's mutual insurance as well as the family's self-insurance mechanisms can amend a lack of effective market and government insurance mechanisms.[1] Hence, the complementarity among market, government, and community is key to a successful disaster management and reconstruction system.

[1] There have been plenty of studies on consumption insurance in developing countries. See, for example, Townsend (1994), and Ligon (2008). Kohara, *et al*. (2008) and Sawada and Shimizutani (2007) applied the framework to test the validity of overall insurance mechanisms against damage caused by the Great Hanshin-Awaji (Kobe) earthquake.

Figure 1.1: Market, State, and Community Insurance Mechanisms



Source: Aldrich, *et al.* (2014) based on Hayami (2009).

2.1. Market Mechanisms

Market insurance mechanisms include mechanisms through direct insurance markets as well as indirect mechanisms based on credit, labour, and other market transactions. Direct market-based insurance can be classified into two types: indemnity-based insurance and index-based insurance. Examples of the former insurance are crop insurance, health insurance, and earthquake insurance. The latter insurance products include micro-insurance or weather insurance such as rainfall index insurance, temperature insurance, area-based index insurance.

According to Table 1.1, during the past decade, Asia experienced more than 150 natural disasters annually (40% of the world total), affecting more than 200 million people annually (about 90% of the world total) and causing more than USD 41.6 billion in annual damage (39%). Yet, Munic Re's 2010

NatCatSERVICE data reports that only 9% of 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 the 2011 Christchurch, New Zealand earthquake.

Table 1.1: Natural Disaster Occurrence and Impacts by Region (Annual Average Figures between 2001 and 2010)

(1) Number of Natural Disasters

	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 (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.

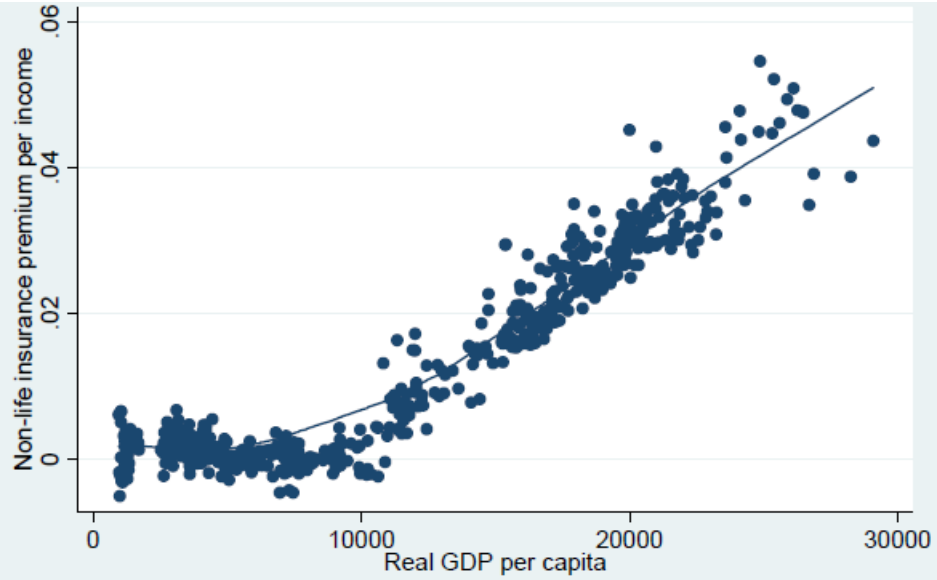
(3) Damage (in Billion USD)

	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.

In fact, cross-country data uncovers the limitation of general insurance mechanisms especially in developing countries (Outreville, 1990; Enz, 2000). According to Figure 1.2, there is a positive relationship between volume of life and non-life premiums per capita and gross domestic product (GDP) per capita. Moreover, it is evident that the fitted slope will be larger than unity. This suggests that formal insurance appears to be a luxury, especially in low- and middle-income countries and that people's preferences are characterised by increasing risk aversion.[2]

Figure 1.2: Cross-Country Income Elasticity for Life and Non-life Formal Insurance Demand



Source: Nakata and Sawada (2009).

Traditional indemnity-based insurance has been suffering from the classical problems of moral hazard, adverse selection, and high transaction costs. Moral hazard is a problem in that being insured raises the probability of losses. The problem of adverse selection is that, for example, those farmers taking the greatest risks or unhealthy individuals are most eager to purchase insurance, undermining fair insurance schemes. Finally, transactions costs are significant because large numbers of small payments need to be made based on damage

[2] However, provided that the poor have higher potential demand for insurance because their marginal utility loss from a downside risk is higher than for the rich, demand for informal insurance instruments is expected to be higher in developing countries. In response to the macro-micro paradox in demand for insurance, Nakata and Sawada (2009) employed wealth data rather than income data to estimate insurance demand elasticity more precisely.

assessed by insurers on an individual basis.

To mitigate such problems, index insurance contracts have been attracting widespread attention (Hazell, 2003; Morduch, 2006; Skees, *et al.*, 2005; Gine and Yang, 2009; Cole, *et al*., 2013; Clarke and Grenham, 2013). Index insurance contracts are drawn up against specific events such as droughts or floods, defined and recorded at the regional level. As such, index insurance contracts have a number of benefits: they can cover aggregate 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 the high transaction costs involved in 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, Viet Nam, Ethiopia, Guatemala, India, Mexico, Nicaragua, Romania and Tunisia. Since natural disasters are typically aggregate events, index insurance is thought to be an appropriate instrument to combat them.

And yet, take-up of rainfall insurance, which is the most popular index insurance, has remained surprisingly low (Gine and Yang, 2009; Cole, *et al*., 2013; Dercon, *et al*., 2014; Clarke and Grenham, 2013). Indeed, designing index type insurance against natural disasters faces three major constraints. First, natural disasters are typically rare events, which makes it difficult to design actuarially fair insurance. Since obtaining historical data on natural disaster patterns is hard, it is almost impossible to set appropriate premiums for insurance (Morduch, 2004). 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 recognise the value of index type insurance against natural disasters or may not be able to purchase such insurance due to financial constraints. This may be an inevitable consequence because natural disasters are often characterised by unforeseen contingencies by nature and because the poor are often myopic with high time discount rates (Pender, 1996). There may also be a lack of trust toward insurance suppliers. Moreover, the existence of “basis risk”, with which an individual could incur damage he/she cannot be sufficiently compensated for, will also constrain 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). Finally, natural disasters are highly covariate risks which often cannot be diversified within a country. Accordingly, insurers may need to secure their financial position by using international reinsurance markets, but reinsurance markets and trades of catastrophe (CAT) bonds are still less developed with limited capacity. Also, as an indication of the overall effectiveness of mutual insurance across national borders, recent studies show that the extent of international risk sharing remains surprisingly small (Obstfed and Rogoff, 2001; Lewis, 1996). Using data on hurricane exposure, Yang (2008) found that the poor's hurricane exposure leads to a substantial increase in migrants' remittances, so that total financial inflows from all sources in the three years following hurricane exposure amount to roughly three-fourths of estimated damage. This suggests that aggregated shock arising from natural disasters can be insured against at least partially depending on income level and the nature of the disasters.

2.2. Non-Market Insurance Mechanisms

Since market insurance mechanisms are still weak, especially against damage caused by disasters, governments and communities can play important roles in strengthening overall insurance mechanisms. The state can provide public insurance schemes and social protection programmes. Examples of public insurance programmes include: publicly provided health and other insurance programmes, subsidisation of private insurance, provision of public re-insurance schemes such as the earthquake re-insurance mechanism in Japan, food aid programmes for disaster-affected people, cash and in-kind transfers to victims, and targeted free social service provisions such as free primary health care.

Community-based informal insurance mechanisms can also make up for a lack of formal insurance schemes. Such mechanisms are achieved by mutual informal reciprocal transfers and credit provision among relatives, friends, and neighbours. Such informal insurance networks themselves comprise the important component of social capital in a broader sense. In fact, several studies found that in East and Southeast Asia many households are likely to be altruistically linked through a widespread and operative informal transfer network. As amounts of public transfers increase, donors of altruistically linked

private transfers cut back their private transfer provisions. A government subsidy intended only for people in need may indirectly benefit donors in rich income groups with little exposure to shocks. In a very strict model of full consumption insurance, idiosyncratic household 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. The theoretical implications for the existence of complete risk-sharing arrangements within an insurance network are widely tested in the literature (Townsend, 1994; Ligon, 2008). The very strict full-insurance hypothesis does seem to be rejected statistically in most data sets, especially for the poorest farmers (Townsend, 1994). Yet, the empirical consensus suggests that, in general, the degree of missing markets is somewhat smaller than many had assumed, and many better-off households seem to face almost complete insurance and credit markets against idiosyncratic shocks (Townsend, 1994). However, natural disasters are typically rare, unexpected events through which people become burdened by sudden damage, making it even harder to design mutual insurance for natural disasters. Sawada and Shimizutani (2007) investigated to what extent victims were insured against unexpected losses caused by the Great Hanshin-Awaji (Kobe) earthquake in 1995. Their evidence overwhelmingly rejects the full consumption insurance hypothesis, suggesting the ineffectiveness of formal and informal insurance mechanisms against the risk of earthquakes.

3. Individual and Social Preferences for Insurance Mechanisms

3.1. Individual and Social Preferences

To strengthen market, state, and community insurance mechanisms, we need to develop a strong grasp of the roles of individual and social preferences. We investigate parameters associated with individual and social preferences, respectively, by eliciting deep parameters of the standard neo-classical utility function and utility functions involving social or other-regarding preferences.

The former set of individual parameters can be described by the following conventional constant relative risk aversion (CRRA) type utility function with quasi-hyperbolic discounting:

(1) $$U(c_t, c_{t+k}) = c_t^{\alpha} + \beta\delta^k c_{t+k}^{\alpha},$$

where β = degree of present bias (or quasi-hyperbolic discounting) and $\beta = 1$ if $t = 0$, 1- α is the coefficient of relative risk aversion, and δ is the exponential discount factor. Note that undesirable behaviours such as obesity, over-eating, debt overhang, gambling, smoking, drinking, and other procrastination behaviours have been attributed to naive hyperbolic discounting (Banerjee and Mullainathan, 2010). There are multiple ways to elicit these deep parameters, such as the dual multiple price list (DMPL) method of Andersen, *et al*. (2008) and the convex time budget method developed by Andreoni and Sprenger (2012) and Andreoni, *et al.* (2013). Note that incorporating the present bias or quasi-hyperbolic discounting in the model is an important deviation from the pure neoclassical model according to which people can make decisions wisely. In contrast to these traditional models, a growing body of work in cognitive psychology lends credence to these doubts, leading to an integrated filed in economics—behavioural economics. With this augmented framework, we believe we can investigate the seemingly irrational anomalies in people's decisions involving risks.

The "social preferences" is a formulation of a utility function which involves utility interdependency, or simply, "other-regarding preferences." Such preferences include altruism, fairness, envy, guilt, trust, reciprocity, and inequality aversion (Cooper, *et al.*, 2014). Dictator, trust, and public goods games can be adopted to quantify the degree of altruism, trust/trustworthiness, and reciprocal cooperation, respectively (Camerer and Fehr, 2004; Levitt and List, 2009; Cardenas and Carpenter, 2008).

In the dictator game, the sender, called the "dictator", is provided with an initial endowment that he/she can either keep or allocate to the receiver. Since there is no self-interested reason for the sender to transfer money, the actual positive amount of transfer is interpreted as the level of altruism (Camerer and Fehr, 2004; Levitt and List, 2009).

Following Berg, *et al*. (1995), we can conduct a standard trust game to measure trust and trustworthiness. In a trust game, all participants are at the outset endowed with an initial stake and each participant is asked as a sender to decide the amount they would send to a receiver. The committed amount of money is tripled, the transfer decision is then sent to its corresponding receiver and each receiver is asked to decide a return amount. In a standard trust game, the set of zero transfers by a receiver and a sender satisfies a sub-game perfect Nash equilibrium. Hence, deviation from zero transfers of a sender and of a receiver can be interpreted as trust and trustworthiness, respectively (Levitt and List, 2009).

In a public goods game, a decision is made within each anonymous group (Camerer and Fehr, 2004; Levitt and List, 2009; Cardenas and Carpenter, 2008). At the beginning of a game, each player is given an endowment and is asked how much to contribute in the group project, keeping the rest for him/herself. The group's total contribution is doubled and redistributed equally to all members. Since the dominant strategy of an egoistic individual is to contribute nothing to the group project, a set of zero contributions by all comprises Nash equilibrium. According to the usual interpretation of the standard experimental games used to measure social preferences, contributions in public goods games reflect reciprocal expected cooperation (Camerer and Fehr, 2004; Levitt and List, 2009; Cardenas and Carpenter, 2008).

3.2. Whether and How a Disaster Affects Preferences

Two issues need careful investigation in our context: first, whether and how a disaster affects preferences; and second, how preferences determine the vulnerability and resilience against damage caused by a disaster.

On the one hand, to identify effective policies to facilitate livelihood recovery of the victims of a disaster, it is imperative to clarify how individual and social preferences are affected by the disaster. By doing so, we can examine, for example, whether the disaster affects the poor disproportionately. In economics, individual preference parameters have long been treated as "deep parameters," i.e., as given and thus constant over time (e.g., Stigler and Becker, 1977). Studies on endogenous formation of individual and social preferences have only recently started to emerge, finding that they are not constant over time and

that they change under some circumstances (Fehr and Hoff, 2011). As natural disasters and manmade disasters are traumatic events, they are likely to affect an individual's behaviour in the short term and possibly in the long term. Two notable examples of such studies, on the Indian Ocean tsunami in 2004, are Cameron and Shah (2012) and Cassar, Healy and Kesseler (2011). Cameron and Shah (2012) found that, in Indonesia, individuals who suffered a flood or earthquake in the past three years are more risk averse than those who did not. Cassar, *et al.* (2011) showed that after the tsunami in Thailand, individuals affected by the disaster were substantially more trusting, risk averse and trustworthy. They also found that individual-level welfare and aggregate growth-level are affected by changes in these social preferences. Callen, *et al*. (2014) investigated the relationship between violence and economic risk preferences in Afghanistan, finding a strong preference for certainty and violation of the expected utility framework. Most importantly, Voors, *et al*. (2012) used a series of field experiments in rural Burundi to find that individuals exposed to violence display more altruistic behaviour towards their neighbours and are more risk seeking. The results indicate that large shocks can have long-term consequences for insurance mechanisms.

The mechanisms of changing individual preferences after being exposed to a disaster, or simply endogenous preferences, can be explained in several ways. First, in the neoclassical model of the short-term adaptation of preferences developed by Becker and Mulligan (1997) individuals can decide to pay to increase their discount factor above the endowed level, allowing them to choose their effort level to change their preferences. Second, evolutionary theory can also explain non-stable preferences in which preferences are determined by matching between the individual and the environment (Robson, 2001; Robson, 2007; and Netzer, 2009). Third, Loewenstein and Lerner (2003) incorporate emotions in decision-making to explain how people discount delayed costs and benefits. Finally, Weitzman (2009) formulates a Bayesian learning model of structural uncertainty of low probability catastrophes, leading to a critical change of deep preference parameters.

3.3. How Preferences Determine the Vulnerability and Resilience

Responses to a disaster will differ according to individuals and social preferences, implying that preferences are critical determinants of vulnerability, resilience, and effectiveness of market and non-market mechanisms in coping with, reconstruction of and the rehabilitation process of a disaster. To illustrate this, we follow Morduch (1995) to capture the negative welfare costs of disaster risks by calculating how much money households would be willing to pay to completely eliminate income variability. Mathematically, this amount of money is represented by *m*, which satisfies the following relationship:[3] $u(\bar{y}-m)=E[u(\tilde{y})]$, where $u(\cdot)$ is a well-behaved utility function, $\tilde{y}$ is a stochastic income and $\bar{y}$ is its mean value. Taking a first-order Taylor expansion of the left-hand side around *m*=0 and a second-order Taylor expansion of the right-hand-side around the mean income gives:[4]

(2) $$\frac{m}{\bar{y}}=\frac{1}{2}\underbrace{\left(-\frac{u''(\bar{y})\bar{y}}{u'(\bar{y})}\right)}_{Coefficient\ of\ RRA}\times\underbrace{\left(\frac{\sqrt{Var(\tilde{y})}}{\bar{y}}\right)^{2}}_{\substack{Coefficient\ of\\ Variation}},$$

Equation (2) indicates that, approximately, the fraction of average income 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. While natural and manmade disasters generate large income volatilities, the welfare impacts are also dependent on the relative risk aversion parameter, one of the important individual preference parameters. Hence, the individual response of a disaster will be driven by a "deep" parameter.

While recent work has begun to investigate the welfare impacts of natural disasters as well as manmade disasters such as economic crises through price changes (Friedman and Levinsohn, 2002), as far as we know only few studies have examined the impacts of a disaster on victims' behavioural change.

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[3] The variable *m* represents a standard risk premium.

[4] This is the so-called Arrow=Pratt risk premium.

4. Project Summary

In this project, our first aim is to produce the academic foundations of the nexus between a disaster and individual/social preferences so that we can fill in the remaining large gap in the literature on behavioural impacts of disasters by investigating two issues: first, whether and how a disaster affects preferences; and second, how preferences determine the vulnerability and resilience against damage caused by a disaster. We believe that such a study is also indispensable in terms of designing and implementing appropriate post-disaster policies. To achieve this aim, we employ both existing data and new experiments from selected fields to quantify heterogeneous behavioural impacts of the disaster.

In order to approach the first issue, whether and how a disaster affects preferences, it is indispensable to grasp people's individual and social preferences correctly by carrying out carefully designed experiments. Canonical methods as well as a new experiment such as the "Convex Time Budget (CTB)" experiment, designed by Andreoni and Sprenger (2012), were conducted in selected sites to elicit and compare social preferences in different Asian countries and areas.

To carry out an assessment of the second issue, how preferences determine vulnerability and resilience, we employ standard and non-standard outcome measures in economics. Our outcome evaluation criteria include: standard individual decisions, particularly consumption and saving decisions based on the standard Euler equation, firm decisions and performance, psychosocial outcomes, and human capital outcomes. Basically, in each component, data on welfare measures such as consumption, ex post risk coping strategy against a disaster, and other dimensions such as social networks were collected and analysed by using multi-purpose household survey instruments together with the carefully designed experiments. Also, we employ relatively new measures in economics such as management practices and psychosocial measures as outcome measures. The former aspects have been studied extensively by Bloom, *et al*. (2014). The latter measure is to capture post-traumatic stress disorder (PTSD), which has been studied extensively in public health and social epidemiology literature.

To strengthen market, state, and community insurance mechanisms, we need to have a strong grasp of the roles of individual and social preferences. By employing these combined data sets, we identify effective policies to facilitate livelihood recovery of the victims of a disaster, considering closely people's behavioural responses against unexpected events caused by a variety of natural and man-made disasters. Through this project, we provide important policy implications for better insurance mechanisms at community, national, and regional level, generating inputs for high-level forums of the Association of Southeast Asian Nations (ASEAN) and East Asia.

4.1. Summary of Chapters

This report begins with the most frequently occurring type of disaster in East and Southeast Asia—hydro-meteorological disasters. More specifically, floods in the Philippines, Cambodia, Thailand, and Viet Nam are investigated. The Viet Nam chapter also investigates other disasters such as avian influenza. The second set of papers looks at the impact of geological disasters in Japan and China: the Great East Japan Earthquake and the Great Sichuan Earthquake in China. The third paper in this set investigates the consequences of a technological disaster—the Fukushima Dai-ichi nuclear power plant accident, induced by the Great East Japan earthquake. The final paper examines a variety of business risks in Lao PDR. Table 1.2 gives an overview of the chapters included in this report.

Table 1.2: A List of Chapters

Country	Philippines	Cambodia	Thailand	Viet Nam
Disaster type	*Flood*	*Flood*	*Flood*	*Flood, AI, Drought and other disasters*
Targeted preferences	Risk attitude Time discount Social preference	Risk attitude Time discount Social preference	Risk attitude Time discount Social preference	Risk attitude Time discount
Other outcomes	Risk coping	Risk management and coping	Risk management and coping	Insurance demand

Country	Iwanuma (and Sendai) Japan	China	Fukushima, Japan	Lao PDR
Disaster type	*Tsunami*	*Earthquake*	*Technology*	*Export market Technology*
Targeted preferences	Risk attitude Social preference	Risk Social preference	Psychosocial	Risk attitude
Other outcomes	Psychosocial	Test score (cognitive) Psychosocial & pro-social	Programme evaluation Psychosocial	Investment & production Safety

Note "AI = Asian influenza.

4.2. Hydro-meteorological and Biological Disasters

The second chapter by Yasuyuki Sawada and Yusuke Kuroishi, "How does a Natural Disaster Affect People's Preference? The Case of a Large Scale Flood in the Philippines using the Convex Time Budget Experiments" is an attempt to contribute to the literature on individual preferences and disasters by investigating the impact of a natural disaster on present bias, time discount, and risk aversion parameters, which are elicited by a new experimental technique

called the Convex Time Budget (CTB) experiments developed by Andreoni and Sprenger (2012). They employed a unique experimental data set collected from a village in the Philippines, which was hit by a strong flood in 2012. Their focus is on the overall impact of the flood on preferences and decisions. They found the following three empirical results. First, the CTB experiments offer reasonable levels of time discounting, curvature and quasi-hyperbolic discounting in the whole sample. Second, this quasi-hyperbolic discounting in a Filipino village is contrasted with the dynamically consistent time preferences in the United States found by Andreoni and Sprenger. Finally, they found that being hit by the flood makes individuals significantly more present-biased than those who are unaffected by the flood.

In the third chapter, "The Consequences of Natural Disasters on Preferences, Risk Assessments, and Behaviours: Evidence from Thai Farmers After the 2011 Mega Flood," Krislert Samphantharak and Sommarat Chantarat assess the impact of the 2011 mega flood in Thailand on subjective expectations, preferences, and behaviours of the Thai farming households affected by the disaster. First, they found that the flood seemed to make the households adjust upward their subjective expectations on future flood events and on possible damage caused by future floods. The flood also affected the expectation of the households of government's assistance. However, they found no evidence of moral hazard arising from the government implicit insurance through disaster assistance. Second, the 2011 mega flood was positively associated with higher risk aversion and more risk averse households were more likely to adopt such strategies. Finally, they found that households directly hit by the flood seemed to be less altruistic. These findings shed light on the credibility of government assistance in the presence of widespread natural disasters and the future role of the government and insurance markets in natural disaster risk management.

The fourth chapter, "The Effects of Natural Disasters on Household's Preferences and Behaviour: Evidence from Cambodian Rice Farmers After the 2011 Mega Flood," by Sommarat Chantarat, Kimlong Chheng, Kim Minea, Sothea Oum, Krislert Samphantharak and Vathana Sann studies the impacts of the 2011 mega flood on preferences, subjective expectations, and behavioural choices among the Cambodian rice-farming households affected by the disaster. They found the flood victims to have larger risk aversion and altruism, and lower impatience with and trust of friends and local governments. The disaster

further induced flooded households to adjust upward their expectations of future floods and use of natural resources as safety net. Mediating (partially if not all) through these changes in preferences and expectations, the 2011 flood also affected households' behavioural choices, some of which could determine long-term economic development and resilience to future floods. They found the flooded households to have lower productive investment and to substitute social insurance with an increasing reliance on private insurance, increasing demand for market-based instruments. They also increased the use of natural resources as insurance. Asian These findings shed light on the design of incentive-compatible safety nets and development interventions.

Chapter 5, "Time Preference, Risk and Credit Constraints: Evidence from Viet Nam," by Hiroyuki Nakata and Yasuyuki Sawada empirically examines the effects of the environment on time preferences of economic agents by using a unique household data set collected in Viet Nam. The environment includes credit constraints and recent loss experience, in terms of frequency, the nature of losses and the causes of losses (types of disasters). Subjective interest rates exhibit inverted yield curves, consistent with the existing results from laboratory experiments and field surveys, but are contrary to what usually can be observed in the financial markets. The empirical analyses indicate that recent past loss experience has a significant impact on subjective overnight interest rates. Also, they estimate Euler equations of a time-additive discounted expected utility model that admits quasi-hyperbolic discounting with a power utility. The results suggest that experience of losses from Asian influenza (AI)an and/or floods has an impact on time preference parameters, although the impacts are not robust when the impacts of AI or flood losses through credit constraints are taken into account, suggesting possible inadequacies in the specification of the model.

4.3. Geological and Technological Disasters

Chapter 6 by Yasuyuki Sawada and Yusuke Kuroishi titled, "How To Strengthen Social Capital in Disaster Affected Communities? The Case of the Great East Japan Earthquake," investigates the nexus between damage caused by the disaster and preference parameters, as well as the impact of individual preference on social capital. They employ unique field experiment data collected exclusively for this study from the residents of Iwanuma city, located

near Senday city in Miyagi Prefecture, who were affected by the March 11th earthquake and tsunami. They conducted carefully designed artefactual experiments using the methodology of the Convex Time Budget (CTB) experiments of Andreoni and Sprenger (2012) to elicit present bias, time discount, and risk preference parameters. They also conducted canonical dictator and public goods games to capture the pro-social behaviour of the subjects of the experiments. Several important findings emerged: First, they found an absence of quasi-hyperbolic discounting in the whole sample. Second, they found that the damage from the disaster seems to have made individuals more present-biased. Third, in dictator games, the amounts of money sent to victims of Great East Japan Earthquake are larger than those sent to anonymous persons in Japan. Also, they found that the present bias parameter and time discount factor are both negatively related to the amount of donations, implying that seemingly altruistic behaviour might be driven by myopic preference. Finally, they found that present bias is closely related to bonding social capital.

In Chapter 7 titled "Natural Disasters and Human Capital Accumulation: The Case of the Great Sichuan Earthquake in China," Albert Park, Yasuyuki Sawada, Heng Wang and Sangui Wang employ original micro data collected from students and schools affected by the Great Sichuan Earthquake in 2008 to uncover the impacts of the earthquake on the broad human capital of students, i.e., their cognitive and non-cognitive outcomes. Two main findings emerge from their empirical analysis. First, the household-level shocks from the earthquake worsen children's psychosocial outcomes as well as family environment uniformly. Second, classroom relocations as a result of the earthquake mitigate depression, enhance self-esteem, improve family environment, and improve Chinese test scores. These effects may reflect positive peer effects through the earthquake-affected students' unexpected exposure to students and facilities in better schools. Since non-cognitive skills may be more malleable than cognitive skills at later ages, the government can play an important role in facilitating human capital accumulation in a broader sense by effectively amending the non-cognitive skills of children affected by a natural disaster directly or indirectly.

Due to grave concerns about radiation exposure after the nuclear power plant accident caused by the Great East Japan earthquake, many parents in

Fukushima prohibited their children from playing outdoors. The Japanese Red Cross organized short-term and large-scale indoor park programmes for preschool children across Fukushima to in an effort to reduce high stress levels among children. Chapter 8, "Do Short-term Indoor Park Programmes Improve Preschool Children's Psychological Health in Fukushima?" by Chishio Furukawa and Yasuyuki Sawada aimed to quantify the impact of the short-term indoor park programmes on the children's psychological health. They used a Strengths and Difficulties Questionnaire to assess the children's psychological health condition. While no causal statement may be made regarding the programme's effectiveness due to lack of randomization, participation in the programme is not negatively correlated with stress levels on average; unexpectedly, there were a few signs of positive correlation with overall stress levels and negative correlation with pro-social behaviour. This correlation was largely found among the children whose parents always prohibit them from playing outdoors and regularly use the indoor playground facilities. This may be due to an actual impact, reporting bias (those who want the programme to continue may overstate the stress level as evidence of the need for the programme), or reverse causality. They also find that stress is correlated with experience of evacuation and parents' prohibition of outdoor play, but this does not apply to those who participated in the regular indoor programmes.

4.4. Business Risks in an Emerging Economy

While there have been numerous micro-econometric studies on risk and poverty in rural developing economies, there have only been a few studies on business risks arising from volatile input and output prices and weak enforcement of contracts. In Chapter 9, "Risk Preference of Managers and Firm Investments in Lao PDR," Mari Tanaka and Yasuyuki Sawada aim to bridge this gap in the literature through their analysis of a unique survey and experiment data from textile and garment firms in Lao PDR, collected exclusively for their study. To investigate the role of risk preference of firm managers on a variety of firm investment decisions, they elicited measures of managers' risk preferences through experiments. They found that firms with risk adverse managers are more likely to self-finance investments than to borrow from banks or informal sources, leading to lower overall asset levels. A risk averse firm manger is more likely to face binding "self-inflicted" borrowing constraints on additional investments. However, their results also

indicated that risk averse managers invest more in their factories' safety measures against fires and injuries. In addition, they examine the association between risk preference of managers and adoption of management practices. While the results are not statistically significant, they find that risk tolerant managers are more likely to have adopted better practices and have achieved employment stability.

5. Policy Implications

There are several policy implications from the findings of our research project.

First, the poor might be significantly risk averse and present-biased as in the case of farmers in the Philippines, Thailand, Viet Nam, and Cambodia. Natural disasters make the poor more present-biased and risk averse than those who are unaffected by disasters. Accordingly, disasters seem to weaken the effectiveness of the pre-existing informal network of social safety nets Such impacts of disasters may stimulate people's too much dependence on financial and non-financial assistance from the government, donor agencies, and NGOs, undermining sound post-disaster reconstruction or "building back better." Reinforced present-bias may induce substantial procrastination behaviors such as over-eating, over-spending, drinking, smoking, gambling, and over-indebtedness. Risk aversion would also facilitate procrastination behaviors. Since careless cash and in-kind transfers to the victims will worsen procrastination behaviors, the government and donor agencies should carefully design incentive-compatible safety net and development interventions to establish "commitments" against procrastination behaviors. Examples may include carefully-designed in-kind or voucher transfers rather than pure cash transfers, disaster loan programs, and commitment micro-saving programs.

Second, the importance of individual preferences can be also found in business investments. As found in the case of Lao PDR, firms with risk adverse managers are more likely to self-finance investments rather than to employ borrowing from a bank or other informal sources, leading to lower overall asset level. A risk averse firm manger is more likely to face binding "self-inflicted" borrowing constraints on additional investments. Risk tolerant managers, are

more likely to have adopted better practices and to achieve employment stability. To facilitate "resilient" firm investments, it will be indispensable to make managers take risks (promoting entrepreneurship) by providing effective insurance mechanisms against business related risks. Concrete examples may include business information sharing network, credit guarantee system, and public facilitation of trade credit.

Third, natural disasters generate not only economic damages but also serious psychosocial and family problems as shown in the case of the Great Sichuan Earthquake in China and preschool children's psychological health in Fukushima. Such negative impacts seem to be large among children and teenagers who are in an important phase of accumulating their human capital. Since non-cognitive skills may be more malleable than cognitive skills at later ages, the government must play an important role in facilitating human capital accumulation of the young who are affected natural disasters in a broader sense effectively by amending not only cognitive skills at school but also the non-cognitive skills of the victimized children and teenagers directly or indirectly. In addition to rehabilitation of infrastructure and reconstruction of family and community economies, special cares and resources should be provided at schools and out of schools to amend psychosocial damages caused on the students. Carefully-designed "rehabilitation camps" for the affected children may also be effective to weather the problems.

In sum, it would be imperative to strengthen market, state, and community insurance mechanisms by promoting risk control and financing instruments such as "hard" insurance schemes within each country and across countries in the region. Yet, we also need to place special care on subtle psychosocial and behavioral problems of the victimized children, teenagers, business managers, and other ordinal people.

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