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School of Economics
University of Economics Ho Chi Minh City
Address: 1A Hoang Dieu, Phu Nhuan, Ho Chi Minh City, Vietnam
Phone: +84-8-3844-8222
Email: kkt@ueh.edu.vn
Website: www.se.ueh.edu.vn

Flood insurance market in Vietnam: Challenging but potentially profitable

Phung Thanh Binh[1], Xueqin Zhu[2], Rolf Groeneveld[2], Ekko van Ierland[2]

Abstract

This research aims to estimate willingness to pay (WTP) of farmers for insurance against flood hazards using a choice experiment with special care of attribute non-attendance and effects coding method. In addition, some challenges and opportunities are identified to provide new insights for policy makers into the design of a flood insurance market. A random sample of 374 households in the Mekong river delta was collected in the year 2015. The results indicate that a large proportion of respondents do not favor a flood insurance scheme, possibly due to the existence of cluster effect, loss aversion, wishful thinking (i.e. a belief that flood will never happen again), and moral hazard. Especially, a young generation of farmers is ignoring flood insurance. The opportunities for flood insurance market development are promising for all potential providers because WTP is high enough to earn profit.

Keywords: flood insurance, choice experiment, attribute non-attendance, random parameter logit, and effects coding.

1. Introduction

Buying insurance is considered as an effective means for spreading and segregating flood risks under increased impacts of climate change (Akter et al., 2011; Botzen and van den Bergh, 2008; Bouwer and Vellinga, 2005; Mills, 2005). It possibly plays a significant role as a complementary flood mitigation mechanism (Huber, 2011; Botzen et al., 2009; Bouwer and Vellinga, 2005; Kabat et al., 2005). Specifically, flood insurance is likely to provide loss-reducing incentives for policyholders to undertake mitigation measures, which are rarely implemented in a voluntary manner by flood-prone communities (Brouwer and Akter, 2010; Botzen et al., 2009; Botzen and van den Bergh, 2008; Kunreuther, 1996). Under well-designed arrangements, the insurer can require his clients to adopt certain mitigation measures to either save money on premium payment or get a lower level of deductibles (Botzen et al., 2009; Kunreuther and Pauly, 2006; Kleindorfer and Kunreuther, 1999). Consequently, this conditional adoption helps the insured reduce vulnerability, and thus financial damages if a catastrophic flood occurs (Bubeck et al., 2012a; Botzen et al., 2009). Empirical evidence indicates that total economic losses suffered by the insured are much less than those of the uninsured (Botzen and van den Bergh, 2008; Hoff et al., 2003). In addition, flood insurance also provides private sectors an opportunity to monitor strategic behavior of the policyholders under information asymmetries (Botzen and van den Bergh, 2008). Given its importance, there has been an increasing number of studies on the flood insurance demand to provide insights into the better design of flood insurance programs.

In the literature, empirical studies on flood insurance demand either use actual data or hypothetical data, depending on whether a flood insurance market exists or not. The factors determining flood insurance demand can be classified into three groups: economic variables,

[1] Department of Environmental, Agricultural and Resource Economics, University of Economics, Ho Chi Minh City, Vietnam. Email: ptbinh@ueh.edu.vn.
[2] Environmental Economics and Natural Resource Group, Wageningen University, The Netherlands.

risk-related variables, and demographic variables. Economic variables include price and income (Atreya et al., 2015; Petrolia et al., 2013; Kriesel and Landry, 2004; Browne and Hoyt, 2000; Bauman and Sims, 1978). Risk-related variables are flood experience (Bauman and Sims, 1978; Browne and Hoyt, 2000; Zahran et al., 2009; Atreya et al., 2015; Petrolia et al., 2013; Lindell and Hwang, 2008; Dumm et al., 2015), flood mitigation efforts (Atreya et al., 2015; Zahran et al., 2009; Kousky, 2010; Burby, 2006), hazard proximity conditions (Atreya et al., 2015; Michel-Kerjan and Kousky, 2010; Kousky, 2010; Zahran et al., 2009), and disaster relief of public compensation (Kunreuther, 1996). Demographic variables consist of education, age, risk perception, risk attitude, social capital, and race (Atreya et al., 2015; Lo, 2013a; Petrolia et al., 2013; Kriesel and Landry, 2004; Kunreuther, 1996; Bauman and Sims, 1978). Some studies have also tested hypotheses of charity hazard, adverse selection (Petrolia et al., 2013; Lo, 2013b; Browne and Hoyt, 2000) and availability heuristic (Atreya et al., 2015) using actual data.

Some other studies (Brouwer and Akter, 2010; Botzen and van den Bergh, 2012a, 2012b; Reynaud and Manh-Hung, 2012; Brouwer et al., 2013) investigate demand for flood insurance using hypothetical data. These studies use different methods to identify other factors that influence demand for flood insurance under increased impact of climate change. Botzen and van den Bergh (2012a, 2012b) introduce a risk-seeking index for measuring risk aversion, a risk ladder technique for communicating risk probabilities, and different proxies for risk perception. For developing countries, flood-prone households are said to favor central government as a fundamental insurance provider. In terms of flood insurance demand, these studies show mixed results. Botzen and van den Bergh (2012a) use the contingent valuation method and conclude that flood-prone homeowners in the Netherlands do not want to buy flood insurance. In contrast, they find evidence of flood insurance demand when using choice experiments (Botzen and van den Bergh, 2012b). There are currently two studies on Vietnam using choice experiments (Reynaud and Manh-Hung, 2012; Brouwer et al., 2013). Reynaud and Manh-Hung (2012) find that households in the north-central area of Vietnam favor the status quo (i.e. respondents disfavor flood insurance). While Brouwer et al. (2013) find a substantial demand for flood insurance in the central area. Brouwer and Akter (2010) employ a choice experiment in Bangladesh and find that most households are strongly interested in micro flood insurance. However, Akter et al. (2011) use the contingent valuation method in Bangladesh, indicating that only half of the interviewed households are interested in a flood insurance program.

We think there are at least five possible explanations for the contradictory findings so far. First, the contingent valuation method may not have been able to provide the respondents enough information for them to decide on 'new' insurance products. Second, unclear coding of the alternative specific constant (ASC) in the choice experiment may have led to misinterpretations. For example, Reynaud and Manh-Hung (2012) state that the significantly positive ASC implies the favor of no insurance, whereas Brouwer and Akter (2010) conclude the opposite. Third, there seems to be evidence of the so-called 'lexicographic preference[3]' (i.e. dominant insurance provider attribute) in the case of central Vietnam because the *t*-statistic of insurance provider is extremely high (t-stat. = 23). This means that respondents may not make a trade-off when making the choice among offered alternatives. Fourth, dummy coding of attributes may cause multicollinearity among these variables and the ASC (Bech and Gyrd-Hansen, 2005). Finally, there could be mistakes in experimental designs. Specifically, they either violate the mutually exclusive rule, apply irrelevant levels for

[3] Lexicographic preferences imply that certain attributes are always preferred to other attributes, no matter what level they are supplied at (Colombo et al., 2013; Scott, 2002).

insurance provider, and set inappropriate levels for insurance premium, or do not describe a complete set of endpoints.

To overcome some of the above-mentioned weaknesses, this study uses scrupulous experts' judgment, and focus group discussion to define relevant attributes and levels, carefully controls attribute non-attendance situations. Our purpose is to provide useful information on flood insurance demand in Vietnam by answering the following four research questions. First, do Vietnamese flood-prone households have demand for flood insurance? Second, is it profitable enough for insurance companies to join the market? Third, what are potential challenges to implement a flood insurance program in Vietnam? Finally, for the methodology, is effects coding method better than dummy coding method in flood insurance choice experiment study?

The paper is structured as follows. The choice experiment is presented in Section 2. Section 3 describes data collection. Section 4 presents and discusses the research results. Conclusions and policy implications are presented in Section 5.

2. The choice experiment

The choice experiment was implemented through the following steps. First, we prepared a list of attributes commonly used in previous studies to discuss with insurance experts. Previous studies used nine attributes: insurance policy, insurance provider, insurance cover, damages, insurance premium, flood return period, probability of fatality, length of social disruption, and monthly payment. Second, we worked with the insurance experts[4] to identify relevant attributes and their levels for a typical flood insurance product in a developing country context. These informants excluded attributes describing the status of surrounding environment because they do not affect designs of flood insurance arrangements. In high flood-risk situations, the insurers would put some constraints on insurance contracts (e.g. insurance policyholder must either implement self-protection measures or pay extra premiums). Consequently, a deductible (i.e. cost sharing between the insurer and policyholder) was recommended (i.e. the part of the damages is not covered by the insurer) to be an attribute of a flood insurance option. Because urban citizens are offered various insurance programs such as housing, property, health, and fire, it is advised that the flood insurance program should be introduced to rural households. For that reason, the informants suggested us to use the value per unit of land area (i.e. VND per 1000m^2) as the unit of measurement for the insurance cover and insurance premium. For the insurance provider, the experts said that both government and state-owned companies no longer provide insurance services. Accordingly, the levels of an insurance provider are organized as joint-stock company, private company, or international company. Finally, we were advised to use a short list of five attributes: insurance policy, insurance provider, coverage, deductible, and premium (See Table 1) for the description of attributes and their levels used in this study.

Table 1: Description of attributes and their levels

Attributes	Description	Levels
Insurance policy	Single flood insurance policy or combined insurance policy	Policy 1: Flood insurance Policy 2: Flood plus waterlog insurance Policy 3: Flood plus whirlwind insurance Policy 4: Flood plus waterlog, and whirlwind insurance
Insurance cover	The loss paid directly to the	VND 2 million per 1000m^2

[4] A representative of BaoViet Insurance Corporation in Dong Thap province and a representative of Saigon-Hanoi Insurance corporation in Ho Chi Minh city.

	insured by the insurer for first-party coverage. It is measured in terms of VND million per $1000m^2$.	VND 3 million per $1000m^2$ VND 4 million per $1000m^2$
Insurance provider	The insurance providers	Joint-stock insurance company Private insurance company International insurance company
Deductible	Part of the damages due to flood hazard is firstly burdened by the insured.	Low deductible level: 10 per cent High deductible level: 25 per cent
Insurance premium	The cost per $1000m^2$ paid by the insured to the insurer at a given time before the flood season.	VND 15.000 per $1000m^2$ VND 30.000 per $1000m^2$ VND 40.000 per $1000m^2$ VND 50.000 per $1000m^2$ VND 65.000 per $1000m^2$

Third, we conducted two focus group discussions (16 participants) at the study sites to check the feasibility of the attributes proposed by the informants and determine appropriate levels for each attribute. For insurance policy, farmers were very much interested in combined natural disaster insurance (i.e. flood plus other natural disasters such as waterlog and whirlwind). The informants from BaoViet Insurance Corporation also approved four levels of insurance policy: flood insurance only, flood with waterlog insurance, flood with whirlwind insurance, and flood with waterlog and whirlwind insurance. For coverage, all participants paid attention to the time of flooding (i.e. early or late floods). Early floods inflict costs of cultivation on farmers (e.g. land preparation, seeds, fertilizers and pesticides, labour, and pumping expenses). The average costs of cultivation and harvesting varied from VND 2.2 million to VND 2.5 million per $1000m^2$ (Ngo, 2013). After extracting the harvesting cost of about VND 0.3 million per $1000m^2$, we chose the minimum level of VND 2 million per $1000m^2$ for the insurance cover. Under late floods, farmers might lose net revenue from harvesting, approximately VND 4 million per $1000m^2$. The third level of VND 3 million per $1000m^2$ was used in between the extreme cases. Three levels for insurance providers were joint-stock company, private company and international company. For the level of the deductible, the participants agreed to the maximum level of 25 per cent, because this is equivalent to the profit per $1000m^2$ of agricultural land if they have a good harvest. To set up the bid levels for the cost attribute, we used information from the pilot agricultural insurance program in the Mekong river delta. The informant from BaoViet Insurance Corporation revealed the prevailing premium rate (VND 37,000 per $1000m^2$ after 60 per cent of premium support from the government) and the premium rate that could bring the break-even point profit for the insurer (VND 20,000 per $1000m^2$). The farmers in the focus group discussions told that VND 14,000 per $1000m^2$ (i.e. the premium that they pay after receiving financial supports from both government and An Giang Plant Protection Joint-Stock Company) is cheap. After in-depth discussions and experts' judgment, we decided to set the maximum level for premium at VND 65,000 per $1000m^2$ of agricultural land. The description of attributes and their levels is presented in Table 1.

Fourth, the choice sets were generated from orthogonal main effects design using SPSS 22 software. At first, the software generated in total 64 choice sets. By manual checking, we found that 13 choice sets contained a dominant choice option, and they were excluded. Out of the remaining 51 choice sets we randomly selected 48 choice sets for two purposes, and randomly divided them into 8 groups of 6 choice sets. In addition to these six 'real' choice sets respondents were presented with two given example choice sets and one repeated choice set (randomly drawn from the six 'real' choice sets). The example choice sets aimed to make

respondents be familiar with choice decisions, whereas the repeated choice sets aimed to check stable preferences. We presented each respondent with 9 choice sets. In each choice set, the respondents were asked to choose the most preferred one among three alternatives, i.e., two generic flood insurance alternatives and one base alternative (opt-out). The base alternative indicated "none of the offered insurance alternatives" was chosen. Immediately after the choice experiment, the survey presented the respondent with follow-up questions to check the understanding of the choice experiment scenario, attribute non-attendance, difficulty of choice decisions, and creditability of flood insurance programs. The general card describing attributes and levels, and an example choice set are presented in Appendix A.

3. Data collection and descriptive statistics

3.1 The questionnaire

The questionnaire (Appendix G) included the following sections. The first section asked general information about the respondent and his family. Three variables were generated: age of household head, household size, and membership of agricultural cooperative. The second section included questions about perceptions and experience on flood risk. Five variables were generated: risk perception, wishful thinking, disaster relief, status of inundation, and health insurance purchase experience. The third section was about the evaluation of flood control management. The fourth section featured a game to assess the respondent's risk attitude, in which the respondent was asked to make choice between a certain outcome and an expected outcome. The respondent is considered risk averse if s/he chooses option A at either scenario 4 or scenario 5 (Appendix B). The fifth section was choice experiment. The final section was about household economic activities. Four variables were generated: agricultural land size, yearly income per capita, share of income from agricultural cultivation activities on total household income, and unprotected area. These variables entered the random parameter logit models in terms of interactions with either the ASC or the attributes. A summary of interaction variables used in the model are presented in Table 2.

Table 2: Interactions with ASC and attributes

Variable	Description	Expected sign
Flood exposures		
ASC x Tan Hong district	High risk area, Dong Thap province	+
ASC x Tan Chau district	High risk area, An Giang province	+
ASC x Cao Lanh district	Medium risk area, Dong Thap province	+
ASC x Cho Moi district	Medium risk area, An Giang province	+
ASC x Unprotected areas	Farms are unprotected by August dike	+
ASC x Inundation status	Farm was inundated by a recent flood	+
Risk perceptions, opinion		
ASC x Risk perception	Flood is the most catastrophic disaster	+
ASC x Wishful thinking	Flood will never happen here again	-
ASC x Disaster relief	Government should provide post flood relief for victims.	-
Socio-economic charateristics		
ASC x Age of household head	Age of household head	?
ASC x Household size	Number of people live in the family during the last six months.	?
ASC x Income per capita	Total yearly income per capita	+
ASC x Agricultural land size	Total areas of agricultural production	-
ASC x Purely agricultural activities	Income share from agricultural activities	?
ASC x Agricultural cooperative	Member of agricultural cooperative	-
Insurance experience		

ASC x Health insurance	Bought health insurance	+
Interactions with attributes		
Cover x Risk averse	Risk aversion from risk attitude game	+
Premium x Income per capita	Total yearly income per capita	+

3.2 Sample characteristics

The study sites consist of five districts from three most representative provinces in the Mekong delta, Vietnam. The map of the study sites is presented in Appendix C. The districts are located along the two main rivers in the Mekong River Delta: Tan Chau (high risk district) on the left bank of Hau river, Tan Hong (high risk district) on the right bank of Tien river; Cao Lanh (medium risk district nearby the protected wetland areas) on the right bank of Tien river, Cho Moi (medium risk district with a modern Vam Nao dike system) between Tien and Hau rivers; and Vi Thuy (low risk district nearby Xang Xa No canal) on the left bank of Hau river. The selected districts were recommended by flood risk experts from Can Tho University.

In the pre-testing stage, we randomly selected one representative commune in each district from a list of communes that had both protected and unprotected areas, provided by the Department of Agriculture and Rural Development. In each selected commune, we asked for the map and the proportion of protected and unprotected population, then decided the proportion of respondents from each area. The proportion of people living in protected areas was about 40 per cent in high risk districts, and about 90 per cent in low risk districts. Our planned sample size in each district was 100 observations, but for various reasons (such as owning no agricultural land, refusing to answer the questionnaires or answering just a part of the questionnaire) we completed 74.8 per cent of the target. We asked the head of village to accompany us an hour before approaching the randomly selected households to make sure that the research team was officially approved to conduct the survey. The village head and other neighbours were not allowed to stay around during the interviews. In Vi Thuy district, we mostly travelled by boat because the road infrastructure was poorly developed. The socio-economic characteristics of the sample are summarised in Table 3.

Table 3: Summary of socio-economic characteristics (sample mean)

	Tan Chau	Tan Hong	Cao Lanh	Cho Moi	Vi Thuy	Whole sample
Planned sample size	100	100	100	100	100	500
Actual sample size	81	81	72	71	69	374
Risk exposure and flood experience						
Percentage of August dike around farm (%)	37.1	42.0	88.9	93.0	85.5	67.7
Inundated by a recent flood (%)	72.8	93.8	95.8	67.6	87.0	83.4
Socio-demographic characteristics						
Gender of household head (male, %)	88.9	90.1	88.9	90.1	88.4	89.3
Age of household head (year)	50.3	50.9	52.7	55.3	51.9	52.1
Schooling years of household head (year)	4.8	5.7	5.5	4.9	4.9	5.2
Family size (number of people)	4.1	3.9	4.2	4.3	4.8	4.0
Agricultural land size (1000m^2)	6.2	25.3	20.8	24.9	14.7	18.3
Total yearly income (VND mil.)	76.6	150.4	154.3	283.1	113.3	153.5
Total income/season/1000m^2 (VND mil.)	3.1	2.4	2.9	3.7	3.1	3.1
Yearly cultivation income (VND mil.)	25.6	68.0	100.0	171.4	67.9	84.6
Cultivation inc./season/1000m^2 (VND mil.)	1.31	0.90	1.65	1.49	1.57	1.39
Share of income from cultivation (%)	33.0	39.1	73.1	59.3	63.4	52.6
Share of off-farm income (%)	41.6	17.8	15.8	22.6	17.8	23.5

Member of agricultural cooperatives (%)	11.1	18.5	38.9	4.2	27.5	19.8
Health insurance purchase (%)	59.3	75.3	77.8	62.0	63.8	67.7
Risk perception characteristics						
Flood is a main problem (%)	50.6	42.0	25.0	18.3	21.7	32.4
Flood will never happen again (%)	17.3	19.8	15.3	25.4	18.8	19.3
Risk coping characteristics						
Number of protection measures in past	10.0	10.7	11.0	8.7	11.3	10.3
Number of protection measures at present	8.1	8.2	9.9	8.0	11.5	9.1
Government relief						
People require disaster relief from government	86.4	86.4	76.4	88.7	82.6	84.2

Source: Household survey by the authors in January 2015.

3.3 Choice analysis

In this section, we describe the choice decisions by the sample respondents. To determine the relevant observations for further econometric analysis, we consider two things. First, we test whether there exist dominant attributes (i.e. the respondent made choice by looking at only one attribute) and attribute non-attendance cases. Second, we test whether respondents make consistent choice decisions.

3.3.1 Attribute non-attendance and dominant attributes

Immediately after the choice scenario session, the respondents who always chose 'none of the two' alternatives were asked to explain reasons of denying flood insurance purchase offers. Thanks to this follow-up question, we identified 10 respondents as protestors. We then excluded them from further analyses. Accordingly, our sample is reduced to 364 relevant respondents. For those making relevant choice decisions, we went on asking what attributes they considered when making choices among alternatives. This follow-up question is used to explore the problem of attribute non-attendance.

A summary of attribute non-attendance and dominant attribute from the follow-up questions are presented in Tables 4 and 5. Table 4 shows that about 8.2 per cent (30), 17.3 per cent (63), 32.4 per cent (118), 36.0 per cent (131), and 20.9 per cent (76) of the sample of 364 respondents ignored attributes of insurance policies, insurance provider, damage coverage, levels of deductible, and insurance premiums, respectively. It seems that the deductible was the most frequently ignored attribute. The third column of Table 4 confirms that the level of deductible was the least important attribute when respondents made choice decisions. Both insurance policy and insurance provider were highly ranked by the sampled respondents. This indicates that the respondents might be interested in what kind of insurance is and who will be the provider.

Table 4: Attribute non-attendance breakdown

Attribute	Ignored the attribute	Most important attribute	Dominant attribute
Insurance policy	8.20%	50.8%	1.65%
Insurance provider	17.3%	30.5%	1.10%
Insurance cover	32.4%	6.04%	0.00%
Level of deductible	36.0%	2.20%	0.00%
Insurance premium	20.9%	7.14%	0.55%

Figures of Table 4 (column four) and Table 5 indicate that about 3.3 per cent of respondents used only one attribute to make choice decisions. In addition, about 2.2 per cent of respondents ignored all five attributes. Thus, 5.5 per cent (=3.3 + 2.2) of the respondents did not provide information on their willingness to make trade-offs among the attributes of flood

insurance products. In the later econometric analyses, this group of respondents (20) are also excluded.

Table 5 also indicates that only 42.9 per cent of respondents considered all five attributes in making their choice decisions. In comparison with previous studies using choice experiments (See Thanh Cong Nguyen et al., 2015), the share of respondents ignoring at least one attribute in our study is relatively high (57.1 per cent). Specifically, 24.7 per cent of respondents ignored one attribute, 14.8 per cent two attributes, 12.1 per cent three attributes, 3.3 per cent four attributes, and 2.2 per cent five attributes. The ignorance of attribute non-attendance in previous flood insurance studies could thus be questionable in assessing the validity of WTP value measures.

Table 5: Attribute processing strategy of respondents

Attribute processing strategy	Number of respondents	Share of respondents
Respondents attended all attributes	**156**	**42.9%**
Respondents ignoring 1 attribute	**90**	**24.7%**
Policy	6	1.65%
Provider	20	5.49%
Cover	20	5.49%
Deductible	31	8.51%
Premium	13	3.57%
Respondents ignoring 2 attributes	**54**	**14.8%**
Policy and provider	0	0.00%
Policy and cover	4	1.10%
Policy and deductible	2	0.55%
Policy and cost	0	0.00%
Provider and cover	4	1.10%
Provider and deductible	7	1.92%
Provider and premium	1	0.27%
Cover and deductible	24	6.59%
Cover and premium	7	1.92%
Deductible and premium	5	1.37%
Respondents ignoring 3 attributes	**44**	**12.1%**
Policy, provider, and cover	0	0.00%
Policy, provider, and deductible	0	0.00%
Policy, provider, and premium	0	0.00%
Policy, provider, and deductible	2	0.55%
Policy, cover, and deductible	1	0.27%
Policy, cover, and premium	1	0.27%
Policy, deductible, and premium	0	0.00%
Provider, cover, and deductible	10	2.75%
Provider, cover, and premium	1	0.27%
Provider, deductible, and premium	4	1.10%
Cover, deductible, and premium	25	6.87%
Respondents ignoring 4 attributes	**12**	**3.3%**
Policy, provider, cover, and deductible	2	0.55%
Policy, provider, cover, and premium	0	0.00%
Policy, provider, deductible, and premium	0	0.00%
Policy, cover, deductible, and premium	4	1.10%
Provider, cover, deductible, and premium	6	1.65%
Respondents ignored all five attributes	**8**	**2.2%**
Total	**364**	**100%**

3.3.2 Choice consistency

Using the Kruskal-Wallis equality-of-populations rank test, we find that there is no statistically significant difference among the eight groups in terms of choice decisions (p-value = 0.9656). This indicates that the random blocking of our experimental design is reliable. In addition, 68.68 per cent of the respondents said that they were aware of the similarity of the repeated set to one of the six choice sets. This awareness rate was higher than the rate estimated by Brouwer et al. (2013) (about 38 per cent). This higher rate could be due to the lower number of choice sets per respondent and attributes per choice option in our study, giving a lower fatigue effect (See Carlsson et al., 2012). In addition, the attributes of flood return period and probability of fatality in Brouwer et al. (2013) could be beyond the cognitive ability of low educated farmers in developing countries. Of the respondents who were aware of the similarity between the two choice sets, 91.2 per cent made consistent choices. This rate is also higher than the study of Brouwer et al. (2013) (about 83 per cent). Therefore, we are confident of stable preferences in the current study.

Table 6: Estimated binary logistic model (1 = changed choice in last choice task)

Variables	*Description*	*Coefficient*
Experimental design characteristics		
Choice set 1	Last card was the first card, dummy	-0.15834
Choice set 2	Last card was the first card, dummy	-0.51178
Choice set 3	Last card was the first card, dummy	0.48236
Choice set 4	Last card was the first card, dummy	0.62357
Choice set 5	Last card was the first card, dummy	-1.0448
Reliability	Not reliable = 1, very reliable = 5	0.33730
Complexibility	Easily = 1, very complex = 5	0.25779
Time	Time to complete the choice experiment	0.08592**
Respondent characteristics		
Gender	Gender of respondents (1 = male)	1.37619
Age	Age of respondents	-0.02982
Education	Schooling years of respondents	-0.24918***
Income per capita	Million VND	0.00056
Model summary statistics		
Log likelihood	-62.02	
Pseudo R^2	0.138	
Number of observations	248	

To explain why respondents made different choice decisions in the last repeated choice set, we regress the dependent variable (1 = changed choice in the last choice task) on a number of socio-demographic and experimental design characteristics. The regression results are presented in Table 6. We realize that the order of the repeated choice sets does not statistically affect choice decisions of the respondents. The choice consistency is also not dependent on respondents' judgment about the choice scenarios and the complexibility of the choice sets. Those who spent more time to complete the choice session, however, were more likely to make inconsistent choices. In addition, higher-educated respondents were more likely to make consistent choices.

4. Econometric analysis

The relevant choices (i.e. 4104 observations) were regressed on the attributes and interactive variables using the random parameter logit model to estimate preference heterogeneity in the population (See Appendix D for the model equation). We also estimated conditional logit models, but the results were not as good as their random parameter logit counterparts. According to Hensher et al. (2005), a normal distribution produces the statistically best fit for

continuous variables, and a uniform distribution is appropriate for dummy variables. The random parameter logit models were estimated using a Halton sequence of 5000 replications in Nlogit 4.0. In addition, we found that a restriction on the variance of qualitative variables (i.e. variance = 0.75*mean) statistically improved the significance of the standard deviation random parameters. Notes: we also run various models with different replications (e.g. 1000, 2000, 3000, 7000, 9000), but the models with a Halton of 5000 replications provided the best statistics. Besides, we put various restrictions on variance (e.g. 0.9, 0.8, 0.7, 0.6), but the restriction of 0.75 resulted in the best fit models (i.e. statistically significant standard deviation of random parameters, smallest AIC, and highest Pseudo R^2 in each model).

Table 7: Coding methods for qualitative variables

Variables	Levels	Dummy coding				Effects coding			
		Code 1	Code 2	Code 3	Code 4	Code 1	Code 2	Code 3	Code 4
Insurance policy	1	0	0	0		-1	-1	-1	
	2	1	0	0		+1	0	0	
	3	0	1	0		0	+1	0	
	4	0	0	1		0	0	+1	
Insurance provider	1	0	0			-1	-1		
	2	1	0			+1	0		
	3	0	1			0	+1		
Deductible	1	0				-1			
	2	1				+1			
District	1	1	0	0	0	-1	-1	-1	-1
	2	0	1	0	0	0	+1	0	0
	3	0	0	1	0	0	0	+1	0
	4	0	0	0	1	0	0	0	+1
	5	0	0	0	0	0	0	0	0
Dike	1	0				-1			
	2	1				+1			
Agricultural cooperative	1	0				-1			
	2	1				+1			
Inundation status	1	0				-1			
	2	1				+1			
Age	1	0				-1			
	2	1				+1			
Wishful thinking	1	0				-1			
	2	1				+1			
Health insurance	1	0				-1			
	2	1				+1			
Risk aversion	1	0				-1			
	2	1				+1			

Because attribute non-attendance exists in our current study, we adopt the estimation method previously used in the study of Thanh Cong Nguyen et al. (2015). In addition, we also investigate whether effects coding results in any differences in comparison with traditional dummy coding in flood insurance choice experiments. We estimated the following models:

Model 1 (full attribute attendance, dummy coding): this model assumes that all respondents have full attendance to the attributes, and qualitative attributes and qualitative covariates are conventionally coded as dummy variables (See Table 7).

Model 2 (full attribute attendance, effects coding): this model assumes that all respondents have full attendance to the attributes, and qualitative attributes and qualitative covariates are coded by using the effects coding method (See Table 7).

Model 3 (restriction of zero parameter, effects coding): this model assumes that the parameters of attributes ignored by respondents are simply assigned zero values. Specifically, if a respondent *i* ignored an attribute *j* in a choice set, the coefficient β_{ij} is constrained to zero. The effects coding is applied to qualitative attributes and qualitative covariates.

Model 4 (attribute non-attendance interaction, effects coding): this model includes interaction terms between the attributes and their corresponding non-attendance dummy variables. We call these non-attendance dummy variables as ignored attributes. If a certain attribute non-attendance influences respondents' choice decision, the coefficient of its corresponding ignored attribute becomes statistically significant. In the same manner with models 2 and 3, the effects coding is applied to qualitative attributes and qualitative covariates.

5. Results

5.1 Random parameter logit models

Table 8 shows that all four models strongly fit the sample data, because they have a pseudo-R^2 greater than 0.2 (Hoyos, 2010). We then select one model that best fits the data by using the Akaike information criterion (AIC), Schwarz's Bayesian criterion (BIC), Hannan-Quinn information criterion (HQIC). Table 8 indicates that model 3 is the best fitted model based on these criteria. We also ran models 3 and 4 using dummy coding, but this did not improve the models' information criteria. This could suggest that the respondent's marginal utility with respect to the ignored attribute was likely to be zero. Accordingly, ignorance of attribute non-attendance could lead to model misspecifications.

Table 8: Model selection criteria (5000 Halton replications)

Model	Parameters	Log likelihood	AIC	BIC	HQIC	Pseudo R^2
Model 1	29	-929.86	1.47177	1.58689	1.51496	0.35043
Model 2	29	-930.11	1.47216	1.58728	1.51535	0.35025
Model 3	29	-920.30	**1.45710**	**1.57222**	**1.50029**	0.35711
Model 4	37	-916.06	1.46287	1.60974	1.51797	0.36007

Although effects coding in model 2 does not statistically improve the model statistics (Table 8), the insignificance at 5 per cent of the ASC and the opposite sign of flood plus whirlwind attribute (Table 9, Appendix E) prove that dummy coding could lead to multicollinearity between dummy variables and the alternative specific constant (Bech and Gyrd-Hansen, 2005). Recall that in all models, the ASC takes zero for the alternative describing the status quo (i.e. none of the flood insurance alternatives), the value one otherwise. By coding this way, the significantly negative signs of the ASC indicate that respondents, on average, favor the status quo to any of the offered insurance alternatives. All effects coding models show that the problem of status quo bias (i.e. respondents disfavor insurance program) exists in the Mekong river delta, Vietnam. In particular, 'none of the two insurance alternatives' was selected in about 64 per cent of the observed choices.

Almost all the standard deviations of random parameters presented in the lower part of Table 9 are statistically significant at 5 per cent. The significant coefficients of standard deviation affirm that there exists preference heterogeneity among respondents in the sample and that the random parameter logit models are better fitted than conditional logit models. Looking at the upper part of Table 9, we see that the signs of all attribute coefficients are as expected in the effects coding models (i.e. models 2-4). Except for 'flood plus whirlwind', main-effect coefficients are statistically significant at 5 per cent in Model 3.

For those who favor insurance policy, the triple disaster insurance is more preferred compared to double disaster insurance, and the double insurance is preferred to single flood insurance. However, the preference is not always the same among the respondents because

the standard deviations of these random parameters are highly significant. Because both coefficient and standard deviation of 'flood plus whirlwind' parameter are not significant, we could expect that farmers generally are indifferent to the purchase of 'flood plus whirlwind' insurance policy. This could be explained by the fact that farmers can protect themselves by planting trees around farms and houses. In addition, whirlwind is often accompanied with heavy rain, which results in inundation. For that reason, people tend to favor triple disaster insurance over 'flood plus whirlwind' insurance.

The significant positive coefficient of 'joint-stock company' and the significant negative coefficient of 'international company' imply that farmers prefer joint-stock companies to private companies, and private companies to international companies. A possible explanation is that international insurance companies operate mostly in urban areas. Therefore, rural households are not familiar with their service quality. Preference heterogeneity is also detected for insurance providers in all effects coding models. This indicates that not all farmers favor joint-stock companies and/or disfavor international companies. Therefore, the international insurance companies will have an opportunity to offer flood insurance services if the market becomes available.

The significant positive coefficient for insurance cover means that the higher cover per $1000m^2$, the more likely farmers will potentially buy flood insurance policy. This also implies that farmers are risk averse. However, the insignificant or less significant coefficients of interactive variables between coverage and risk aversion could indicate that not only risk-averse farmers are looking for higher insurance cover. In the lower part of Table 9, we see that the standard deviation of this random parameter is statistically significant in model 3.

The significant negative coefficients of 'high deductible' and 'premium' mean that, for those who choose insurance policy, they are more likely to favor lower levels of deductible and cheaper premium. This indicates that respondents are willing to adopt self-protection measures to expect a lower payment of premium. The positive coefficient of the interactions between premium and income per capita suggests that the richer the households, the more likely they are willing to pay more for flood insurance. However, this is only true if we accept 10 per cent level of significance. The insignificance of the standard deviation of the premium parameter shows that farmers always prefer lower to higher premiums. The standard deviation of the random parameter for the deductible is statistically significant in all models. Depending on self-protection efforts of farmers, the insurance providers will negotiate the reasonable level of deductible to share the risk of flooding.

5.2 Willingness to pay for flood insurance

The willingness to pay (WTP) for each insurance package is calculated from the estimated random parameter logit models presented in Table 10. To estimate the WTP value for each insurance package and its corresponding standard error, we use the Wald command in Nlogit 4.0. The WTP for an insurance package depends on the following factors:

1) **Insurance policy:** flood insurance, flood plus waterlog, flood plus whirlwind, and flood plus waterlog and whirlwind.
2) **Insurance provider:** joint-stock company, international company, and domestic private company.
3) **Insurance coverage:** VND 2 million/$1000m^2$, VND 3 million/$1000m^2$, and VND 3 million/$1000m^2$.
4) **Deductible level:** low deductible (10 per cent), and high deductible (25 per cent).

The formula of WTP calculation is the same as that used in Brouwer and Akter (2010). It is defined as follows:

$$WTP = -\frac{(\hat{\beta}_{\text{insurance type}} + \hat{\beta}_{\text{provider}} + \hat{\beta}_{\text{cover}} * \text{cover} + \hat{\beta}_{\text{deductible}} * \text{deductible})}{\hat{\beta}_{\text{premium}}}$$

For the base case, which is a single flood insurance policy with high deductible offered by a private company, the estimated WTP depends on how the qualitative attributes are coded. The mean WTPs and their corresponding standard errors are presented in Tables 10-12 (See Appendix F). From these tables, we have the following remarks:

First, the dummy coding method overestimates the WTP values, and thus increases the level of significance (i.e. comparing the corresponding insurance packages between model 1 and model 2). This implies a potential risk for policy decision making.

Second, ignorance of attribute non-attendance could also overestimate the WTP of insurance packages because the respondents that ignored a certain attribute could assign a very low or even zero value for that attribute. This is also a potential risk for policy decision making.

Third, farmers do not have demand for flood insurance only. There is a potential market for combined insurance policy (i.e. flood with other disasters insurance). Because farmers often face various natural disasters during the rainy season, they have an interest in coping with the most prevalent disasters at once instead of only one.

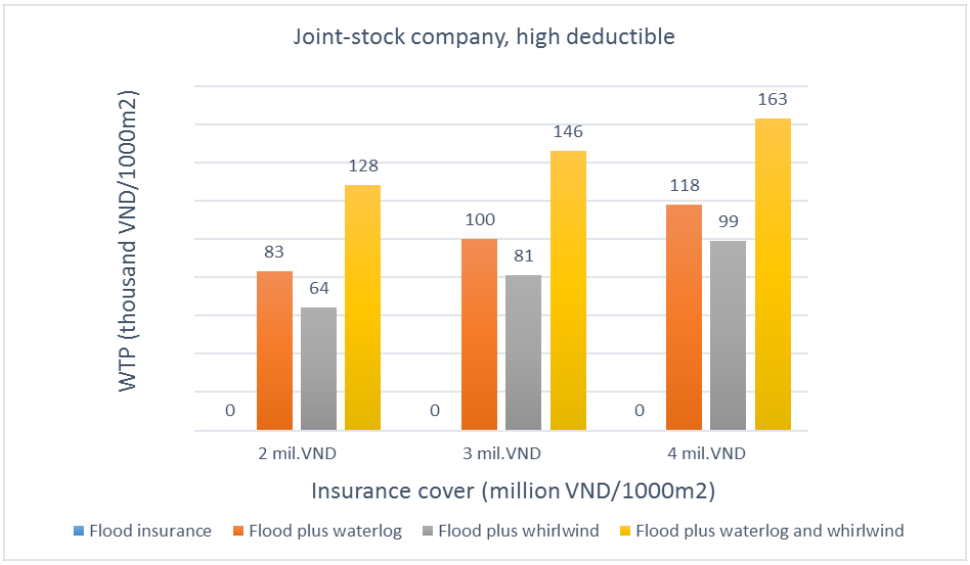
Fourth, the triple-disaster insurance could offer opportunities for all potential providers, not just joint-stock companies. If the break-even profit point is about VND 20,000, both private and international insurance companies could make a profit by providing triple-disaster insurance products. Farmers who are only interested in insuring floods combined with either waterlog or whirlwind risks can choose the joint-stock companies in the region.

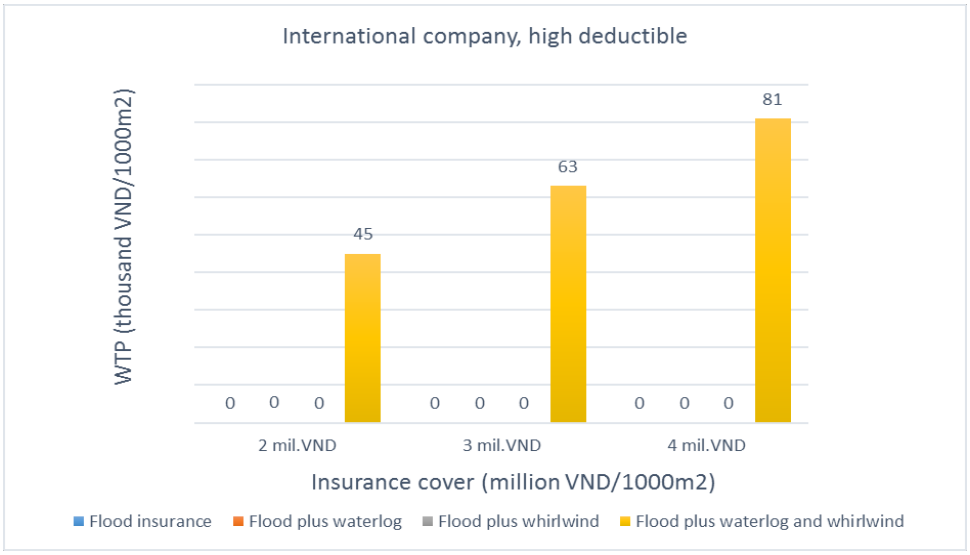
Fifth, farmers have ability to pay for flood insurance packages because the WTP just accounts for a small percentage of their income from agricultural cultivation (See Table 3). Particularly, if they choose triple-disaster insurance packages, the WTP per 1000m^2 per season is just equivalent to 2.8 per cent (for low cover, international company) to 10.6 per cent (for high cover, join-stock company) of agricultural cultivation activities. The percentage becomes even smaller if we compare to total income.

The mean willingness to pay for various flood insurance packages estimated from model 3 is depicted in Figure 1.

5.3 Challenges and opportunities of insurance markets

Our results suggest that a very high proportion of the sample disfavor flood insurance (approximately 64 per cent chose the status quo). This indicates that flood insurance might be beyond the understanding of farmers in a poor country. If this is the case, the government can provide information through various communication programs. In addition to relatively high WTP for flood insurance policy as discussed in the previous section, perceptions and attitudes of farmers towards insurance programs could provide a positive signal for developing an insurance market. This section aims to exploit the challenges and opportunities of implementing a flood insurance in the Mekong river delta, Vietnam. To answer these questions, we look at the significant coefficients of interactive variables between the ASC and socio-demographic characteristics in Table 9.





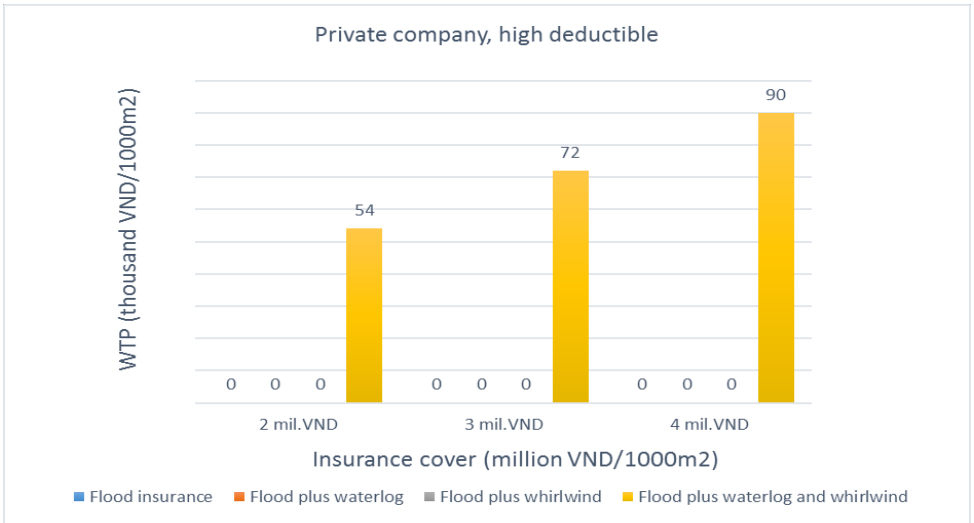


Figure 1: Estimated WTP for various flood insurance packages per type of insurance company, for a high deductible.

5.3.1 Challenges

First, the significant negative coefficients of the interaction of the ASC with Tan Chau, Tan Hong and Cao Lanh indicate that people at higher risk regions do not favor the insurance plan compared to those who live in low risk regions (Vi Thuy district). This could be explained by the 'full-dike and cluster' effect. After the catastrophic flood in year 2000, the government made huge investments in construction of large-scale full-dike systems and residential clusters[5]. This might cause residents from that region to blindly trust in the safety of the infrastructure. Households in Cao Lanh district, in addition to the flood regulating function of the surrounding wetland, are relatively far away from the main river and canals. Therefore, they might feel safe from flooding.

Second, the significant negative coefficients of the interaction of the ASC with 'wishful thinking' indicate that respondents who a believe that floods will never happen again in their area are not interested in buying flood insurance. This may reflect the gambler's fallacy, which may "lead some respondents to believe that the odds of another flood occurring in the area in subsequent years have declined after a recent flood" (Atreya et al., 2015). In our case, however, not all respondents have the same wishful thinking, because the standard deviations of the random parameters are statistically significant in all models.

Third, the significant negative interaction term of the ASC and 'purely agricultural households' imply that the more a household depends on agricultural activities, the more likely the household heads refuse insurance. This could be a big challenge, because the focus of the insurance program is to help farmers to be less vulnerable to natural disaster risks. However, purely agricultural households may resist adoption of institutional (e.g. insurance) innovations because they "are not risk-averse but rather loss averse" (Hazell and Rahman, 2014, p.237).

Fourth, the significant positive interaction term of the ASC and 'age of household head' and its corresponding standard deviation of random parameter mean that people over 40 years old are often interested in flood insurance program. This can be explained in two ways. Risk aversion rises as age increases, so demand for flood insurance increases with age (Atreya et al., 2015). In addition, the older the household head, the more flood disasters probably have been experienced, and this leads to more demand, because flood experience was widely found to have a positive effect on demand for insurance.

Finally, the significant negative interaction term of the ASC and 'agricultural cooperative' reveals that members of agricultural cooperatives disfavor an insurance plan. The governments in the Mekong River Delta expect to expand the agricultural cooperative development program to realise economies of scale. Currently, about 20 per cent of households in the study sites joined agricultural cooperatives, and the number of members will increase in coming years. This phenomenon could be explained by moral hazard. Besides the state-of-the-art production technology, the cooperative implicitly provides commonly adaptation measures such as pump stations, early weather warning system, special loan policy for cooperative members, and various agricultural extension services. Therefore, members of cooperatives do not have further incentives to cope with disaster risks themselves via the insurance scheme. In the lower part of Table 9, we see that the statistically significant standard deviations of this random parameter, however, indicate that some cooperative members think differently, and have a desire for a flood insurance scheme.

[5] The residential clusters provide basic infrastructures such as roads, electricity, water supply, and sewage systems and concrete house foundations. Almost all households who lived on their farms before the year 2000 have been moved to the nearby residential clusters.

5.3.2 Opportunities

First, the significant positive coefficients of 'unprotected area' mean that households with farms and farming properties not protected by August dikes[6] (i.e. it is risky to produce summer-autumn and autumn-winter crops) are more likely to buy flood insurance. However, the significant standard deviations of its random parameter in the lower part of Table 9 indicate that a part of the respondents might dislike flood insurance.

Second, the significant positive coefficients of 'inundation status' and 'flood risk perception' in effects coding models indicate that those who experienced a recent flooding favor insurance alternatives. This is consistent with previous studies in both developed and developing countries. The most appropriate explanation for this behavior is the availability heuristic (i.e. "a recent flood event can be easily brought into mind and therefore heightens the perceived probability of a future flood, which leads to purchasing flood insurance" (Atreya et al., 2015)). The standard deviation of 'inundation status' random parameter is statistically significant, which suggests that a part of respondents with flood experience might not buy flood insurance.

Third, the significant positive coefficients of 'government disaster relief' in all models mean that the charity hazard might not exist in the Mekong river delta. This could be that the post flood disaster reliefs from government cannot fully compensate for the damage costs. For example, after the catastrophic flood in 2011, local farmers only received a subsidy about VND 0.5 million per 1000m^2 (Ngoc Anh, 2011).

Finally, the significant positive coefficients of 'income per capita' in models 3 and 4 imply that households with higher income per capita are willing to join a flood insurance program. This is quite clear because households with higher income have higher ability to pay for insurance premium. In our study site, the WTPs just account for approximately 2.8 to 10.6 per cent of agricultural cultivation value per 1000m^2, and approximately 1.3 to 4.8 per cent of total income per 1000m^2.

6. Conclusion

Insurance has played an important role in adapting to climate risks, particularly for flood hazards. There has been an increasing number of studies on the flood insurance demand in various developed countries. Studies in developing countries, mostly using stated preference methods, have been not only rare, but are often problematic either in terms of experimental designs or estimation techniques. Consequently, mixed results were found even in the same country. We, therefore, have tried to make novel contributions to the existing literature of the field by changing the experimental design and by applying different coding methods. The purpose of this study was to estimate WTP for flood insurance using a choice experiment with special care of attribute non-attendance and effects coding of qualitative variables. We collected a random sample of 374 households from five districts in the Mekong river delta during the flooding season in year 2015, used random parameter logit models, and found some interesting results.

First, effects coding method results in better econometric estimation thanks to solving multicollinearity among the ASC and qualitative attributes. Second, attribute non-attendance has significant effects on model coefficients and WTP values. Third, a large proportion of respondents still favor the status quo because they are influenced by the full-dike and cluster effect, endowment effect, wishful thinking, and moral hazard. Fourth, a young generation of

[6] In the Mekong river delta, farms are protected by a semi-dike made of clay and trees. Besides the dike is an irrigation canal which connects to rivers.

household heads is averse to flood insurance schemes. Fifth, there is a potential for a profitable activity for the insurers if the market becomes available because the WTPs are much higher than necessary to reach the estimated break-even profit. Seventh, combined insurance policy and joint-stock company are more preferred to single flood insurance policy and other private companies. Finally, the prospect of a future insurance market is favorable because there is no evidence of adverse selection and charity hazard found in this study.

We hope the findings can provide some guidance for policy making in Vietnam. First, for a successful implementation of a future flood insurance program it is important to enhance the understanding and awareness of purely agricultural communities, especially the younger population regarding the role and operation mechanism of insurance in reducing damages. Second, communication programs should clearly define the responsibility of each stakeholder in integrated flood management strategies, because a part of the households in high risk areas still blindly trust in the wonder of large-scale dikes and collective adaptation measures. To get reduce wishful thinking, awareness campaigns should target on how climate change affects the strength and frequency of floods, especially in the Greater Mekong Sub-region countries. The communication could focus on immediate reminders of exposure to flood risk. Finally, it is recommended that the government should not provide a generous subsidy because the average WTP for risk reduction is relatively high.

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References

Aerts, J.C.J.H., Botzen, W.J.W., 2011. Climate change impacts on pricing long-term flood insurance: A comprehensive study for the Netherlands. Global Environmental Change. 21(3), 1045-1060.

Akter, S., Brouwer, R., van Beukering, P.J.H., French, L., Silver, E., Choudhury, S., Aziz, S.S., 2011. Exploring the feasibility of private micro flood insurance provision in Bangladesh. Disasters. 35(2), 287-307.

Atreya, A., Ferreira, S., Michel-Kerjan, E., 2015. What drives households to buy flood insurance? New evidence from Georgia. Ecological Economics. 117, 153-161.

Baumann, D.D., Sims, J.H., 1978. Flood insurance: Some determinants of adoption Economic Geography. 54, 189-196.

Bech, M., Gyrd-Hansen, D., 2005. Effects coding in discrete choice experiments. Health Economics. 14, 1079-1083.

Botzen, W.J.W., Aerts, J.C.J.H., van den Bergh, J.C.J.M., 2009. Willingness of homeowners to mitigate climate risk through insurance. Ecological Economics. 68(8–9), 2265-2277.

Botzen, W.J.W., van den Bergh, J.C.J.M., 2008. Insurance against climate change and flooding in the Netherlands: Present, future, and comparison with other countries. Risk Analysis. 28(2), 413-426.

Botzen, W.J.W., van den Bergh, J.C.J.M., 2012. Risk attitudes to low-probability climate change risks: WTP for flood insurance. Journal of Economic Behavior and Organization. 82(1), 151-166.

Bouwer, L. M., Vellinga, P., 2005. Some Rationales for risk sharing and financing adaptation. Water Science and Technology. 5(51), 89–95.

Bouwer, L.M., Bubeck, P., Aerts, J.C.J.H., 2010. Changes in future flood risk due to climate and development in a Dutch polder area. Global Environmental Change. 20(3), 463-471.

Bouwer, L.M., Vellinga, P., 2002. Changing climate and increasing costs: Implications for liability and insurance. In Beniston, D. (Ed.), Climatic change: Implications for the hydrological cycle and for water management (Vol.10, 429–444). Springer, Dordrecht and Boston, MA: Advances in Global Change Research.

Brissette, F.P., Leconte, R., Marche, C., Rousselle, J., 2003. Historical evolution of flooding damage on a USA/Quebec river basin. Journal of the American Water Resources Association. 39(6), 1385-1396.

Brouwer, R., Akter, S., 2010. Informing micro insurance contract design to mitigate climate change catastrophe risks using choice experiments. Environmental Hazards. 9(1), 74–88.

Brouwer, R., Tinh, B.D., Tuan, T.H., Magnussen, K., Navrud, S., 2013. Modeling demand for catastrophic flood risk insurance in coastal zones in Vietnam using choice experiments. Environment and Development Economics. 19(02), 228-249.

Browne, M., Hoyt, R., 2000. The demand for flood insurance: Empirical evidence. Journal of Risk and Uncertainty. 20(3), 291-306.

Bubeck, P., Botzen, W.J.W., Aerts, J.C.J.H., 2012a. A review of risk perceptions and other factors that influence flood mitigation behavior. Risk Analysis. 32(9), 1481-1495.

Bubeck, P., Botzen, W.J.W., Suu, L.T.T., Aerts, J.C.J.H., 2012b. Do flood risk perceptions provide useful insights for flood risk management? Findings from central Vietnam. Journal of Flood Risk Management. 5(4), 295-302.

Burby, R.J., 2006. Hurricane Katrina and the paradoxes of government disaster policy: bringing about wise governmental decisions for hazardous areas. Ann. Am. Acad. Pol. Social Science. 604 (1), 171 –191.

Carlsson, F., Morkbak, M.R., Olsen, S.B., 2012. The first time is the hardest: A test of ordering effects in choice experiments. Journal of Choice Modelling. 5(2), 19-37.

Colombo, S., Christie, M., Hanley, N., 2013. What are the consequences of ignoring attributes in choice experiments? Implications for ecosystem service valuation. Ecological Economics. 96, 25-35.

Dumm, R. E., Eckles, D. L., Nyce, C., Volkman-Wise, J. (2015). Demand for catastrophe insurance and the representative heuristic. Retrieved from http://www.stjohns.edu/sites/default/files/tcb/eckles_chubb2015.pdf

Hazell, P.B.R., Rahman, A., 2014. New directions for smallholder agriculture. Oxford University Press.

Hensher, D.A., Rose, J.M., Greene, W.H., 2005. Applied choice analysis: A primer. Cambridge University Press.

Hoff, H., Bouwer, L., Berz, G., Kron, W., Loster, T., Warner, K., Bank, D., 2003. Risk management in water and Climate–the role of insurance and other financial services. Dialogue on Water and Climate/Munich Reinsurance Company, Delft/Munich.

Hoyos, D., 2010. The state of the art of environmental valuation with discrete choice experiments. Ecological Economics. 69, 1595-1603.

Huber, M., 2011. Insuring climate change – managing political and economic uncertainties in flood management. In Gramelsberger, G., Feichter, J., (Ed.), Climate change and policy: The calculability of climate change and the challenge of uncertainty. New York: Springer.

Kabat, P., Vierssen van, W., Veraart, J., Vellinga, P., Aerts, J., 2005. Climate Proofing the Netherlands. Nature. 438, 283–284.

Kleindorfer, P., Kunreuther, H., 1999. The Complementary Roles of Mitigation and Insurance in Managing Catastrophic Risks. Risk Analysis. 19(4), 727-738.

Kousky, C., 2010. Understanding the demand for flood insurance. Natural Hazards Review. 12 (2), 96 –110.

Kriesel, W., Landry, C., 2004. Participation in the national flood insurance program: An empirical analysis for coastal properties. The Journal of Risk and Insurance. 71, 405-420.

Kunreuther, H., 1996. Mitigating disaster losses through insurance. Journal of Risk and Uncertainty. 12(2-3), 171-187.

Kunreuther, H., 2008. Reducing losses from catastrophic risks through long-term insurance and mitigation. Social Research: An International Quarterly. 75(3), 905-930.

Kunreuther, H., Michel-Kerjan, E., 2009. Managing catastrophes through insurance: Challenges and opportunities for reducing future risks. Philadelphia, Pa.: Wharton Risk Management and Decision Processes Center. Working Paper, 11-30.

Kunreuther, H., Pauly, M., 2006. Rules rather than discretion: Lessons from Hurricane Katrina. Journal of Risk and Uncertainty. 33(1-2), 101-116.

Lindell, M.K., Hwang, S.N., 2008. Households' perceived personal risk and responses in a multihazard environment. Risk Analysis. 28(2), 539 –556.

Lindell, M.K., Perry, R.W., 2000. Household adjustment to earthquake hazard: A review of research. Environment and Behavior. 32, 461-501.

Lo, A. Y. (2013a). Household preference and financial commitment to flood insurance in South-East Queensland. Australian Economic Review. 46(2), 160-175.

Lo, A. Y. (2013b). The role of social norms in climate adaptation: Mediating risk perception and flood insurance purchase. Global Environmental Change. 23(5), 1249-1257.

Michel-Kerjan, E., Kousky, C., 2010. Come rain or shine: evidence on flood insurance purchases in Florida. Journal of Risk and Insurance. 77 (2), 369 –397.

Mills, E. 2005. Insurance in a Climate of Change. Science. 309, 1040-1044

Ngo, D. V., 2013. Một hạt lúa cõng bao nhiêu phí [How much is cost of paddy production per season]. Tuổi trẻ online. Retrieved from http://tuoitre.vn/tin/tuoi-tre-cuoi-tuan/20130527/mot-hat-lua-cong-bao-nhieu-phi/550231.html.

Ngoc Anh, 2011. Thiệt hại gần 1.000 tỷ đồng vì lũ ở ĐBSCL [1.000 billion damage in the floods in the Mekong river delta]. Retrieved from http://vietnamnet.vn/vn/xa-hoi/42922/thiet-hai-gan-1-000-ty-dong-vi-lu-o-dbscl.html.

Petrolia, D.R., Landry, C.E., Coble, K.H., 2013. Risk preferences, risk perceptions, and flood insurance. Land Economics. 89(2), 227-245.

Reynaud, A., Manh-Hung, N., 2012. Monetary valuation of flood insurance in Vietnam. VIETFLOOD Working Paper.

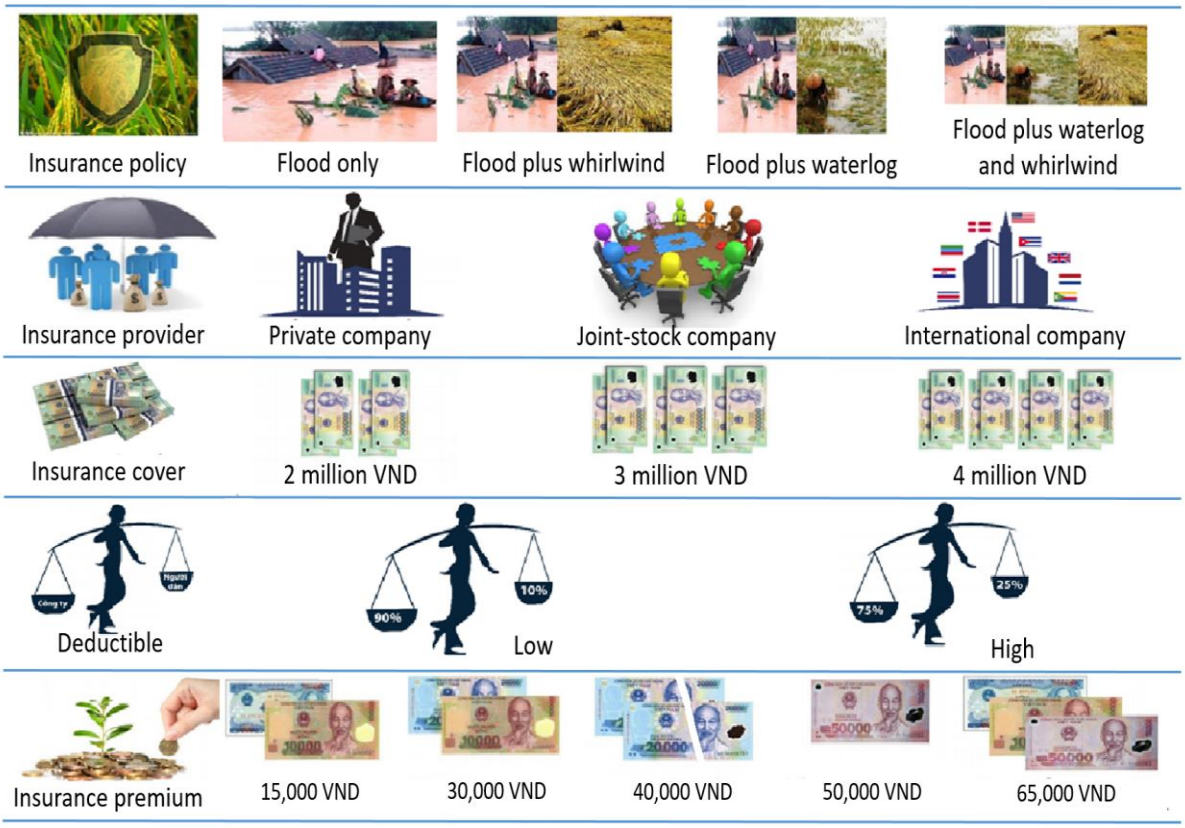
Scott, A., 2002. Identifying and analysing dominant preferences in discrete choice experiments: An application in health care. Journal of Economic Psychology. 23, 383-398.

Thanh Cong Nguyen, Robinson, J., Whitty, J.A., Keneko, S., 2015. Attribute non-attendance in choice experiments: A case study in a developing country. Economic Analysis and Policy. 47, 22-33.

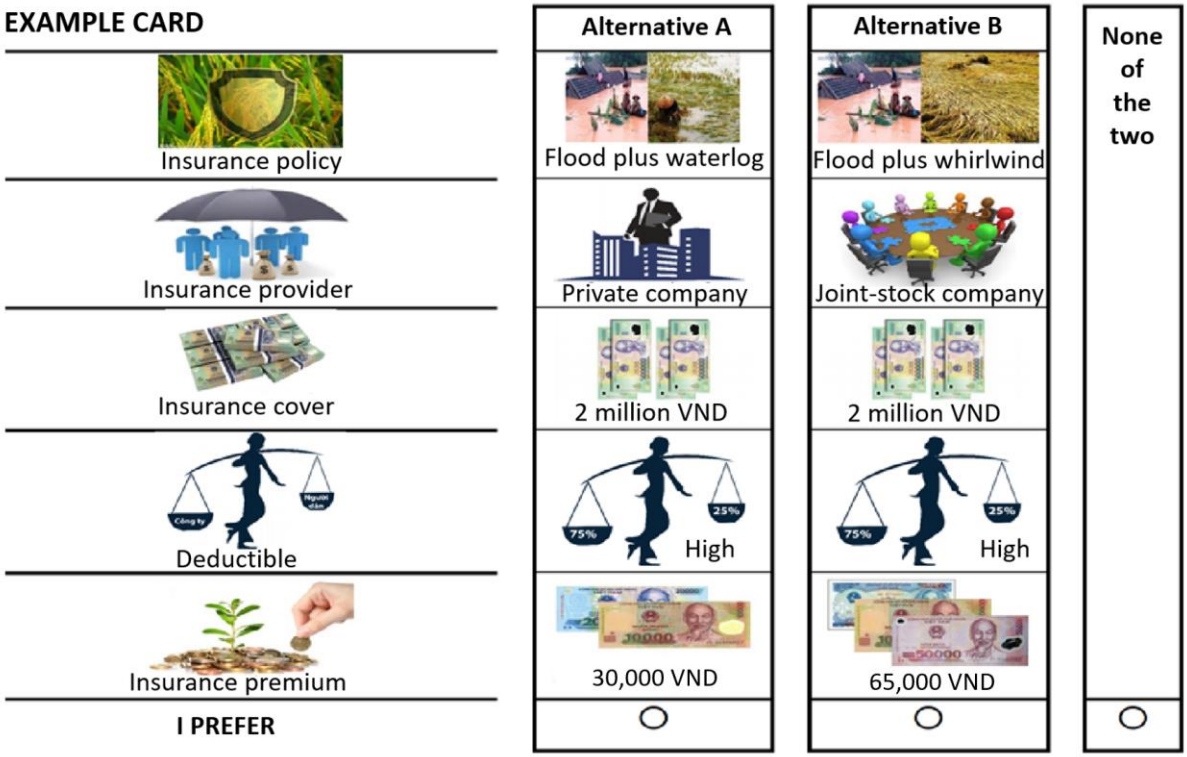
Zahzran, S., Weiler, S., Brody, S.D., Lindell, M.K., Highfield, W.E., 2009. Modeling national flood insurance policy holding at the county scale in Florida, 1999-2005. Ecological Economics. 68, 2627-2636.

APPENDIX A: GENERAL CARD AND EXAMPLE CARD

GENERAL CARD



EXAMPLE CARD



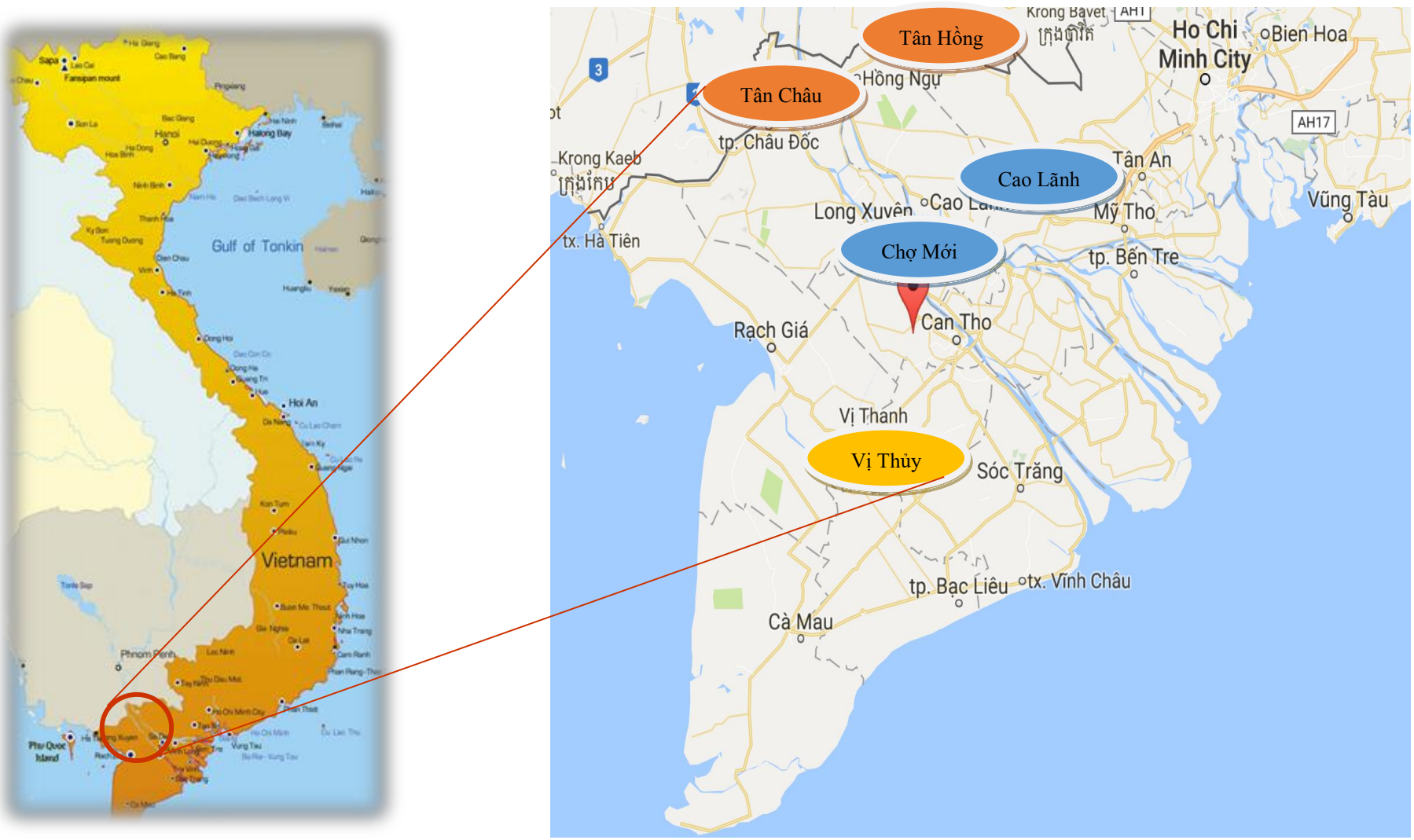
APPENDIX B: RISK ATTITUDE GAME

Now, you have a short break before we go on asking you other information. During the break, we invite you to play a game with us. This game has five rounds (you have a right to stop the game at any round because the scenarios are independent to each other). Each scenario has two options. Suppose you choose 'option A', you then certainly receive a telephone card that is equivalent to the amount offered; and suppose you choose 'option B', you then have to draw a lottery from a bag with two possibilities: (1) If you draw the YELLOW ball from the bag, then you will win a telephone card that is equivalent to the amount VND; (2) If you draw the WHITE ball, then you get nothing. Note that, before playing the game, our enumerator will ask you to check the balls inside the bag to make sure that the game is fair.

As the game is over, our enumerator will invite you to draw one of the five scenarios to decide which scenario you will really play.

Scenario	Option A	Option B	Which one you choose, A or B?	For enumerator
1	VND 25.000	VND 30.000 if you draw YELLOW ball; VND 0 if you draw WHITE ball.		If the respondent chose A, enumerator goes to scenario 2. If chose B, enumerator lets the respondent draw the ball, and stop the game.
2	VND 20.000	VND 30.000 if you draw YELLOW ball; VND 0 if you draw WHITE ball.		If the respondent chose A, enumerator goes to scenario 3. If chose B, enumerator lets the respondent draw the ball, and stop the game.
3	VND 15.000	VND 30.000 if you draw YELLOW ball; VND 0 if you draw WHITE ball.		If the respondent chose A, enumerator goes to scenario 4. If chose B, enumerator lets the respondent draw the ball, and stop the game.
4	VND 10.000	VND 30.000 if you draw YELLOW ball; VND 0 if you draw WHITE ball.		If the respondent chose A, enumerator goes to scenario 5. If chose B, enumerator lets the respondent draw the ball, and stop the game.
5	VND 5.000	VND 30.000 if you draw YELLOW ball; VND 0 if you draw WHITE ball.		Enumerator takes note the final scenario.

APPENDIX C: STUDY SITES



APPENDIX D: REGRESSION EQUATION

The indirect utility equations (for Models 1-3) are specified as follows:

$$U_{insurance} = (B_1+b_1)Policy_1 + (B_2+b_2)Policy_2 + (B_3+b_3)Policy_3 + (B_4+b_4)Joint\text{-}stock + (B_5+b_5)International + (B_6+b_6)Cover + (B_7+b_7)Deductible + (B_8+b_8)Premium + B_9(Cover \times Risk\ averse) + B_{10}(Premium \times Income\ per\ capita) + \varepsilon_{insurance}$$

$$U_{no\ insurance} = B_{11}ASC + B_{12}ASCxTanChau + B_{13}ASCxTanHong + B_{14}ASCxCaoLanh + B_{15}ASCxChoMoi + (B_{16}+b_{16})ASCxUnprotected\ area + (B_{17}+b_{17})ASCxInundation\ status + B_{18}ASCxRisk\ perception + (B_{19}+b_{19})ASCxWishful\ thinking + B_{20}ASCxDisaster\ reief + (B_{21}+b_{21})ASCxAge + B_{22}ASCxHousehold\ size + B_{23}ASCxIncome\ per\ capita + B_{24}ASCxLand\ size + B_{25}ASCxPurely\ agricultural\ households + (B_{26}+b_{26})ASCxAgricultural\ cooperative + B_{27}ASCxHealth\ insurance + \varepsilon_{no\ insurance}$$

The first equation for Model 4 is specified as follows:

$$U_{insurance} = (B_1+b_1)Policy_1 + (B_2+b_2)Policy_2 + (B_3+b_3)Policy_3 + (B_4+b_4)Joint\text{-}stock + (B_5+b_5)International + (B_6+b_6)Cover + (B_7+b_7)Deductible + (B_8+b_8)Premium + B_9(Cover \times Risk\ averse) + B_{10}(Premium \times Income\ per\ capita) + \alpha_1 Policy_1 xIgnored\ insurance\ policy + \alpha_2 Policy_2 xIgnored\ insurance\ policy + \alpha_3 Policy_3 xIgnored\ insurance\ policy + \alpha_4 Joint\text{-}stockxIgnored\ insurance\ provider + \alpha_5 InternationalxIgnored\ insurance\ provider + \alpha_6 CoverxIgnored\ cover + \alpha_7 DeductiblexIgnored\ deductible + \alpha_8 PremiumxIgnored\ premium + \varepsilon_{insurance}$$

where

- $Policy_1$: Flood plus waterlog insurance
- $Policy_2$: Flood plus whirlwind insurance
- $Policy_3$: Flood plus waterlog and whirlwind
- ASC = 1 if the respondent chooses insurance alternative, = 0 if chose no insurance alternative. Therefore, positive B_{11} implies that the respondent favors insurance, and negative B11 implies that the respondent does not favour insurance.
- B_k: mean coefficient of the variable k
- b_k: standard deviation of random parameter of the variable k

APPENDIX E: RANDOM PARAMETER LOGIT MODELS

Table 9: Estimated flood insurance choice models

Variables	Model 1	Model 2	Model 3	Model 4
Mean fixed parameters				
ASC	-3.86073*	-7.41447***	-7.65509***	-7.17840***
Choice attributes				
Flood + waterlog	1.24509***	0.18831**	0.23045**	-0.00811
Flood + whirlwind	0.89443***	-0.13601	-0.10829	-0.25610
Flood + waterlog + whirlwind	2.13374***	0.99340***	1.03421***	0.69037**
Joint-stock company	1.14352***	0.74452***	0.92813***	0.45881***
International company	-0.02859	-0.38906***	-0.53891***	-0.20571**
Insurance cover	0.20354**	0.48734***	0.31922**	0.46362***
High deductible	-0.29742*	-0.26644**	-0.32596**	-0.23078**
Insurance premium	-0.01978**	-0.01788***	-0.01783***	-0.01398***
Interactions with ASC				
ASC x Tan Chau district	-4.41640*	-2.00270***	-2.35322***	-1.87765***
ASC x Tan Hong district	-4.85868*	-2.18936***	-2.48737***	-2.04225***
ASC x Cao Lanh district	-4.30930*	-2.18936***	-2.26738***	-1.8347***
ASC x Cho Moi district	-0.81863	-0.38122	-0.46948	-0.36457
ASC x Unprotected area	1.17582	0.47430*	0.52054**	0.41635**
ASC x Inundation status	1.94177	0.84838**	0.86457**	0.75512**
ASC x Flood perception	0.30087	0.26744*	0.28998*	0.27673**
ASC x Wishful thinking	-1.33796	-0.63147*	-0.76654**	-0.57854*
ASC x Disaster relief	1.18247	1.03221***	1.02002**	0.96722***
ASC x Age of household head	2.27315	0.93611**	1.01540***	0.90145***
ASC x Household size	0.61132	0.56468**	0.58289***	0.53864***
ASC x Income per capita	0.01491	0.01328*	0.01459**	0.01311**
ASC x Agricultural land size	-0.01347	-0.01240	-0.00911	-0.01232
ASC x Purely agricultural households	-1.60984*	-1.46734**	-1.66774**	-1.40963**
ASC x Agricultural cooperative	-1.72469	-0.83640**	-1.08116 ***	-0.74359**
ASC x Health insurance	0.77629	0.33582	0.42499	0.33533
Interactions with attribute				
Insurance cover x Risk averse	0.59422*	0.28946**	0.06472	0.25397*
Premium x Income per capita	0.000049	0.000046	0.00046*	0.000043*
Ignored attribute				
Flood + waterlog				-0.22160
Flood + whirlwind				-0.13857
Flood + waterlog + whirlwind				-0.23917
Joint-stock company				-0.36203***
International ompany				0.27183***
Insurance cover				0.01436
High deductible				0.73894
Insurance premium				0.00301
St.dev. of random parameters				
Flood + waterlog	0.93382***	0.14124**	0.17284***	0.00340
Flood + whirlwind	0.67083***	0.10201*	0.08122	0.19311
Flood + waterlog + whirlwind	1.60030***	0.74505***	0.77565***	0.51094**
Joint-stock company	0.85764***	0.55839***	0.69610***	0.33819***
International company	0.02145	0.29179***	0.40419***	0.15125**
Insurance cover	0.39864	0.38525	0.82920***	0.21646
High deductible	0.22307*	0.19983**	0.24447**	0.17027**
Insurance premium	0.03250	0.02748	0.02569	0.02231
ASC x Unprotected area	0.88186	0.35572*	0.39041**	0.31603**
ASC x Agricultural cooperative	1.29352	0.62730**	0.81087***	0.53672***
ASC x Inundation status	1.45633	0.63625**	0.64843**	0.54656**
ASC x Wishful thinking	1.0035	0.47360*	0.57490**	0.42686**
ASC x Age of household head	1.70486	0.70209**	0.76155***	0.65889***

Significant levels: *10%, **5%, ***1%.

APPENDIX F: WILLINGNESS TO PAY FOR FLOOD INSURANCE

Table 10: WTP/1000m^2, joint-stock company and high deductible (1000 VND)

Insurance cover (1000 VND /1000m^2)		Insurance policy			
		Flood	Flood plus waterlog	Flood plus whirlwind	Flood plus waterlog, and whirlwind
MODEL 1	2.000	63.36*** (20.73)	126.31*** (34.00)	108.58*** (28.98)	171.24*** (42.05)
	3.000	73.65*** (24.94)	136.60*** (37.87)	118.87*** (32.82)	181.53*** (45.66)
	4.000	83.94*** (29.36)	146.89*** (41.96)	129.16*** (36.91)	191.82*** (49.49)
MODEL 2	2.000	22.77 (16.84)	91.81*** (26.25)	73.66*** (22.50)	136.85*** (33.73)
	3.000	50.04** (24.69)	119.07*** (34.55)	100.93*** (30.88)	164.11*** (41.75)
	4.000	77.30** (33.09)	146.33*** (43.09)	128.19*** (39.49)	191.37*** (50.07)
MODEL 3	2.000	4.73 (15.85)	82.53*** (24.10)	63.53*** (20.84)	127.62*** (32.53)
	3.000	22.64 (21.23)	100.44*** (30.13)	81.44*** (27.05)	145.53*** (38.10)
	4.000	40.55 (27.41)	118.35*** (36.56)	99.35*** (33.62)	163.44*** (44.13)

Table 11: WTP/1000m^2, international company and high deductible (1000 VND)

Insurance cover (1000 VND/ 1000m^2)		Insurance policy			
		Flood	Flood plus waterlog	Flood plus whirlwind	Flood plus waterlog, and whirlwind
MODEL 1	2.000	4.10 (12.47)	67.05*** (22.05)	49.32*** (17.87)	111.98*** (29.48)
	3.000	14.39 (16.29)	77.34*** (26.11)	59.61*** (21.77)	122.27*** (33.22)
	4.000	24.68 (20.57)	87.63*** (30.42)	69.90*** (26.01)	132.56*** (37.222)
MODEL 2	2.000	-40.64** (17.88)	28.39* (17.07)	10.25 (15.82)	73.43*** (22.34)
	3.000	-13.38 (21.95)	55.65** (25.13)	37.51* (23.09)	100.69*** (30.65)
	4.000	13.88 (28.33)	82.92** (33.63)	64.77** (31.23)	127.96*** (39.23)
MODEL 3	2.000	-77.58*** (26.10)	0.23 (15.47)	-18.78 (17.29)	45.32** (17.96)
	3.000	-59.67** (27.28)	18.14 (20.75)	-0.87 (21.44)	63.23*** (24.09)
	4.000	-41.76 (30.14)	36.04 (26.89)	17.04 (26.87)	81.14** (30.65)

Table 12: WTP/1000m^2, private company and high deductible (1000 VND)

Insurance cover (1000 VND/ 1000m^2)		Insurance policy			
		Flood	Flood plus waterlog	Flood plus whirlwind	Flood plus waterlog, and whirlwind
MODEL 1	2.000	5.54 (10.43)	68.49*** (21.71)	50.77*** (17.11)	113.42*** (29.19)
	3.000	15.83 (14.77)	78.78*** (22.03)	61.06*** (21.14)	123.71*** (32.95)
	4.000	26.13 (19.38)	89.07*** (30.17)	71.35*** (25.48)	134.00*** (36.98)
MODEL 2	2.000	-38.76** (17.01)	30.27* (17.80)	12.13 (15.93)	75.31*** (22.98)
	3.000	-11.50 (21.47)	57.53** (25.82)	39.39* (23.38)	102.57*** (31.28)
	4.000	15.76 (28.14)	84.80** (34.29)	66.65** (31.59)	129.84*** (39.84)
MODEL 3	2.000	-69.18*** (23.67)	8.62 (16.16)	-10.38 (16.49)	53.72*** (19.73)
	3.000	-51.27* (25.43)	26.53 (21.81)	7.53 (21.36)	71.63*** (25.90)
	4.000	-33.36 (28.90)	44.44 (28.14)	25.44 (27.24)	89.54*** (32.45)

APPENDIX G: THE QUESTIONNAIRE

CONTROL SECTION

Questionnaire code: _____ Group _____ Card _____ Date of interview: ___ - ___ - 2015

Full name of enumerator: _____

Full name of data entry person: _____

Location: Latitude N ____° ____' ___._____" Longitude E ____° ____' ___._____"
Degree Minute Second Degree Minute Second

Phone No: _____ Village _____ Commune _____

SECTION 1: GENERAL INFORMATION

Question 1: How many members are there in your family? _____ members.
Only including those who regularly live here at least 6 months out of the last twelve months.

Question 2: General information about your family's members:

Member code	a) Name	b) Relationship with the respondent *	c) Age	d) Gender **	e) Years of schooling	Occupation ***	
						f) Main job	g) Secondary job
1		Respondent					
2							
3							
4							
5							
6							
7							
8							
9							
10							

** 1 = Wife/husband; 2 = Son/daughter; 3 = Grandchild; 4 = Parent; 5 = Brother/sister; 6 = Other.*
*** 1 = Male; 0 = Female.*
**** 1 = Cultivation, 2 = Fish raising; 3 = Fish catching; 4 = Other agricultural jobs; 5 = Nonfarm self-employment; 6 = Wage laborer; 7 = Student; 8 = Unemployment 9 = Housewife; 0 = Out of labor forces.*

Question 3: Who is the household head? *Please fill the member code in **Question 2** here* _____.

Question 4: How long has your family lived here? _____ years. *Fill 99 if 'we have lived here for a long time' and/or 'don't know exactly how many years'.*

Question 5: What are main agricultural activities that contribute main sources of income for your family now and about 10 years ago?
Note 1 for the most important activity, 2 for the second, the third, ...

Activity	1) Now	2) Before *
a. □ Paddy		
b. □ Vegetables		
c. □ Fruits		
d. □ Husbandry		
e. □ Aquaculture		

** About the last 10 years.*

Question 6: [*if there is any change in the importance of these activities in the last 5 years as mentioned in the previous question*] Why did the most important activity of your family change? *Chose **all** relevant answers.*

a) □ Input price and suppliers
b) □ Output price and buyers
c) □ Improved dike system
d) □ Increased mechanization
e) □ Increased natural disasters
f) □ Other reasons, in detail _____

Question 7: What is the type of your house? *Enumerator observes and takes note*.

(1) □ Concrete house
(2) □ Concrete house on stilts
(3) □ Wooden house
(4) □ Wooden house on stilts
(5) □ Temporary house

Question 8: What is the main source of drinking water during the flooding season? *Only **one** option.*

(1) □ Pipeline water (community/government)
(2) □ Well water
(3) □ River water
(4) □ Rain water
(5) □ Other, in detail _____

Question 9: Where does your family discharge waste? *Choose **all relevant** answers.*

(1) □ Public landfill
(2) □ Discharge into nearby canal, river
(3) □ Self-treatment (such as burning)
(4) □ Other, in detail _____

Question 10: Has your family joined in agricultural cooperative?

a. □ No
b. □ Yes

SECTION 2: FLOOD EXPERIENCE AND PERCEPTIONS

Question 11: Did you experience the following flood events? *Select all relevant answers*.

□ 1961 □ 1966 □ 1978 □ 1984 □ 1991 □ 1994
□ 1996 □ 2000 □ 2001 □ 2002 □ 2011 □ Other

Total: _____ *(enumerator takes note number of flood events experienced)*.

Question 12: Was your farm inundated during the most recent catastrophic flood event?

a) □ Yes b) □ No

Question 13: How many days was your farm inundated? _____ days.

Question 14: What are difficulties that your family often experiences during the flood season?

a) Increase flood adaptation costs	□ Yes	□ No
b) Reduce jobs of family's members	□ Yes	□ No
c) Cause damage to crops and/or properties	□ Yes	□ No
d) Increase diseases (so, increase pesticide costs)	□ Yes	□ No
e) Danger to children and elderly people	□ Yes	□ No
f) Travel becomes more difficult	□ Yes	□ No
g) Feeling of fear	□ Yes	□ No

Question 15: Did your family adopt the following mitigation measures to cope with flood and other natural disasters?

Mitigation measures	a) last 10 years	b) Now
To protect houses, important house contents		
1) Raise floor, reinforce houses	□	□
2) Rope and strenthen houses	□	□
3) Lift/protect house contents and properties	□	□
Agricultural activities		
4) Change cultivation calender	□	□
5) Diversification/crop changes	□	□
6) Prepare private water pumbing machince	□	□
Nonfarm activities		
7) Handicraft activities	□	□
8) Fishing and/or collecting natural vegetables	□	□
9) Temporary work elsewhere	□	□
Health care		
10) Buy health insurance	□	□
11) Prepare medicines chest	□	□
12) Use mosquito net and/or mosquito incense	□	□
13) Prepare food, water, and water treatment chemical	□	□
Other measures		
14) Prepare fuels/accumulators	□	□
15) Prepare shelter for livestock	□	□
16) Prepare evacuation means	□	□
17) Prepare awnings to to protect crops/properties	□	□
18) Search for weather information	□	□
19) Teach children swimming and basic living skills	□	□
20) Self-insurance measures	□	□
Total		

Question 16: Please rank the level of impacts of the following disasters on lives and properties at your place (in the last 10 years). *Note 1 for the most dangerous disaster, 2 for the next, …*

	Rank
a) Storm	
b) Flood	
c) Waterlog	
d) Whirlwind	
e) Drought	

Question 17: In your own judgement, what is the "flood return period" of a flood like the one in 2000 in your neighbourhood? _____ years/time. *Fill number 99 if the answer is 'I think catastrophic flood will never happen here again'.*

Question 18: How do you think of catastrophic floods in this area?

(1) □ High probability, but low consequence.
(2) □ High probability, and high consequence.
(3) □ Low probability, and low consequence.
(4) □ Low probability, but high consequence.

Question 19: Do you think annually normal flood is good for local people ...

a) Source of fish catching for local people	□ Yes	□ No	□ Don't know
b) Supply silt and fertilizer for soil	□ Yes	□ No	□ Don't know
c) Throw away toxic soil substances	□ Yes	□ No	□ Don't know
d) Kill mice and insect that cause harm to crop	□ Yes	□ No	□ Don't know
e) Create additional jobs for local people	□ Yes	□ No	□ Don't know

Question 20: Do you agree with the following statement: "*The dike systems here is too concrete to adopt private adaptation measures*"?

(1) Completely disagree	(2) Disagree	(3) Agree	(4) Completely agree
□	□	□	□

Question 21: Do you agree with the following statement: "*Catastrophic flood is hard to happen here, so my family does not need to adopt private adaptation measures*"?

(1) Completely disagree	(2) Disagree	(3) Agree	(4) Completely agree
□	□	□	□

Question 22: Do you agree with the following statement: "*Catastrophic flood is a natural disaster that men can not cope with*"?

(1) Completely disagree	(2) Disagree	(3) Agree	(4) Completely agree
□	□	□	□

Question 23: Do you agree with the following statement: "*Catastrophic flood happened here long time ago, so my family does not need to cope with*"?

(1) Completely disagree	(2) Disagree	(3) Agree	(4) Completely agree
□	□	□	□

Question 24: Do you agree with the following statement: "*My family used to adopt private adaptation measures, but flood never happenned, so we now do not want to adopt anymore*"?

(1) Completely disagree	(2) Disagree	(3) Agree	(4) Completely agree
□	□	□	□

Question 25: Do you agree with the following statement: "*We realize that the private adaptation measures of my family were not effective, so we do not want to adopt anymore*"?

(1) Completely disagree	(2) Disagree	(3) Agree	(4) Completely agree
□	□	□	□

Question 26: Do you agree with the following statement: "*The government is likely to provide a part of disaster relief for the victims of flood events*"?

(1) Completely disagree	(2) Disagree	(3) Agree	(4) Completely agree
□	□	□	□

SECTION 3: EVALUATION OF FLOOD CONTROL MANAGEMENT

Question 27: Please evaluate the flood hazard in your place (in comparison with the past ten years) in terms of the following dimensions:

Item	Reduced/ Worse off	Stayed the same	Increased/ Better off	Don't know/ Not avalable
1) Inundation possibility	□	□	□	□
2) Depth and duration of inundation	□	□	□	□
3) Number of irrigation projects	□	□	□	□
4) Water velocity of canal system	□	□	□	□
5) Quality of dike system	□	□	□	□
6) Dike maintenance and upgrading	□	□	□	□
7) Dike breach possibility	□	□	□	□
8) Canal dredging activities	□	□	□	□
9) Drainage culvert system	□	□	□	□
10) Water pumping stations	□	□	□	□
11) Trees along the dike system	□	□	□	□

Question 28: Please evaluate flood exposure in your place (in comparison with the past ten years) in terms of the following dimensions:

Item	1) Reduced/ Worse off	2) Stayed the same	3) Increased/ Better off	99) Don't know/ Not avalable
1) Land use density	□	□	□	□
2) Land use regulations	□	□	□	□
3) Asset value of local people	□	□	□	□
4) House building regulations	□	□	□	□
5) Population density	□	□	□	□
6) Flood dependent activities	□	□	□	□
7) Resettlement programs	□	□	□	□
8) Flood map	□	□	□	□
9) Cultivation regulations	□	□	□	□
10) Crop regulations	□	□	□	□

Question 29: Could you please evaluate the vulnerability with flooding of your place (comparison with 10 years ago) in terms of the following items:

Item	1) Reduced/ Worse off	2) Stayed the same	3) Increased/ Better off	99) Don't know/ Not avalable
1) Properties are prone to damages	□	□	□	□
2) Risk perceptions of people	□	□	□	□
3) Risk awareness campaigns	□	□	□	□
4) Private mitigation measures	□	□	□	□
5) Community-based mitigation efforts	□	□	□	□
6) Community flood management plans	□	□	□	□
7) Flood risk communication systems	□	□	□	□
8) Health care activities in flooding season	□	□	□	□
9) Post-flood recovery preparation	□	□	□	□
10) Preparing shelters for local people	□	□	□	□
11) Health risk warning activities	□	□	□	□
12) Mosquito and insect repellents	□	□	□	□
13) Provision of water purification chemicals	□	□	□	□

Question 30: Do you often _____ to know information about the weather such as heavy rain, storm, or water level?

	(1) Never	(2) Rare	(3) Sometime	(4) Often	(5) Very much
a) □ Watch television					
b) □ Listen radio					
c) □ Follow local weather announcement					
d) □ Attend group discussion/meeting					
e) □ Meet local officers					
f) □ Attend flood risk training					

Question 31: Please rank the usefulness and evaluate the current conditions of the following communication channels in your place:

	1) Rank the usefulness (*)	2) Evaluate current condition (**)
a) □ Television		
b) □ Radio		
c) □ Local weather announcement		
d) □ Group discussion/meeting		
e) □ Local officers		
f) □ Training		

(*) Only rank those channels that you have known. Note 1 for the most effective channel, 2 for the second, 3 for the third, … (and you can rank them equally).

(**) Only evaluate the channels that you have known. Note 1 for very bad, 2 for bad, 3 for normal, 4 for good, and 5 for very good. If the channel is not available, please note 1.

SECTION 4: RISK ATTITUDE

Enumerator describe the risk attitude game and its rules.

Question 32: What is the most preferred scenario? _____ (noted by enumerator). *Amount of money paid*: _____ VND.

SECTION 5: FLOOD INSURANCE EXPERIMENTS

Introduction

In future, according to flood management experts, the frequency of extreme flood events like the one in the year 2000 is expected to increase due to impact of climate change. Also the damage associated with flood events is more likely to be more serious under increased pressure of population growth and economic development. In order to find appropriate mitigation measures and risk transfer tools, economists and policy makers propose a flood insurance program.

It is suggested that insurance against natural risks has recently been proposed as a means for adaptation to climate change in various countries. Flood insurance is likely to provide incentives for reducing risks and adapting to climate change because insurance policy can be designed to reward private self-protection behavior. This means that under the insurance arrangements, your family will commit to have certain precautionary measures, and this results in reducing the probability of getting losses in terms of financial aspect. In the context of flood disaster, this policy is considered as a complementary adaptation mechanism because structural flood protection measures by the government are likely to be insufficient to reduce risks under climate change.

Research results from other countries indicate that purchasing flood insurance can benefit your family if a worse year of extreme flood occurs. Unfortunately, markets for such an insurance are not readily available in Vietnam; and your family is basically dependent on *ad hoc* compensation by the government for potential damages. Such *ad hoc* compensation can simply provide your family either basic needs or a small amount of money, and you are always put in a passive situation.

The flood insurance program

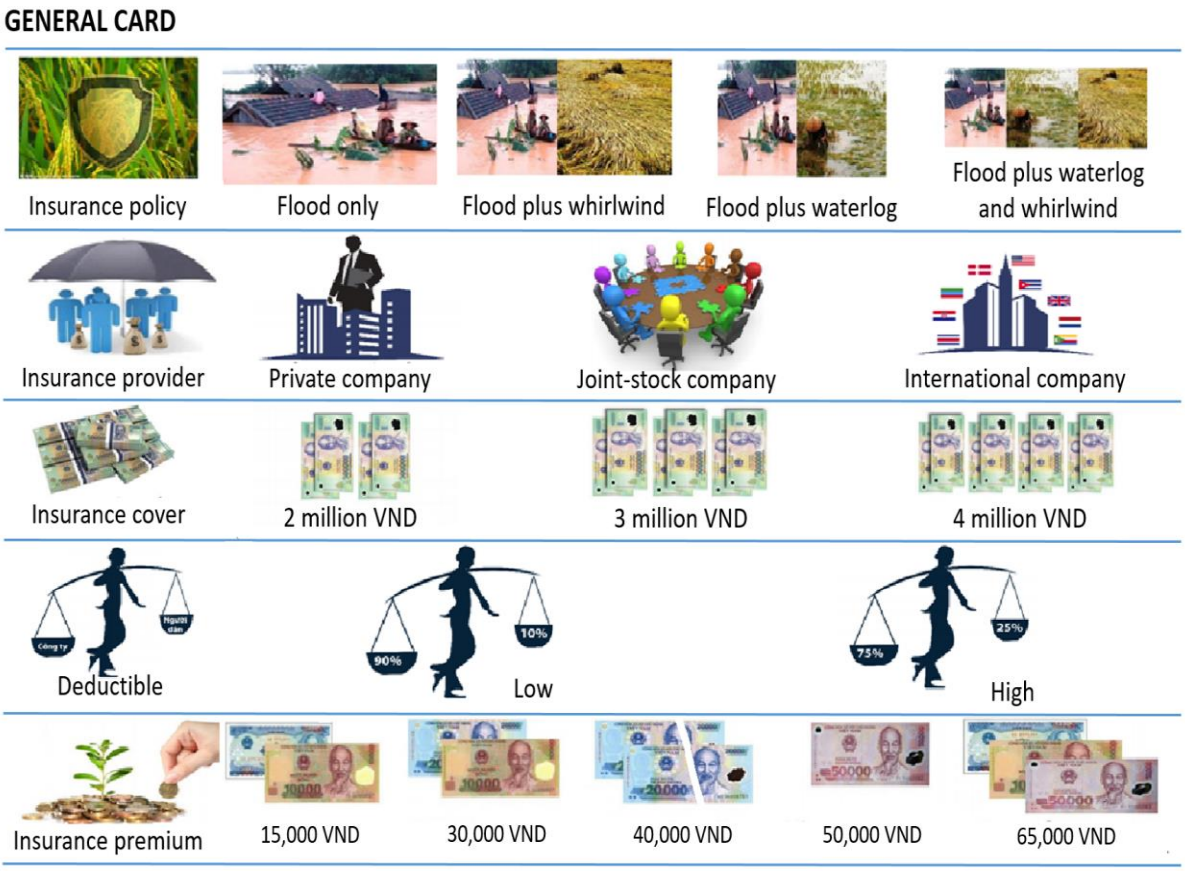
We would now like to ask you a number of questions related to the possible introduction of a flood insurance in Vietnam. Such an insurance would help your family to cover any future financial risks as a result of extreme flood events like the one in year 2000. The objective of the flood insurance program is to compensate your family for any possible future losses due to floods and other natural disasters such as waterlog and whirlwind. You can choose to insure yourself for damages your family may suffer during a disaster given the expected future situation.

The principle is as follows: your family will pay a fixed amount of money per cong (i.e. 1000m^2) per crop season – called an insurance premium – given the expected insurance alternative. It is noted that you are free to buy flood insurance for any season that you are mostly interested in. With this insurance premium you are paid off any financial damage (regarding the actual damage and bound in the insurance cover agreed under the insurance contract) that your family suffers if it is struck by either a flood, a waterlog, or a whirlwind. It is worth noting that only in the case of an officially acknowledged disaster, you will get compensated for loss you suffer.

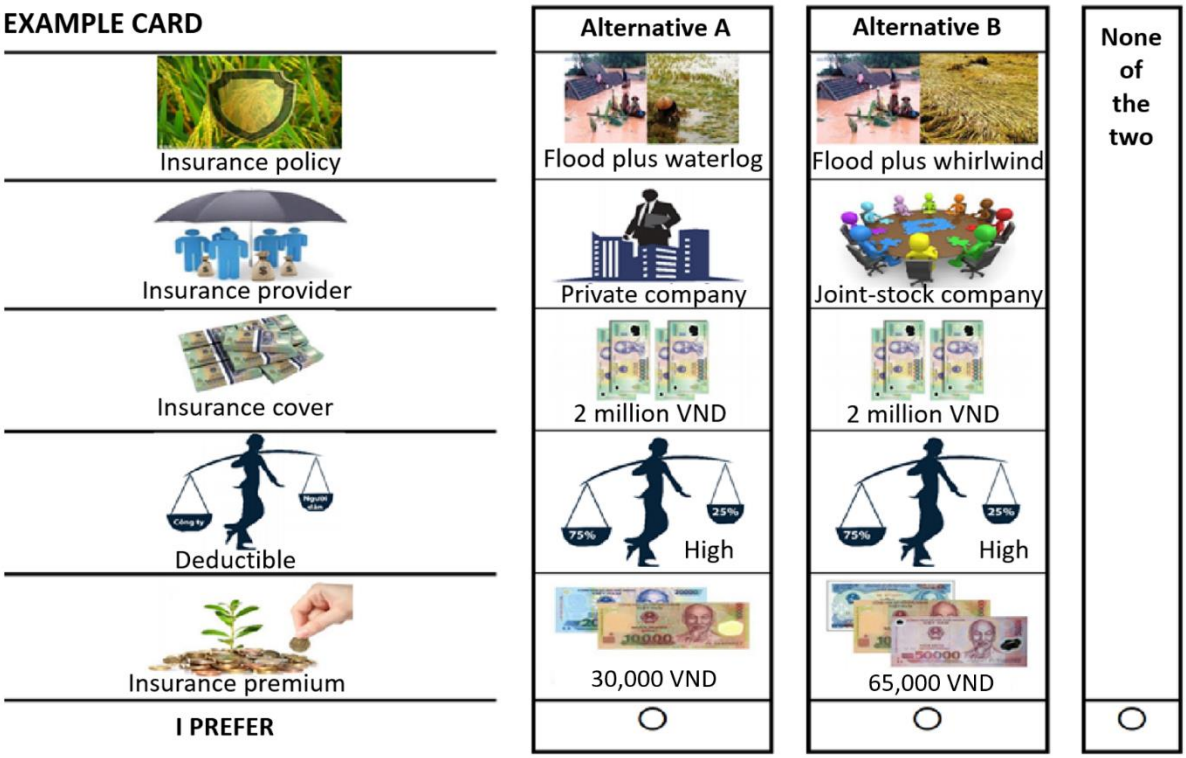
It is important to point out that your family will only receive compensation for any damage if this is due to an officially acknowledged disaster event. The maximum amount of compensation depends upon your chosen insurance option. If there is a disaster (e.g. a flood, a waterlog, or a whirlwind) and you claim compensation, an independent surveyor will visit you and assess the extent of damage your family suffered. Based on the surveyor's independent assessment your family will be compensated under the terms in the insurance contract with an insurance company. The terms and conditions of your insurance policy are protected by law.

Before going further, we want to emphasize that this insurance program is implemented in accordance with market and your family will, of course, not receive any subsidy for paying insurance premium. As the insurance program is implemented, you will mainly work with the insurance provider under a business contract, and the government just assures a fair policy from the insurance by laws. In addition, it is also noted that you are required to buy insurance for the whole agricultural land that you currently own.

Suppose that we have an insurance program at the Mekong river delta, and your family is a potential client. We will now present you with an overview card first to explain to you what the situations represent. Following the example cards, we will show you seven other cards and for each of these cards, you will be asked to indicate which situation you prefer most.



In each choice card, there are two proposed insurance alternatives, and please let's know your most preferred alternative. If you do not prefer any alternative, you can choose "none of the two alternatives". Here is an example card:



Question 33: Please consider the following choice sets, one after another, and let's know which alternative you most prefer in each choice set? (Enumerator offers each choice set from 1 to 7 after the first two example choice sets.) .

	Alternative A	Alternative B	None of the two
Example choice set 1	○	○	○
Example choice set 2	○	○	○
(1) Choice set 1	○	○	○
(2) Choice set 2	○	○	○
(3) Choice set 3	○	○	○
(4) Choice set 4	○	○	○
(5) Choice set 5	○	○	○
(6) Choice set 6	○	○	○
(7) Choice set 7	○	○	○

If the respondent continuously chose "none of the two" move to **Question 37**.

Question 34: Did you realize that the final choice set is similar to the choice set _____? (***Note:*** Enumerator check and notes the repeated choice set).

(1) □ Yes (0) □ No (move **Question 35**)

Question 35: If Yes in Question 34, did the respondent make the same choice as the pervious choice set? (***Note:*** enumerator takes note this).

(1) □ Yes (0) □ No

Question 36: What attributes did you pay attention when making choice among alternatives in each choice set?

Attribute	1) Yes/No	2) Most important attribute	3) Least important attribute
a) Insurance policy	□	□	□
b) Insurance provider	□	□	□
c) Insurance cover	□	□	□
d) Deductible	□	□	□
e) Insurance premium	□	□	□

Question 37: Please let's know why you always chose "none of the two"? *Choose **all** the relevant answers.*

a) □ I am not interested in buying flood insurance .
b) □ I do not trust in insurance companies.
c) □ My family's conditions at present is good enough.
d) □ My family is not able pay for insurance premium.
e) □ Flood insurance is the responsibility of the government, not of my family.
f) □ I have a belief that the government and other organizations will compensate the victims if catastrophic flood happens.

Question 38: In your opinion, are the offered insurance choice sets credible? *Only **one** answer.*

(1) □ Completely incredible
(2) □ Incrediable
(3) □ Crediable
(4) □ Completely crediable

Question 39: Please evaluate the level of difficulty of the choice sets that you have to consider when making decisions?

(1) □ Very difficult to understand
(2) □ Difficult to understand
(3) □ Normal
(4) □ Easy to understand
(5) □ Very easy to understand

Question 40: Time to complete the description of choice experiment scenario and insurance choice sets? _____ minutes. *Starting time*_____ *and ending time* _____. (***Note:*** enumerator takes notes).

SECTION 6: FAMILY BUSINESS ACTIVITIES (during last 12 months)

A. CULTIVATION ACTIVITIES

Question 41: Is your agricultural cultivation area protected by August dike?

(1) □ Yes	(0) □ No

Question 42: How does the August dike affect your agricultural cultivation activities?

(1) □ Bad	(2) □ No effect	(3) □ Good

Question 43: What are the difficulties of your agricultural cultivation activities?

a) Lack of land	□ Yes	□ No

b) lack of capital	□ Yes	□ No
c) Lack of labor	□ Yes	□ No
d) Input prices and suppliers	□ Yes	□ No
e) Output prices and buyers	□ Yes	□ No
f) Flood, waterlog, and whirlwind	□ Yes	□ No
g) Disease	□ Yes	□ No

Question 44: How many lots of land did you cultivate in year 2015? _____ lots.

1

Question 45: PLOT 1	**Season 1** (Winter – Spring)	**Season 2** (Summer – Autumn)	**Season 3** (Autumn – Winter)
(01) Crop/fruit			
(02) Actual area	m^2	m^2	m^2
COSTS			
1/ Soil preparation			
(11) Plough	VND	VND	VND
(12) Family labor	____ days	____ days	____ days
(13) Hired labor	VND	VND	VND
(14) Initial fertilizers	VND	VND	VND
(15) Other materials	VND	VND	VND
2/ Seeding/Breeding			
(21) Cost of seeding/breeding	VND	VND	VND
(22) Family labor	____ days	____ days	____ days
(23) Hired labor	VND	VND	VND
3/ Irrigation (including pumbing water out if farm was inundated)			
(31) Family labor	____ days	____ days	____ days
(32) Hired labor	VND	VND	VND
(33) Cost of irrigation	VND	VND	VND
(34) Depreciation of irr. system	VND	VND	VND
(35) Cost of maintenance	VND	VND	VND
4/ Fertilizers (excluding initial fertilizer)			
(41) Cost of fertilizers	VND	VND	VND
(42) Family labor	____ days	____ days	____ days
(43) Hired labor	VND	VND	VND
5/ Pesticides			
(51) Cost of insecticide/herbicide	VND	VND	VND
(52) Family labor	____ days	____ days	____ days
(53) Hired labor	VND	VND	VND
6/ Other labor costs			

(61) Family labor	____ days	____ days	____ days
(62) Hired labor	VND	VND	VND
7/ Other farm equipments/costs			
(71) Depreciation	VND	VND	VND
(72) Maintenance/Repair	VND	VND	VND
(73) Other costs (rent)	VND	VND	VND
HARVEST			
(81) Total harvest (kg)			
(82) Sold quantity (kg)			
(83) Price (VND/kg)	VND	VND	VND
(84) Transport cost	VND	VND	VND
(85) Harvest cost	VND	VND	VND

Question 46: PLOT 2	**Season 1** (Winter – Spring)	**Season 2** (Summer – Autumn)	**Season 3** (Autumn – Winter)
(01) Crop/fruit			
(02) Actual area	m^2	m^2	m^2
COSTS			
1/ Soil preparation			
(11) Plough	VND	VND	VND
(12) Family labor	____ days	____ days	____ days
(13) Hired labor	VND	VND	VND
(14) Initial fertilizers	VND	VND	VND
(15) Other materials	VND	VND	VND
2/ Seeding/Breeding			
(21) Cost of seeding/breeding	VND	VND	VND
(22) Family labor	____ days	____ days	____ days
(23) Hired labor	VND	VND	VND
3/ Irrigation (including pumping water out if farm was inundated)			
(31) Family labor	____ days	____ days	____ days
(32) Hired labor	VND	VND	VND
(33) Cost of irrigation	VND	VND	VND
(34) Depreciation of irr. system	VND	VND	VND
(35) Cost of maintenance	VND	VND	VND
4/ Fertilizers (excluding initial fertilizer)			

(41) Cost of fertilizers	VND	VND	VND
(42) Family labor	____ days	____ days	____ days
(43) Hired labor	VND	VND	VND
5/ Pesticides			
(51) Cost of insecticide/herbicide	VND	VND	VND
(52) Family labor	____ days	____ days	____ days
(53) Hired labor	VND	VND	VND
6/ Other labor costs			
(61) Family labor	____ days	____ days	____ days
(62) Hired labor	VND	VND	VND
7/ Other farm equipments/costs			
(71) Depreciation	VND	VND	VND
(72) Maintenance/Repair	VND	VND	VND
(73) Other costs (rent)	VND	VND	VND
HARVEST			
(81) Total harvest (kg)			
(82) Sold quantity (kg)			
(83) Price (VND/kg)	VND	VND	VND
(84) Transport cost	VND	VND	VND
(85) Harvest cost	VND	VND	VND

B. AQUACULTURE ACTIVITIES

Question 47: Is your aquaculture area protected by August dike?

(1) □ Yes	(0) □ No

Question 48: How does the August dike affect your aquaculture activities?

(1) □ Bad	(2) □ No effect	(3) □ Good

Question 49: What are the difficulties of your aquaculture activities?

a) Lack of land	□ Yes	□ No
b) lack of capital	□ Yes	□ No
c) Lack of labor	□ Yes	□ No
d) Input prices and suppliers	□ Yes	□ No
e) Output prices and buyers	□ Yes	□ No
f) Flood, waterlog, and whirlwind	□ Yes	□ No
g) Disease	□ Yes	□ No

Question 50: POND 1	**Season 1**	**Season 2**
(01) Kind of fish		
(02) Actual area	m^2	m^2
COSTS		

1

1/ Pond preparation (excluding costs of digging pond)		
(11) Clean pond (pumb mud out)	VND	VND
(12) Fish medicine	VND	VND
(13) Lime	VND	VND
(14) Other chemical costs	VND	VND
(15) Family labor	____ days	____ days
(16) Hired labor	VND	VND
2/ Juvenile fish		
(21) Cost of buying juvenile fish	VND	VND
3/ Chemicals		
(31) Cost of chemicals	VND	VND
(32) Family labor	____ days	____ days
(33) Hired labor	VND	VND
4/ Feed		
(41) Cost of feed	VND	VND
(42) Family labor	____ days	____ days
(43) Hired labor	VND	VND
5/ Water treatment		
(51) Cost (excluding labor)	VND	VND
(52) Family labor	____ days	____ days
(53) Hired labor	VND	VND
6/ Other costs		
(61) Agricultural engineer	VND	VND
(62) Electricity/fuels	VND	VND
(63) Other costs (rent, …)	VND	VND
HARVEST		
(71) Times of harvesting	times	times
(72) Average cost per time	VND	VND
(73) Family labor	____ days	____ days
(74) Hired labor	VND	VND

Question 51: POND 2	**Season 1**	**Season 2**
(01) Kind of fish		
(02) Actual area	m^2	m^2
COSTS		
1/ Pond preparation (excluding costs of digging pond)		
(11) Clean pond (pumb mud out)	VND	VND
(12) Fish medicine	VND	VND

2

(13) Lime	VND	VND
(14) Other chemical costs	VND	VND
(15) Family labor	____ days	____ days
(16) Hired labor	VND	VND
2/ Juvenile fish		
(21) Cost of buying juvenile fish	VND	VND
3/ Chemicals		
(31) Cost of chemicals	VND	VND
(32) Family labor	____ days	____ days
(33) Hired labor	VND	VND
4/ Feed		
(41) Cost of feed	VND	VND
(42) Family labor	____ days	____ days
(43) Hired labor	VND	VND
5/ Water treatment		
(51) Cost (excluding labor)	VND	VND
(52) Family labor	____ days	____ days
(53) Hired labor	VND	VND
6/ Other costs		
(61) Agricultural engineer	VND	VND
(62) Electricity/fuels	VND	VND
(63) Other costs (rent, …)	VND	VND
HARVEST		
(71) Times of harvesting	times	times
(72) Average cost per time	VND	VND
(73) Family labor	____ days	____ days
(74) Hired labor	VND	VND

C. LIVESTOCK BREADING

Question 52: Is your livestock breading protected by August dike?

(1) □ Yes	(0) □ No

Question 53: How does the August dike affect your livestock breading activities?

(1) □ Bad	(2) □ No effect	(3) □ Good

Question 54: What are the difficulties of your family livestock?

a) Lack of land	□ Yes	□ No
b) lack of capital	□ Yes	□ No
c) Lack of labor	□ Yes	□ No
d) Input prices and suppliers	□ Yes	□ No

e) Output prices and buyers	□ Yes	□ No
f) Waste treatment	□ Yes	□ No
g) Disease	□ Yes	□ No

Question 55: How many kinds of livestock do you bread? _____ kind.

Question 56:	Kind 1	Kind 2
(01) Quantity of year 2015	animals	animals
(02) Current value of the livestock	VND	VND
(03) Value of the livestock in last 12 months	VND	VND
COSTS		
1/ Cage (excluding costs of building cage)		
(11) Amending cage	VND	VND
(12) How long do you amend it?	_____ year	_____ year
(13) Family labor	___days	___days
(14) Hired labor	VND	VND
2/ Breading		
(21) Cost of breading in year 2015	VND	VND
3/ Veterinary		
(31) Cost of veterinary medicine	VND	VND
4/ Feeding		
(41) Cost of feeding	VND	VND
(42) Family labor	___days	___days
(43) Hired labor	VND	VND
5/ Water and water treatment		
(51) Cost (excluding labor)	VND	VND
(52) Family labor	___days	___days
(53) Hired labor	VND	VND
6/ Other costs		
(61) Veterinary surgeon	VND	VND
(62) Other costs	VND	VND
HARVEST		
(71) Times of harvesting	time	time
(72) Average value per time	VND/time	VND/time
(73) Other revenue	VND	VND

D. OTHER INCOME

Question 57: Did your family grow any other trees/crops for sales this year?

(1) □ Yes (0) □ No (move to **Question 59**)

Question 58: How much does your family have from selling these fruits/crops? _____ VND.

Question 59: Did your family raise any other fish for sales this year?

(1) □ Yes (0) □ No (move to **Question 61**)

Question 60: How much did your family have from selling the fish? _____ VND.

Question 61: Did your family bread poultry for sales this year?

(1) □ Yes (0) □ No (move to **Question 63**)

Question 62: How much did your family have from selling the poultry?_____ VND.

Question 63: Agricultural services that your family earns income this year?

	Amount (VND)		Amount (VND)
1. □ Lease land		4. □ Sell breed	
2. □ Lease machines		5. □ Consultancy	
3. □ Sell seeding		6. □ Others, specify _____	

Question 64: Nonfarm income that your family earn this year?

	Amount (VND)		Amount (VND)
1. □ Salary		4. □ Remittance	
2. □ Self-employed		5. □ Interest	
3. □ Handicraft		6. □ Others, _____	