Risk Preferences and Development Revisited*

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Abstract

We obtain rich measures of the risk preferences of a sample of Vietnamese farmers, and revisit the link between risk preferences and economic well-being. Far from being particularly risk averse, our farmers are on average risk neutral and thus more risk tolerant than typical Western subject populations. This generalises recent findings indicating that students in poorer countries are more risk tolerant than students in richer countries to a general population sample. Risk aversion is furthermore negatively correlated with income within our sample, but does not correlate with wealth. This also casts doubt on high levels of risk aversion causing failure to adopt new technologies, which we discuss.

Keywords: risk preferences; development; prospect theory;

JEL-classification: C93; D03; D80; O12

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1 Introduction

Development economists have long discussed the link between poverty and risk aversion. On the one hand, people in developing countries in general have been depicted as very risk averse (see e.g. Haushofer and Fehr, 2014, for a recent literature review). Such risk aversion may then lead to the perpetuation of poverty, by inducing suboptimal, risk-averse behavior (Liu, 2012; Liu and Huang, 2013). The evidence on both counts is, however, less than uniform. On the one hand, the supposed correlation between risk preferences and economic well-being cannot always be replicated (see e.g. Cardenas and Carpenter, 2013). On the other, tasks used to measure risk preferences in the developing world are often specifically designed to pick up pronounced risk aversion, and thus make the findings difficult to compare to preferences measured in developed countries using different elicitation tasks. In the presence of random switching, such measurement tasks will furthermore systematically over-estimate risk aversion (Vieider, 2018).

In this paper, we take a fresh look at the relation between risk preferences and economic well-being. We obtain a rich set of experimental measures of risk preferences for a randomly selected, geographically confined group of farmers in Vietnam. The measures are obtained using certainty equivalents, which are easy to understand and administer. They also allow us to compare the results to a large number of experiments that have used the same type of tasks in the West (e.g., Abdellaoui, Baillon, Placido and Wakker, 2011; Fehr-Duda and Epper, 2012), and to recent comparative data across a large number of countries obtained with students (Vieider, Lefebvre, Bouchouicha, Chmura, Hakimov, Krawczyk and Martinsson, 2015). The richness of the data allows us to separate preferences from noise using structural models, while at the same time we can back up the findings with nonparametric data. Using a geographically confined and uniform sample allows us to obtain good and comparable income measures, which are not confounded by other differences across subject groups or geographical regions.

We show that—far from conforming to the stereotype of extreme risk aversion—our Vietnamese farmers are on average risk neutral (although preferences change systematically across task characteristics). Comparing their risk preferences to data obtained with other subject populations using the same experimental tasks to put the findings in perspective, we conclude that Vietnamese farmers are significantly *less* risk averse than American students, which serve but as an example of other student populations

in the West. We also find the Vietnamese farmers to be slightly more risk averse than Vietnamese students. Once again, this finding is consistent with previous findings from the West, with for instance Fehr-Duda and Epper (2012) finding Swiss students to be less risk averse than the Swiss general population using tasks similar to ours.

The evidence we present is also highly consistent with recent findings of students in poorer countries being more risk tolerant than students in richer countries (Rieger, Wang and Hens, 2014; Vieider et al., 2015), and thus extends the finding from students to a general population sample. At the same time, we find a strong negative correlation between risk aversion and income amongst farmers (while finding no correlation with other measures of well-being, such as wealth). The evidence here presented thus fits the narrative of a risk-income *paradox* presented by Bouchouicha and Vieider (2017), whereby risk aversion decreases with income within countries, but increases with national income between countries.

The experimental evidence here presented needs to be reconciled with the observed real world behavior of farmers in poor countries. There is indeed considerable evidence that farmers employ risk averse strategies in their real decisions. For instance, Rosenzweig and Binswanger (1993) famously described the use of risk averse income smoothing strategies by poor farmers in India, and Jayachandran (2006) showed that the poorest often sell their labour at a considerable risk premium rather than employing it more fruitfully on their own farms. This type of evidence, however, does not lend itself to comparison with Western populations, which generally have much lower risk *exposure*—over-insuring even modest risks is all too common in the West (Sydnor, 2010). Indeed, many elements other than the small stake risk preferences measured in experiments may play a role in such decisions (we will return to this point in the discussion).

This paper proceeds as follows. Section 2 describes our subject pool, the measurement tasks, and the general setup of the experiment. Section 3 introduces the theoretical setup and discusses the econometric specifications used. Section 4 presents the results. Section 5 discusses the results and concludes the paper.

2 Experimental setup

We recruited 207 farmers in the Vietnamese villages Phu Hiep, Phu Loi and Phu Quoi in An Giang province, close to the border with Cambodia alongside the Tien river. The

villages were chosen at random amongst a number of locations where we could obtain the backing of the local party authorities. No systematic selection effects are likely to be caused by this—we will discuss this point more at length below. The households were randomly chosen from a complete population list of the three villages. Using repeated visits and trying to make appointments in case household heads were absent in the first visit, we achieved a 100% participation rate of our target population. This means that our sample is representative of the village reality of Southern Vietnam, although we cannot claim representativeness outside of this specific subject pool.

The median household in our sample has an income of 9.9m Dong per capita per year. This corresponds to $1.32 per capita per day for the median households in current exchange rates at the time of the experiment, and to $2.89 in purchasing power parity (PPP; calculated using World Bank data for 2011). The corresponding means are $2.26 (sd: 3.38) and $4.95 (sd: 7.39) respectively. About 24% of our subjects fall below the official poverty line of the Vietnamese government.[1] Income was measured by asking farmers about different categories of income (e.g., income from farming, animals husbandry and aquaculture, from labour, leased land, remittances, etc.) and then aggregating across those categories (the full questionnaire is reported in the supplementary materials). Since most farmers in the region produce for the market, and since we ran our experiments not too long after the main harvest season, the information was relatively recent and hence easy to remember. Given the importance of income for our study, we also compare our sample to the corresponding figures for comparable population groups, as obtained from the Vietnamese statistical office (www.gso.gov.vn). The income per capita of our farmers is indeed not significantly different from the one of the rural population in Vietnam at large ($t(198) = -1.01, p = 0.312$, two-sided t-test).

We elicit certainty equivalents (CEs) to measure risk preferences. CEs provide a rich amount of information, are easy to explain to subjects, and the sure amounts of money to be used in the elicitation are naturally limited between the lower and upper amount of the prospect. They are also flexible enough to allow for the detection of risk-seeking as well as risk neutral and risk averse behavior. This makes them well-suited to estimate structural models of decision making (Abdellaoui et al., 2011; Bruhin, Fehr-Duda and

[1]The poverty line applied here is based on "Decision of the Prime Minister 9/2011/QD-TTG: Promulgating standards of poor households, poor households to apply for stage from 2011 to 2015", in which the poverty line for rural areas is 400,000 Dong per capita per month and for urban areas it is 500,000 Dong per capita per month.

Table 1: decision tasks, amounts in 1000s of Dong

gains	losses	mixed
(1/2: 40; 0)	(1/2: -40; 0)	0∼(1/2: 160; z*)
(1/2: 80; 0)	(1/2: -80; 0)	
(1/2: 160; 0)	(1/2: -160; 0)	
(1/2: 240; 0)	(1/2: -160; -40)	
(1/2: 240; 80)	(1/2: -160; -80)	
(1/2: 240; 160)		
(1/8: 160; 0)	(1/8: -160; 0)	
(1/8: 160; 40)	1/8: -160; -40)	
(2/8: 160; 0)	(2/8: 160; 0	
(3/8: 160; 0)	(3/8: -160; 0)	
(5/8: 160; 0)	(5/8: -160; 0)	
(6/8: 160; 0)	(6/8: -160; 0)	
(7/8: 160; 0)	(7/8: -160; 0)	
(7/8: 160; 40)	(7/8: -160; -40)	

Epper, 2010; Tversky and Kahneman, 1992). Overall, we elicited 44 CEs per subject. The tasks used for the elicitation procedure were chosen so as to allow for the estimation of multi-parameter models, and were tested in extensive pilots with students before being deployed in the field. Table 1 provides an overview of the decision tasks, and figure 1 shows an example of a choice list. Prospects are described in the format $(p : x; y)$, where p is the probability of obtaining x, and y obtains with a complementary probability $1 - p$, $|x| > |y|$. Outcomes are shown in thousands of Dongs (8,000 Dong = 1 Euro in PPP). Losses were deducted from an endowment equivalent to the highest potential loss, given conditional on playing the loss part of the experiment. The highest loss is smaller than the largest gain. This was necessary to limit financial exposure, since all subjects who were randomly selected to play the loss part were given an endowment equal to the highest possible loss. In addition to the prospects over gains and losses, we used one mixed prospect, which is necessary to obtain a measure of loss aversion. In this case, we obtained the value z* which satisfies the indifference $0 \sim (1/2 : 160; -z)$, where z varied in a choice list from 160,000 to 16,000 Dong.[2]

Gains were administered before losses, which took part from an endowment (see Etchart-Vincent and L'Haridon, 2011, for evidence that it does not matter whether losses take place from an endowment or are real). We also had prospects with unknown or vague probabilities that will not be analyzed here, and which were always presented

[2]The choice tasks (though not the instructions, this experiment being run in individual interviews) and payoffs were the same as the ones used by Vieider et al., 2015 in experiments with students across 30 countries. For an overview of the tasks, see the instructions available for download in various languages at www.ferdinandvieider.com/instructions.html.

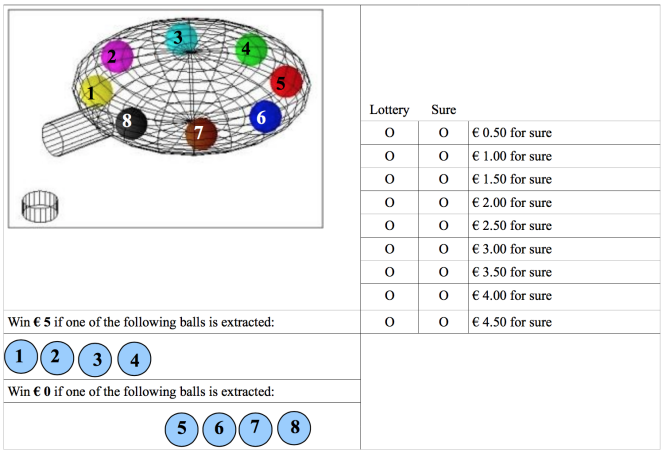

Figure 1: Example of choice list to elicit a CE (in PPP Euros)

in block after the risky prospects. The prospects were presented to subjects in a fixed order, whereby first 50-50 prospects were presented in order of ascending expected value, and then the remaining prospects were presented in order of increasing probability. The fixed order was kept so as to make the task less cognitively demanding for subjects, since in the fixed ordering only one element would change from one decision task to the next, which could be easily pointed out by the enumerator. To test whether such a fixed ordering of tasks might influence decisions, we ran a large-scale pilot at Ho-Chi-Minh-City University involving 330 subjects. The pilot revealed no differences between the fixed ordering used here and a random ordering (results available upon request).

CEs were elicited in individual interviews by a team of 18 enumerators. The enumerators were extensively trained before going to the field, and had acquired experience by running the same experiment with students. They were furthermore supervised in the field by one of the authors. The actual experiment was preceded by a careful explanation of the decision tasks involved. The subjects were told that they would face choices between amounts of money that could be obtained for sure and risky allocations, in which different amounts would obtain with some probabilities indicated next to them. They then learned that the interview would consist in a number of such tasks that would differ in the amounts they offered as well as the likelihood with which these amounts obtained. At the end, one of the tasks would be extracted at random, and one of the lines in which they had indicated a choice between a sure amount and the prospect would be played for real money (the standard procedure in this sort of task: Abdellaoui et al., 2011; Baltussen, Post, van den Assem and Wakker, 2012; Bruhin et al., 2010; Choi, Fisman,

Gale and Kariv, 2007). Losses were only introduced once all the gain prospects had been played. Small breaks were taken between the different parts of the elicitation procedure.

Once a subject had understood the general structure, he was presented an example of a decision task for risky gains. The enumerator then explained why for a safe amount equal to the lower amount in the prospect, he would likely prefer to take the prospect. Equivalently, once the sure amount reached the highest amount to be won in the prospect, the subject would be explained that he would most likely prefer the sure amount. This would lead naturally to a point at which a subject should switch from the prospect to the sure amount. At which amount this would happen would be purely up to the subjects's preference. Most subjects understood this very quickly. If subjects wanted to switch multiple times, enumerators were instructed to simply record such choices. This, however, never happened.

Since all farmers were literate, they were shown the lottery depiction and the amounts involved on the interview sheet. Every time a major change occurred in the decision tasks (e.g. a change in probabilities or outcomes, or from gains to losses), the enumerator pointed out the change and gave additional explanations of what this would involve. In the course of the explanation, farmers were also shown bags containing numbered ping pong balls that would be used for the random extraction, and were encouraged to examine their contents. This served to make the decision problems more tangible and concrete.

The prospects concerned payoffs between 0 and 320,000 Dong (in the mixed prospect, including the endowment), which were added to a fixed participation payment of 8,000 Dong (these payoffs are the PPP-equivalent of the payoffs used by Vieider et al., 2015; see Vieider, 2012, for evidence that small stake variations potentially caused by local differences in PPP do not impact estimated risk preferences). These are substantial sums, with the expected payoff from participation corresponding to about 6 days' per capita income of the median household, and the highest prize to over 10 days. This indicates a general tendency by which PPP conversions used for developing countries underestimate the amounts used if one were to employ income instead of prices as a gauge. Notice how, given the well-established finding of risk aversion increasing in stakes (Binswanger, 1980; Fehr-Duda, Bruhin, Epper and Schubert, 2010; Holt and Laury, 2002; Kachelmeier and Shehata, 1992; Santos-Pinto, Astebro and Mata, 2009), this tends to bias our findings *against* risk tolerance. Notice also that the payoffs we offer are at

least as high as most of the payoffs offered in similar studies in developing countries (for instance, Attanasio, Barr, Cardenas, Genicot and Meghir, 2012, have average payoffs of about $2, corresponding to about 1 day's pay; Yesuf and Bluffstone, 2009 have an average payoff of about 3 days of pay).

The overall quality of our data is reasonably good, although there are also significant levels of noise. About 25% of our subjects violated first order stochastic dominance at least once for gains, and about 31% for losses.[3] This is only slightly higher than violation rates observed with student samples from the West. Abdellaoui, Bleichrodt, L'Haridon and Van Dolder (2013) found about 20% of subjects to violate stochastic dominance in a laboratory experiment with students in the Netherlands using individual interviews. Overall violations relative to total number of CEs in our farmer data amount to only about 3.0% for gains, and to 4.3% for losses.

3 Theory and Econometrics

3.1 Theoretical setup

The results presented in this paper are stable to using most major theories, including expected utility theory (EUT) and prospect theory (PT). The main modelling approach in the paper is motivated by obtaining the highest possible descriptive accuracy, conditional on keeping the analysis tractable from an empirical point of view. We will adopt a reference-dependent modelling approach throughout. Such an approach is an integral part of prospect theory (Kahneman and Tversky, 1979). It was first proposed for expected utility by Markowitz (1952), in an attempt to accommodate the observation of lottery and insurance purchase by the same person, and has by now been widely adopted into expected utility models in both theory and empirical analysis (Diecidue and van de Ven, 2008; Kőszegi and Rabin, 2007; Sugden, 2003; von Gaudecker, van Soest and Wengström, 2011).[4] The elicitation tasks are designed in such a way as to fix the reference point to zero—see L'Haridon and Vieider (2018) for a more detailed discussion.

[3] Violations of first order stochastic dominance are not transparent in our experiment. They could occur for instance, if a CE for a given prospect (p: x; y) is larger than a CE for another prospect $(p + \epsilon : x; y)$ or a prospect $(p : x + \epsilon; y)$, where $\epsilon > 0$, and $x > y$.

[4] We refer to these models as models of 'expected utility' insmuch as they still transform outcomes into utilities and then take the expectation of these utilities. The main difference with (original) EUT is that reference-dependent models define utility over changes in wealth, while the original model defined utility over total wealth.

We will start by representing our preferences through a PT model. We describe decisions for binary prospects. For outcomes that fall purely into one domain, i.e. $x > y \geq 0$ or $0 \geq y > x$, we can represent the utility of a prospect ξ_i, $U(\xi_i)$, as follows:

$$U(\xi_i) = w^j(p_i)v(x_i) + [1 - w^j(p_i)]v(y_i) \tag{1}$$

whereby the probability weighting function $w(p)$ is a strictly increasing function that maps probabilities into decision weights, and which satisfies $w(0) = 0$ and $w(1) = 1$; the superscript j indicates the decision domain and can take the values $+$ for gains and $-$ for losses; and $v(.)$ represents a utility or value function which indicates preferences over outcomes, with a fixed point such that $v(0) = 0$, and $v(x) = -v(-x)$ if $x < 0$. Contrary to expected utility models, utility curvature in the full PT model cannot be automatically equated with risk preferences, since the latter are determined jointly by the utility function and the weighting function (Schmidt and Zank, 2008). For mixed prospects, where $x > 0 > y$, the utility of the prospect can be represented as:

$$U(\xi_i) = w^+(p_i)v(x_i) + w^-(1 - p_i)v(y_i) \tag{2}$$

In our experimental tasks, we elicit certainty equivalents, such that by definition $ce \sim (x, p; y)$, where $\sim$ indicates indifference. We can represent the certainty equivalents estimated according to the model just presented as follows:

$$\hat{ce}_i = v^{-1}\left[w^j(p_i)v(x_i) + (1 - w^j(p_i))v(y_i)\right] \tag{3}$$

In order to specify the model set out above, we need to determine the functional forms to be used. We start by assuming utility to be piecewise linear:

$$v(x) = \begin{cases} x & \text{if } x > 0 \\ \\ -\lambda(-x) & \text{if } x \leq 0 \end{cases} \tag{4}$$

where the parameter λ indicates loss aversion, generally represented as a kink in the utility function at the origin (Abdellaoui, Bleichrodt and Paraschiv, 2007; Köbberling and Wakker, 2005).

Simplifying our model by assuming utility to be linear has several advantages in our setup, which we belief more than outweigh potential drawbacks. Yaari (1987) powerfully made the point that representing risk preferences through subjective probability transformations is just as legitimate as representing them through outcome transformations, and may be more psychologically accurate for small stakes. Our model is then the natural extension of Yaari's Dual Theory to reference-dependent models (see Schmidt and Zank, 2007, for an axiomatization of this model). Most importantly, this assumption allows us to directly compare subject pools in terms of their risk preferences. This is much more difficult using a full prospect theory model, given issues of collinearity between utility and weighting functions, which may both reflect risk preferences under prospect theory (Zeisberger, Vrecko and Langer, 2012). The obvious cost of our simplification is that we largely ignore any variation taking place over different stake levels. This variation is, however, modest in our data, and most interesting patterns with our stake levels typically emerge over the probability dimension (Fehr-Duda and Epper, 2012; Prelec, 1998). Most importantly, none of the results presented below depend on the linear probability assumption (see appendix A for a stability analysis using the full PT model).

For probability weighting, we adopt the 2-parameter weighting function proposed by Prelec (1998). (Other functional forms from the two-parameter family deliver similar results. One-parameter forms are, on the other hand, not well suited to describe our data, for reasons that will become apparent below):

$$w(p) = exp(-\beta^j(-ln(p))^{\alpha^j}) \tag{5}$$

For $\beta = 1$, this function conveniently simplifies to the 1-parameter function proposed by Prelec, which has a fixed point at $1/e \simeq 0.368$, and which has been developed to fit typical aggregate data from the West.[5] In terms of interpretation, β is a parameter that governs mostly the elevation of the weighting function, with higher values indicating a

[5]The one-parameter formulation was for instance adopted by Tanaka, Camerer and Nguyen (2010) to investigate risk preferences in Vietnam. We will discuss their results in more detail below.

lower function. Since this indicates the weight assigned to the best outcome for gains, and the weight assigned to the worst outcome for losses, a higher value of β indicates increased probabilistic pessimism for gains, and increased probabilistic optimism for losses. Since we assume utility to be linear, we can directly interpret this parameter to indicate risk aversion for gains, and risk seeking for losses on average over the probability spectrum. For $\alpha = 1$, the parameter indeed represents standard risk aversion, with $\beta \geq 1$ indicating risk aversion and $\beta \leq 1$ risk seeking. The parameter α governs the slope of the probability weighting function, with $\alpha = 1$ indicating linearity of the weighting function (the EUT case), and $\alpha < 1$ representing the typical case of *probabilistic insentivity*.

3.2 Stochastic modeling and econometric specification

The model considered so far is fully deterministic, assuming that subjects know their preferences perfectly well and execute them without making mistakes. It also assumes that we can capture such preferences perfectly in our model. Both assumptions seem untenable, especially in a development setting such as ours. We thus abandon this restrictive assumption and introduce an explicit stochastic structure. Given our setup, the certainty equivalent of a given prospect i we observe, ce_i will thus be equal to the certainty equivalent for the same prospect calculated from our model, $\hat{ce}_i$, plus some error term, or $ce_i = \hat{ce}_i + \epsilon_i$. We assume this error to be normally distributed, $\epsilon_i \sim (0, \sigma_i^2)$, which allows for the errors to be serially correlated (see Train, 2009). We can now express the probability density function $\psi(.)$ for a given subject n as follows

$$\psi(\theta_n, \sigma_{nij}, \xi_i) = \phi\left(\frac{\hat{ce}_{ni\theta} - ce_{ni}}{\sigma_{nij}}\right) \tag{6}$$

where ϕ is the standard normal density function, and $\theta = \{\lambda, \alpha^j, \beta^j, \}$ indicates the vector of parameters to be estimated. The subscript n to the parameter vector θ indicates that we will let the parameters depend linearly on the observable characteristics of decision makers, such that $\hat{\theta} = \hat{\theta}_k + \beta X$, where $\hat{\theta}_k$ is a vector of constants and X represents a matrix of observable characteristics of the decision maker.[6] Finally, σ indicates a

[6]We always carry out the regression within the overall maximim likelihood model. A possible alternative is to estimate the parameters at the individual level, and then to separately regress these parameters on the characteristics of the decision makers. We deem such an approach less suitable for our purposes, both because estimations at the individual level are based on relatively few data points and may result in outliers, and because it is not clear how to treat the standard errors in separate regressions of parameters that result from one and the same estimation procedure.

so-called Fechner error (Hey and Orme, 1994). The subscripts emphasize that we are allowing for three different types of heteroscedasticity, whereby n indicates as usual the observable characteristics of the decision maker, j indicates the decision domain (gains vs. losses), and i indicates that we allow the error term to depend on the specific prospect, or rather, on the difference between the high and low outcome in the prospect, such that $\sigma_i = \sigma|x_i - y_i|$ (see Bruhin et al., 2010). For mixed prospects, we adopt the error term for losses, since only losses vary in the mixed choice list.

These parameters can now be estimated by maximum likelihood procedures. To obtain the overall likelihood function, we need to take the product of the density functions above across prospects and decision makers:

$$L(\theta) = \prod_{n=1}^{N} \prod_{i} \psi(\theta_n, \sigma_{nij}, \xi_i) \tag{7}$$

where θ is the vector of parameters to be estimated such as to maximize the likelihood function. Taking logs, we obtain the following log-likelihood function:

$$LL(\theta) = \sum_{n=1}^{N} \sum_{i} \ln \left[\psi(\theta_n, \sigma_{ni}, \xi_i)\right] \tag{8}$$

We estimate this log-likelihood function in Stata using the Broyden-Fletcher-Goldfarb-Shanno optimization algorithm. Errors are always clustered at the subject level.

4 Results

4.1 Risk preference comparison

Table 2 shows a regression comparing the parameter estimates for farmers to those of American and Vietnamese students. The student data were obtained using the same experimental tasks as the ones used with the farmers and stakes are the same in terms of PPP. The American student data are borrowed from L'Haridon and Vieider (2018), who amongst other things report parameter estimates for the same model for students across 30 countries, and are meant to relate our current data to the results of that paper.[7]

[7]The data for American students were obained using sessions instead of individual interviews. For Vietnamese students, we obtained the data partially in interviews using identical procedures as for farmers, partially in sessions. We pool the data since we did not find any differences between the two methods (except for loss aversion, which is found to be lower in the interview condition; see Vieider, 2009, for a potential explanation). A regression showing this is reported in the supplementary materials.

In this sense, American students are meant to proxy for Western populations more in general—a point to which we will return shortly.

The regression controls for the sex of the respondent to address concerns that differences may be driven by gender effects that are often found for risk (Croson and Gneezy, 2009), but the differences found are stable to dropping the demographic controls. Adding additional controls is difficult, as the control variables obtained for the student and farmer subject pools are generally not comparable. An exception to this is age. However, given that all our students are very young compared to the farmer sample, adding age results in high degrees of collinearity with the student dummies. We find that women are less sensitive to probabilistic change for both gains and losses, as well as less risk tolerant for losses. This is in line with the results reported by L'Haridon and Vieider (2018), who find a gender effect mostly on probabilistic sensitivity using a sample of almost 3000 students from 30 countries.

Table 2: Comparison between farmers and Vietnamese and US students

N=424, LL=-33,294	α^+	β^+	α^-	β^-	λ	σ
students US	0.309***	0.220***	0.353***	-0.144**	0.099	-0.141***
	(0.053)	(0.053)	(0.060)	(0.060)	(0.144)	(0.021)
students Vietnam	0.236***	-0.036	0.221***	-0.026	-0.128	-0.088***
	(0.053)	(0.054)	(0.056)	(0.065)	(0.093)	(0.020)
female	-0.140***	0.049	-0.105**	-0.114**	0.131	0.027
	(0.048)	(0.044)	(0.052)	(0.055)	(0.101)	(0.022)
constant	0.492***	0.821***	0.535***	1.069***	1.664***	0.300***
	(0.031)	(0.042)	(0.032)	(0.047)	(0.068)	(0.011)

We find both student groups to be significantly more sensitive to probabilistic change than farmers, as indicated by the larger α parameter. This holds for both gains and losses, and is consistent with the interpretation of the sensitivity parameter as a proxy for rationality or numeracy (Tversky and Wakker, 1995; Wakker, 2010). Students also show less noise in their decisions compared to the farmers. The farmers are slightly (but not significantly) less risk tolerant than Vietnamese students for gains, as indicated by the negative coefficient for the β^+ parameter. The farmers are, however, significantly *more* risk tolerant than the American students for both gains and losses. Indeed, American students exhibit decision patterns as they have typically been estimated in the West (see again L'Haridon and Vieider, 2018), with a β^+ parameter slightly larger than one.[8] For

[8]For the prospect theory formulation shown in the appendix, $\beta^+ = 1$ cannot be rejected for American students, so that the function reduces to its one-parameter formulation. This estimate is thus at the lower end in terms of risk aversion of the range of estimates obtained in Western countries—see Booij, Praag and van de Kuilen (2010) for an overview.

loss aversion we find again that our farmers are intermediate between the two student populations, although none of the differences are significant.

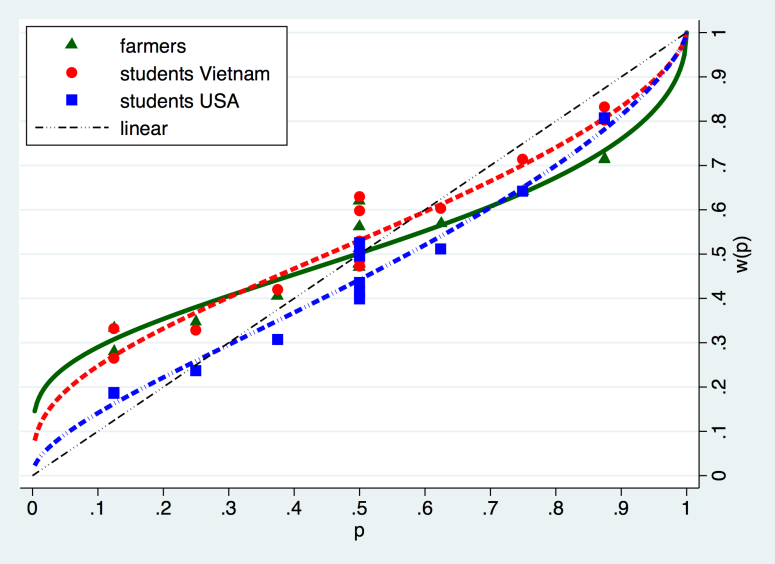

Figure 2: Risk-preference functions for gains, farmeres versus students

Figure 4 shows the three risk preference functions for gains together with the non-parametric data points (for losses see supplementary materials).[9] The estimated functions can be seen to trace the nonparametric data closely. The risk-preference function for farmers is more elevated than the one of the American students up to and including $p = 5/8$, and becomes very similar and somewhat lower for the two highest probability levels respectively. Compared to Vietnamese students, the risk preference functions are very similar up to at least $p = 3/8$, after which the two functions start to diverge, as reflected in the farmers' lower probabilistic sensitivity.

The comparison results may appear surprising, given a large number of studies showing risk aversion as the prevalent pattern in decisions under risk (we will discuss this point further below). To investigate the stability of these findings—and to be able to discuss average risk preferences over all choices with one simple measure—we now take the risk premium, given by $EV - CE$, averaged over all gain prospects (in PPP Euros; PPP US Dollars obtain by multiplication with 1.2).[10] We here concentrate on

[9]The non-parametric data are made comparable to the parametric estimates by normlisation of the certainty equivalent, $\frac{CE-y}{x-y}$, which are then plotted against the probability of winning the prize x.

[10]Notice how using a normaised risk premium, $\frac{EV-CE}{EV}$ attributes more weight to small-probability prospects relative to large-probability prospects, thus distorting the picture. Nonetheless, all our results are even stronger under this definition, as the largest differences are observed for small to moderate probability prospects.

gains—an equivalent analysis for losses is shown in the supplementary materials. Farmers have a significantly lower risk premium than American students ($z = -2.07, p = 0.039$, two-sided Mann Whitney test), and a (non-significantly) larger risk premium than Vietnamese students ($z = 1.54, p = 0.123$). While American students are significantly risk averse ($z = 4.67, p < 0.001$; two-sided Wilcoxon signed-rank test), the farmers are on average risk neutral (z=0.23, p=0.815), and Vietnamese students are on average risk *seeking* ($z = -2.38, p = 0.017$). These findings are in no way unique to American students, whom we use as a typical exponent of Western subject pools. L'Haridon and Vieider (2018) indeed show a strong positive correlation between risk aversion and GDP per capita using students subject pools from 30 different countries over a wide range of income levels, and Vieider, Beyene, Bluffstone, Dissanayake, Gebreegziabher, Martinsson and Mekonnen (2018) report results for a general population sample from Ethiopia that is consistent with the evidence obtained for students.

4.2 Risk preferences and economic well-being

So far we have only considered aggregate preferences. The next step will be to look into individual characteristics and their correlation with risk preferences. In particular, we are interested in income, as well as measures of wealth. Table 3 shows the results of a regression of risk preferences on income per capita, education, and the age of the respondent (z-values are used for age, education, and income; using discrete categories for education does not change our results). Our subject pool is reduced to 197 subjects, since for the remaining subjects one of the observable characteristics is not reported.

Table 3: Effects of income on risk preferences

N=197, $LL = -16,382$	α^+	β^+	α^-	β^-	λ	σ
	alpha	beta	gamma	delta	lambda	noise
income	-0.007	-0.074**	-0.007	0.078*	-0.065**	-0.009
	(0.036)	(0.030)	(0.031)	(0.046)	(0.028)	(0.006)
education	0.053	0.030	0.060	0.028	0.174**	-0.016**
	(0.037)	(0.040)	(0.043)	(0.129)	(0.088)	(0.007)
age	-0.075**	0.025	-0.062**	-0.027	0.094	0.017
	(0.032)	(0.051)	(0.031)	(0.053)	(0.089)	(0.011)
female	0.141	0.223	0.120	-0.385***	0.832	-0.078***
	(0.169)	(0.364)	(0.101)	(0.104)	(0.663)	(0.026)
constant	0.489***	0.820***	0.529***	1.095***	1.676***	0.312***
	(0.032)	(0.043)	(0.031)	(0.049)	(0.073)	(0.012)

Standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01

We start by looking at the elevation of the risk preference function. For both gains and

losses, we find risk tolerance to increase in income, as indicated by the negative coefficient for β^+ and the positive coefficient for β^- (since for losses we transform probabilities attached to the *worst* outcome, following the going convention; see Wakker, 2010). Loss aversion is also found to decrease in income. Probabilistic sensitivity for both gains and losses decreases with age. Given that probabilistic sensitivity is often taken to be an indicator of rationality or cognitive ability, this corresponds well to what we would expect. Also, the result corresponds closely to the results reported by L'Haridon and Vieider (2018), who find sensitivity to decrease in age and increase in grade point average. It is also in general agreement with findings by Choi, Kariv, Müller and Silverman (2014), who found violations of rationality principles to increase with age and decrease with education and income (the latter effect is not significant in our data). Loss aversion is also found to increase in education. This is contrary to the findings of Gächter, Johnson and Herrmann (2010), but in agreement with the findings by von Gaudecker et al. (2011).

An important issue is whether our findings are indeed driven by income, and not by wealth. To capture wealth levels we use the first two components from a principal component analysis into which all variables capturing wealth in our data set are entered, such as size and type of house, access to running water, sanitation facilities, motorcycles owned, ownership of TV or fridge, etc. (Filmer and Pritchett, 2001). Table 4 reproduces the results from table 3 controlling for these wealth indicators.[11] The wealth controls do not show any significant effects. This goes against the traditional assumption of risk aversion decreasing in wealth. The effect of income, however, only results reinforced from the introduction of wealth controls.

We thus find clear evidence of a negative correlation between risk aversion and income in our data. Such a negative correlation has frequently been reported in Western population samples (e.g., Dohmen, Falk, Huffman, Sunde, Schupp and Wagner, 2011; Donkers, Melenberg and Van Soest, 2001; Hopland, Matsen and Strøm, 2016), although sometimes it has been found only for a subset of the risk preference measures used (for instance, von Gaudecker et al., 2011, and Booij et al., 2010 both only found the effect for loss aversion in representative Dutch samples, but not for utility curvature over gains), and at least one study found an effect going in the opposite direction (Harrison, Lau and Rutström, 2007). A similar negative relationship with income or income proxies and risk

[11] Wealth is positively correlated with income, as one might expect. However, the correlations of our income measure with the first principal component of wealth is relatively modest at r=0.31.

Table 4: Income regression with wealth controls

N=185, $LL = -15383$	α^+	β^+	α^-	β^-	λ	σ
income	-0.004	-0.082**	-0.009	0.103*	-0.050**	-0.004
	(0.048)	(0.034)	(0.033)	(0.056)	(0.025)	(0.009)
education	0.065	0.023	0.074*	0.080	0.170*	-0.014**
	(0.041)	(0.041)	(0.038)	(0.119)	(0.088)	(0.006)
age	-0.066*	0.016	-0.060*	-0.008	0.098	0.018
	(0.039)	(0.065)	(0.034)	(0.057)	(0.091)	(0.011)
female	0.099	0.203	0.107	-0.351***	0.544	-0.071***
	(0.188)	(0.361)	(0.088)	(0.120)	(0.422)	(0.025)
pc1 wealth	0.006	0.010	-0.007	-0.034	-0.034	-0.011***
	(0.021)	(0.026)	(0.026)	(0.025)	(0.054)	(0.004)
pc2 wealth	0.015	0.024	-0.013	0.025	-0.108*	-0.007
	(0.027)	(0.041)	(0.043)	(0.025)	(0.062)	(0.005)
constant	0.487***	0.823***	0.539***	1.103***	1.702***	0.316***

Standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01

aversion has also been found repeatedly in developing countries (Liebenehm and Waibel, 2014; Vieider et al., 2018; Yesuf and Bluffstone, 2009). Other studies, especially in developing countries, have not found any correlation between risk preferences and measures of well-being (Binswanger, 1980; Cardenas and Carpenter, 2013).

5 Discussion and Conclusion

The results presented in this paper break radically with some assumptions on risk preferences of rural populations in developing countries. Far from finding high levels of risk aversion amongst poor farmers, we find farmers in Vietnam to be quite risk tolerant in comparison to typical Western populations. Taken together with international comparisons based on student samples (Rieger et al., 2014; Vieider et al., 2015), and with results from other general population samples of poor countries (Vieider et al., 2018), the results here presented provide increasingly solid evidence of a systematic negative relationship between risk tolerance and GDP per capita between countries. We have furthermore shown a clear increase in risk tolerance with income within the farmer sample itself, while risk preferences were found to be uncorrelated with wealth. This may indeed show one of the reasons why past studies especially in developing countries have not always found a correlation with measures of well-being.

Given how strong the relationship with income is, it seems unlikely that other factors would constitute a better explanation for these aggregate risk preferences. In particular, we do not think that our data can be explained in any way by noise or systematic error.

While answering randomly on our choice lists would produce risk neutrality on average, the choice patterns we find are clearly not random. Indeed, purely random choice would result in much higher frequency of violations of first order stochastic dominance than the ones we found, and would be picked up mostly by the error term.

For the development literature, the high level of risk tolerance we find at the aggregate level poses the issue of what may hold back technology adoption on the farm. To the extent that preferences cannot be blamed for this, we may look at other factors that hinder adoption. Feder (1980) observed how "risk and risk-aversion have been used to explain differences in input use and the relative rate of adoption of modern technologies by farmers of different sizes. But different patterns of behaviour are observed in different regions, and thus the impact of risk and risk-aversion needs to be examined in relation to other factors and constraints [...]" (p. 263). This conclusion is reinforced in some of the recent literature. Karlan, Osei, Osei-Akoto and Udry (2012) present results suggesting that it is the sheer amount of risk exposure that makes investments unprofitable in some cases. Mobarak and Rosenzweig (2012) present evidence that risk taking in production goes up once farmers are sheltered from the worst risks through insurance. This suggests that risk averse coping behavior may be driven by external constraints, rather than or in addition to individual preferences (Feder, Just and Zilberman, 1985). This obviously does not preclude an effect of individual risk attitudes on the *relative* likelihood of a farmer to adopt new technology. This issue is, however, beyond the scope of this paper.

The high levels of risk tolerance we find seem to contrast with a large part of the existing development literature. This may at least in part be due to the popularity enjoyed amongst development economists by choice list that are systematically distorted in the direction of risk aversion. For instance the task developed by Binswanger (1980) remains hugely popular in development economics because of its simplicity (Attanasio et al., 2012; Bauer, Chytilová and Morduch, 2012; Giné, Townsend and Vickery, 2008; Yesuf and Bluffstone, 2009). While it may be perfectly adequate to detect within-sample differences, it is capped at risk neutrality, thus making it impossible to register risk seeking behavior. In the presence of noise registering in terms of random choices, it will thus result in a drastic overestimation of risk aversion (Vieider, 2018).

Our results are also quite different from the ones obtained by Tanaka et al. (2010) in the same area of southern Vietnam. Once again, this may be due to the asymmetric choice lists employed by the latter. The case of risk neutrality, which in their model

would obtain for linear utility in combination with linear probability weights, obtains in their model when subjects switch around the middle of list 1, but at the very first question in list 2 (list 3 is used only to determine loss aversion). The relation of risk aversion to each step in the choice list is furthermore highly nonlinear, so that each step beyond the point of risk neutrality results in increasingly large steps in terms of estimated risk aversion. Just like the Binswanger task, the elicitation tasks are very unlikely to result in the detection of risk seeking behavior in the presence of noise, with noise counted systematically towards risk aversion. Clearly, there are also other differences in both elicitation and estimation that might drive the differences in our findings. More direct comparative evidence on risk elicitation tasks is needed in order to disentangle the influence of different factors.

A Subject pool comparison under PT

Table 5 shows the subject pool comparison using the full PT model, using a domain-specific power utility function. Utility for gains can be seen to be slightly convex for our farmers, an effect that is marginally significant ($\chi^2(1) = 3.63, p = 0.057$). Utility is more convex for Vietnamese students and linear for American students, although neither of the two differences is statistically significant. To examine the results in terms of risk preferences, however, we must consider them jointly with the results on probability weighting. Both student populations are significantly more probabilistically sensitive than the farmers. American students are also marginally significantly more pessimistic than the farmers, as indicated by the higher value of β^+. However, the difference between farmers and American students on utility curvature and the elevation of the probability weighting function *jointly* is highly significant ($\chi^2(1) = 15.59, p < 0.001$). While Vietnamese farmers show significant probabilistic optimism ($\chi^2(1) = 4.13, p = 0.042$, rejecting $\beta^+ = 1$), for American students we cannot reject the hypothesis that $\beta^+ = 1$ ($\chi^2(1) = 0.27, p = 0.605$), which corresponds to typical findings from the West. The results for losses are similar and will not be discussed further.

Table 5: Subject pool comparison, PT

N=425, $LL = -33,261$	μ	ν	λ	α^+	β^+	α^-	β^-	σ
students US	-0.072	-0.073	-0.449	0.317***	0.157*	0.348***	-0.195*	-0.140***
	(0.093)	(0.098)	(0.348)	(0.050)	(0.092)	(0.058)	(0.116)	(0.018)
students Vietnam	0.072	0.247*	-0.577*	0.227***	0.017	0.212***	0.153	-0.089***
	(0.096)	(0.132)	(0.335)	(0.052)	(0.093)	(0.055)	(0.158)	(0.020)
female	-0.153	0.050	-0.451	-0.129***	-0.074	-0.103**	-0.085	0.029
	(0.098)	(0.127)	(0.293)	(0.047)	(0.091)	(0.051)	(0.127)	(0.021)
constant	1.093***	1.228***	1.687***	0.490***	0.884***	0.532***	1.266***	0.301***
	(0.049)	(0.061)	(0.249)	(0.031)	(0.057)	(0.031)	(0.083)	(0.011)

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SUPPLEMENTARY MATERIALS

A Graphs for losses

A.1 Nonparametric data fit

Figure 3 shows the fit of the estimated functional form to data for losses. Similar as for gains in the main text, the risk-preference function provides a close fit to the non-parametric data. The eception to this rule are once again the observations with $p = 0.5$ and varying outcomes that were explicitly inserted to separate utility curvature from probability weighting.

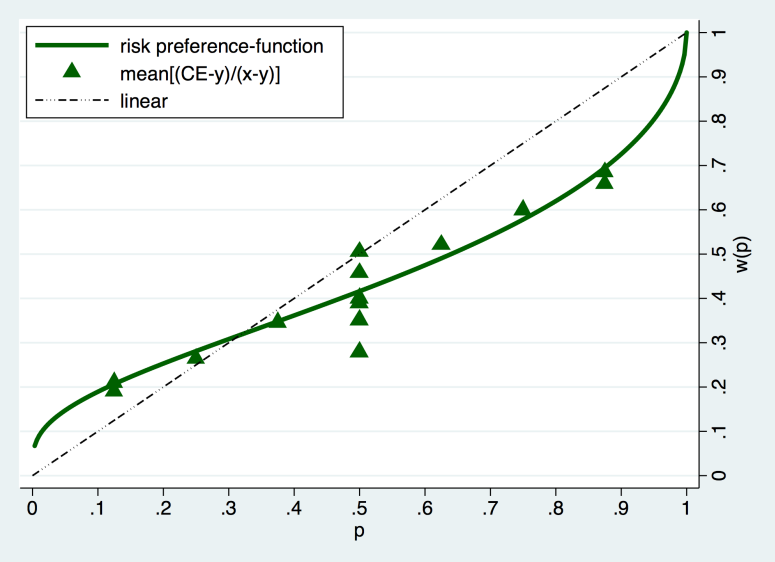

Figure 3: Fit of risk preference function to non-parametric data, losses

A.2 Subject pool comparison

The comparison of our farmers to the two students subject pools for losses is shown in figure 4. Similar to the results obtained with losses in the main text, and consistently with the comparison across the 30 countries shown in the appendix, Vietnamese students are more risk tolerant than American students, which is ow shown by a *less* elevated risk-preference function. Farmer, on the other hand, are even more risk tolerant.

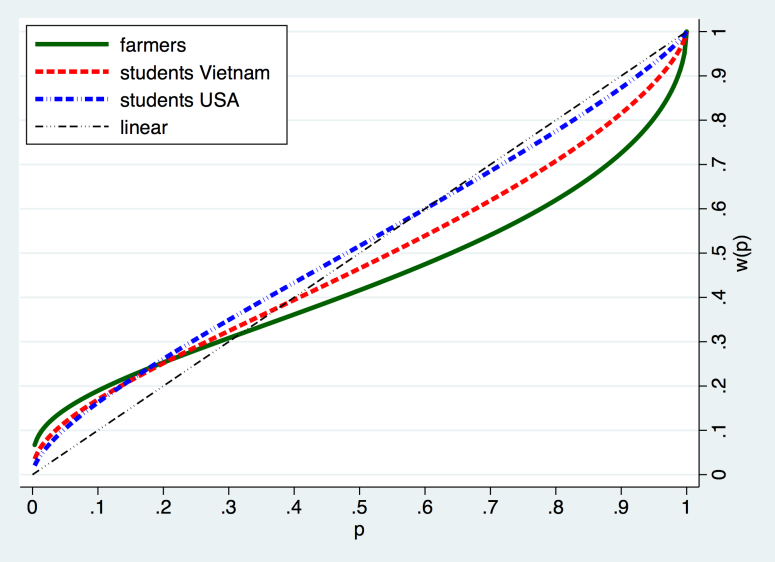

Figure 4: Risk-preference functions for losse4s, farmeres versus students

B Regression results

B.1 Non-parametric income regression

Table 6 shows a regression of the mean risk premium per domain on income and the demographic variables as in the main text. Regression I reproduces the simple regression including income per capita, education, and age, while regression II adds the first two principal components of wealth. Income shows a consistent negative effect, indicating that risk aversion decreases in income for both gains and losses. This effect is marginally significant in all regressions. There are no other significant effects.

Table 6: OLS regression of mean risk premium on income and demographics

	gains		losses	
	I	II	I	II
income	-0.519*	-0.558*	-0.422*	-0.479*
	(0.306)	(0.335)	(0.253)	(0.279)
education	-0.008	-0.050	-0.187	-0.237
	(0.322)	(0.346)	(0.265)	(0.288)
age	0.271	0.278	0.021	0.010
	(0.321)	(0.349)	(0.265)	(0.290)
pc1		0.066		0.156
		(0.209)		(0.174)
pc2		0.106		0.025
		(0.256)		(0.213)
Subjects	197	197	197	197

B.2 Interviews versus sessions with Vietnamese students

The data for farmers were obtained in individual interviews, whereas most of the comparison results with students discussed in the text were obtained in experimental sessions. To test whether this makes a difference, we compare 47 students in Vietnam who were interviewed using the same procedures as for farmers to 84 students who participated in regular experimental sessions.

Table 7: Comparison between interviews and sessions (Vietnamese students)

N=131, $LL = -9,824$	α^+	β^+	α^-	β^-	λ	σ
interview	0.111	-0.090	-0.054	0.089	-0.360***	0.053**
	(0.071)	(0.066)	(0.083)	(0.084)	(0.095)	(0.027)
female	-0.089	0.021	-0.167**	-0.072	0.024	-0.009
	(0.065)	(0.057)	(0.078)	(0.074)	(0.092)	(0.020)
age	0.016	-0.008	-0.014	-0.021	0.026	-0.004
	(0.029)	(0.020)	(0.029)	(0.023)	(0.033)	(0.008)
constant	0.339	0.988**	1.095*	1.416***	1.186*	0.274*
	(0.593)	(0.399)	(0.611)	(0.461)	(0.656)	(0.165)

The results are reported in table 7. There is no effect of the interview dummy on the sensitivity or risk preference parameters for either gains or losses. The one effect we do find is on loss aversion. This is indeed consistent with previous findings in the literature, according to which loss aversion is reduced if subjects are asked to justify their decisions (Pahlke, Strasser and Vieider, 2012; Vieider, 2009). Although there was no explicit justification requirement here, subjects in interview sessions may have felt increased pressure and observability nevertheless. Somewhat surprisingly, noise is also significantly *higher* in the interviews than in the sessions. A more thorough analysis of the data will be provided elsewhere.

C Questionnaire

Date:_____ **ID:** _____
Interviewer: _____
Name of household head:_____
Location of the house: _____

QUESTIONNAIRE

Interviewer Information:		
Are there people at home? with the survey **1st Visit**	Yes _____ No _____	Proceed
Are there people at home? with the survey **2nd Visit**	Yes _____ No _____	Proceed

Good morning (afternoon, night). My name is_____ I am conducting a survey regarding flooding and we are interested in know your opinion about this topic. In the survey you will have the opportunity to make some money by participating in a game. We would like to interview the person in the household who makes decision related to farming activities. This survey is totally confidential. Is it you? Or Could I talk to him/her?

Yes _____ Thank you very much.
No _____ Reason:
[01] _____ Is not at home*
[02]_____ Cannot answer in this moment*
[03] _____Do not want to respond
[04]_____ Other _____

* Can I come back in other day/moment for apply it?

Yes _____ Day: _____
Time _____
No _____ Finish the survey

If respondent does not show up in the second visit, the household is classified as non-respondent. Enumerator picks a neighbor as a replacement.

Background information

1-9 [ENUMERATOR: Please ask these questions in below table for all household members.]

List	1. Yearofbirth	2. Marital status	3. What class of school did you complete or what degrees have you received?	4. Main occupation	5. Gender (1=Male; 0=Female)	6. For the last 12 months, how many months has […] been staying with the household	7. Why did […] leave this household?	8. Which province does […] work in?	9. What does […] work?
1									
2									

Marital status	Educationlevel	Reasons for leaving	Occupation list	
1= Single 2= Married 3= divorced 4= widow	1=no school 2= Elementary school (first grade to fifth or sixth grade) 3= Middle School (sixth or seventh grade to ninth grade 4= High School (tenth grade to twelfth grade) 5= vocational school 6= college/university 7=post graduate	1= For work 2 = Married 3 = Household split 4 = For study 5 = Moved with Family 6= Other (specify)	1= Farmer/gardener 2= Housewife 3= work at local NGOs 4= work at local government offices 5= Unskilled manual worker/Contracted laborer 6= Skilled manual worker 7= Food seller on the street 8= Street seller 9= Teacher 10=under labor age 11=Driver 12=Soldier	13= Retired 14= Owner of business 15= Sewage Worker 16= Small business 17 = Fisherman 18 = Service worker (eg. hotels, restaurants) 19 = Unemployed 95 = Other

10. What is your religion?
    1= AncestorWorship
    2 = Buddhist
    3 = Catholic
    4 = Protestant
    5 = No Religion
    6= Other, specify

11. And your race?
1=Kinh 2=Khmer 3=Thai 4=Han (China) 5=Islam 6= Other (Specify)

12. How would you say your health is in general? (circleone option)

Very good	1
Good	2
Neither good nor poor	3
Poor	4
Very poor	5

13. How tall are you?_____cm

13.1 Are you member of Communist party? 1= yes 0= no

(if yes, go to question 13.2: if no, go to question 14)

13.2 For how many years have you been the member of the party? _____ (year)

13.3 How many other household members are member of Communist party? 1= yes _____people

Economic Status

14. How much is your family average monthly income?

Income source	**Amounts (Local currency)**
Salary	
Farming (cultivating, gardening)	
Animal husbandry (cow, aquaculture)	
Fishing	
Rentedlabor	
Leased land	
Remittance	
Other_____	

Note: (98) no response (99) don't know/not sure

15. Would you say that your annual income is stable or varies in the past 5 years?

Very Stable										Very variable
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

16. How large proportion of the food consumed comes from your own land? ____%

17. How much would it cost if you had purchased the food that comes from own land in the market?_____(in local currency)

18. How much is your family's monthly expenditure?

Source	Amount (Local currency)
Food	
Education	
Health	

Electricity and domestic water	
Small shopping	
Social events (for example wedding or funeral)	
Telephone	
Other _____	
Total	

Householdwealth

Housing

19. What are the following parts of your house made of?

Floor: 1 = Stone
2 = Cement
3 = Clay/Mud
4 = Brick
5 = Other:_____

Wall: 1 = Stone
2 = Cement
3 = Clay/Mud
4 = Brick
5 = Metal
6 = Rattan
7 = Other:_____

Roof: 1 = Thatch
2 = Cement
3 = Clay/Mud
4 = Tile
5 = Metal
6 = Other:_____

20. How many rooms do you have in the house? _____ rooms

21. What is the source of lighting in the house?
1 = Electricity
2 = Biogas
3 =Kerosene
4 = Other _____

22. What is the main fuel used for cooking in the house? (Enumerator: Readresponses)
1 = Electricity
2 = Gas
3 = Firewood
4 = Kerosene
5 = Charcoal
6 = Other

23. What is your household's main source of water for cooking and drinking?
1 = Private tap
2 = Private well

3 = Public standpipe
4 = Canal or river water
5 = Other

24. How far is the water source? _____minutes

25. Do you have a private toilet in the house? 1= yes 0= no

26. If "no" to question 25, where do you defecate? 1 = Open toilet 2= Community toilet

27. If "yes" to question 25, where does the waste discharge to?

1 = Sewer system
2 = Septic tank
3 = Pit
4 = Do not know

Consumer and productive durables

28. How many of the following devices does your household have?

A. Sewing machine	
B. Air-conditioning unit	
C. Refrigerator	
D. Television	
E. DVD/VCD/VHS player	
F. Computer/Laptop	
G. Gaming console	
H. Mobile Phone	
I. Motorcycle	
J. Bicycle/electric bicycle	
K. Car	
L. Boat with engine	
M. Boat without engine	

Land holdings and agricultural investment

29. How many ha of land does your household own?
…….ha

30 . How many of your ha has your household rentedin the previous season?

…….ha

31 . How many of your ha has your household leasedin the previous season?

…….ha

30. CALCULATE LAND AVAILABLE 29-30+31

You have ….. ha available for farming IF ZERO SKIP TO Q31.
If yes, please indicate for each category:

Land for rice production:_____ha

Land for vegetable production:_____ha

Otherland:_____ha

31. Do you have a fish farm? 1 =yes 0 = no

    If a pond - please indicate size:_____(m^2)

    If a cage in river - please indicate size:_____ (m^2)

32. Do you own any livestock? If yes, please indicate quantity for each type:

    pigs:_____

    water buffalo:_____

    cattle:_____

    chicken:_____

    other:_____

33. In general, what proportion of your agricultural and fishing production do you sell on the market?

    Agricultural: I sell_____%

    Fishing: I sell_____%

Savings and Borrowing

34. How does your household save money?

    1 = save at a banking account

    2 = save at home

    3 = save at a relatives/friend/neighbor's home

    4 = save in Rotating Savings and Credit Association (ROSCA)

    5 = don't save at all

35. If yes, how much is your household's total saving now? _____

36. If you are using ROSCA to save, how long have you been a member? (months) ____ (years)____

37. What does the arrangement you are sending your saving to ROSCA?

    1 = Daily 2 = Weekly 3 =Monthly 4 = Whenever money is available

38. What are the purposes of the saving?

    1 = To build or buy a house
    2 = To buy consumer durables
    3 = To invest in income generating activities
    4 = To cater for a family emergency
    5 = Other _____

39. Has your householdborrow money since last 5 years? 1=yes 0=no

If yes	Credit source*	Amount (local currency)	Interest (per cent per month)	Main credittaker **	Expiration date
Most important loan					
2nd most important loan					
3rd most important loan					

*: 1=bank; 2=relatives, neighbors and friends; 3=socio-organizations, 4=private lenders, 5=development programs
** 1= Householdhead 2= Spouse 3= Other

40. How easy would it be to borrow 125 EUR? *(Enumerator: read responses)*

1 = Very easy
2 = Somewhat easy
3 = Somewhat difficult
4 = Very difficult
5 = Impossible
6 = Don't know/not sure

41. If you want to borrow 125 EUR and cannot borrow it from a family member, where would you want to go to borrow it?

1 = Neighbor/Friend
2 = ROSCA
3 = Official State-run Bank
4 = Market money lender
5 = Pawn shop (the place to take the motorbike or TV to get the money)
6 = Other (*please specify*) _____
7 = Don't know/not sure

42. How many lottery tickets do you buy during a normal month?_____

Perception of weather and adaptation

43. Do you know the [*name of the station*] gauging station? 1 = yes 0 = no

44. What water level measured atthe [*name*] gauging station that starts to have negative effects on your economic activities and family welfare? ……Meters

45. What water level measured at the [*name*] gauging station that starts to have positive effects on your economic activities and family welfare? ……Meters

46. What water level measured at the [*name*] gauging station do you most prefer in terms of your family economic activities and welfare?……Meters

Recent flood years

Please indicate on the scale below how good the flood was in recent years for you personally in terms of overall consequences to your economic activity and family welfare, with 0

indicating an extremely bad year and 10 indicating and extremely good year. Please also indicate the main reason for thisbelow.

47. Flood 2011

Very bad										Very good
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

[Enumerator: ask the following question if response is from 0 to 9]

If the year was not very good, what were the main reasons for this? Please cross one or more of the reasons below:

1 = water too high
2 = water too low
3 = flood came too early
4 = flood lasted too long
5 = high winds and waves in combination with the flood
6 = other; pleasespecify _____

48. Flood 2010

Very bad										Very good
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

[Enumerator: ask the following question if response is from 0 to 9]

If the year was not very good, what were the main reasons for this? Please cross one or more of the reasons below:

1 = water too high
2 = water too low
3 = flood came too early
4 = flood lasted too long
5 = high winds and waves in combination with the flood
6 = other; please specify _____

49. Flood 2009

Very bad										Very good
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

[Enumerator: ask the following question if response is from 0 to 9]

If the year was not very good, what were the main reasons for this? Please cross one or more of the reasons below:

1 = water too high
2 = water too low
3 = flood came too early
4 = flood lasted too long
5 = high winds and waves in combination with the flood
6 = other; please specify _____

50. Flood 2008

Very bad										Very good
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

[Enumerator: ask the following question if response is from 0 to 9]

If the year was not very good, what were the main reasons for this? Please cross one or more of the reasons below:

1 = water too high
2 = water too low
3 = flood came too early
4 = flood lasted too long
5 = high winds and waves in combination with the flood
6 = other; please specify _____

51. Flood 2007

Very bad										Very good
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

[Enumerator: ask the following question if response is from 0 to 9]

If the year was not very good, what were the main reasons for this? Please cross one or more of the reasons below:

1 = water too high
2 = water too low
3 = flood came too early
4 = flood lasted too long
5 = high winds and waves in combination with the flood
6 = other; please specify _____

52. Flood 2006

Very										Very

bad										good
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

[Enumerator: ask the following question if response is from 0 to 9]

If the year was not very good, what were the main reasons for this? Please cross one or more of the reasons below:

1 = water too high
2 = water too low
3 = flood came too early
4 = flood lasted too long
5 = high winds and waves in combination with the flood
6 = other; please specify _____

53. Do you believe that the flooding pattern is changing over the last five years, or would you rather say that floods are as they always have been?

No change at all									Dramatic change	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

54. Do you believe that the drought pattern is changing over the last five year, or would you rather say that droughts are as they always have been?

No change at all									Dramatic change	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

55. Do you believe that the start of the rainy season has been delayed over the last five year, or would you rather say that the starts of the rainy seasons are as they always have been?

No change at all									Dramatic change	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

56. Do you believe that the rainy season has ended sooner over the last five year, or would you rather say that the ends of rainy seasons are as they always have been?

No change at all									Dramatic change	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

57. What adaptation practices have your household made to cope with long term shifts in flooding during the last 5 years?

Adaptation practices	57.1 Done the practices (1=yes, 0=no)	57. 2 When have you done this practice (year) and what did you do
1. Changed crop variety		
2. Built a water harvesting system		
3. Built higher dykes		
4. Bought insurance		
5. Irrigated more		
6. Changed from crop to livestock		
7. Migrated to another area		
8. Found off-farm jobs		
9. Leased your land		

58. Last year did you receive information about the forecasted date of onset of the flooding season from
[*Enumerator: multiple answer*]

1= yes	0= no	government
1= yes	0= no	NGO
1= yes	0= no	farmer's association
1= yes	0= no	lead farmer
1= yes	0= no	peer farmer (neighbor/relative)
1= yes	0= no	media

59. If yes in at least one of the above sources, please indicate on the scale below how accurate the forecast was.

………… [*Enumerator: fill in the name of the organization in the 'yes' answer*]

Not accurate at all									Extremely accurate	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

………… [*Enumerator: fill in the name of the organization in the 'yes' answer*]

Not accurate at all									Extremely accurate	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

………… [*Enumerator: fill in the name of the organization in the 'yes' answer*]

Not accurate at all									Extremely accurate	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

………… [*Enumerator: fill in the name of the organization in the 'yes' answer*]

Not accurate at									Extremely	

all									accurate	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

……. [*Enumerator: fill in the name of the organization in the 'yes' answer*]

Not accurate at all									Extremely accurate	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

……. [*Enumerator: fill in the name of the organization in the 'yes' answer*]

Not accurate at all									Extremely accurate	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

60. Please indicate how yourfamily's livelihood is affected by the following risks.

Drought….

Not at all affected									Severely affected	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

Flood….

Not at all affected									Severely affected	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

Early flood…

Not at all affected									Severely affected	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

Protracted flood …

Not at all affected									Severely affected	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

Heavy rainfall …

Not at all affected									Severely affected	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

Changes in prices of agricultural products …

Not at all affected									Severely affected	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

Disrupted infrastructure …

Not at all affected									Severely affected	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

61. In case any heavy flooding should occur which damages houses and production in your community, how strongly do you expect that the government will provide relieve?

Will not help out									Will certainly help out	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

62. In case any heavy flooding should occur which damages houses and production in your community, how strongly do you expect that NGOs will provide relieve?

Will not help out									Will certainly help out	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

63. In case any heavy flooding should occur which damages houses and production in your community, how strongly do you expect that your neighbors/local community will provide relieve?

Will not help out									Will certainly help out	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

64. In case any heavy flooding should occur which damages houses and production in your community, how strongly do you expect that Buddhist monk will provide relieve?

Will not help out									Will certainly help out	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

Social capital, insurance and health behavior

Insurance availability/awareness and health behavior

65. Do you know or have you heard of any insurance that you could purchase to protect yourself against risks associated with flooding and/or drought? Pleasespecifybelow:

    1 = I have been approached by someone outside your family
    2 = I have heard about the possibility, but have never been approached personally
    3 = I have never heard about such insurance

66. [*Enumerator: ask this question if answer to question above =1*] Who is this person?
    1 = village leader
    2 = insurance agent
    3= friend/neighbor/relatives
    4 = others

67. If you have heard about such insurance or have been approached, please answer the following:
    I am insured: 1= yes 0= no

68. Please provide details about the insurance you are insured or you decided not to be insured:
    The premium …… $ per hectare (in local currency)
    The coverage (*please describe*) …….
    Other (specify)……

69. If you don't know the premium, how much do you expect for the premium_____

70. If you have heard about it but are not insured, please indicate the most important reasons for this below:

    1 = the insurance was too expensive
    2 = I did not have the money at the time/ insufficient funds
    3 = who knows if they are really going to pay in case of damage
    4 = the administrative procedures are too complicated
    5 = I have neighbors/friends/family helping me out, so I do not need insurance
    6 = the insurance offered me was too complicated, I did not understand it
    7 = I felt I did not have enough information about the insurance
    8 = the government would help in case of disaster, so no need for insurance
    9 = I have not thought about it
    10 = I have not had time to think about it
    11= Do not need insurance for other reasons:_____

71. If you have decide to be insured, please indicate the most important reasons for this

below
1= the price of the insurance is appropriate.
2= the high probability of flood occurring in the future
3= the administrative procedures are easy
4= this program is carried out by the government, so I trust this program completely
5= I will be less worried about the flood if buying the insurance.
6 = I feel pressure to buy
7=other reasons:_____

72. Have you bought health insurance last year?
1 = Yes → go to question 73
0 = No → go to question 74

73. Please indicate the most important reasons for buying the health insurance:
1= the price of the insurance is appropriate.
2= the high probability of health problems in the future
3= the administrative procedures are easy
4= this program is carried out by the government, so I trust this program completely.
5= I will be less worried about health problems if buying the insurance.
6 = I feel pressure to buy
7=other reasons:_____

74. Please indicate the most important reasons for not buying the health insurance:
1 = the insurance was too expensive
2 = I did not have the money at the time/ insufficient funds
3 = who knows if they are really going to pay in case of sickness
4 = the administrative procedures are too complicated
5 = I have neighbors/friends/family helping me out, so I do not need insurance
6 = the insurance offered me was too complicated, I did not understand it
7 = I felt I did not have enough information about the insurance
8 = the government would help in case of sickness, so no need for insurance
9 = I have not thought about it
10 = I have not had time to think about it
11= do not need insurance for other reasons:_____

75. [*Enumerator: ask this question if the family has children*] Did your children in your family have vaccination in the last three years?
1 = Yes
0 = No

76. Do you smoke?
1 = Yes
0 = No

Social capital

77. If you suddenly needed a small amount of money enough to pay for expenses for your household for one week, how many people beyond your immediate household could you turn to who would be willing to provide this money?
1 = No one

2 = One or two people
3 = Three or four people
4 = Five or more people

Please indicate below how much you trust several institutions, with zero indicating that you do not trust them at all, and 10 indicating that you fully trust them:

78. The local authorities:

Do not trust at all									Fully trust	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

79. Flood warnings:

Do not trust at all									Fully trust	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

80. NGOs:

Do not trust at all									Fully trust	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

81. Banks and micro-insurance:

Do not trust at all									Fully trust	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

82. Insurance companies:

Do not trust at all									Fully trust	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

83. My neighbors:

Do not trust at all									Fully trust	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

84. My family:

Do not trust at all									Fully trust	
0	1	2	3	4	5	6	7	8	9	10

O	O	O	O	O	O	O	O	O	O	O

85. Budhist Monk:

Do not trust at all								Fully trust	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

Are you a member in any local NGOs

Group	86. Membership (1=yes, 0= no)	87. Please rank the importance of the group for your household in general (rank 1 to 3, where 1 is the most important)	88. Are you an active member (1=active, 0=not, 2= passive)
Religious or spiritual			
Red Cross			
Veteran's Association			
Women's Union			
Youth Union			
Peasants Association			
Elderly Association			
Savings groups			
Others			

89. How do you see yourself? Are you generally a person who is fully willing to take risks or do you try to avoid taking risks? Please tick a box on the scale below, where 0 means "risk averse" and 10 means "fully prepared to take risks":

Risk averse								Fully prepared to take risks	
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

90. People can often behave differently in different situations. Please indicate your willingness to take risks for each of the areas indicated below:

	Risk averse									Fully prepared to take risks	
- in financialmatters	0	1	2	3	4	5	6	7	8	9	10
-withyourhealth?	O	O	O	O	O	O	O	O	O	O	O
-withyourfamily'shealth?	O	O	O	O	O	O	O	O	O	O	O
- for work?	O	O	O	O	O	O	O	O	O	O	O
-In agriculturalproduction?	O	O	O	O	O	O	O	O	O	O	O
-with respect to my house and possessions?	O	O	O	O	O	O	O	O	O	O	O

91. Imagine when you harvest, a middleman approaches and offers a term of payment that you agree on. You could obtain either a delayed paymentsix months from now, or a different smaller amount immediately. There is no risk involved—both amounts will be paid out for sure. Please indicate below instead of receiving a delayed payment of 800 EUR six months from now, which is the smallest amount that you would need to be paid right now.

I would need to be given _____Dong right now to give up the payment of 800 EUR six months from now.

92. Imagine when you harvest, a middleman approaches and offers a term of payment that you agree on. You could obtain either a delayed payment one year from now, or a different smaller amount six months from now. There is no risk involved—both amounts will be paid out for sure. Please indicate below instead of receiving a delayed payment of 800 EUR one year from now, which is the smallest delayed payment that you would need to be paid six months from now.

I would need to be given _____Dong six months from now to give up the payment of 800 EUR one year from now.

Happiness

93. How satisfied are you today with the following areas of your life? Please answer by using the following scale: **0** means **"totally unhappy", 10** means **"totally happy"**

How satisfied are you with

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
– yourhealth	O	O	O	O	O	O	O	O	O	O	O
– yoursleep	O	O	O	O	O	O	O	O	O	O	O
– yourwork	O	O	O	O	O	O	O	O	O	O	O
– yourincome	O	O	O	O	O	O	O	O	O	O	O
– yourdwelling	O	O	O	O	O	O	O	O	O	O	O
– yourfreetime	O	O	O	O	O	O	O	O	O	O	O
– yourfamily	O	O	O	O	O	O	O	O	O	O	O

94. In conclusion, we would like to ask you about your satisfaction with your life in general. Pleaseanswer accordingto the followingscale:

0 means"completely dissatisfied" and **10** means **"completely satisfied"**

How satisfied are you with your life, all things considered?

Completely dissatisfied										Completely satisfied
0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
O	O	O	O	O	O	O	O	O	O	O

Ask these following questions if the household is cultivating rice

95. Where do your paddy fields locate?
    1 = All my paddy fields are outside the dike system
    2 = All my paddy fields are inside the dike system
    3 = Part of my paddy fields are outside the dike_____ (ha) and a part is inside_____(ha)

96. Last year, how many crops did your household cultivate and what were the yields?

	Inside the dike system			Outside the dike system		
	Crop (1 = yes, 0 = no)	Size (ha)	Total yield (ha)	Crop (1 = yes, 0 = no)	Size (ha)	Total yield (ha)
Winter - Spring						
Summer - Autumn						
Autumn - Winter						

Ask these following questions for those have paddy field outside the dike system

97. What time do you forecast that the first flood will come? ___/_____(day/month of the lunar calendar)

98. What probability do you think that this year flood will come before you harvest the Summer - Autumn crop? _____%

99. Do you decide to invest the Summer – Autumn crop? 1 = yes 0 = no

100. When you decide whether to invest in the Summer – Autumn crop, do you consult your fellow farmers?
    1 = yes, my decision is affected by them
    0 = no, I decideindependently

101. When you decide whether to invest in the Summer – Autumn crop, do you consult the local government?
    1 = yes, my decision is affected by them
    0 = no, I decideindependently

102. If you decide not to invest in the Summer Autumn crop, how do you use your land?
    1 = let it idle
    2 = rent it out with price _____ thousand dong/ha
    3 = other _____

Technology adoption

103. In the current Winter – Spring crop, did you change rice varieties?
    1 = yes, from _____to _____
    0 = no

104. Have your household participated in the following programs?\

Program	**Participation**	**Which years?**
Produce and use Green fungus (Mo hinh nhan nuoi nam xanh tai nong ho)	1 = yes 0 = no	
Water saving technique (Tuoi tiet kiem nuoc tren lua)	1 = yes 0 = no	
One must five reduction (Chuong trinh 1 phai 5 giam)	1 = yes 0 = no	