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# **Experimentally-validated survey evidence on individual risk attitudes in rural Thailand**

by Bernd Hardeweg, Lukas Menkhoff and Hermann Waibel

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## Abstract

This study validates a survey-based measure of general risk attitude by an incentive compatible experiment among more than 900 participants in rural Thailand. The survey measure of self-assessed risk attitude provides a useful approximation of the experimentally derived risk attitude. This holds when we add various socio-demographic control variables to the survey-experiment-relation which are available from the representative household survey and which are related to risk attitude in plausible ways. The survey measure also predicts individual behavior towards risk in other cases; the survey measure even outperforms the experimental measure in this respect.

JEL-Classification: C93 (field experiment), D81 (decision-making under risk), O1 (economic development)

Keywords: field experiment, socio-economic survey, risk attitude

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# Experimentally-validated survey evidence on individual risk attitudes in rural Thailand

## 1 Introduction

Individual risk attitudes are a core determinant of economic behavior and have thus been under close scrutiny (e.g. Guiso and Paiella, 2005, Tanaka et al., 2010). There are now many experimental studies being conducted – also in developing countries – which provide comprehensive information about behavior towards risk (e.g. Eckel and Grossman, 2008, Cardenas and Carpenter, 2009). The shortcoming of this line of research is, however, that evidence is derived from smaller samples due to the efforts necessary in conducting experiments. These restricted samples hardly have enough variation (and scope) in their socio-economic variables to be useful in broader micro-econometric analyses. Thus there is an urgent need to generate information about individual risk attitudes in a more simple way so that it can be implemented for example in the increasingly popular large panel studies (see Dercon, 2008).

We take the route of Dohmen et al. (2009) and test the validity of a simple survey item on risk attitude by a related field experiment. As in their benchmark study in Germany, we find for our sample of more than 900 respondents in rural Thailand that a simple self-assessment of one's risk attitude – as part of a survey study – provides a useful measure. This self-assessed risk attitude indicates risk aversion of respondents on average, it has appealing socio-demographic correlates (see Donkers et al., 2001) and it is validated by an experiment with the same persons. Reassuringly, the self-assessed risk attitude also predicts behavior in other cases of risk taking (see also Jaeger et al., 2007, or Dohmen and Falk, 2010).

Different from Dohmen et al. (2009) we conduct the experiment with exactly the same persons as the underlying survey. The direct linkage between survey and experiment allows comparing relative merits of the two measures across all survey-based items of interest. If we use the experiment-based measure instead of the survey-based measure, the predictions of behavior in other cases of risk taking become weaker, and if we consider both measures together in a kind of horse-race it is the survey item that dominates.

Our study is part of a larger research project which relies on a representative survey of rural households in three provinces of Northeast Thailand. In order to test the validity of simple questions about risk attitudes in a large scale survey we compare answers with a standard risk experiment of the Holt and Laury (2002) type. This validation is essential as

survey items are not incentive compatible and thus may yield accidental findings. The expected financial incentive for participation at the half hour experiment is about a full day wage of a rural laborer. As we are addressing exactly the same persons, we can directly compare more than 900 participants' responses for the survey item and for the experiment. We find that the survey item predicts the outcome of the experiment to a statistically significant degree. This relation is not disturbed by considering several further possible determinants of risk attitudes, such as age, gender etc. Thus a simple survey item giving the self-assessed risk aversion of a person may be a useful measure. This result is in line with related literature.

In order to check the reliability of our result we proceed in three steps: first, the self-assessed risk attitude is examined further by relating it to socio-demographic variables. These correlations – bivariate or multivariate – have largely conventional signs. Nevertheless, some cases seem to be noteworthy, as they probably reflect respondents' living circumstances in a poor developing area. In this sense, among income and wealth-related variables it is consumption that seems best to capture standard effects of economic status on risk attitude. Interestingly, the variables of being married, living in larger households and being a civil servant are insignificant and rather tend to be related to more willingness to take risk in our sample. It seems possible that these circumstances buffer against adverse shocks and thus do not limit risk taking, whereas the opposite often holds in advanced economies. Moreover, the influence of gender and height on self-assessed risk attitude is weak at best for our group. Although coefficients have the expected signs they turn insignificant in most (multivariate) regressions.

Second, we further challenge the explanatory power of the general risk attitude survey measure for the experimental outcome in two ways: we exclude those respondents whose answers may be questionable, which does not affect our results. Then, we form three subgroups with different degrees of education and repeat the analyses. The explanatory power is better for respondents with longer years of schooling, indicating less noise in responses, but it is important for our purpose that the relation also holds for the least educated group with only four years of schooling.

Third, we take again the route of Dohmen et al. (2009) and examine whether the general risk attitude survey measure does predict other cases of behavior towards risk. Therefore, we make use of three survey items asking for risk-related behavior, e.g. (1) regarding a hypothetical investment lottery. This case addresses risk aversion in a financial environment and is thus different from the general risk aversion addressed in the standard survey item and the experiment. Reassuringly, we find that the general risk attitude does predict behavior in the

hypothetical investment lottery. Moreover, we find that the general risk attitude is a useful proxy in predicting answers on other cases of behavior towards risk too, i.e., (2) the purchase of lottery tickets and (3) the fact of being self-employed. The relevance of the survey measure is supported by horse-races with the experimental measure in these three cases of behavior towards risk: the survey measure has more explanatory power.

Our study is related to the many studies conducting *experiments* in developing countries with a focus on eliciting people's risk aversion, starting with Binswanger (1980, 1981) and being surveyed by Cardenas and Carpenter (2008). Our results are similar to the literature; so in this respect we add a new study with a comparatively large sample of more than 900 participants. Our study is of course also related to the increasingly popular (panel) *survey* studies uncovering very broad aspects of people's lives in developing countries as we also have a broad set of socio-demographic variables available.

Regarding its research design our study is built on Dohmen et al. (2009). They are the first validating survey evidence on risk aversion by an experiment, in their case based on a large socio-economic panel in Germany. We deliberately rely on their survey items and experiment and apply it to a developing country. We differ in research design as they run the experiment with another group than the underlying survey, although their experimental group is large (450 participants) and representative for the even larger survey group. Moreover, due to the high income level in Germany, monetary incentives relative to income are higher in the poor Thai area. Tanaka et al. (2010) directly link survey and highly-incentivized experiments to the same persons, however, three years lie in between survey (2002) and experiment (2005). Moreover, they consider only few socio-economic control variables. Finally, there are two other recent studies building on Dohmen et al. (2009) which analyze, however, smaller student populations. Lönnqvist et al. (2010) compare the same 232 students' risk attitude elicited via self-assessment and via an incentivized laboratory experiment. Surprisingly, the two measures are not significantly related but the survey measure can predict other dimensions or risky behavior whereas the experimental measure cannot. Ding et al. (2010) also compare survey and several experiments for 121 Chinese students and find among others that survey measure and experimental are correlated as expected. Overall, we contribute to this strand of literature in that we consequently integrate the experimental validation into a representative household survey in developing countries.

Our study is structured into four more sections. Section 2 describes our data, i.e. the survey sample and the experiment. Section 3 presents results of the self-assessment and Section 4 of the experiment. Section 5 examines the usefulness of the survey item for

predicting behavior towards risk in further cases and Section 6 reports more robustness tests. Finally, Section 7 discusses findings and Section 8 concludes.

## 2 The survey sample

Our study is based on a survey sample which is typical for the rural population in the Northeastern part of Thailand. This area is the poorest among the large five regional areas of Thailand.

The survey data was collected in 2008 as part of a larger research project on the measurement of vulnerability to poverty in rural Thailand. Therefore, we have focused on the less industrialized and relatively poor Northeastern region and picked three distinct provinces from this region. Within each of these three provinces the sample is representative for their *rural* areas, i.e. capital cities have been excluded. As the three provinces are weighted according to their population, the overall survey also provides more general information about the rural population in Northeastern Thailand. When it comes to personal information, however, the survey is biased towards household heads as they were the preferred survey participants.

The overall survey covers a sample of almost 2,200 households which has been drawn in a three stage sampling procedure. In the first stage sub-districts within a province were chosen with probability proportional to size (number of households) and implicit stratification by population density. From each sampled sub-district two villages were sampled with probability proportional to size. In the third stage, a systematic random sample of ten households was drawn from household lists of the rural census ordered by household size.

Questionnaire items cover a range of socio-demographic characteristics of rural households and respondents. Because of our goal to examine risk attitudes, respective items were included in the survey wave conducted during April and May 2008. In addition, an experiment for eliciting risk attitudes from the respective respondents was conducted in the largest of the three provinces, i.e. Ubon Ratchathani. It covers 950 of the 2,200 households. This provides our regular sample, for which we have the full questionnaire information plus the experimental results.

Due to our focus on risk attitudes and their relation – among others – to financial variables such as income and wealth, we restrict our sample to answers from respondents to the age group of 18 to 80 years. It does not seem convincing to ask quite young or quite old people about financial affairs of the household. This reduces our sample by 16 people (whose

inclusion does not change results qualitatively), so that we normally have a maximum of 934 responses.

### **3 Self-assessment of risk attitude**

#### **3.1 Result of the self-assessment**

The self-assessed risk attitude by the Thai respondents (from our Ubon Ratchathani sample) is qualitatively the same as in other studies, regarding their tentative risk aversion and other characteristics of the response.

In order to elicit risk attitudes of our target population, we have adopted the general risk question from the German socio-economic panel, the so-called SOEP. The SOEP introduced in 2004 the following question: “Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?”. Responses are given on an 11-point Likert scale where the value 0 means “not at all willing to take risks” and the value 10 means “very willing to take risks”. It is intended that this self-assessment is very general and does not refer to any specific circumstances, such as financial affairs or financial lotteries.

The histogram of respondents’ self-assessment is shown in [Figure 1](#). The fact that the bars are slightly higher on the left of the diagram than the right could be a hint for some average risk-aversion within our sample. This interpretation is supported by a mean value of 4.56 which is slightly smaller than a middle value of 5.0. A second feature of this histogram is the high bar at its middle with about a 40% share of all responses. Whereas it is expected that a Likert scale generates many responses at its middle, the size of this effect is strong, compared for example to the German SOEP data with about 22% (Dohmen et al., 2009). A third interesting feature in Figure 1 is the high response to the two extreme categories with about 12% each. The second and third features taken together seem to indicate that these Thai respondents are very decisive decision-makers.

Overall, the response is within the range of expectations. As a next step to further examine the risk attitude of our sample, we analyze simple rank correlations between the self-assessment and variables that are potentially related to risk attitude.

#### **3.2 Correlates of the self-assessment**

The self-assessment of risk attitude in our sample is significantly correlated to a variety of variables, mostly in the expected way. Some signs, however, differ from studies in advanced countries and indicate that studies in developing countries deserve attention.

We derive variables of potential interest from earlier studies and allocate them into five groups. (1) First, we consider variables that are largely *exogenous* with respect to risk attitude. This refers to the sex and age of respondents, two variables that are widely covered in the literature. Findings tend towards women and older people being more risk averse. If one would allow for further alternatives there may be even risk-seeking by older respondents on the assumption that prospect theory generates the decision (see Harrison et al., 2010). In addition, Dohmen et al. (2009) suggest considering the height of respondents; they expect and find that taller persons tend to accept more risk (see Persico et al., 2004), although this variable has the relatively smallest (and sometimes insignificant) impact. Despite their largely exogenous character, these three variables may be possibly and partially endogenous because gender, age and height are related to economic status and thus to risk taking. To put it differently, it may be crucial to also control for economic status.

(2) It is known from many experiments and it can be expected from theory that the *economic status* will impact risk attitude. Accordingly, higher income and higher wealth will tentatively go along with less risk aversion. We add consumption because the measurement and interpretation of income is subject to difficulties in developing countries. Finally, as human capital is an important determinant of economic status we include the years of education that the adults in our sample have experienced. (3) Some studies find that *family status* is related to risk attitude. Married respondents with larger families, i.e. usually having more dependents, tend to be more risk averse. (4) As next group of variables we consider respondents' *employment status*. It has often been found that self-employed people are less risk averse, the opposite is expected to apply to unemployed and civil servants. (5) Finally, we consider other *subjective attitudes*. People who say that they feel to be less healthy tend to be more risk averse, whereas people with more optimistic expectations regarding their life are expected to be less risk averse.

The full list of variables which we consider is given in [Table 1](#). The exact items of the questionnaire are described at the table's bottom where necessary. Column (1) gives the number of observations which is consistently above 930, with the exception of income where about 20 cases are missing. Column (2) presents the variable's mean, column (3) the respective standard deviation.

In addition to these descriptive statistics column (4) gives the coefficient of the Spearman rank correlation between the variable and the item of general risk attitude introduced above (see Figure 1); the p-value is given in parenthesis. It is obvious at first sight that many of these coefficients are statistically significant. Moreover, many of these



coefficients have the expected sign, among them the three largely exogenous variables. We find indeed that female, older and shorter respondents all show a more risk averse attitude. Regarding economic status variables, results fit with expectations as well; consumption and education have significant signs, whereas coefficients on income and wealth are not significant. Regarding the family status, variables provide some surprise because being married and living in a larger household do not go along with higher risk aversion and only having more dependents has the expected significant relation towards more risk aversion. However, Miyata (2003) found “co-residence”, i.e. in our case being married and living in a larger household, goes along with less risk aversion and interprets this as a security blanket. Regarding the employment status the coefficient on self-employment and on unemployed meet the expectation (Cramer et al., 2002, Caliendo et al., 2009), whereas being a civil servant has an unexpected positive sign, indicating risk acceptance, although at a p-level of 15% only. Finally, subjective attitudes have the expected (significant) signs.

Overall, correlates mainly suggest the conventional structure in our sample. Interestingly, with respect to being a civil servant, being married and living in larger households – these characteristics are *not* correlated with more risk aversion, although evidence from advanced countries shows this relation. An explanation could be that these variables have a different meaning depending on living circumstances. In a developing country, for example, civil servants, married respondents and those in larger households can afford accepting more risk than others. Before interpreting these correlations even further, possible relations will be tested in a multivariate approach (Hill, 2009).

### **3.3 Determinants of the self-assessment**

The multivariate interval regressions confirm our earlier findings on correlates, although coefficients on several variables become insignificant.

Regarding the estimation approach, we take an interval regression approach whenever possible because the marginal categories may be understood as open intervals. Alternatively, ordered probit regressions lead to similar results. More important seems to consider the complex sample design by correcting standard errors for clustering and unequal sample weights (see Wooldridge, 2002, pp.134f.). In a few cases this procedure cannot be fully applied because of empty clusters; we report this in table notes.

As a first specification we only consider the three largely exogenous variables so that causality does not seem to be a major issue. The result in [Table 2](#), column (1) shows, that signs are the same as for the correlates but only age has a significant coefficient. The insignificant

gender coefficient may require further consideration as several studies, such as Harrison et al. (2007) or Dohmen et al. (2009), find a negative coefficient which is statistically significant. However, Eckel and Grossman (2008) comment on this result with the qualification that "... there is enough counter-evidence to warrant caution". They criticize in particular a lack of crucial controls, an issue where our data allow quite some adequate coverage.

As second specification we also consider variables for economic status. If we include them one by one, in order to account for their correlation to each other, wealth (in logarithmic form) has a p-value of 10%, income (also in logs) has a p-value of 5% and comparatively best is consumption (in logs) with a p-value of 2%. Therefore we only present this last result in column (2). Here and for some further socio-demographic variables we are aware that causality is less clear as, for example, the willingness to take risk may impact the economic status. We are not aware of a good instrument, however, so that we report correlations in this case between risk attitude and variables instead of determinants of risk attitude.

As our last specification we include all variables being considered so far in one regression. The result in column (3) shows that signs are basically as expected but that only age stays significant, consumption loses significance and self-employment as well as optimistic expectations turn significant. These findings are quite robust in that significant variables keep significance even with some modified specifications, whereas the gender variable has a positive coefficient here but is insignificant (and never becomes significant with a positive coefficient).

In summary, the self-assessed risk attitude has intuitive correlates which tend to hold in a multivariate regression as well. This is our basis to introduce the experiment.

## **4 Experiment on risk attitude**

In addition to the self-assessment, an experimental elicitation of risk preferences was conducted among the sample from Ubon Ratchathani province. We describe the standard experiment in Section 4.1, then we test in Section 4.2 whether the self-assessed risk attitude provides useful information in explaining the experimental result and show some robustness considerations in Section 4.3.

### **4.1 The experiment**

Upon completion of the survey questionnaire, the respondent was asked to participate in a risk experiment which is designed as in Dohmen et al. (2005). This experiment is of the established Holt and Laury (2002) type. The exact experimental design, including the

presentation to participants, was decided after several test runs in order to ensure appropriateness. The interviewers conducting this experiment received an intensive training ensuring uniform treatment in the field. Indeed, the ex post evaluation does not reveal any significant differences in results between interviewers.

In the experiment, the respondent was confronted with 20 choices between a safe payoff and a lottery. These choices are presented on a table showing 20 rows. At each row the participant was asked in ascending order of the rows whether she would prefer to receive the increasingly higher safe payoff or to play a lottery where the payoff could be either zero or 300 Thai Baht, corresponding to about 17.46 US-dollars at purchasing power parity or about a full day salary; this financial incentive should be large enough to address any respective concerns (Camerer and Hogarth, 1999, Holt and Laury, 2002). The participant was also informed that after the 20 choices had been noted, a random number between 1 and 20 would determine which of the 20 choices was to be played with real payoffs. A preference for lower row numbers implies higher risk aversion, a safe payoff at 150 Baht versus the zero or 300 Baht lottery (row 16) implies risk neutrality, whereas preferring the lottery at rows 17 to 20 corresponds to risk loving behavior. The row in which the respondent's preference switched from the lottery to the safe amount was marked. This "switching row" informs about the person's risk attitude.

After the choice had been noted, a number between 1 and 20 was drawn randomly. In case the number drawn was below the respondent's switch point, the lottery would be played by tossing a coin and 300 THB would be paid upon "King" and 0 otherwise. If the random number was higher than the switch point, the respondent received the safe amount. By this procedure, the incentive to reveal actual preferences was ensured. The cash payment to everyone is different from Dohmen et al. (2005, 2009) where the game was only played with real money with a probability of 1/7 and the money was transferred by cheque.

The result of the experiment is shown in [Table 3](#). Column (1) gives the share of answers in the respective row and column (2) gives the cumulative shares. We see that participants in the experiment behave quite risk averse, a finding that has been stated for Ethiopia too (Yesuf and Bluffstone, 2007) and which corresponds to the high incentives (Holt and Laury, 2002). The share of risk-neutral and risk-loving respondents is 10% and thus smaller than in Holt and Laury (2002) with 19% and in Dohmen et al. (2009) with 13%. Looking at details, however, the tendency to answer at the extremes resembles the response to the self-assessed risk attitude. There are 40 participants who rather reject to play the experiment as they do not want any money. Many of them explained that they never play any lotteries, which according to

casual observation may be related to the misuse of lotteries by sales people. Then there are another 234, i.e. about a quarter of participants, who prefer a safe 10 Baht to anything else. At the other extreme there is a comparatively large group of 75 participants, i.e. about 8%, who choose row 20, i.e. who are risk-loving by preferring a lottery to all safe alternatives even though the expected value of the lottery is clearly smaller than the expected value of the riskless alternative.

As a last step we transform the experimental results for each row into simple conventional coefficients of risk aversion. For convenience, we assume a utility function with constant relative risk aversion  $r$  as given by equation (1), intervals for the coefficient of relative risk aversion implied by the switch point between lottery and certain amount can be calculated if initial wealth is assumed to be 0.

$$u(w) = \frac{w^{1-r}}{1-r} \quad (1)$$

The coefficients of partial risk aversion are reported in column (3) of Table 3. The median switch-point at 40 Baht implies that half of the population exhibits a coefficient of relative risk aversion above 0.6

## 4.2 Experiment and self-assessment

As the experiment shows some risk aversion of respondents on average and the self-assessment allows for this possibility too, we are now interested to know whether these two measures are related. In particular, we want to examine whether the self-assessment is a good proxy for the experiment and can thus predict the experimental outcome.

In order to test this hypothesis we estimate various models in which the experimental outcome, i.e. the choice of a “switching row” (between 1 and 20), is to be explained by the same person’s self-assessment (between 0 and 10). Results presented in [Table 4](#) are very similar to Dohmen et al. (2009) and indicate that these examinations can be applied in poor developing areas too.

Column (1) gives the simplest specification, i.e. an interval regression where just the two mentioned variables are related to each other plus a constant. Obviously, the coefficient on the self-assessment is positive and highly significant. It is also of some economic importance as a change by one unit in the self-assessment goes along with a change in the experiment by almost 0.3 rows. In order to test the robustness of this relation and to control whether the exogenous determinants of the self-assessment have an independent meaning for the experiment, see column (2). The coefficient on the self-assessment is hardly different and the

control variables are all insignificant. The result is qualitatively unchanged by including further variables. We just present the specification when all control variables are used (see column 3), but the size and significance of the “general willingness to take risk” variable is basically unaffected by the particular specification. Thus we do not care further about possible multicollinearity between explanatory variables in certain specifications (which is also justified by low variance inflation factors for respective OLS regressions).

### **4.3 Robustness considerations**

Despite the robustness of this finding regarding the inclusion of several socio-demographic variables (see Section 4.2), we apply two more tests which consider the specific circumstances of less educated respondents. As a first test we exclude those 40 persons from our sample who chose row 1 in the experiment (see Table 3), i.e. who did not even take the safe amount of 10 Baht without any risk by choosing row 2. These respondents may be regarded as making a mistake as their preference most probably violates monotonicity and thus a very basic assumption of any theory on human decision making. If we speculate that these persons did not understand the experiment one should exclude them from the sample. Reassuringly, doing so does not affect our qualitative result (available on request).

As a second test we split our sample into three subgroups according to their years of education. One may expect that the survey question or the experiment could be difficult to understand for the less educated. Accordingly, we split the total sample into three groups: a first group with up to 4 years of schooling (which was the minimum years of schooling until the 1980s) which encompasses 597 participants, i.e. more than 60%. The next group has 5 or 6 years of schooling reflecting the increase of minimum school years to 6; this group has 167 members. So, the remaining group with more school years than 6 has 164 members. We basically run the same regressions as reported in Table 4 separately for these three groups. Results in [Table 5](#) show indeed that the coefficient of interest increases with better education from 0.26 over 0.30 to 0.38. This indicates that longer education supports the matching between experiment and self-assessment, which may be caused by better understanding (and thus less noisy answers) or by a better anticipation of consistency checks done by researchers. However, more important for our purpose is the fact that the main relation also holds for the least educated so that the overall result is not driven by any of these subgroups.

In summary, we find for our sample in rural Thailand that the outcome of the incentivized experiment on risk attitude can be explained by the survey item on risk attitude. This is consistent with Dohmen et al. (2009) who pioneered this kind of research with a

German sample. The following section provides tests whether the survey item is also useful in explaining further explicit or implicit statements on individual risk attitude.

## **5 Evidence on individual risk attitude in other cases**

Evidence provided in this section shows that the survey item on general risk attitude is also useful in predicting individual behavior towards risk in three other cases: regarding a hypothetical investment lottery (Section 5.1), regarding buying lottery tickets (Section 5.2) and being self-employed (Section 5.3). In all three cases, the survey measure has more predictive power than the experimental measure.

### **5.1 Results on a hypothetical investment lottery**

The survey contains a lottery question on respondents' decision about a hypothetical investment (see Dohmen et al., 2005). The scenario is as follows: "Imagine you had just won 100,000 Baht in a lottery and you can invest this money in a business. It is equally likely that the business goes well or not. If it goes well you can double the amount invested after one year. If it does not go well you will lose half the amount you invested. What fraction of the 100,000 Baht would you invest in the business?" This lottery is less abstract than the other risk items and thus may be more appealing to some participants. Another intended difference is its clear reference to a financial issue and thus its specificity compared to a general risk item. We examine whether the general risk attitude can explain the investment lottery and how well the experimental measure succeeds.

Table 6 shows similar regressions as before, where various variables are understood as determinants of the outcome of the hypothetical investment lottery. Among the three largely exogenous variables, gender has a consistently negative and highly significant sign. This is new for our data and is not to be expected in the context of experiments from advanced economies, where women are more *risk averse* than men in abstract experiments but not so in a contextual environment (Schubert et al., 1999). Eckel and Grossman (2008) summarize the evidence that a greater female risk aversion "is less conclusive" in a contextual environment. A possible explanation for our unexpected sign could be that women feel more responsible for sustaining daily life and are thus less willing to risk large amounts of money. So the effect may be driven by the amount of money at stake and not by the context.

Interestingly, all other determinants keep their signs although in a few cases different determinants become significant compared to explaining the general risk attitude. When we also consider the general willingness to take risk in columns (2) and (3), the signs of other

variables stay the same but coefficients become smaller and in some cases turn insignificant. Obviously, the general risk attitude is also a very good proxy for capturing risky behavior as derived from the investment lottery. Consequently, the general willingness to take risk is the best predictor for behavior in the investment lottery, as indicated by the extremely high t-value.

When we relate the experimental measure of risk attitude, i.e. the switching row, to this investment lottery, see columns (4) and (5), we find that it can also predict the behavior at the hypothetical investment lottery. However, the explanatory power is weaker than that of the survey measure. If we run both measures in the same regression, see column (6), we find that the experimental measure turns insignificant and that the outcome is almost identical to the specification without the experimental measure as shown in column (3).

## **5.2 Results on buying lottery tickets**

Next, we rely on another risk-related item of the survey, i.e. whether a household member buys lottery tickets. The incidence is about 50%. We test again whether the general risk attitude can predict this decision and how well the survey measure succeeds in comparison to the experimental measure.

We analyze the question whether any member of the household had in fact purchased lottery tickets during the last 12 months, i.e. we want to explain a binary variable. [Table 7](#) presents respective regressions in an analogous ordering of columns to the former Table 6. That is column (1) shows the contribution of all socio-demographic variables in explaining the purchase of lottery tickets, whereas the next two columns also rely on the survey-based general risk attitude. Column (2) is restricted to the largely exogenous variables and consumption and column (3) gives the specification result with the full set of controls. Obviously, gender, height and consumption level have some explanatory power which is clearly improved, however, by adding the general risk attitude.

When we turn to the experimental measure being considered in columns (4) and (5), we see again that it has some explanatory power, although the coefficient being significant to a lesser degree than for the survey measure. When the survey and the experimental measure are considered contemporaneously, see column (6), the experiment-based measure becomes insignificant.

## **5.3 Results on being self-employed**

Finally, we examine the fact whether the respondent is self-employed apart from farming. The incidence is 12% for self-employment. We test again the predictive role of the survey-based general risk attitude and the experimental measure.

The respective [Table 8](#) has the same ordering of columns as the last two tables. As one may expect for a risky decision, the significant signs indicate more risk aversion for younger people and people with lower consumption level. Being married is also related to not being self-employed, which is the finding from advanced economies but different from earlier results here. So, the fact of being self-employed is different from stating lower risk aversion. Nevertheless, the survey-based measure of the general risk attitude predicts the fact of being self-employed in the expected way, whereas the experimental measure does not in this case.

## **6 Further robustness examinations**

This section shortly reports more robustness examinations in four directions: first, we report findings on further variations of our core regressions by leaving out the 40 respondents with inefficient choices in the experiment, by dropping the potentially endogenous self-employment variable and by reducing regressors to significant ones. In all cases, results do not change qualitatively (results are available on request).

Second, we use the full sample from all three provinces in Northeast Thailand that are covered by the survey. However, the experiment was only conducted in one, albeit the largest among the three provinces, so that the comparison with a larger sample than reported in the tables above is incomplete. Moreover, there is no difference with respect to the survey-based risk measure even though some other variables may turn (in)significant due to the extension of the sample (results are available on request).

Third, we modify the approach explaining the purchase of lottery tickets (Section 5.2). In order to consider the fact that respondents may not be responsible for the decision under review here, we reduce our sample to those respondents who are household heads. This may improve precision at the cost of reducing the sample size. The outcome is still qualitatively the same as [Appendix 1](#) shows and rather sharpens the difference between the two measures of risk attitude when compared to Table 7: the coefficients of the survey measure becomes slightly bigger and of the experimental measure slightly smaller.

Fourth, we have repeated all examinations including the experimental measure but with a different definition of this measure. Instead of just taking the number of the switching row (from 1 to 20) as indicator of less risk-averse behavior, we now take the respective coefficient of relative risk aversion. In order to make results easier comparable, we multiply it with minus



one. [Appendix 2](#) reproduces former Table 4 and [Appendix 3](#) shows the three former columns (6) from Table 6 to 8, respectively. The role of the experimental measure does not change, independent of its exact measuring.

Overall, major findings are unaffected by these robustness examinations.

## 7 Discussion

The use of survey-based measures of risk attitudes does not seem to be fully convincing *ex ante*. On the contrary, economists invest great effort in designing and conducting incentive-compatible experiments in order to reveal behavior, even though experiments do not need to be superior for all purposes (e.g., Handa and Maluccio, 2010). Therefore, one needs good reasons to use a survey measure instead of an experimental measure.

An argument to do so is very practical. Risk aversion is an important ingredient of real-world behavior and people are very heterogeneous in their degree of risk aversion at an individual level (Donkers et al., 2001). Individual behavior is often studied with the help of large panel data sets that are generated with enormous effort. So, it is tempting to include a simple item referring to risk attitude which would be easy to implement. However, researchers doubt the reliability of a survey-based measure so that there may be a trade-off between data availability and data precision.

In order to address the empirical relevance of this possible trade-off Dohmen et al. (2009) conduct an experiment testing the validity of the survey evidence. They find that the survey measure is a good proxy for the experimental measure. We take their route with one important difference, i.e. we conduct the experiment with the *same persons* as the survey. This provides socio-demographic information on the experimental subjects (as in Tanaka et al., 2010), it may also improve precision and it also opens the possibility for a various direct comparisons between both measures. In independent work, Lönnqvist et al. (2010) also exercise the direct comparison between both measures on a sample of 232 students: they do not find a positive correlation between the two measures, different from Dohmen et al. (2009) and our study. Moreover, they find that only the survey measure is related to personality measures, indicating that the survey measure may be even more reliable than the experimental measure – a finding that is qualitatively like ours, despite their completely different research design. The resulting cautious optimism on the survey measure is also supported by more general findings on subjective expectation statements in developing countries as people understand probability concepts and give reliable responses (Delavande et al., 2010).

Our research design is conservative by relying on the procedures of Dohmen et al. (2009) so that wording of the survey items and the experiment design is identical. Thus, our findings can be directly related to other studies also relying on Dohmen et al. (2009), including Jaeger et al. (2007), Ding et al. (2010), Dohmen and Falk (2010) and Lönnqvist et al. (2010). All these studies indicate some usefulness of the survey measure, although in very different ways.

Our study is unique in conducting the experiment with the respondents of a representative household survey in a developing country at the same time. If the outcome of this line of studies could be generalized – over regions, times or other variations – it might be very helpful for research based on large household panel data sets because individual risk attitudes can be approximated by a simple survey-based item. However, further research seems necessary to examine survey-experiment-relations and to test, for example, whether the very simple measure used here can be extended to more complex concepts of risk attitude as recently analyzed in developing countries for example by Yesuf and Bluffstone (2009), Harrison et al. (2010) or Tanaka et al. (2010).

## **8 Conclusions**

This is the first study examining the merit of a survey based measure of individual risk attitude by way of a representative survey being directly linked with an experiment in a developing country. We confirm the Dohmen et al. (2009) finding for a German sample that the simple self-assessment of risk attitude is validated by a highly incentivized experiment, here within the identical sample of more than 900 participants. The general risk attitude significantly predicts behavior in the experiment and this fit is not improved much in our sample by considering further determinants, such as age, gender, income and others. This finding is corroborated by the fact that the self-assessed risk attitude has meaningful and plausible correlates.

We also find that the survey measure predicts behavior towards risk in three further cases: (1) it predicts the decision in a hypothetical investment lottery, addressing financial decision making, (2) it predicts the purchase of lottery tickets and (3) it predicts the fact of being self-employed. Interestingly, the experimental measure succeeds less in the same examinations and if we compare the survey and the experimental in a kind of horse-races the survey measure dominates. This indicates that a simple survey-based measure may provide useful evidence on risk attitude, being particularly appealing for developing country research.

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**Table 1: Descriptive statistics**

	No. Obs.	Mean	Std. Dev.	Spearman rank correlation	
	(1)	(2)	(3)	Coeff.	(p-value)
				(4)	
General willingness to take risk (WTR)	933	4.556	2.945	1	
Switching row in experiment	930	6.797	5.533	***0.090	(0.006)
Negative of coefficient of RRA	930	-0.470	0.489	***0.090	(0.006)
Amount invested in risky asset (1000 THB)	933	45.081	26.665	***0.407	(0.000)
Female	934	0.566	0.496	-0.010	(0.763)
Age (years)	934	50.75	12.604	***-0.171	(0.000)
Height (cm)	933	158.26	7.722	**0.074	(0.024)
Log. consumption (\$PPP per AE)	933	1.600	0.620	***0.099	(0.002)
Log. income (\$PPP per AE)	912	1.625	1.018	*0.055	(0.100)
Log. wealth (\$PPP per adult)	934	9.506	0.996	0.029	(0.371)
Education (years)	934	5.708	3.443	***0.146	(0.000)
Married	934	0.827	0.379	0.041	(0.208)
Dependency ratio	934	0.676	0.681	***-0.086	(0.009)
Household size	934	4.105	1.836	0.022	(0.496)
Self-employed	934	0.117	0.321	***0.115	(0.000)
Unemployed	934	0.045	0.207	**0.076	(0.020)
Civil servant	934	0.035	0.185	0.048	(0.145)
Subjective health impairment	933	0.159	0.366	*-0.060	(0.067)
Optimism	931	0.314	0.841	***0.120	(0.000)

**Notes:**

General willingness to take risk is measured on an 11-point Likert scale ranging from 0 (unwilling to take risk) to 10 (fully prepared to take risk). Switching row in experiment refers to the row number of the lottery at which the subject's preference changes from the lottery to the safe amount. Alternatively, the experimental result can be described by intervals for the coefficient of relative risk aversion (RRA) assuming zero initial wealth. We use a negative transform of the interval midpoints in order to consistently represent increasing willingness to take risks with increasing values. Height is body height as reported by the respondent. Log consumption refers to the natural logarithm of household consumption per day divided by OECD adult equivalents AE ( $AE = 1 + 0.7 * (\text{adults} - 1) + 0.5 * \text{children}$ ), log income is calculated analogously, whereas log wealth refers to household wealth divided by the number of adults (i.e. persons aged  $\geq 15$ ). The dependency ratio is the number of resident household members below 15 or above 64 years divided by the number of household members between 15 and 64 years of age. Household size is the headcount of persons living in the household for at least half of the reference period. Subjective health impairment takes the value of 1 if the respondent considers herself to be sick and zero otherwise. Optimism is proxied by the question on expectations for well-being after one year's time and takes values from -2 (much worse) to +2 (much better).

Spearman rank correlation coefficients and respective p-value are reported for the general willingness to take risk paired with all other variables.

**Table 2: Determinants of the self-assessment of general risk attitude**

	(1)	(2)	(3)
Female	-0.023 (0.299)	-0.044 (0.294)	0.048 (0.309)
Age (years)	-0.050*** (0.011)	-0.047*** (0.011)	-0.031*** (0.011)
Height (cm)	0.027 (0.018)	0.023 (0.018)	0.021 (0.018)
Log. consumption (\$PPP per AE)		0.502* (0.257)	0.237 (0.300)
Education (years)			0.035 (0.041)
Married			0.149 (0.416)
Dependency ratio			-0.254 (0.204)
Household size			0.040 (0.068)
Self-employed			1.404*** (0.456)
Unemployed			-0.669 (0.645)
Civil servant			0.140 (0.691)
Subjective health impairment			-0.096 (0.404)
Optimism			0.323* (0.172)
Constant	2.827 (3.202)	2.545 (3.168)	1.828 (3.258)
Log. sigma	1.332*** (0.037)	1.329*** (0.037)	1.316*** (0.037)
Observations	932	932	929

Notes:

The table reports coefficients of interval regression of the general willingness to take risk considering the complex sample design. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% levels, respectively.

**Table 3: Results of the experiment**

Row	Safe amount	Lottery payoffs		Frequency	Cumulative relative frequency	Implied interval for the coefficient of relative risk aversion $r$		
		$p_0=0.5$	$p_1=0.5$			(3)		
				(1)	(2)			
1	0	0	300	40	0.043	0.796	to	inf
2	10	0	300	234	0.295	0.744	to	0.796
3	20	0	300	98	0.400	0.699	to	0.744
4	30	0	300	68	0.473	0.656	to	0.699
5	40	0	300	65	0.543	0.613	to	0.656
6	50	0	300	63	0.611	0.569	to	0.613
7	60	0	300	39	0.653	0.524	to	0.569
8	70	0	300	35	0.690	0.476	to	0.524
9	80	0	300	36	0.729	0.424	to	0.476
10	90	0	300	34	0.766	0.369	to	0.424
11	100	0	300	73	0.844	0.309	to	0.369
12	110	0	300	10	0.855	0.244	to	0.309
13	120	0	300	20	0.876	0.171	to	0.244
14	130	0	300	5	0.882	0.091	to	0.171
15	140	0	300	7	0.889	0	to	0.091
16	150	0	300	17	0.908	-0.103	to	0
17	160	0	300	4	0.912	-0.220	to	-0.103
18	170	0	300	4	0.916	-0.357	to	-0.220
19	180	0	300	3	0.919	-0.518	to	-0.357
20	190	0	300	75	1.000	- inf	to	-0.518

Observations: 930



**Table 4: Determinants of the experiment**

	(1)	(2)	(3)
General willingness to take risk	0.266*** (0.070)	0.280*** (0.071)	0.257*** (0.069)
Female		0.294 (0.401)	0.111 (0.442)
Age (years)		0.021 (0.016)	0.027 (0.017)
Height (cm)		0.005 (0.030)	-0.004 (0.031)
Other controls	no	no	yes
Constant	5.760*** (0.365)	3.726 (5.195)	3.817 (5.218)
Log. sigma	1.780*** (0.034)	1.779*** (0.034)	1.771*** (0.034)
Observations	929	928	925

Notes: The table reports interval regression coefficient estimates and standard errors in brackets considering the complex sampling design. The dependent variable is the switching row in the experiment. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% levels, respectively. Other controls include: education (years of schooling), dependency ratio, household size, optimism and dummies for being married, self-employed, unemployed and employed as a civil servant and subjective health impairment.

**Table 5: Determinants of the experiment by education level**

	(1) 0 – 4 years of schooling	(2) 5 – 6 years of schooling	(3) 7 or more years of schooling
General willingness to take risk	0.258*** (0.083)	0.304* (0.171)	0.376** (0.161)
Female	0.293 (0.583)	1.711 (1.328)	-0.436 (1.218)
Age (years)	0.008 (0.025)	0.161*** (0.060)	0.001 (0.038)
Height (cm)	0.013 (0.038)	0.025 (0.078)	-0.054 (0.074)
Constant	3.254 (6.458)	-6.130 (13.680)	14.122 (12.655)
Log. sigma	1.794*** (0.031)	1.735*** (0.059)	1.745*** (0.059)
Observations	597	167	164

Notes: The table reports interval regression coefficient estimates and standard errors in brackets. The dependent variable is the switching row in the experiment. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% levels, respectively.

**Table 6: Determinants of amount invested in risky asset**

	(1)	(2)	(3)	(4)	(5)	(6)
General willingness to take risk		3.476*** (0.330)	3.378*** (0.325)			3.354*** (0.317)
Switching row in experiment				0.325* (0.173)	0.308* (0.181)	0.100 (0.160)
Female	-4.609** (1.997)	-5.356*** (1.817)	-4.886** (1.898)	-5.410*** (1.998)	-4.596** (1.995)	-4.845** (1.906)
Age (years)	-0.144* (0.078)	-0.087 (0.064)	-0.065 (0.073)	-0.211*** (0.072)	-0.149* (0.079)	-0.068 (0.074)
Height (cm)	0.129 (0.147)	0.065 (0.133)	0.068 (0.129)	0.134 (0.151)	0.131 (0.147)	0.071 (0.129)
Log. consumption (\$PPP per AE)	3.909** (1.700)	4.079*** (1.253)	3.354** (1.416)	5.172*** (1.542)	3.725** (1.673)	3.286** (1.415)
Education (years)	-0.292 (0.333)		-0.388 (0.291)		-0.305 (0.337)	-0.396 (0.297)
Married	4.186* (2.237)		3.931* (2.170)		4.515* (2.247)	4.109* (2.196)
Dependency ratio	-2.110* (1.120)		-1.566 (1.000)		-2.093* (1.114)	-1.550 (1.001)
Household size	0.168 (0.487)		0.070 (0.510)		0.105 (0.488)	0.042 (0.510)
Self-employed	9.440*** (2.526)		6.085*** (2.116)		9.550*** (2.517)	6.177*** (2.121)
Unemployed	-6.749 (5.088)		-5.060 (4.327)		-6.123 (5.203)	-4.847 (4.410)
Civil servant	7.842 (6.050)		7.082 (5.489)		7.735 (6.098)	7.088 (5.522)
Subjective health impairment	2.877 (2.875)		3.108 (2.588)		2.683 (2.863)	2.998 (2.595)
Optimism	1.542 (1.174)		0.643 (1.071)		1.511 (1.164)	0.640 (1.074)
Constant	25.176 (24.571)	19.839 (21.926)	17.943 (22.108)	27.118 (25.277)	23.411 (24.748)	17.189 (22.318)
R <sup>2</sup>	0.07	0.18	0.20	0.05	0.07	0.20
Observations	929	932	929	928	925	925

Notes:

The table reports OLS regression coefficients and standard errors in brackets considering the complex sample design. The dependent variable is the amount invested in a hypothetical risky asset in thousand Thai Baht. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% levels, respectively.

**Table 7: Determinants of purchase of lottery tickets**

	(1)	(2)	(3)	(4)	(5)	(6)
General willingness to take risk		0.023*** (0.006)	0.023*** (0.006)			0.022*** (0.006)
Switching row in experiment				0.006** (0.003)	0.006* (0.003)	0.005 (0.003)
Female	-0.080* (0.042)	-0.083** (0.041)	-0.084** (0.042)	-0.087** (0.041)	-0.083* (0.042)	-0.086** (0.043)
Age (years)	-0.004*** (0.002)	-0.004*** (0.001)	-0.004** (0.002)	-0.005*** (0.001)	-0.005*** (0.002)	-0.004** (0.002)
Height (cm)	-0.005* (0.003)	-0.005* (0.003)	-0.006** (0.003)	-0.005* (0.003)	-0.005** (0.003)	-0.006** (0.003)
Log. consumption (\$PPP per AE)	0.144*** (0.032)	0.120*** (0.028)	0.141*** (0.032)	0.127*** (0.028)	0.143*** (0.032)	0.141*** (0.032)
Education (years)	0.004 (0.006)		0.003 (0.006)		0.003 (0.006)	0.002 (0.006)
Married	0.064 (0.047)		0.064 (0.047)		0.074 (0.047)	0.073 (0.048)
Dependency ratio	0.035 (0.026)		0.040 (0.026)		0.036 (0.026)	0.040 (0.026)
Household size	0.009 (0.010)		0.009 (0.010)		0.009 (0.010)	0.008 (0.010)
Unemployed	-0.034 (0.085)		-0.021 (0.085)		-0.016 (0.085)	-0.005 (0.085)
Self-employed	-0.006 (0.054)		-0.029 (0.055)		0.002 (0.054)	-0.019 (0.055)
Civil servant	-0.039 (0.102)		-0.044 (0.102)		-0.038 (0.102)	-0.042 (0.102)
Subjective Health status	0.020 (0.047)		0.022 (0.048)		0.015 (0.048)	0.017 (0.048)
Optimism	-0.007 (0.020)		-0.013 (0.020)		-0.006 (0.020)	-0.012 (0.021)
Constant		*		*		
Pseudo R <sup>2</sup>	0.03	0.04	0.05	0.03	0.04	0.05
Observations	929	932	929	929	925	925

Notes:

Purchase of lottery tickets takes the value of 1 if the household reports expenditures for lottery tickets and zero otherwise. The table reports marginal effects at the mean (0.50) and standard errors in brackets of a probit regression. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% levels, respectively.

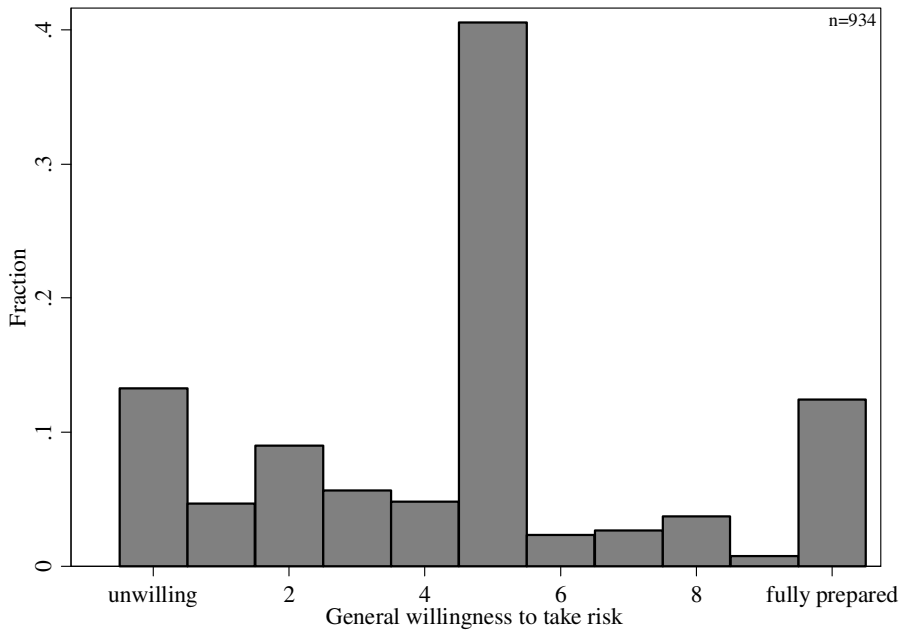
**Table 8: Determinants of being self-employed**

	(1)	(2)	(3)	(4)	(5)	(6)
General willingness to take risk		0.010*** (0.003)	0.010*** (0.003)			0.011*** (0.003)
Switching row in experiment				0.000 (0.002)	0.000 (0.002)	-0.001 (0.002)
Female	0.002 (0.025)	0.003 (0.025)	-0.003 (0.025)	0.004 (0.025)	-0.000 (0.025)	-0.005 (0.025)
Age (years)	-0.002** (0.001)	-0.002* (0.001)	-0.002** (0.001)	-0.002** (0.001)	-0.002** (0.001)	-0.002** (0.001)
Height (cm)	-0.000 (0.002)	-0.001 (0.002)	-0.001 (0.002)	-0.001 (0.002)	-0.000 (0.002)	-0.001 (0.002)
Log. consumption (\$PPP per AE)	0.094*** (0.017)	0.087*** (0.015)	0.091*** (0.017)	0.090*** (0.015)	0.092*** (0.017)	0.089*** (0.017)
Education (years)	-0.001 (0.003)		-0.002 (0.003)		-0.001 (0.003)	-0.001 (0.003)
Married	-0.058** (0.033)		-0.059** (0.033)		-0.062** (0.033)	-0.063** (0.033)
Dependency ratio	-0.010 (0.017)		-0.008 (0.017)		-0.011 (0.017)	-0.009 (0.017)
Household size	0.004 (0.006)		0.004 (0.006)		0.004 (0.006)	0.005 (0.006)
Subjective health impairment	-0.010 (0.028)		-0.007 (0.028)		-0.009 (0.028)	-0.005 (0.028)
Optimism	-0.014 (0.012)		-0.016 (0.012)		-0.016 (0.012)	-0.018 (0.012)
Constant	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Pseudo R <sup>2</sup>	0.08	0.08	0.09	0.07	0.08	0.09
Observations	929	932	929	929	925	925

**Notes:**

The dependent takes the value of 1 if the respondent reports to be self-employed as the primary occupation and zero otherwise. The table reports marginal effects at the mean and standard errors in brackets of a probit regression. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% levels, respectively.

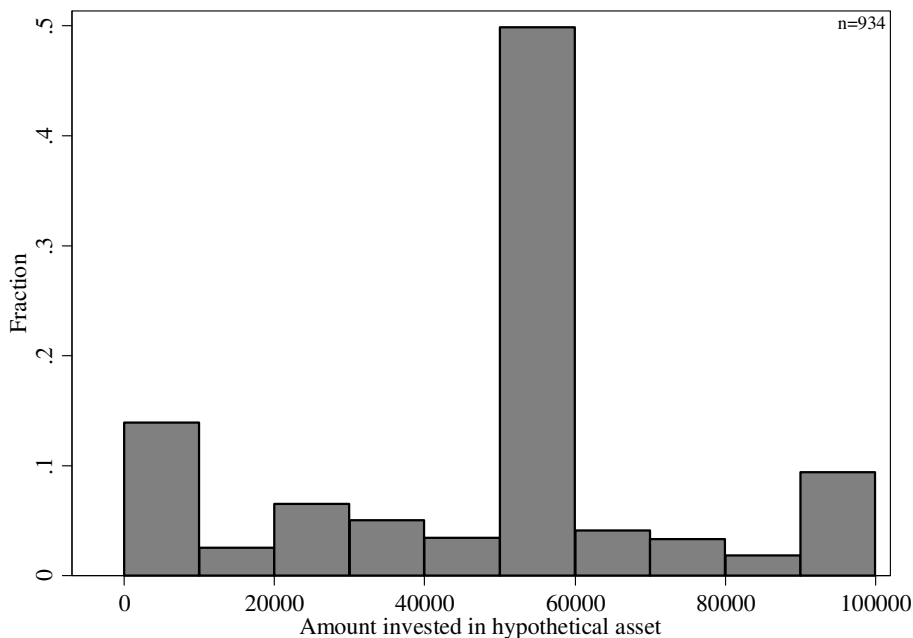
**Figure 1: Responses to self-assessment of general risk attitude**



Notes:

Responses to the survey question: “Are you generally a person who is fully prepared to take risks or do you try to avoid taking risk? Please choose a number on a scale from 0 (unwilling to take risk) to 10 (fully prepared to take risk)”.

**Figure 2: Amount invested in risky asset**



Notes:

Responses to the survey question: “Imagine you had just won 100,000 Baht in a lottery and you can invest this money in a business. It is equally likely that the business goes well or not. If it goes well you can double the amount invested after one year. If it does not go well you will lose half the amount you invested. What fraction of the 100,000 Baht would you invest in the business?”

**Appendix 1: Determinants of purchase of lottery tickets for respondents, who are household heads**

	(1)	(2)	(3)	(4)	(5)	(6)
General willingness to take risk		0.027*** (0.008)	0.025*** (0.008)			0.024*** (0.008)
Switching row in experiment				0.005 (0.004)	0.005 (0.004)	0.004 (0.004)
Female	-0.149** (0.064)	-0.163*** (0.056)	-0.159** (0.064)	-0.170*** (0.056)	-0.160** (0.064)	-0.169*** (0.064)
Age (years)	-0.003 (0.002)	-0.004* (0.002)	-0.002 (0.002)	-0.005** (0.002)	-0.003 (0.002)	-0.003 (0.002)
Height (cm)	-0.008** (0.004)	-0.008** (0.003)	-0.009** (0.004)	-0.008** (0.003)	-0.008** (0.004)	-0.009*** (0.004)
Log. consumption (\$PPP per AE)	0.117*** (0.041)	0.115*** (0.037)	0.111*** (0.041)	0.122*** (0.037)	0.118*** (0.041)	0.113*** (0.042)
Other controls	yes	no	yes	no	yes	yes
Constant	*	**	*	**	*	**
Pseudo R <sup>2</sup>	0.04	0.05	0.06	0.04	0.05	0.06
Observations	517	518	517	515	514	514

Notes:

Purchase of lottery tickets takes the value of 1 if the household reports expenditures for lottery tickets and zero otherwise. The regressions include only respondents who are concurrently head of the household. The table reports marginal effects at the mean (0.52) and standard errors in brackets of a probit regression. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% levels, respectively. Other controls include: education (years of schooling), dependency ratio, household size, optimism and dummies for being married, self-employed, unemployed and employed as a civil servant and subjective health impairment, none of which is significant.

**Appendix 2: Determinants of experiment using the negative of the relative risk aversion coefficient from the experiment as dependent variable**

	(1)	(2)	(3)
General willingness to take risk	0.020*** (0.005)	0.021*** (0.005)	0.019*** (0.005)
Female		0.009 (0.027)	-0.004 (0.030)
Age (years)		0.001 (0.001)	0.002 (0.001)
Height (cm)		-0.000 (0.002)	-0.001 (0.002)
Other controls	no	no	yes
Constant	-0.590*** (0.025)	-0.646* (0.352)	-0.641* (0.351)
Log. sigma	-0.895*** (0.043)	-0.895*** (0.043)	-0.905*** (0.044)
Observations	929	928	925

Notes:

Table reports interval regression coefficient estimates and standard errors in brackets considering the complex sampling design. The dependent variable is the negative transform of the experimental coefficient of relative risk aversion. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% levels, respectively. Other controls include: education (years of schooling), dependency ratio, household size, optimism and dummies for being married, self-employed, unemployed and employed as a civil servant and subjective health impairment. Different from results in table 4, the positive coefficient of log consumption becomes significant at the 10% level.

**Appendix 3: Determinants of behavioral indicators using the negative of the relative risk aversion coefficient from the experiment as an explanatory variable**

Dependent variable	Amount invested in risky asset	Purchase of lottery tickets	Being self-employed
General willingness to take risk	3.364*** (0.316)	0.022*** (0.006)	0.011*** (0.003)
Negative of coefficient of RRA	0.546 (1.945)	0.048 (0.035)	-0.013 (0.020)
Female	-4.826** (1.912)	-0.085** (0.043)	-0.005 (0.025)
Age (years)	-0.066 (0.074)	-0.004** (0.002)	-0.002** (0.001)
Height (cm)	0.071 (0.130)	-0.006** (0.003)	-0.001 (0.002)
Log. consumption (\$PPP per AE)	3.298** (1.424)	0.140*** (0.032)	0.090*** (0.017)
Education (years)	-0.394 (0.296)	0.002 (0.006)	-0.001 (0.003)
Married	4.078* (2.196)	0.073 (0.048)	-0.063** (0.033)
Dependency ratio	-1.544 (1.000)	0.041 (0.026)	-0.009 (0.017)
Household size	0.050 (0.510)	0.008 (0.010)	0.005 (0.006)
Unemployed	6.172*** (2.117)	-0.008 (0.085)	
Self-employed	-4.965 (4.375)	-0.018 (0.055)	
Civil servant	7.125 (5.508)	-0.040 (0.102)	
Subjective health impairment	3.025 (2.599)	0.018 (0.048)	-0.005 (0.028)
Optimism	0.640 (1.077)	-0.012 (0.021)	-0.018 (0.012)
Constant	17.904 (21.914)	n.s.	n.s.
(Pseudo) R <sup>2</sup>	0.20	0.05	(0.09)
Observations	925	925	925

Notes: The table presents alternative specifications for those shown in the last columns of tables 6 to 8, which use the negative of the coefficient of relative risk aversion from the experiment instead of the switching row as an explanatory variable. The first column reports coefficients and standard errors in brackets of an OLS regression and corresponds to column (6) in table 6. The second and third columns report marginal effects and standard errors in brackets of probit regressions and correspond to column (6) in table 7 and table 8, respectively. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% levels, respectively.