Journal of Agricultural and Resource Economics 34(3):518–538

Do Fishermen Have Different Attitudes Toward Risk? An Application of Prospect Theory to the Study of Vietnamese Fishermen

Quang Nguyen and PingSun Leung

Field experiment and household survey data are combined to investigate whether working in a risky occupation such as fishing makes fishermen have different risk preferences than individuals in other occupations. Prospect theory is utilized as the main analytical framework and a structural model approach is developed to simultaneously correlate the parameters of the utility function under prospect theory with other socioeconomic variables. The key finding is that working in fishing makes economic agents less risk averse than others. Fishermen also tend to be less sensitive to probability weighting changes in the experiment. It is possible that fishermen have adapted to their unique environment by using specific heuristics for decision making under conditions of uncertainty.

Key words: experimental economics, prospect theory, risk behavior, Vietnamese fishermen

Introduction

Fishing exhibits a distinguishable risk pattern from other professions. It is widely agreed that fishermen's risk preference is a major determinant of their responses to various changes in fishing stock, market, and weather conditions (Mistiaen and Strand, 2000). Therefore, understanding fishermen's risk preference is a key aspect of modeling and analyzing their decision-making behavior. The standard method of studying risk behavior is to estimate the parameter representing the concavity of the utility function under the expected utility framework. The more concave the utility function, the more risk averse is the agent. This traditional approach, however, lacks an important element: loss aversion. Such an aspect of risk behavior is of great relevance to the fishing occupation, in which receiving a negative profit for a fishing trip is not uncommon.

In this paper we apply prospect theory as an alternative framework to expected utility theory in order to study the risk behavior of fishermen. To our knowledge, only one other study has applied a similar framework in the fishery economics literature (Nguyen and Leung, 2008). The authors found that the target revenue model, a version of prospect theory, can explain

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Review coordinated by David K. Lambert.

decision-making behavior on trip length for a majority of Hawaii's longline fishermen. Prospect theory enables us to integrate the loss aversion aspect into risk behavior analysis. Since prospect theory gives a more comprehensive description of risk preferences, we are able to capture some insights that may otherwise be missed by using only the expected utility framework.

The specific objective of this study is to answer the question: Do fishermen exhibit different risk behavior from workers in other professions? This paper makes a contribution to the field of economics in several ways. First, it introduces the idea of combining experimental data and household survey data. The combination is made by matching information collected under a controlled environment (i.e., the field experiment) with information collected in a natural environment (i.e., the household survey). This combination allows us to make optimal use of both data sets. Data quality from the field experiment is enhanced since it is collected in a highly controlled environment. Furthermore, data from the experiments provide us with behavioral information that is not available in traditional household survey data, while data from the household survey offer a number of socioeconomic variables that can be used to explain risk behavior. Our study's second contribution is that we are able to investigate the causal relationship between working in fishing and risk behavior. As discussed below, the unique characteristics of Vietnam's fishing industry make this contribution possible by overcoming potential endogeneity of occupational choice in the risk behavior equation employed in other studies.

We believe this paper represents the first study to focus on risk preferences of fishermen in fishing villages in developing countries. These villagers are not only engaged in subsistence fishing (fishing for personal or family consumption), but also in small-scale commercial fishing. Working as fishermen under such circumstances involves risks associated with both income and other uncontrollable factors such as weather conditions. We are particularly interested in how the working environment may affect the risk behavior of these fishermen.

In terms of empirical strategy, we develop a structural model approach to correlate parameters of the utility function under prospect theory with other socioeconomic variables. To our knowledge, only one previous study (Andersen et al., 2008) has employed the same approach as ours. This paper extends the work of Andersen et al. by partially addressing the causal relationship between risk preferences and occupation. Further, by integrating a national household living standard survey into the field experiment, we have more control variables in the econometric models which largely help in dealing with omitted variables bias.

The remainder of the paper proceeds as follows. The next section discusses relevant literature on fishermen's behavior. Special attention is given to studies using experimental methods. Next, we elaborate on the data and methodology used in this study. In this section, we also discuss the method of simultaneously estimating parameters of the utility function under prospect theory. A section is then devoted to our major findings and their interpretations. The final section presents concluding remarks and offers potential extensions of this research.

Literature Review and Discussion of Prospect Theory

Sutinen's (1979) paper is one of the early studies to specifically integrate the role of risk preferences in fishermen's decision-making behavior. In his study of remuneration practice in fishing, Sutinen assumes fishermen exhibit risk-averse behavior, just like people in other occupations. Since publication of his work, it basically has been taken for granted that fishermen are risk averse; most empirical evidence on fishermen's risk behavior appears to support that hypothesis. For instance, using the random parameter logit (RPL) framework to study location choice in North Atlantic multiple species fishing, Mistiaen and Strand (2000) found that 95% of fishermen are risk averse.

Only a few studies report results differing from Sutinen's assumption that fishermen are risk averse. For example, Bockstael and Opaluch (1983) were the first to test risk preferences empirically, and they could not reject the assumption that fishermen are risk averse. Using a similar methodology, Dupont (1993) rejected risk aversion in three of four fisheries, but actually drew the wrong inference that fishermen are risk preferring (see Mistiaen and Strand, 2000). Revealed preference data were used by Eggert and Tveterås (2004), who found that a substantial number of fishermen in Sweden are not risk averse. Also, McConnell and Price (2006) argued that risk neutrality is common among fishermen.

Most of the above studies are based on the expected utility theory framework, using data from either surveys or logbooks. Instead of making initial assumptions or deriving general conclusions about risk behavior as was done in those studies, here we directly measure the level of risk aversion. In particular, we are interested in parameterizing the level of risk aversion under the prospect theory framework using data from field experiments. The benefit of field experiments, as Falk and Fehr (2003) pointed out, is that it enables the researchers to generate truly exogenous variation in the data that would otherwise be unavailable in natural or empirical data. Also, random assignment of participants by hand-picking may help in reducing selection bias and problems with omitted variables.

Eggert and Martinsson (2004) conducted one of the first experimental studies on fishermen's risk behavior. In their investigation, risk preferences of Swedish commercial fishermen were estimated using data from a stated preference experiment. Stated preference methods are the broad class of hypothetical data collection methods (as opposed to revealed preference methods) which include contingent valuation, rankings, conjoint, and choice experiments (sometimes called stated choice). The participants were asked to choose between pairs of fishing trips characterized by the mean and spread of net revenue. Risk is measured by the spread of the net revenue and is assumed to follow a uniform distribution to make it easier for the experiment participants to make a choice (Johansson-Stenman, Carlsson, and Daruvala, 2002).

Eggert and Martinsson (2004) found that 87% of the respondents in their study were not risk neutral. In contrast, Rabin (2000) noted that expected utility theory predicts people will be virtually risk neutral not only over modest stakes, but also for quite sizable and economically important stakes. Accordingly, we can infer that almost 90% of the experiment participants in the Eggert and Martinsson study did not behave according to expected utility theory. Eggert and Martinsson also reported that 48% of the fishermen can be broadly characterized as risk neutral and risk preferring, with 26% modestly risk averse, while 26% are strongly risk averse.

As pointed out by Eggert and Lokina (2007), despite a growing interest in examining fishermen's risk preferences, most studies involve commercial fisheries. To check the robustness of the results, Eggert and Lokina, following a similar approach, investigated the risk preferences of artisanal fishermen in Tanzania. They report that about 53% of Tanzanian fishermen can be considered broadly as risk preferring or risk neutral, 25% as modestly risk averse, and about 22% as strongly risk averse. Approximately 19% of fishermen in their sample behaved as expected return maximizers. According to Eggert and Lokina, this finding represents a marked difference from those in other commercial fisheries in which most fishermen are found to be risk averse.

The studies by Eggert and Martinsson (2004) and Eggert and Lokina (2007) assert that expected utility theory may be appropriate in describing risk behavior regarding long-term decisions or decisions involving a large amount of money, such as purchasing a new boat in which lifetime wealth has to be properly taken into account. Yet, most decisions made in the fishing industry consider more immediate horizons. More importantly, as noted by Eggert and Martinsson, loss aversion may explain why only a small proportion of the fishermen in their study exhibit risk-averse behavior. This aspect of loss aversion, however, is absent under the expected utility theory framework. Accordingly, it is worth exploring fishermen's risk behavior from an alternative model that incorporates broader aspects of risk behavior. As discussed below, prospect theory has increasingly proven to offer a better description of risk preferences under a wide range of applications. A particular advantage of using prospect theory is that it allows us to integrate the loss aspect (negative profit) into the model. This feature is of great relevance to fishing where experiencing a net loss for fishing trips due to uncontrollable factors, such as changes in weather conditions, is not uncommon.

A Discussion of Prospect Theory

Expected utility theory has long been the standard approach in economic modeling. Due to its limitations, several alternatives to expected utility theory have been advanced. Most notable is prospect theory, first introduced by Daniel Kahneman and Amos Tversky in 1979. The key difference between prospect theory and expected utility is that the former integrates the loss aversion aspect of risk behavior into the utility function. Utility is measured based on a comparison of the realized income and the reference income. If the difference is positive, the economic agent receives a gain in utility, and vice versa. The basic premise is that people may be simultaneously risk averse to gain and risk preferring to loss. This new aspect of loss aversion has enabled prospect theory to explain a wide variety of economic phenomena that were considered puzzles from the expected utility perspective. Examples include the equity premium puzzle of Benartzi and Thaler (1995), as well as the status quo bias and endowment effect anomalies assessed by Kahneman, Knetsch, and Thaler (1991).

In connection with fishing, prospect theory is appealing for a number of reasons. Nguyen and Leung (2008) found that the target revenue model, a version of prospect theory, can explain decision-making behavior on trip length for a majority of Hawaii's longline fishermen. Also, suffering a net loss in profit for a fishing trip is not an unusual occurrence in fishing. Therefore, the loss aversion aspect is particularly relevant in fishing studies.

A Brief Introduction to Vietnam's Fishing Sector and Fishermen

Endowed with long coastlines and many rivers, Vietnam has a great potential for fishing development. "Com and Ca," which can be translated into English as "Rice and Fish," has been an important element of food consumption among Vietnamese for many centuries. According to recent statistics, the per capita annual consumption of fishing products was 13 kg in 2001 (Vietnam Association of Seafood Exporters and Producers, 2001). Fishing can be classified into two main categories: freshwater and ocean fishing. The former includes fishing in rivers, lakes, and ponds. In 2002, there were about 550,000 fishermen in Vietnam, of whom 450,000 were ocean fishermen and 100,000 were freshwater fishermen (Nguyen, 2002).

Freshwater fishing, characterized by simple boats and rudimentary equipment, requires much less financing compared to ocean fishing, generally with more advanced and expensive boats. In addition to fishing, most fishermen are involved in farming or aquaculture activities to earn additional income for their families (Nguyen, 2002).

A typical characteristic of Vietnamese fishermen is a strong sense of community. The fishing village is an integral element of the fishermen's lifestyle. Adult males in fishing villages are fishermen, and fishing is expected to be the main occupation of men in the village. Consequently, men in a fishing village have little occupational freedom, regardless of their individual risk behavior. This feature plays a key role in the subsequent regression analyses in which we can safely infer a causal relationship between the occupation of fishing and risk behavior.

Data and Methodology

A noteworthy aspect of this study is the combination of experimental and household survey data. Tanaka, Camerer, and Nguyen (forthcoming) use the same set of data to study risk and time preferences. The main difference between that study and ours is that we apply a structural model approach in the estimation. Also, we pay particular attention to studying fishermen's risk preferences. (Further detail of the data is reported in Tanaka, Camerer, and Nguyen.) In what follows, we describe the key components of the data and experimental design.

The baseline information is compiled from the 2002 Vietnam Household Living Standard Survey (VNLSS), which covers a total of 75,000 households in Vietnam. The survey provides key information on socioeconomic characteristics of Vietnamese households and individuals. The sample was designed in such a way that each household had the same probability of being selected. In the 2002 survey, 25 households[1] were interviewed in each of 142 and 137 rural villages in the Mekong Delta (in the South) and the Red River Delta (in the North, excluding villages in Hanoi City), respectively. Experiments were conducted in July and August of 2005, with the same members of households previously interviewed during the VNLSS 2002 survey. In particular, we chose nine villages—five villages in the south and four villages in the north—with substantial differences in mean income, inequality, and market access to permit statistically significant cross-village comparisons. The map in figure 1 shows the locations of these research sites. We then combined the data using ID numbers of individuals who participated in both the experimental and the VNLSS 2002 household survey as the linking variable.

In addition to its obvious advantages, the use of household survey data in combination with experimental data also calls for some caution. The experimental data from the participant's decision-making behavior were collected under a different hypothetical context. The household data observe how people make decisions in a real-world context and, more precisely, the outcomes of their decisions. We must consider whether there is consistency in the participant's behavior under these two different contexts. It may be argued that the subjects are less serious under experimental conditions compared to a real-world scenario, especially when the subject's reward is relatively small. Fortunately, participants in our experiment could receive rewards of up to several days of salary for reasonably made decisions; hence,

[1] Some households had moved during the 2002–2005 period. Accordingly, the number of participants may be fewer than 25 in some experimental sites.

Figure 1. Locations of experimental sites

they had a strong incentive to make their decisions thoughtfully and carefully (Tanaka, Camerer, and Nguyen, forthcoming).

Another argument against the use of experimental data is based on the notion that the same person may behave differently under different circumstances. For instance, a fisherman may be risk preferring when he is fishing; however, he may be risk averse when making a household investment decision. Yet, in a large study on risk behavior in Europe, Dohmen et al. (forthcoming) found that people show consistent risk behavior under different decision-making scenarios such as vehicle driving, financial matters, health, and career. This finding supports the use of experimental data in our study.

Concerning the theoretical framework of this study, we assume economic agents' behavior is elicited by prospect theory. As noted earlier, expected utility theory is a special case of prospect theory. Accordingly, we could uncover additional findings that might otherwise be obscured when simply applying expected utility theory. Here, we use cumulative prospect theory[2] (Kahneman and Tversky, 1979; Tversky and Kahneman, 1992) and the one-parameter form of Prelec's (1998) axiomatically derived weighting function. Specifically, the utility function under prospect theory can be expressed as follows:

(1) $$PT(x, y; p) = pv(x) + (1 - p)v(y),$$

where

[2] For a discussion on the application of cumulative prospect theory to natural resources, the interested reader is referred to Shaw and Woodward (2008).

$$v(x) = \begin{cases} x^{\alpha} & \text{for} \quad x \geq 0 \\ -\lambda(-x^{\alpha}) & \text{for} \quad x < 0 \end{cases}$$

and

$$w(p) = \exp[-(-\ln p)^{\gamma}].$$

$PT(x, y; p)$ is the expected prospect value over binary prospects consisting of the outcome (x, y) with the corresponding probability $(p, 1 - p)$. In our experiment, $(x, y; p)$ is specified for option A and option B in all scenarios. Note that the value function $v(x)$ should be examined with x^{α} for $x > 0$ or $-\lambda(-x^{\alpha})$ for $x < 0$. The parameter α represents concavity of the value function (risk aversion), λ represents the degree of loss aversion, and γ is a proxy for the probability weighting. The three parameters α, λ, and γ were estimated using data from the field experiment conducted in Vietnam during the summer of 2005. The experiment aims at measuring social preference, time discounting, risk preference, and, most importantly, risk behavior among Vietnamese villagers.

The experimental design is presented in the appendix. Each experimental subject (participant) was asked to make decisions in choosing between option A and option B under different scenarios. Each scenario is characterized by monetary rewards and the corresponding probabilities of receiving those rewards. After all participants in the experiment had completed making decisions, a scenario was randomly selected to decide how much the participants would receive from the experiment. On average, the participant earned 21,431 VND, which is equivalent to $1.3 US.

To estimate the parameters α, λ, and γ of the utility function for each individual, we generate 35 scenarios. These scenarios are divided into three subcomponents. The first two subcomponents aim at measuring the risk-aversion parameter α. The third subcomponent focuses on estimating the loss-aversion parameter λ.

It is important to note that the highly nonlinear nature of the utility function under prospect theory makes the estimation procedure relatively difficult to handle. A number of procedures have been developed to estimate parameters of the utility function under prospect theory. However, these procedures focus only on estimating elements of the utility function separately. For instance, to estimate parameters of the weighting function, Wu and Gonzalez (1996) developed the least-squares method for minimizing the actual and estimated probability of choosing one prospect over the other. Abdellaoui (2000) and Abdellaoui, Bleichrodt, and Paraschiv (2007) developed a two-stage procedure to estimate the weighting function and loss-aversion coefficients. In this paper, we applied an empirical strategy allowing for simultaneous estimation of the three parameters of the utility function under prospect theory as well as the correlation of these parameters with other socioeconomic variables. Table 1 provides a list of our study's socioeconomic variables and their definitions.

Following Holt and Laury (2002), we present the difference in expected payoffs for each scenario (as shown in table 2). There are 35 scenarios grouped into three series. Series 1 includes scenarios 1–14. Notice that the expected payoff for option A is the same for all scenarios, whereas it increases for option B as the scenario number increases. Thus, the expected payoff for scenarios 6 and 7 are the same under option A, while it is higher for scenario 7 under option B. In series 2 (scenarios 15–28) option B has a higher expected payoff than option A throughout. The expected payoff for option B also improves, while it remains the same for option A. Series 3 is the last batch (scenarios 29–35) with the same

Table 1. Definitions of Socioeconomic Variables

Variable Name	Description
Age	Age of the subject
Gender	Gender of the subject: 1 = male, 0 = female
Education	Number of years the subject attended school
Acquaintance Ratio	Number of other participants the subject knows by name divided by the total number of subjects in the session
Farming/Livestock	Binary variable indicating whether subject's main occupation is farming or raising livestock
Fishing	Binary variable indicating whether subject's main occupation is fishing
Trade	Binary variable indicating whether subject's main occupation is trading
Family Business	Binary variable indicating whether subject is engaged in household business
Government Official	Binary variable indicating whether the subject works for local government
Relative Income	Subject's household income divided by mean household income of the village
Mean Village Income	Mean household income of the village (million dong)
Distance to Market	Distance to the nearest local market (km)
Expenditure/Income Ratio	Household expenditure divided by household income per year

pattern of expected payoffs as observed in series 1 and series 2 except there is also a chance of losing money.

In each series the scenarios are ordered in such a way that option B improves compared to option A. To be consistent, the individual will either choose option A for all scenarios or switch to option B in some scenario and choose B for all remaining scenarios in the series. Series 1 and series 2 are designed to estimate the level of risk aversion, whereas series 3 addresses the loss-aversion aspect. For each of the three series, the subject may make a switch from option A to option B in some scenario. Note also that we provided examples in the experiment instructions (see appendix) to illustrate for the participants that it was alright for them to choose option A in all scenarios of a given series (i.e., no switching); likewise, they could make a switch immediately at the first scenario of the series (choosing option B for every scenario in the series).

Table 3 reports the distribution of participants by their switching points in series 1, 2, and 3. As indicated in table 3, there were always some participants making the switch from A to B. In addition, some participants never made a switch in a given series. Thus, we can trust the participants' comprehension of the experimental instructions.

In the next section a structural model approach is presented to address the correlation between parameters of the utility function under the prospect theory framework and socio-economic variables such as age, gender, occupation, education, and wealth level proxied by agricultural land holding. Information on the latter variables was obtained from the 2002 Vietnam Household Living Standard Survey.

Empirical Specifications

Following Andersen et al. (2008), we applied the random utility model approach (Train, 2003) to develop our empirical strategy. Let $U_i^{A;j}$ be the utility participant *i* receives from option A for scenario *j*. Only agent *i* knows the value of $U_i^{A;j}$. We don't observe $U_i^{A;j}$, but rather assume that *i*'s utility follows prospect theory. Also, we can observe *i*'s demographic

Table 2. Expected Payoff Difference of Pairwise Lottery Choices

Option A	Option B	Expected Payoff Difference (A − B)
Series 1 (Scenarios 1–14)		
3/10 of 40,000 and 7/10 of 10,000	1/10 of 68,000 and 9/10 of 5,000	7,700
3/10 of 40,000 and 7/10 of 10,000	1/10 of 75,000 and 9/10 of 5,000	7,000
3/10 of 40,000 and 7/10 of 10,000	1/10 of 83,000 and 9/10 of 5,000	6,200
3/10 of 40,000 and 7/10 of 10,000	1/10 of 93,000 and 9/10 of 5,000	5,200
3/10 of 40,000 and 7/10 of 10,000	1/10 of 106,000 and 9/10 of 5,000	3,900
3/10 of 40,000 and 7/10 of 10,000	1/10 of 125,000 and 9/10 of 5,000	2,000
3/10 of 40,000 and 7/10 of 10,000	1/10 of 150,000 and 9/10 of 5,000	−500
3/10 of 40,000 and 7/10 of 10,000	1/10 of 185,000 and 9/10 of 5,000	−4,000
3/10 of 40,000 and 7/10 of 10,000	1/10 of 220,000 and 9/10 of 5,000	−7,500
3/10 of 40,000 and 7/10 of 10,000	1/10 of 300,000 and 9/10 of 5,000	−15,500
3/10 of 40,000 and 7/10 of 10,000	1/10 of 400,000 and 9/10 of 5,000	−25,500
3/10 of 40,000 and 7/10 of 10,000	1/10 of 600,000 and 9/10 of 5,000	−45,500
3/10 of 40,000 and 7/10 of 10,000	1/10 of 1,000,000 and 9/10 of 5,000	−85,500
3/10 of 40,000 and 7/10 of 10,000	1/10 of 1,700,000 and 9/10 of 5,000	−155,500
Series 2 (Scenarios 15–28)		
9/10 of 40,000 and 1/10 of 30,000	7/10 of 54,000 and 3/10 of 5,000	−300
9/10 of 40,000 and 1/10 of 30,000	7/10 of 56,000 and 3/10 of 5,000	−1,700
9/10 of 40,000 and 1/10 of 30,000	7/10 of 58,000 and 3/10 of 5,000	−3,100
9/10 of 40,000 and 1/10 of 30,000	7/10 of 60,000 and 3/10 of 5,000	−4,500
9/10 of 40,000 and 1/10 of 30,000	7/10 of 62,000 and 3/10 of 5,000	−5,900
9/10 of 40,000 and 1/10 of 30,000	7/10 of 65,000 and 3/10 of 5,000	−8,000
9/10 of 40,000 and 1/10 of 30,000	7/10 of 68,000 and 3/10 of 5,000	−10,100
9/10 of 40,000 and 1/10 of 30,000	7/10 of 72,000 and 3/10 of 5,000	−12,900
9/10 of 40,000 and 1/10 of 30,000	7/10 of 77,000 and 3/10 of 5,000	−16,400
9/10 of 40,000 and 1/10 of 30,000	7/10 of 83,000 and 3/10 of 5,000	−20,600
9/10 of 40,000 and 1/10 of 30,000	7/10 of 90,000 and 3/10 of 5,000	−25,500
9/10 of 40,000 and 1/10 of 30,000	7/10 of 100,000 and 3/10 of 5,000	−32,500
9/10 of 40,000 and 1/10 of 30,000	7/10 of 110,000 and 3/10 of 5,000	−39,500
9/10 of 40,000 and 1/10 of 30,000	7/10 of 130,000 and 3/10 of 5,000	−53,500
Series 3 (Scenarios 29–35)		
5/10 of 25,000 and 5/10 of −4,000	5/10 of 30,000 and 5/10 of −21,000	6,000
5/10 of 4,000 and 5/10 of −4,000	5/10 of 30,000 and 5/10 of −21,000	−4,500
5/10 of 1,000 and 5/10 of −4,000	5/10 of 30,000 and 5/10 of −21,000	−6,000
5/10 of 1,000 and 5/10 of −4,000	5/10 of 30,000 and 5/10 of −16,000	−8,500
5/10 of 1,000 and 5/10 of −8,000	5/10 of 30,000 and 5/10 of −16,000	−10,500
5/10 of 1,000 and 5/10 of −8,000	5/10 of 30,000 and 5/10 of −14,000	−11,500
5/10 of 1,000 and 5/10 of −8,000	5/10 of 30,000 and 5/10 of −11,000	−13,000

Table 3. Number of Subjects by Switching Points

	Number of Participants Making the Switch		
Switching Points	Series 1	Series 2	Series 3
1	9	33	38
2	2	4	26
3	6	4	27
4	6	7	29
5	8	14	26
6	21	9	6
7	28	20	3
8	27	19	29
9	14	18	
10	14	4	
11	14	10	
12	5	7	
13	1	3	
14	0	3	
Never	29	29	
Total	184	184	184

characteristics and information on scenario j, including probabilities and payoffs for options A and B. Thus, the relationship between $U_i^{A;j}$ and $PT_i^{A;j}$ can be expressed as follows:

$$U_i^{A;j} = PT_i^{A;j}(\mathbf{X}_i;\, \mathbf{Z}^j) + \varepsilon_i^{A;j}, \tag{2}$$

where $PT_i^{A;j}$ is the utility under prospect theory defined in (1) that agent i receives from option A for scenario j, $\mathbf{X}_i$ is a vector of participant i's demographic characteristics such as age, education, and gender; $\mathbf{Z}_i$ is information on scenario j including probabilities and payoffs for options A and B; and $\varepsilon_i^{A;j}$ is the error term which captures either misspecification in the functional form of PT or unobserved characteristics of agent i. By standard convention, we also assume that $\{\varepsilon_1^{A;j}, \varepsilon_2^{A;j}, ..., \varepsilon_N^{A;j}\}$ are independently and identically distributed (i.i.d.) and follow a normal distribution. The joint density of this distribution is denoted as $f(\varepsilon)$.

Likewise, we can define the relationship between $U_i^{B;j}$ and $PT_i^{B;j}$ as:

$$U_i^{B;j} = PT_i^{B;j}(\mathbf{X}_i;\, \mathbf{Z}^j) + \varepsilon_i^{B;j}. \tag{3}$$

Given scenario j, using (2) and (3), the probability that option A is chosen can be expressed as:

$$\Pr(A) = \Pr\left\{ PT_i^{A;j}(\mathbf{X}_i;\, \mathbf{Z}^j) + \varepsilon_i^{A;j} - PT_i^{B;j}(\mathbf{X}_i;\, \mathbf{Z}^j) - \varepsilon_i^{B;j} \geq 0 \right\}$$
$$\therefore \Pr(A) = \Pr\left\{ PT_i^{A;j}(\mathbf{X}_i;\, \mathbf{Z}^j) - PT_i^{B;j}(\mathbf{X}_i;\, \mathbf{Z}^j) \geq \varepsilon_i^{B;j} - \varepsilon_i^{A;j} \right\}$$
$$\therefore \Pr(A) = \Phi\left\{ PT_i^{A;j}(\mathbf{X}_i;\, \mathbf{Z}^j) - PT_i^{B;j}(\mathbf{X}_i;\, \mathbf{Z}^j) \right\},$$

where

$$\Phi(x) = \int f(\varepsilon)\, d\varepsilon$$

is the cumulative distribution of the error term ε.

Next, we define the latent index for option A given scenario *j* as follows:

$$I_i^{A;j} = PT_i^{A;j} - PT_i^{B;j}.$$

Similarly, the latent index for option B is defined as:

$$I_i^{B;j} = PT_i^{B;j} - PT_i^{A;j}.$$

We can then write $\Pr(A) = \Phi(I_i^{A;j})$ and $\Pr(B) = \Phi(I_i^{B;j})$.

To apply the maximum log-likelihood estimation technique, we note that the conditional log likelihood for each individual depends on the utility function parameters (α, λ, γ) under prospect theory as well as the observed choices. More specifically, the conditional log likelihood for participant *i* can be written as:

(4) $$\ln \mathrm{L}^i(\alpha,\lambda,\gamma;\, y^j, \mathbf{X}_i, \mathbf{Z}^j) = \sum_{j=1}^{35} \left\{ \left[\ln \Phi(I_i^{A;j}) \,|\, y_i^j = 1 \right] + \left[\ln \Phi(I_i^{B;j}) \,|\, y_i^j = 0 \right] \right\},$$

where $y_i^j = 1$ when individual *i* chooses option A in scenario *j*; similarly, $y_i^j = 0$ when individual *i* chooses option B in scenario *j*. **X** is a vector of individual *i*'s characteristics.

To address the correlation between the parameters (α, λ, γ) and demographic variables, we allow each of the former to be a linear function of the latter as follows:

$$\alpha = \alpha_0 + \beta_F \mathbf{X}_F + \beta \mathbf{X} + \eta,$$
$$\lambda = \lambda_0 + \theta_F \mathbf{X}_F + \theta \mathbf{X} + \nu,$$

where $\mathbf{X}_F$ is a vector of binary variables indicating whether the individual is a fisherman; **X** is a vector of other socioeconomic and demographic variables including age, education, distance to market, savings, agricultural land ownership, and membership in a ROSCA;[3] η and ν are the error terms which are assumed to be i.i.d. and uncorrelated (Cov(η, ν) = 0).

The joint likelihood for all individuals can then be represented by:

(5) $$\mathrm{L}(\alpha,\lambda,\gamma;\, y, \mathbf{X}) = \sum_{i=1}^{N} \ln \mathrm{L}^i(\alpha,\lambda,\gamma;\, y^j, \mathbf{X}_i \mathbf{Z}^j)$$
$$= \sum_{i=1}^{N} \sum_{j=1}^{35} \left\{ \left[\ln \Phi(I_i^{A;j}) \,|\, y_i^j = 1 \right] + \left[\ln \Phi(I_i^{B;j}) \,|\, y_i^j = 0 \right] \right\}.$$

The maximum-likelihood estimation for (α, λ, γ) is therefore:

$$\left(\hat{\alpha}, \hat{\lambda}, \hat{\gamma}\right) = \arg\max \mathrm{L}\left(\alpha,\lambda,\gamma;\, y, \mathbf{X}\right).$$

---

[3] ROSCA is also known as rotating savings and credit associations, which are informal credit institutions and very popular in a number of developing countries.

We develop a maximum-likelihood procedure in STATA to estimate the correlation of α, λ, and γ with other socioeconomic variables based on (5). It is worth noting that we can derive (5) under the assumption that the error terms for each individual are independent across scenarios. A more realistic assumption would be to allow for some correlation between these error terms. In that case, a cross-sectional time-series approach would be more appropriate. One can then apply the simulated maximum-likelihood technique (Train, 2003) to estimate (α, λ, γ). However, this approach requires a great deal of computational power.[4] Instead, we applied the standard maximum-likelihood procedure using the cluster option in STATA, which takes into account arbitrary intra-group correlation.

Prior to conducting the econometric analysis, we address an important consideration in this type of study: direction of causality. The key research question is whether being involved in fishing makes fishermen less risk averse. In other words, we are interested in whether the estimated coefficient γ is significantly negative. However, the causality may go in both directions. A number of studies in labor economics have shown that less risk-averse agents are more likely to choose a riskier job for better compensation (Viscusi and Hersch, 2001). For example, King (1974) found that individuals from wealthier families tend to choose riskier occupations. Cramer et al. (2002) showed that less risk-averse agents are attracted to becoming entrepreneurs, which is a risky occupation choice.

It could be that working in fishing makes people more accustomed to taking risks. But, it could also be the case that less risk-averse people would choose a risky occupation, such as fishing, to suit their preferences. Fortunately, this ambiguous direction of causality is somewhat resolved in the context of our study. As mentioned above, Vietnam's fishermen possess a unique characteristic in the sense that fishing is mostly a traditional occupation concentrated in certain areas. People, especially men from those areas, almost automatically become fishermen when they reach adulthood—as fishing is considered the only available occupation option for most men in these fishing villages.

This unique characteristic of Vietnam's fishermen provides us with a great advantage in studying the causal relationship between working in fishing and risk behavior. A related concern here is that individuals can avoid becoming fishermen by moving away from the villages. While this may be somewhat true, it is important to note that occurrences of migration and job mobility in Vietnam are very low compared to developed countries. This was especially true before Vietnam's economic reform policy in 1986, during which time migration from one province to another was strictly monitored by the government. Many fishermen in our study (74%) started their career during that time.

Main Findings

First, we investigate the descriptive statistics of key variables used in the analysis. As can be seen from table 4, the majority of participants work in the farming sector. The mean years of schooling is around seven years. This relatively high educational level is a crucial factor that ensures the participants' comprehension of the experiments (Tanaka, Camerer, and Nguyen, forthcoming). There are notable differences between participants from villages in the North and those in the South in a number of respects. Southern participants are wealthier. The proportion of participants who work in fishing is also greater in the South. People in the

[4] For instance, Andersen et al. (2008), in a complementary document to their paper in *Econometrica*, stated that it may take four days to run the simulated maximum likelihood.

Table 4. Basic Descriptive Statistics of Main Variables

Variable	Total	North	South
Number of Experiment Participants	184	84	100
Mean Household Income (10^6 VND)			
Mean	20.23	14.65	24.95
Standard Deviation	10.04	7.95	9.20
Age			
Mean	47.45	48.54	46.53
Standard Deviation	12.04	13.42	12.39
Gender (1 = male)	0.61	0.45	0.75
Education			
Mean	6.74	6.91	6.60
Standard Deviation	3.84	3.79	3.88
Main Occupation (%):			
Farming and Livestock	46.17	49.08	43.71
Fishing	14.70	4.86	22.96
Trade	7.22	8.75	5.95
Family Business	5.87	6.40	5.42
Government Official	10.59	12.61	8.90
Casual and Unemployed	15.44	18.25	13.05
Distance to Nearest Market (km)	1.48	1.19	1.72
Agricultural Land Holding (m^2)	3,175	1,647.6	4,481.4

South hold more land. On the other hand, there is a greater proportion of participants in the North working for the government. Given these differences between the North and South, we use a binary variable in subsequent regression analyses to indicate whether the participant is from the South or the North.

The curvature of the utility function (α), the loss-aversion parameter (λ). and the probability weighting function parameter (γ) were estimated against demographic variables using the structural model approach described above. The main results are reported in table 5. We first examine the determinants of α, which serves as a proxy for risk aversion. A positive value of the coefficient implies that the corresponding variable has a negative impact on risk-aversion level, or the greater this variable is, the less risk averse the participant. The most interesting finding is that working in fishing makes the participants less risk averse than casual workers and unemployed individuals (the reference category). We also compared the coefficient for the fishermen variable with those of other occupation variables and found the coefficient for fishermen to be significantly higher. This result suggests participants in occupations involving high risk such as fishing might be more willing to take risks, though fishermen are not necessarily more risk preferring than individuals in other occupations (Smith and Wilen, 2005).

Other factors having a significant impact on the risk-aversion level include gender, family business, ROSCA membership, amount of agricultural land owned, and distance to market. Interestingly, men are found to be more averse to risk than women. This finding challenges the common belief that men are more willing to assume risk than women. Individuals running family businesses are more willing to take risk. Land ownership, which is a proxy for wealth,

Table 5. Correlation of Utility's Parameters Under Prospect Theory with Socioeconomic Variables Using a Structural Model Approach

	Risk Aversion (α)		Loss Aversion (λ)		Probability Weighting (γ)	
Variable	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Age	−0.003	0.002	0.075**	0.034	0.008	0.006
Gender (1 = male)	−0.157***	0.057	−9.470***	2.475	−0.031	0.104
Education	−0.003	0.012	−0.309***	0.105	0.038	0.023
Fishermen	3.794***	0.532	0.655	1.022	−3.824***	0.530
Farmers	−0.118	0.115	−14.840***	3.261	−0.344	0.232
Sales/Trade	0.082	0.111	24.117***	5.168	0.041	0.170
Family Business	0.990***	0.326	−4.271***	1.502	−0.741**	0.356
Government Official	0.095	0.081	0.233	1.793	−0.061	0.160
Distance to Market	−0.110***	0.024	6.236***	1.330	0.123***	0.033
ROSCA Member	0.415***	0.117	−1.791	1.638	−0.404**	0.167
Bidding ROSCA Member	−0.169	0.122	11.852***	3.048	0.487*	0.256
South	0.025	0.081	27.432***	5.454	−0.092	0.142
Log(*Savings*)	−0.022**	0.011	−0.666***	0.206	0.032**	0.015
Ag Land Holding	4.6e-06***	1.6e-06	0.002***	0.001	−2.3e-08	6.3e-06
Constant	0.586***	0.216	1.200**	0.470	−0.491	0.303

No. of Observations = 6,440
Pseudo-Log Likelihood = −4,166

Notes: Single, double, and triple asterisks (*,**,***) denote $p < 0.10$, 0.05, and 0.01, respectively. We conducted robust regressions, and adjusted standard errors for correlations within individuals.

is also found to have a negative effect on risk aversion. One explanation is that the response to a change in income may be different between the rich and the poor. The same variation in harvesting revenue may be perceived as negligible for the wealthy, while it may have a substantial impact on poorer families. Regarding the effect of distance to market on risk aversion, the closer the participant lives to the market, the less risk averse she is. It could be that living close to the market exposes the participant to the daily uncertainties of business activities, therefore acclimating her to income fluctuation. ROSCA members are less averse to risk than non-ROSCA members. The higher willingness to take risk among ROSCA members may relate to the risky decision on joining a ROSCA given the possibility of losing money as a result of potential default.

With respect to loss aversion, the coefficient for the constant is 1.2, and the corresponding 95% confidence interval is [0.3, 2.1] which includes 1 but does not include 0. Accordingly, there is some evidence of loss aversion in our sample. Farmers and people who run family businesses are found to be more averse to loss, as are people who save more. Individuals who are involved in sales and trade activities are less loss averse, as are people who own more agricultural land. The relationship between land holding and loss aversion is consistent with results reported by Tanaka, Camerer, and Nguyen (forthcoming), who found that higher income participants are less averse to loss than others. Members of bidding ROSCAs are less averse to loss than non-ROSCA members. No significant difference is found between fishermen and the reference group.

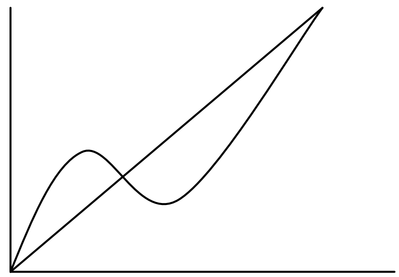

Figure 2. Probability weighting function

In examining the correlation between the probability weighting function parameter (γ) and other socioeconomic variables, fishermen appear to underweight probabilities. Likewise, people who run family businesses and members of ROSCAs are found to have inflected probability weightings and thus respond less to probability information and, possibly, stronger outcome orientation. In contrast, those who live close to the market and those with greater savings are more inclined to overweight favorable probabilities.

Discussion

A key significant finding in this study is that fishermen are less risk averse than people in other occupations (farmers, trade/sales people, government officials) and the unemployed. A natural question emerges: To what extent can we say that being involved in fishing makes fishers have different risk preferences? It may also be that fishing attracts people with a certain type of preferences. The causal relationship between preferences and occupational choice is still an open question. We prefer the balanced view that preferences are both biologically and environmentally influenced. Quoting Strotz (1956, p. 177): "My own supposition is that most of us are 'born' with discount functions . . . [but that] true discount functions become sublimated by parental teaching and social pressure." Being faced with uncertainty on an almost daily basis perhaps makes fishermen less averse to risk, possibly explaining their different weighting probability.

Fishermen also have more inflected probability weightings (lower γ). Wu and Gonzalez (1996) point out that γ reflects a person's responsiveness to changes in probability. Intuitively, we can view γ as a winning gamble's attractiveness. A lower γ implies fishermen are less disposed to gamble. Specifically, the more inflected the probability weighting curve, the lower are the weights placed on the probabilities. In this sense, one person finds a gamble less attractive than does another individual if she places less weight on the (larger outcome's) probability. The elevation of the curve also determines where the curve intersects the diagonal, i.e., the linear probability weighting line in (p, $w(p)$) space. As can be seen from figure 2, the lower the point of intersection with the diagonal, the smaller the range of probabilities where the subject displays optimism ($w(p) > p$).

While we don't have a definite explanation for this finding, the framework of bounded rationality provides some interesting insights (Fehr-Duda, de Gennaro, and Schubert, 2005). Following this framework, fishermen have to make many small (but occasionally some big) financial decisions whose probabilities of outcomes are usually not well-defined numbers, but are instead ambiguous. It is possible that fishermen have adapted to their unique environment by using specific heuristics for decision making under conditions of uncertainty. When confronted with purely risky decisions which we imitate in the experiment, fishermen may be drawn more strongly to their rules for ambiguous situations which result in a lower responsiveness to probability information and, possibly, stronger outcome orientation. We believe a focus on occupation-specific heuristics is an exciting direction for future research.

Conclusions

Prospect theory has been applied to investigate whether working in fishing makes fishermen less averse to risk than others. Our findings reveal that working in fishing does make the participants less averse to risk. Fishermen also tend to be less sensitive to probability changes. The result is highly significant. The combination of experimental field data and household survey data plays an important role in the investigation process. Also, the unique characteristic of Vietnamese fishermen, who consider fishing as their only occupational choice, makes it possible to infer the causal relationship between fishing occupation and the resulting risk behavior.

An interesting aspect of our study is that we applied a structural model approach to estimate the correlation between parameters of the utility function under prospect theory with other demographic variables. More specifically, we developed a maximum-likelihood estimation procedure using inputs from the binary choice made by participants in the experiment and their corresponding socioeconomic characteristics collected from a household survey.

Several policy implications benefited from the finding that fishermen are less risk averse than others. First, fishery closure is a matter of debate among policy makers as they attempt to balance the fishermen's economic well-being with the need for biological preservation. Fisheries managers are concerned that fishermen would rather prefer less variation in revenue that may come as a result of fisheries closures, and the need for fishermen to relocate to other fishing grounds. The finding in this paper shows that fishermen are not so much averse to income variation, but rather to income loss. Thus, a more relevant question is how closures may lead to a reduction in fishing revenue, as fishermen are just as loss averse in terms of revenue as people of other occupations. Second, a number of programs that aim to help the poor in developing countries, such as the World Bank-initiated microfinance programs, assume fishermen are risk averse. Under this assumption, programs are being developed that implement risk-sharing mechanisms to encourage more risky investment behavior. According to our findings, a more effective program would seek to develop a safety net to protect fishermen in the event of an economic loss.

Results of this study suggest a potential for extension of our research. As observed from table 4, the majority of respondents report farming and livestock as their main occupations. Yet, a much lower proportion of participants, especially those in the North, claim fishing as their main occupation.[5] Our research primarily addresses variation in risk attitudes among people involved in different occupations, with farmers comprising the largest group represented. Most fishermen and other workers in our data take farming as a secondary job, although we don't have the data to confirm this. In other words, our sample group may be considered to be composed of agriculturists, some of whom also fish. The effect of risk attitude on being a fisherman may be linked simultaneously with the effect of being a farmer.

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[5] We thank the editor for this insight.

An interesting future research question is how to estimate the net effect of fishing on risk attitude for a fisherman having multiple jobs by controlling for the number of years the fisherman has been working in fisheries.

There remain areas for improvement relating to the potential endogeneity in the models. For instance, working in the business sector may affect risk behavior. On the other hand, people with certain risk behaviors may choose business as an occupation. In the context of cross-sectional data like ours, it is not possible to solve all the endogeneity problems. Future research can more clearly establish the causal relationships between risk behavior and other variables by employing panel data or randomized field experiments (Tanaka, Camerer, and Nguyen, forthcoming).

Our study shows that new research methodologies can be integrated into the study of labor economics. Field experiment and household data can be combined and can complement each other. In addition to expected utility theory, prospect theory can also provide insights into risk behavior. The methodology developed here is applicable to a broad spectrum of research, both within fishing and in other fields as well.

[*Received January 2009; final revision received October 2009.*]

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Appendix:
Experiment Design and Sample Record Sheets

Instructions to Experiment Participants

In this game, your earnings will depend partly on your decisions and partly on chance. There are 3 series of questions. Series 1 consists of 14 questions. Series 2 consists of 14 questions, and Series 3 consists of 7 questions. So, there are 35 questions in total. In each question, we will offer you two options: Option A and Option B. We would like you to choose either Option A or Option B for each question. After you complete the record sheet, we will place 35 balls in a bingo cage and draw one numbered ball to select 1 question out of the 35 questions. We will play the selected question for real money. For example, if the number 21 ball is drawn, we will play Question 21 for real money. Once the question is determined, we will place 10 balls in the cage and play the selected question.

RECORD SHEET, Game 2: Series 1

	Option A	**Option B**
1	40,000VND if ①②③ 10,000 VND if ④⑤⑥⑦⑧⑨⑩	68,000VND if ① 5,000 VND if ②③④⑤⑥⑦⑧⑨⑩
2	40,000VND if ①②③ 10,000 VND if ④⑤⑥⑦⑧⑨⑩	75,000VND if ① 5,000 VND if ②③④⑤⑥⑦⑧⑨⑩
3	40,000VND if ①②③ 10,000 VND if ④⑤⑥⑦⑧⑨⑩	83,000VND if ① 5,000 VND if ②③④⑤⑥⑦⑧⑨⑩
4	40,000VND if ①②③ 10,000 VND if ④⑤⑥⑦⑧⑨⑩	93,000VND if ① 5,000 VND if ②③④⑤⑥⑦⑧⑨⑩
5	40,000VND if ①②③ 10,000 VND if ④⑤⑥⑦⑧⑨⑩	106,500VND if ① 5,000 VND if ②③④⑤⑥⑦⑧⑨⑩
6	40,000VND if ①②③ 10,000 VND if ④⑤⑥⑦⑧⑨⑩	125,000VND if ① 5,000 VND if ②③④⑤⑥⑦⑧⑨⑩
7	40,000VND if ①②③ 10,000 VND if ④⑤⑥⑦⑧⑨⑩	150,000VND if ① 5,000 VND if ②③④⑤⑥⑦⑧⑨⑩
8	40,000VND if ①②③ 10,000 VND if ④⑤⑥⑦⑧⑨⑩	185,000VND if ① 5,000 VND if ②③④⑤⑥⑦⑧⑨⑩
9	40,000VND if ①②③ 10,000 VND if ④⑤⑥⑦⑧⑨⑩	220,000VND if ① 5,000 VND if ②③④⑤⑥⑦⑧⑨⑩
10	40,000VND if ①②③ 10,000 VND if ④⑤⑥⑦⑧⑨⑩	300,000VND if ① 5,000 VND if ②③④⑤⑥⑦⑧⑨⑩
11	40,000VND if ①②③ 10,000 VND if ④⑤⑥⑦⑧⑨⑩	400,000VND if ① 5,000 VND if ②③④⑤⑥⑦⑧⑨⑩
12	40,000VND if ①②③ 10,000 VND if ④⑤⑥⑦⑧⑨⑩	600,000VND if ① 5,000 VND if ②③④⑤⑥⑦⑧⑨⑩
13	40,000VND if ①②③ 10,000 VND if ④⑤⑥⑦⑧⑨⑩	1,000,000VND if ① 5,000 VND if ②③④⑤⑥⑦⑧⑨⑩
14	40,000VND if ①②③ 10,000 VND if ④⑤⑥⑦⑧⑨⑩	1,700,000VND if ① 5,000 VND if ②③④⑤⑥⑦⑧⑨⑩

Answer:

I choose Option A for Questions 1 – [___]

I choose Option B for Questions [___] – 14

RECORD SHEET, Game 2: Series 2

	Option A	**Option B**
15	40,000VND if ①②③④⑤⑥⑦⑧⑨ 30,000 VND if ⑩	54,000VND if ①②③④⑤⑥⑦ 5,000 VND if ⑧⑨⑩
16	40,000VND if ①②③④⑤⑥⑦⑧⑨ 30,000 VND if ⑩	56,000VND if ①②③④⑤⑥⑦ 5,000 VND if ⑧⑨⑩
17	40,000VND if ①②③④⑤⑥⑦⑧⑨ 30,000 VND if ⑩	58,000VND if ①②③④⑤⑥⑦ 5,000 VND if ⑧⑨⑩
18	40,000VND if ①②③④⑤⑥⑦⑧⑨ 30,000 VND if ⑩	60,000VND if ①②③④⑤⑥⑦ 5,000 VND if ⑧⑨⑩
19	40,000VND if ①②③④⑤⑥⑦⑧⑨ 30,000 VND if ⑩	62,000VND if ①②③④⑤⑥⑦ 5,000 VND if ⑧⑨⑩
20	40,000VND if ①②③④⑤⑥⑦⑧⑨ 30,000 VND if ⑩	65,000VND if ①②③④⑤⑥⑦ 5,000 VND if ⑧⑨⑩
21	40,000VND if ①②③④⑤⑥⑦⑧⑨ 30,000 VND if ⑩	68,000VND if ①②③④⑤⑥⑦ 5,000 VND if ⑧⑨⑩
22	40,000VND if ①②③④⑤⑥⑦⑧⑨ 30,000 VND if ⑩	72,000VND if ①②③④⑤⑥⑦ 5,000 VND if ⑧⑨⑩
23	40,000VND if ①②③④⑤⑥⑦⑧⑨ 30,000 VND if⑩	77,000VND if ①②③④⑤⑥⑦ 5,000 VND if ⑧⑨⑩
24	40,000VND if ①②③④⑤⑥⑦⑧⑨ 30,000 VND if ⑩	83,000VND if ①②③④⑤⑥⑦ 5,000 VND if ⑧⑨⑩
25	40,000VND if ①②③④⑤⑥⑦⑧⑨ 30,000 VND if ⑩	90,000VND if ①②③④⑤⑥⑦ 5,000 VND if ⑧⑨⑩
26	40,000VND if ①②③④⑤⑥⑦⑧⑨ 30,000 VND if ⑩	100,000VND if ①②③④⑤⑥⑦ 5,000 VND if ⑧⑨⑩
27	40,000VND if ①②③④⑤⑥⑦⑧⑨ 30,000 VND if ⑩	110,000VND if ①②③④⑤⑥⑦ 5,000 VND if ⑧⑨⑩
28	40,000VND if ①②③④⑤⑥⑦⑧⑨ 30,000 VND if ⑩	130,000VND if ①②③④⑤⑥⑦ 5,000 VND if ⑧⑨⑩

Answer:

I choose Option A for Questions 15 – [___]

I choose Option B for Questions [___] – 28

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	Option A	**Option B**
29	Receive 25,000VND if ①②③④⑤ Lose 4,000 VND if ⑥⑦⑧⑨⑩	Receive 30,000VND if ①②③④⑤ Lose 21,000 VND if ⑥⑦⑧⑨⑩
30	Receive 4,000VND if ①②③④⑤ Lose 4,000 VND if ⑥⑦⑧⑨⑩	Receive 30,000VND if ①②③④⑤ Lose 21,000 VND if ⑥⑦⑧⑨⑩
31	Receive 1,000VND if ①②③④⑤ Lose 4,000 VND if ⑥⑦⑧⑨⑩	Receive 30,000VND if ①②③④⑤ Lose 21,000 VND if ⑥⑦⑧⑨⑩
32	Receive 1,000VND if ①②③④⑤ Lose 4,000 VND if ⑥⑦⑧⑨⑩	Receive 30,000VND if ①②③④⑤ Lose 16,000 VND if ⑥⑦⑧⑨⑩
33	Receive 1,000VND if ①②③④⑤ Lose 8,000 VND if ⑥⑦⑧⑨⑩	Receive 30,000VND if ①②③④⑤ Lose 16,000 VND if ⑥⑦⑧⑨⑩
34	Receive 1,000VND if ①②③④⑤ Lose 8,000 VND if ⑥⑦⑧⑨⑩	Receive 30,000VND if ①②③④⑤ Lose 14,000 VND if ⑥⑦⑧⑨⑩
35	Receive 1,000VND if ①②③④⑤ Lose 8,000 VND if ⑥⑦⑧⑨⑩	Receive 30,000VND if ①②③④⑤ Lose 11,000 VND if ⑥⑦⑧⑨⑩

Answer:

I choose Option A for Questions 29 – [___]

I choose Option B for Questions [___] – 35