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Interactions between Risky Choice Framing Effect and the Risk-seeking Propensity

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1. Risky Choice Framing Effect

Framing effects are considered as the effect that our decisions are influenced by the way decision problems are framed . It suggests that we may make different decisions, if a question is expressed differently, even when the content of the decision problem is logically equivalent. Kuhberger (1998) conducted a meta analysis based on 136 empirical studies and concluded that framing effect is a reliable phenomenon, although he reported there were profound differences existed in research designs among the studies. Levin, Schneider, and Gaeth (1998) reported a literature review for framing effects in which they classified framing effects into three categories, risky choice, attribute and goal framing. Those three different types of framing effects seem to occur based on somewhat different psychological mechanisms, despite being designated under the general term "framing effect".

Risky choice framing effect is a specific type of framing effects caused by the description of a decision problem which asks to choose a risky or non-risky choice. A typical risky choice framing effect is described as follows; while a majority of respondents choose a low risk option when a decision problem is described positively, if the same decision problem is described negatively without changing the logical content of the problem, the respondents' preferences are reversed.

A pair of positive and negative items, conveying logically the same content, is compared in terms of the responding frequencies to a risk-seeking choice versus risk-averse choice (Kuhberger, 1995; Kuhberger, 1998; Levin et al., 1998). Risky choice framing effect is typically evaluated based on a single item frequency analysis, which may cause difficulties in term of relating risky choice framing effect with other variables because of a low reliability. Kuhberger (1998) stated that the two most important factors for influencing the framing effect were whether framing is manipulated by changing reference points or outcome salience, and the response mode (choice vs. rating/judgment). Another factor known to influence the framing effect is the content arena of the risk, such as amount of money or number of human lives. It may not be a problem to mix those factors known to affect the framing effect across multiple items as long as a single item analysis is utilized for evaluating the framing effect. On the other hand, mixing those confounding factors in multiple items which constitute a scale for measuring a trait such as risk attitude may cause difficulties for not only detecting a targeted framing effect, but also for measuring the risk attitude (Watanabe & Shibutani, 2007a).

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2. Mechanism of Risky Choice Framing Effect

Expected utility theory has been used for explaining decision making behaviors for long time, although it has been known that some phenomena, risky choice framing effect being one, may not follow the predictions of expected utility theory. In order to provide an explanation for risky choice framing effect, Kahneman and Tversky (1979) proposed prospect theory in which the decision making process has two distinctive phases, editing and evaluation. A decision frame of a given problem is constructed in the editing phase, and a decision will be made through the evaluation of a given problem based on the constructed decision frame. Prospect theory indicates shapes of the utility functions are different between the gain and loss regions which are separated by a reference point. It assumes that a location of the reference point is determined by the way a respondent interprets the context given in a problem. It means that the reference point itself may shift towards or away from either gain or loss region depending on how a decision frame is constructed by a respondent in the editing phase. Prospect theory is taken as the most prominent theory for explaining the mechanism of risky choice framing effect, although there are some unclear issues. Fujii and Takemura (2001) pointed out how the shift of a reference point occurs is not completely clear in prospect theory. Takemura (2001) also indicated the possibility of the existence of multiple reference points. Fujii and Takemura (2001) proposed the contingent focus model for solving the issues regarding the reference point, and providing better predictions for the decision behavior under the risky choice framing context with some promising results.

It is important to note that both expected utility theory and prospect theory emphasize that respondents are passive entities who respond rationally to a given context. It means that the choices made by respondents are readily predictable based on how decision problems are presented. Tversky and Kahneman (1981) stated that a construction of the decision frame can be affected by social norms adopted by a decision maker and expectations which correspond to a level of aspirations, which may or may not be realistic. This position is logically conceivable, but how the social norms and expectations affect the construction of a decision frame is not clear. It is rational to consider that personal characteristics such as a level of aspiration or risk-seeking propensity would directly affect choices made by respondents, besides affecting how the decision frame is constructed in the editing phase. Since respondents are asked to choose a risk-seeking or risk-aversive choice in a risky choice framing problem, respondents with a high level of risk-seeking propensity may choose a risk-seeking option and respondents with a low level of risk-seeking propensity may choose a risk-aversive option, regardless the way the decision problem is presented. It has to be true to certain degree, since we are the ones who make decisions. The way the problem is presented cannot make decisions for us, although it is known that factors besides ourselves can affect our decisions. Then, decisions made by respondents who are not inclined in either way in terms of the risk-seeking propensity must be strongly affected by the way the decision is framed, because it is known that risky choice framing effect exists. At this point, what is not known is how the interactions between the risky choice framing effect and the risk-seeking propensity occur. This paper will provide information regarding the interactions based on two different analytical methods, traditional frequency analyses and analyses based on IRT.

3. Risk-seeking Propensity and Risky Choice Framing Effect

The relationship between risk attitude and the risky choice framing effect has not often been investigated. Schneider (1992) found no empirical evidence for a relationship between strong and stable risk attitudes and risky choice framing effect in her literature review, although most current theories of risk choice rely heavily on the assumption that people have systematic and reliable risk attitudes. Fagley and Miller (1990) reported that risk-taking propensity did not show any interactions with risky choice framing effect. However, it is psychometrically sound to assume that the most influential factor for item responses is the trait being measured by the set of items. Item responses under a framing context, despite Fagley and Miller's findings (1990), should be assumed to be based on the interactions between the trait related to risk-seeking and the ways of items being framed.

Zickar and Highhouse (1998) reported that a latent construct, labeled as preference for risk, was influential in predicting risky choices based on the IRT analysis of four risky choice framing items. They also partially confirmed Fagley and Miller's hypothesis (1990), which predicts that the more one diverges from risk neutrality the less effect framing should have on choice, by interpreting the item response functions (IRFs) of four framing items estimated by a 2-parameter logistic (2PL) model under the differential item functioning (DIF) assumption (Zickar & Highhouse, 1998). The DIF model assumes item discrimination parameters for the focal and reference groups are the same, so that the differences in item difficulty parameters in the two groups can be estimated. Toyoda et al. (2007) utilized a nine-item questionnaire for investigating risky choice framing effect utilizing a 2 PL model. The results confirmed the presence of typical risky choice framing effect, and the scalability of risk-seeking tendencies was firmly indicated. They also reported that the higher the risk-seeking tendencies, the higher the probability of choosing risky choices, in both sides of the reference point. Recent studies with IRT analysis indicated that an interaction between the risk-seeking tendencies and risky choice framing effect was strongly suggested (Toyoda et al., 2007; Zickar & Highhouse, 1998).

In order to conduct an empirical study for investigating the relationship between the risk-seeking propensity and risky choice framing effect, it is necessary to operationally define risky choice framing effect. When ratios of a response frequency in the risk-averse option to the positive and negative items are designated as p and q, respectively, the response ratios of risk-seeking options in the positive and negative items can be expressed as $1 - p$ and $1 - q$, respectively. Tversky and Kahneman (1981) defined risky choice framing effect as $p > 1 - p$ and $q < 1 - q$, which translates into the numerical ratios of $p > 0.5$ and $q < 0.5$. Wang (1996) categorized risky choice framing effect into two fundamental categories, the bidirectional and unidirectional framing effect. The bidirectional framing effect is the same as the definition adopted by Tversky and Kahneman (1981). The unidirectional framing effect does not require p to be greater than 0.5. Wang (1996) farther classified the unidirectional framing effect into two subcategories, the risk-aversion augmenting and risk-seeking augmenting. The risk-aversion augmenting is defined as $p > 0.5$ and $q > 0.5$ and also $p > q$. The risk-seeking augmenting is defined as $p < 0.5$ and $q < 0.5$ and also $p > q$. Watanabe and Shibutani (2004) pointed out that one of the problems of adopting the bidirectional definition is the empirical difficulty of achieving the criteria. If $1 - p$ is greater than 0.5, which often happens, the bidirectional definition automatically rejects the existence of the framing effect. The definition of unidirectional framing is adopted in this study so that important characteristics of risky choice framing effect may be revealed by encompassing a wider range of phenomenon for the analysis.

4. Item Response Theory

It is a precarious psychometric practice to make an inference based on single item analysis. In order to improve the stability of analysis, item responses from multiple items can be pooled to provide a scale measuring a single trait related to risk-seeking behavior. A total score, the sum of all the item responses as described in classical test theory, has been the most widely utilized scale structure in social and behavioral sciences. The method used for evaluating risky choice framing effect has been almost exclusively a single item frequency analysis, although there are some studies which used a total score analysis. Since neither of the two analytical methods has any psychometric constraint which defines the relationship between the item responses and the underlying psychological trait, any data can be analyzed by either method without evaluating the internal structure of the item responses. Unlike CTT analysis which develops a scale based on a sum of the allocated score point for each response option, the analysis based on IRT estimates respondent's trait level as the value which would most likely generates his/her response pattern to a set of items. Both CTT and IRT have the same goal, developing a scale for a target trait, although they have different ways of doing so. It is one of the most important processes of IRT analysis to evaluate a level of fit between a selected IRT model and the given data. Parameters are estimated in a way that a set of constraints imposed by a selected IRT model are best satisfied. When the model-data fit is satisfactory, an IRT analysis can offer many advantageous features for evaluating psychological characteristics, such as invariant properties for item and person parameters (Lord & Novick, 1968). Estimated item parameters in IRT models are different in nature from indexes used in CTT analyses. Embretson and Reise (2000) stated that it is not uncommon to observe discrepancies in statistical significance between the IRT trait level and the proportion-correct scale.

The most frequently used IRT models are binary IRT models which may have different numbers of item parameters, typically one, two, and three parameters. Binary IRT models are typically used for analyzing achievement test data scored in a correct-incorrect format. In this study 2PL model, where a relationship between the trait and the probability of responding to a particular option is depicted through a logistic function with two item parameters (threshold and discrimination), was used in this study for analyzing the relationship between the risk-seeking propensity and probability of responses. The probability of a respondent with a trait level of θ responding with a high risk option in item j estimated by a 2PL model is given in Equation 1, where aj and bj are the item discrimination and difficulty parameters respectively.

Equation 1

$$P_j(\theta) = \frac{exp^{[a_j(\theta - b_j)]}}{1 + exp^{[a_j(\theta - b_j)]}}$$

It is capable of expressing how a probability of responding to a particular option change along with different levels of θ by estimating the location and the slope of the item characteristic function.

IRT models are very informative psychometric models, when a suitable IRT model is chosen for the given data. The most hindering difficulty in applying IRT models for evaluating the risky choice framing effect is that a very small number of risky choice framing items can be used at one administration. Each risky choice framing item requires a unique scenario which allows respondents to choose either a high or low risk option. Four scenarios, Asian disease, terrorism, cancer, and avalanche, were used in this study. We thought using more than four scenarios may complicate responses to the items because of emotional reactions to the scenarios which are based on rather unusual hypothetical conditions. It is known that a magnitude of standard error for the person parameter gets smaller as the number of items gets larger. Hambleton, Swaminathan, and Rogers (1991) explained the importance of having a large number of items and a large number of heterogeneous samples for getting accurate estimates for item and person parameters. Thissen and Steinberg (1988) presented how IRT analysis could be applied for analyzing personality and attitude measurement with a very small number of items (two to four items). They presented several features of IRT analysis which could reveal insightful characteristics behind the data, although they did not clearly explain how a model-data fit could be justified in their examples. In general, using measurement instruments with a very small number of items for scaling is not considered a sound psychometric practice (Embretson & Reise, 2000; Shibutani, 2007). It seems clear, from a theoretical point of view, that a sample size must be large, if only a limited number of items are available, such as in this study, for IRT analysis (Hambleton et al., 1991).

5. Purpose of the Study

This study was motivated to provide information regarding risky choice framing effect on the following three specific areas.

A) Properties of a scale measuring the risk-seeking propensity constructed with four risky choice framing items.

B) Interactions between risky choice framing effect and a level of respondents' risk-seeking propensity.

C) Risky choice framing effect is weaker at the extreme regions of the risk-seeking propensity in comparison to the other regions.

6. Method

Survey Data and Framing Items

Data collected in a social survey conducted in 2000 were reanalyzed by CTT and IRT analyses. Shibutani (2002) reported the initial analysis for the data, which confirmed the typical framing effect in all four items based on single item response frequency analysis. Two forms of a questionnaire, positive and negative, were sent to 2,000 participants drawn randomly from the voters' lists in two northern cities in Japan. Eight hundred twenty nine participants completed four risky choice framing items; 661 non-elder adults (M=44.8 years old, SD=11.5) and 168 elders (M=72.5 years old, SD=4.1). An interaction between the age group (non-elder adults: 20 to 64 years old, and elder adults: more than 64 years old) and framing effect was reported by Watanabe and Shibutani (2004) based on the analysis of the data used in this study; there was no framing effect among elder adults, while non-elder adults showed clear response patterns of framing effect. In this study IRT and CTT scale analyses were conducted only with the non-elder adults, so that it became possible to evaluate the relationship between the risk-seeking propensity and risky choice framing effect under the context of the framing effect being clearly present.

There were four risky choice framing items in the survey questionnaire. All four items had the same item format as the Asian disease item in Kahneman and Tversky (1979), except there were four response options as shown below, instead of two options in the original item:

Scenario: Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows.

Positive frame item: If program A is adopted, 200 people will be saved. If program B is adopted, there is 1/3 probability that 600 people will be saved and 2/3 probability that no people will be saved. Which of the two programs would you favor? Please circle the number of the option which is closest to your opinion.

i. Strongly agree with A
ii. Agree with A
iii. Agree with B
iv. Strongly agree with B

Negative frame item: If program C is adopted 400 people will die. If program D is adopted, there is 1/3 probability that nobody will die and 2/3 probability that 600 people will die. Which of the two programs would you favor? Please circle the number of the option which is closest to your opinion.

i. Strongly agree with C
ii. Agree with C
iii. Agree with D
iv. Strongly agree with D

All four items had the same content arena, human lives, and the risk probability level levels of 1/3 vs. 2/3, although different numbers of lives were at stake, 90, 600, 9 000, and 600 000. The content of the risky events were avalanche, cancer, and terrorism, in addition to the Asian disease. Participants received only a set of four positive or negative items. The assignment of the frame type to the participants was done randomly so that the IRT parameters between the two groups were randomly equivalent. Participants were asked to choose either a risk-seeking-solution or a risk-averse-solution in each item. Item format allowed participants to choose either strongly agree or agree on either of the solutions, in order to expand the binary nature of the original items used by Kahneman and Tversky (1979) to a polytomous structure. The options 1 and 2 were combined to form the low risk option (score 0 was allocated), and options 3 and 4 were pooled to form the high risk option (score 1 was allocated). In this way, originally polytomous data were collapsed into a binary structure.

7. Analysis

A single frequency analysis was conducted first for providing the traditional evaluation of the framing effect. Then, CTT based total score analysis with a factor analysis was conducted. Then, a 2PL model was used in order to investigate the interactions between the framing effect and risk-seeking propensity. Item response functions from the 2PL model were compared for evaluating the interactions. IRT parameters in IRT analyses were estimated by Bilog-MG and Parscale. The following hypotheses were tested in order to provide information for the three topics stated in the purpose section.

A) A scale for measuring the risk-seeking propensity is valid and reliable.

B) Interactions between risky choice framing effect and a level of respondents' risk-seeking propensity exist.

C) Risky choice framing effect is weaker at the extreme regions of the risk-seeking propensity in comparison to the other regions.

8. Results

8.1 Scaling Risk-seeking Propensity

Response frequencies on options in all four items and mean scores for the participants are presented in Table 1. There were 28 participants who responded to option 1 in item 1, and the mean total score for those 28 participants was 4.96. The results of the response frequency analysis indicated that items 1, 2, and 4 showed the risk-seeking augmenting unidirectional framing effect, and item 3 showed the bidirectional framing effect. All the framing effects were statistically significant ($p < .01$) in $\chi 2$ tests. The typical findings on the risky choice framing effect from the previous studies were confirmed by the response frequency analysis in this study.

It was assumed that the four items composed a scale for measuring a risk-seeking propensity, based on a logical examination of the contents of the items and the empirical evidence from the previous research (Toyoda et al. 2007; Watanabe & Shibutani, 2006; Zickar and Highhouse, 1998). A factor analysis for the four items indicated that variances accounted for the first factor was 68.0% and the factor loadings of the four items were ranged from .80 to .88. Cronbach's alpha coefficient was .89. Item p-values were from .46 to .50 and the item-remainder coefficients were from .78 to .82. The results shown above were based on the pooled data for positive and negative items. The results of the two separate scale analyses for a set of positive and negative items did not show any noteworthy differences except having significantly different group mean total scores.

The mean total scores for response option 1 to response option 4 in all four items clearly indicated a monotonically increasing pattern (Table 1). The mean total scores for each option showed about the same differences among the adjacent options, across all four items, which suggests the distances among the options are about the same. Results from the factor analysis on the sets of positive and negative items support the scales are unidimensional, and both scales measure a trait related to risk-seeking behavior. Mean total scores for the positively framed items were 2.32 and 10.33 for the binary and polytomous data respectively. Mean total scores for the negatively framed items were 2.90 and 11.11 for the binary and polytomous data respectively. The differences in the mean total scores between the positively and negatively framed items were statistically significant; $t(659) = -4.61$, $p = .00$ for the binary data and $t(659) = -3.80$, $p = .00$ for the polytomous data. Respondents who answered to a set of differently framed items showed highly significant differences in the mean total scores, although both groups of respondents were randomly equivalent. It suggests that the two scales, one consists of positively framed items and the other negatively framed items, measure the same trait, the risk-seeking propensity, although the two scales have different sets of unit of measurement. The differences in the two scales seem to be created by the framing effect, so it is crucial to evaluate the interaction between risky choice framing effect and the risk-seeking propensity.

8.2 Interactions between the Framing Effect and Risk-seeking Propensity

Two types of IRT models, 1-parameter logistic (1PL) model and 2-parameter logistic model, were utilized for analyzing the binary data. The point biserial correlations between the item responses and total scores were about the same across the four items. Therefore, the 1PL model was the first choice. However, the 2PL model showed a significantly better fit in a $\chi 2$ test based on the -2 log likelihood values. Table 2 presents the estimated item parameters with the item fit statistics for the 2PL model. There is no item fit statistic which would evaluate an item fit reliably with only four items in a scale. The results of the fit analysis must be interpreted carefully with some reservations. It seems that the positive items indicated better fit than the negative items. It confirmed one of the concluding remarks made by Schneider (1992) in her literature review. The threshold parameters indicated a clear pattern for the framing effect: all the threshold parameters in the positive frame were higher than the ones in the negative frame.

The probability of choosing a risky option is systematically higher when a person is given a set of negative items than the probability of a person who responded to a set of positive items even when the trait level is

Table 1. Response Frequencies and Mean Total Scores for Each Option

Item	Frame	Stat.	Option 1	Option 2	Option 3	Option 4	Low Risk	High Risk	Total
1	Pos.	Freq.	28	81	181	37	109	218	327
		Mean	4.96	8.27	11.27	14.22	7.42	11.78	10.33
	Neg.	Freq.	11	67	227	29	78	256	334
		Mean	4.55	8.76	11.55	15.76	8.12	12.02	11.11
2	Pos.	Freq.	29	101	155	42	130	197	327
		Mean	4.62	8.49	11.51	14.29	7.62	12.11	10.33
	Neg.	Freq.	16	74	209	35	90	244	334
		Mean	5.75	8.73	11.69	11.14	8.20	12.18	11.11
3	Pos.	Freq.	43	129	127	28	172	155	327
		Mean	6.12	9.01	11.91	15.70	8.28	12.59	10.33
	Neg.	Freq.	19	90	188	37	109	225	334
		Mean	5.74	9.09	11.84	15.08	8.50	12.37	11.11
4	Pos.	Freq.	35	104	157	31	139	188	327
		Mean	5.40	8.67	11.57	15.13	7.85	12.16	10.33
	Neg.	Freq.	18	74	207	35	92	242	334
		Mean	5.89	8.80	11.72	15.09	8.23	12.21	11.11

Table 2. 2PL Model Parameters for the Four Binary Items

Items	Frame	Slope	S.E.	Threshold	S.E.	Item fit statistic $\chi^2(df.)$	P
Item 1	Positive	3.160	0.558	-0.506	0.073	1.4 (3)	.7093
	Negative	3.177	0.668	-0.873	0.102	12.3 (3)	.0065
Item 2	Positive	4.431	0.951	-0.305	0.067	1.9 (3)	.6014
	Negative	3.437	0.935	-0.713	0.091	10.4 (2)	.0054
Item 3	Positive	4.224	0.679	0.144	0.072	5.7 (3)	.1288
	Negative	2.941	0.747	-0.515	0.081	18.8 (2)	.0001
Item 4	Positive	2.956	0.421	-0.210	0.071	0.6 (2)	.7375
	Negative	4.059	1.458	-0.672	0.091	6.4 (3)	.0929

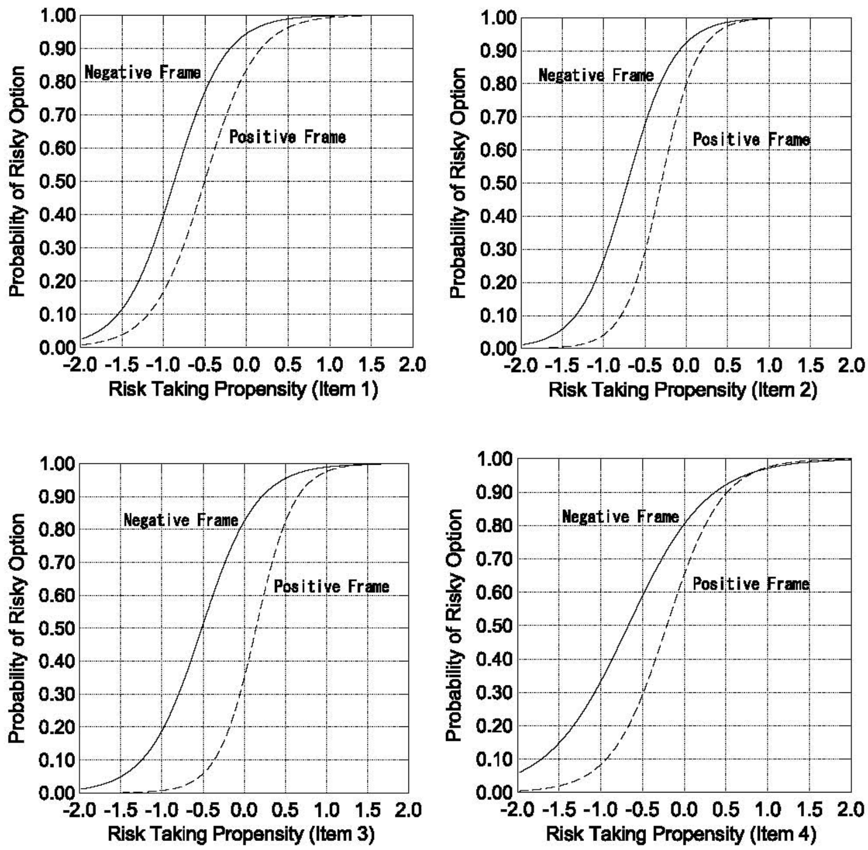

Fig. 1 Item response functions for the 2-parameter logistic model.

Table 3. Rating Scale Model Parameters for the Four Polytomous Items

Items	Frame	Slope	S.E.	Location	S.E.	Item fit statistic $\chi^2(df.)$	p
Item 1	Positive	1.845	0.111	-0.211	0.078	32.2 (7)	0 .000
	Negative	2.500	0.167	-0.424	0.079	11.59 (5)	0 .004
Item 2	Positive	2.298	0.182	-0.132	0.071	25.4 (7)	0 .001
	Negative	2.237	0.137	-0.367	0.071	11.43 (6)	0 .075
Item 3	Positive	2.517	0.214	0.158	0.068	15.79 (6)	0.016
	Negative	2.305	0.146	-0.255	0.067	28.07 (6)	0 .000
Item 4	Positive	2.522	0.185	-0.022	0.069	8.36 (6)	0 .212
	Negative	2.187	0.132	-0.349	0.073	9.80 (6)	0 .132
Category Parm. (S.E.)		Positive	1.283(.123)		0.128(.123)	-1.411(.123)	
Category Parm. (S.E.)		Negative	1.431(.123)		0.279(.123)	-1.710(.123)	

identical (Figure 1). The estimated item slope parameters were very high in both frame conditions, from 2.956 to 4.431, which characterized the IRFs covering a narrow spectrum of the trait level. It was not possible to evaluate the interactions between the trait level and framing effect in the extreme trait regions, since IRFs did not cover the extreme trait regions.

Table 3 presents the estimated item parameters for the rating scale model. The estimated location parameters indicated a clear sign of the framing effect: all the location parameters in the positive frame were higher than the ones in the negative frame, although the location parameters interact with the slope parameters in expressing a probability for each option in the rating scale model. The category response curves (CRCs) in Figure 2 showed the interactions of the framing effect and risk-seeking propensity:

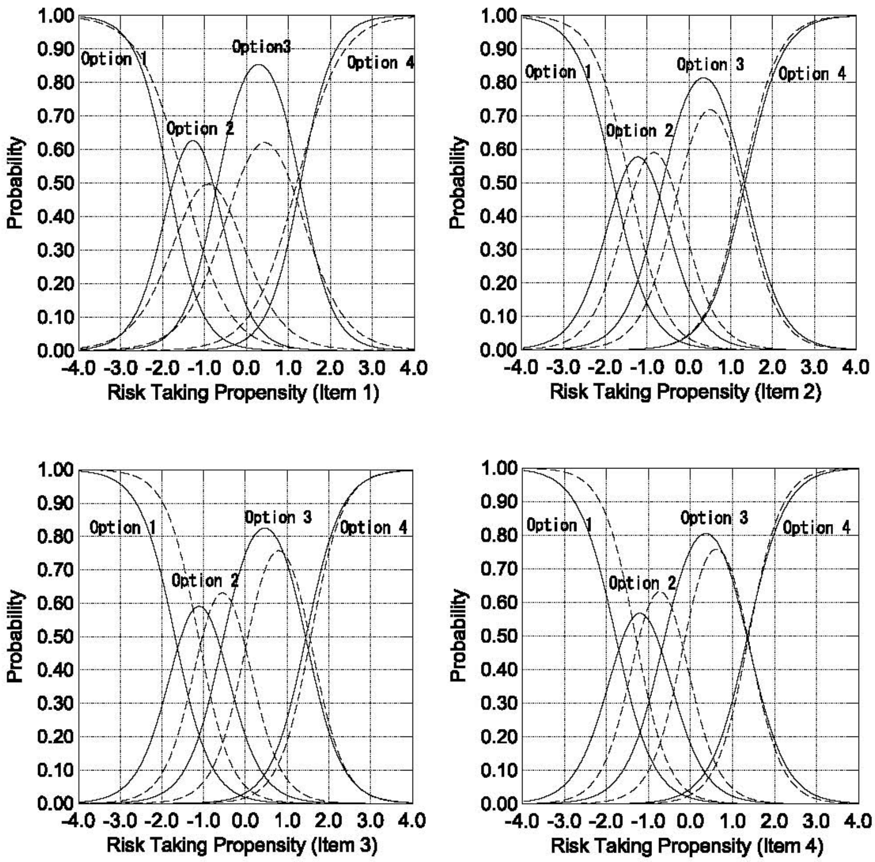

Fig. 2 Category response curves for the rating scale model.

the negative frame CRCs were depicted with solid lines and the positive frame CRCs were depicted with broken lines. The characteristics of the framing effect among the CRCs in options 1 through 3 were evident in all four items. However, there was no response probability shift in option 4 in any of the four items. The response frequencies shown in Table 1 indicated the same pattern in all four items. The framing effect was present throughout the entire trait level except in the highest region. The rating scale model was better in describing the characteristics of the interactions between the risk-seeking propensities and framing effect than the 2PL model.

9. Discussion

The CTT and IRT analysis both confirmed the typical risky choice framing effect was present in all four items. There was no noteworthy conflict between the results of the CTT and IRT analysis. However, the IRT analysis revealed some important characteristics of the relationship between the risky choice framing effect and risk-seeking propensity, which the CTT analysis failed to capture. The risky choice framing effect occurred throughout all levels of the risk-seeking propensity except in the highest region. Schneider (1992) predicted the framing effect would not occur in the extreme regions of a risk attitude, and Zickar and Highhouse (1998) concluded that the Schneider's prediction was correct based on the evaluation of IRFs estimated by the 2PL model.

This study concurs with the results of Zickar and Highhouse (1998), except the framing effect occurred in the region of extremely weak risk-seeking propensity also. The non-DIF model was used with the binary and polytomous IRT analysis in this study.

Zickar and Highhouse (1998) used DIF model with the binary IRT analysis only. It seems that differences between the two sets of IRFs, one with the DIF model and the other with non-DIF model, are not large enough for us to draw different conclusions. However, differences between the binary and polytomous analysis were clear: the CRCs clearly showed that the only region with no framing effect was the highest risk-seeking region (scale score interval of 1.5 and 4.0). The IRFs in both studies failed to provide the information regarding the probability of choosing a risky option for participants with trait levels beyond 2.5.

Three items out of four indicated clear CRC differences at the trait level of -2.5. The differences between the IRFs and CRCs can be explained in terms of the amount of information extracted from the item responses. A polytomous item with four options can be considered as an item parcel with a set of 4 binary items, so that the polytomous data may contain four times more information than the binary data in this study, although the calculation may not be so simple in reality. When there are an extremely small number of items such as the case in this study, the differences in the extracted amounts of information between the binary and polytomous model may make large enough differences in the analysis to lead us to different conclusions.

Watanabe and Shibutani (2004) reported that non-elders were susceptible to the framing effect, while elders did not show any sign of the framing effect. Shibutani and Watanabe (2005) reported similar results. Elders showed no framing effect while non-elders showed a clear pattern of the framing effect based on the analysis of the 2005 social survey. The reason why elders do not show the framing effect is not exactly known: In order to understand the reason for the conflict, the mechanism underlying the differences in the utility between the two groups must be explained. The prospect theory does not explain the conflict between the two groups. The flexible Bayesian approach proposed by Shigemasu and Yokoyama (1994) can be applied to explain the conflicting behavior between the elders and non-elder adults by assuming subjective probability distributions are different in the two groups (Watanabe & Shibutani, 2007b).

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