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DO RISK ATTITUDES REFLECT IN THE EYE OF THE BEHOLDER?

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ABSTRACT. Research in risky decision making has shown that choices between gambles with monetary outcomes often reflect around the status quo: preferences are "risk averse" in the gain domain and "risk seeking" in the loss domain. These "economic" risk attitudes are based on an a priori definition of risk: riskier gambles are those with greater variance. We contrast economic risk attitudes with "perceived-risk" attitudes in which the decision maker defines the riskiness of gambles. Those who choose a gamble they judge as less risky than another gamble are perceived-risk averters, and those who choose a gamble they judge as riskier are perceived-risk seekers. We presented subjects with pairs of gambles and obtained both choices and judgments of relative riskiness. We replicated earlier results with economic risk attitudes by showing that the most frequent overall pattern was risk averse preferences in the gain domain and risk seeking preferences in the loss domain. When we examined perceived-risk attitudes in the same set of data, we found that the most frequent overall pattern was perceived-risk aversion in *both* domains. perceived-risk attitudes do *not* tend to reflect in the eye of the beholder. These risk attitudes show considerably more stability across domains than do economic risk attitudes.

1. INTRODUCTION

For over 200 years, expected utility theory has provided a normative framework for decision making under risk. The rule is simple: When making risky choices, people should select the option with the greatest expected utility. Within this framework, two individuals who select different options are assumed to differ in their utilities. Differing utility functions imply differing risk attitudes. We will refer to these risk attitudes, defined by the shape of the utility function, as economic risk attitudes, because they were originally proposed by economists (Pratt, 1964; Arrow, 1965). Later, we distinguish between economic risk attitudes and perceived-risk attitudes, a psychological approach to risky choice described below.

Key words and phrases. Risk attitudes, reflection effect, risk perceptions, risky decision making.

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Consider a choice between a sure thing and a gamble of equal expected value. A person who prefers the sure thing is said to be "risk averse" and is assumed to have a negatively-accelerated utility function. A person who prefers the gamble is called "risk seeking" and is assumed to have a positively-accelerated utility function. Research over the past several years has shown that people are often risk averse in their preferences. Why? The most common explanation has been that people have diminishing marginal utility over wealth. That is, a dollar means less to a millionaire than a pauper. In recent years, this explanation has been challenged by those who theorize that risk averse preferences arise from a nonlinear, rank-dependent probability-weighting function, in addition to, or instead of, a negatively-accelerated utility function (Birnbaum et al., 1992; Lopes, 1987, 1990; Luce, 1991; Luce & Fishburn, 1991; Quiggin, 1982; Yaari, 1987; Tversky & Kahneman, 1992).

Although risk aversion is often considered the norm, people do have risk seeking preferences, especially in the domain of losses (Laughhunn, Payne, & Crum, 1980). To some, a sure loss may be less desirable than a gamble with *some* chance of breaking even, despite the possibility of an even greater loss. In a classic paper on risky choice, Kahneman and Tversky (1979) showed that risk attitudes often reflect around the status quo; people have risk averse preferences in the domain of gains and risk seeking preferences in the domain of losses. They called this reversal of risk attitudes the reflection effect.

Kahneman and Tversky (1979) offer many examples of the reflection effect. In one case, they asked Israeli respondents to choose between A and B, where A was an 80% chance of winning 4,000 Israeli pounds, otherwise nothing, and B was 3,000 Israeli pounds for sure. Eighty percent of respondents exhibited risk aversion for gains by preferring B over A. Another group of respondents chose between C and D, where C was an 80% chance of losing 4,000 pounds and D was a sure loss of 3,000 pounds. Ninety-two percent of respondents displayed risk seeking preferences for losses by preferring C over D. These results suggest that, when the probabilities of winning and losing are large, people have risk averse preferences for gains and risk seeking preferences for losses[1].

What accounts for the reflection effect? Kahneman and Tversky (1979) proposed a theory of risky choice known as prospect theory. People evaluate risky options by means of a value function and a probability-weighting function. The value function is concave for gains and convex for losses; furthermore, it is steeper for losses than gains. The probability-weighting function is convex and implies that smaller probabilities are overweighted and larger probabilities are underweighted. In addition, riskless outcomes are weighted more heavily than risky outcomes. Taken together, these functions imply that when gambles with large probabilities are compared to sure things, economic risk attitudes should reflect around the status quo.

[1]Other studies have not found the same degree of support, and there is some debate about the magnitude of the reflection effect in both between-subject and within-subject designs (Cohen, Jaffray, & Said, 1987; Hershey & Schoemaker, 1980; Laughhunn et al., 1980; Schneider & Lopes, 1986).

2. PERCEIVED-RISK ATTITUDES

Weber and Bottom (1989) and Weber and Milliman (1997) took a different approach to understanding the reflection effect. They proposed that risk attitudes might not reflect around the status quo if risk is defined by the decision maker. Risk attitudes that treat risk as a psychological variable are called "perceived-risk" attitudes. Perceived-risk attitudes are based on the assumption that choices between risky options depend both on peoples' perceptions of risk and their preferences for risk. The perceived riskiness of a gamble is *not* based on an apriori definition, such as variance or mean-preserving spread (Rothschild & Stiglitz, 1970). Rather, it is elicited from the decision maker. Preferences for perceived risk express one's taste for risk. Some people are attracted to risk, while others are repelled by it. Those who avoid perceived risk are called perceived-risk averters, and those who seek it out are called perceived-risk seekers.

Perceived-risk attitudes differ from economic risk attitudes in a fundamental way: Risk is a perceptual variable that may differ across individuals and decision contexts. Weber (this volume) describes both individual differences and situational differences in risk perceptions. If risk is assumed to be a psychological variable rather than an a priori characteristic of choice alternatives, then choices are no longer sufficient to infer a person's perceived attitude toward risk. Perceived-risk attitudes require knowledge about both choices *and* perceptions of risk.

A wide range of studies suggest that people have different perceptions of risk. Bromiley and Curley (1992) pointed out that many individuals who appear to be risk takers based on their decisions and actions do not perceive themselves as such. Keyes (1985) quoted a wire walker as saying, "I have no room in my life for risk. You can't be both a risk taker and a wire walker. I take absolutely no risks" (p. 10). He argued that people who believe in their ability to manage or control the events in their lives (i.e., those with an internal, rather than an external, locus of control) often take large risks, but that they do not believe they are taking such risks. In support of this hypothesis, Miller, Kets de Vriess, and Toulouse (1982) found that risk taking in a sample of CEOs was primarily associated with an internal locus of control. By implication, a CEO with an internal locus of control may engage in risky options without perceiving them as risky. In addition, Cooper, Woo, and Dunkelberg (1988) found that risk seeking entrepreneurs were best differentiated from risk averse managers by their overly optimistic perceptions about risks. An outside observer who perceives risks differently (and perhaps more realistically) might be less likely to assume those risks. After differences in risk perceptions are factored out, entrepreneurs have a preference for situations with only moderate perceived risk (Brockhaus, 1982).

Table 1 illustrates how one can infer perceived-risk attitudes from observed choice and judgments of comparative risk (risk perceptions). Consider a choice between two gambles with identical expected values. One gamble has higher variance (HV), and the other has lower variance (LV). Columns refer to risk perceptions; either the LV gamble or the HV gamble could be perceived as riskier. Rows refer to preferences; either the LV gamble or the HV gamble could be chosen. Cell entries

Preferred	Perceived Risker: LV	Perceived Risker: HV
LV	PRS	PRA
HV	PRA	PRS

TABLE 1. Illustration of how choices (rows) between a pair of gambles with identical expected values but different variances (LV = low variance gamble, and HV = high variance gamble) and risk perceptions produce different perceived attitudes, shown as cell entries (PRA = perceived-risk averse, and PRS = perceived-risk seeking).

designate perceived-risk attitudes. Perceived-risk averters (PRA) choose the gamble they judge to be less risky, and perceived-risk seekers (PRS) select the gamble they perceive as riskier.

Table 2 presents the framework from Table 1 in a slightly different fashion. Choices (cell entries) are the result of risk perceptions (columns) and perceived-risk attitudes (rows). When might two people select the *same* option? Not surprisingly, two people with identical risk perceptions and identical perceived-risk attitudes will pick the same gamble. Perhaps less obvious is the fact that two people with different risk perceptions *and* different perceived-risk attitudes will also pick the same option. For example, a perceived-risk averter could choose the LV gamble because he perceives the HV gamble as riskier, and a perceived-risk seeker could also choose the LV gamble if he perceives the LV gamble as riskier. Two people make identical choices when they share both risk perceptions and perceived-risk attitudes or when they share neither.

Perceived-Risk Attitude	Perceived Risker: LV	Perceived Risker: HV
PRA	HV	LV
PRS	LV	HV

TABLE 2. Illustration of how different perceived-risk attitudes (rows) and risk perceptions (columns) produce different choices. Cell entries represent the preferred gamble in a choice between a LV and HV gamble.

When might two people select *different* options? Two people would select different options if they have different risk perceptions and identical perceived-risk

attitudes. For example, two perceived-risk averters could perceive either the LV gamble or the HV gamble as riskier. The one who judged the LV gamble as riskier would choose the HV gamble, and the one who thought the HV gamble was riskier would select the LV gamble. Second, two people would select different options if they have different perceived-risk attitudes and identical risk perceptions. For example, a perceived-risk averter and a perceived-risk seeker could agree that the LV gamble seemed riskier. If so, the perceived-risk averter would choose the HV gamble and the perceived-risk seeker would choose the LV gamble. Differing choices imply that people differ *either* in their risk perceptions or their perceived-risk attitudes, but not both.

To summarize, perceived-risk attitudes are based on the premise that choices depend on both risk perceptions and preferences for perceived risk. Two people who select identical options have either identical risk perceptions and identical perceived-risk attitudes or different risk perceptions and different perceived-risk attitudes. Two people who select different options have either identical risk perceptions and differing perceived-risk attitudes or differing risk perceptions and identical perceived-risk attitudes.

The reflection effect is usually a demonstration that the same person has differing economic risk attitudes in the domain of gains and losses. Why might the same person have risk averse preferences in the gain domain and risk seeking preferences in the loss domain? In Weber and Milliman's framework, that person might have different risk perceptions and identical perceived-risk attitudes or different perceived-risk attitudes and identical risk perceptions across domains.

Weber and Bottom (1989) suggested that people with reflecting economic risk attitudes might have identical perceived-risk attitudes for gains and losses, but differing risk perceptions. This account would mean that perceived-risk attitudes are more stable and consistent across domains than traditional risk attitudes. In two experiments, Weber and Milliman (1997) asked subjects to choose between risky options and judge the comparative risk of each. One experiment examined decisions between commuter trains varying in arrival times, and the other investigated financial decisions between stock market investments. They found that, in both experiments, a large percentage of subjects had preferences that reflected around the status quo. Furthermore, an even larger percentage of subjects had identical perceived-risk attitudes across domains, and most of them were perceived-risk averters. That is, people chose the option that they perceived as less risky in both domains; however, the low variance option was judged to be less risky in the gain domain, and the high variance option judged to be less risky in the loss domain. The following experiment further examines perceived-risk attitudes using familiar stimuli in the field of decision making – namely, gambles with monetary outcomes.

3. METHOD

People made choices and comparative risk judgments between pairs of risky options described as gambles, with two nonnegative outcomes (in the gain domain) or two nonpositive outcomes (in the loss domain). Gambles in the gain domain had expected values of \$40, and those in the loss domain had expected values of -\$40.

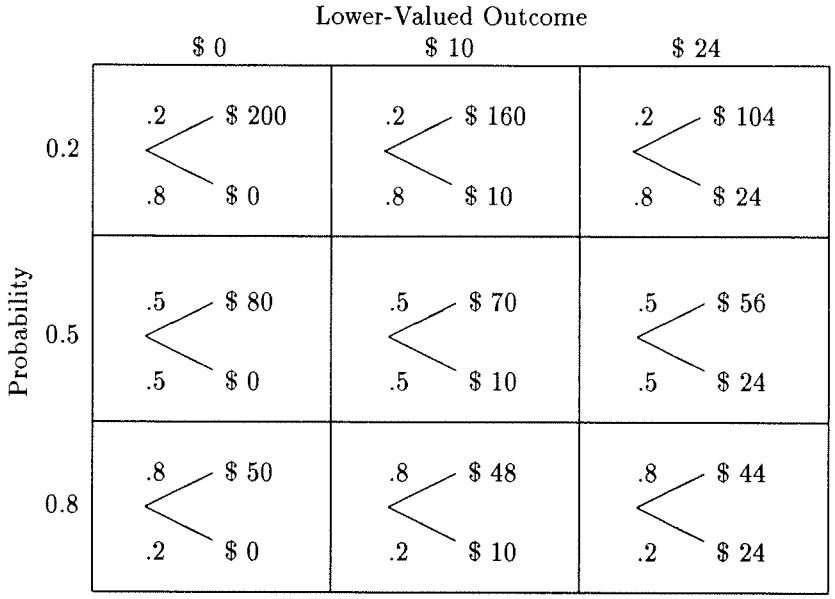

TABLE 3. Experimental design. Each cell represents a gamble. Rows are probabilities of high-valued outcomes, and columns are lower-valued outcomes. Expected values for all 9 gambles are $40.

Gambles with positive expected values were constructed from a factorial design of Probability by Outcome, and these gambles are shown in Table 3. Gambles with negative expected values had the same structure, except the signs of the outcomes were negative. Each set of options included the nine gambles and a sure thing equal to the expected value of the gambles.

Participants made choices and reported the strength of their preference for all possible pairs of options with the same expected value (45 pairs in each set). After stating all of their preferences, subjects were presented with the same pairs and indicated which option was riskier[2]. There were 90 choices and 90 comparative risk judgments in total.

Gambles were displayed as pie charts on IBM computers. People were told to imagine a spinner attached to the center of the pie chart. An example is shown in Figure 1. For this gamble, if the imaginary spinner was spun and the pointer landed in the white region, the outcome would be a win of $70. If the pointer landed in the grey region, the outcome would be a win of $10.

One hundred and thirty seven undergraduates at the University of California at Berkeley served as subjects and received credit in a psychology course for their participation. A few additional subjects who did not follow instructions were excluded from the analyses.

[2]Pilot work suggested no effect of task order.

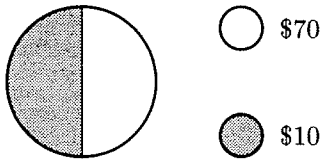

FIGURE 1. Gamble display. The white region corresponds to a 0.50 chance of winning $70. The grey region corresponds to a 0.50 chance of winning $10.

4. RESULTS

Consider a choice between a sure win of $40 and a gamble with an 80% chance of winning $50. Which would you prefer? Now consider a choice between a sure loss of $40 and a gamble with an 80% chance of losing $50. Although neither option is desirable, which would you prefer? The left-hand panel in Table 4 shows our subjects' choices for this pair of questions[3].

In the gain domain, 95 out of 133 subjects (71%) preferred the sure thing; these subjects were risk averse according to the economic definition. In the loss domain, the majority of subjects (69%) preferred the gamble; these subjects were risk seekers in the traditional sense. These percentages provide between-subject support for the reflection effect. Within-subject support can be found in the lower-left cell; 67 subjects (50%) were both risk averse for gains and risk seeking for losses.

The right-hand panel of Table 4 shows *perceived*-risk attitudes for these subjects. In the gain domain, 93 subjects (70%) were perceived-risk averters, and in the loss domain, 59% of the subjects were also perceived-risk averters. These percentages provide between-subject support for the notion that people are perceived-risk averters in both domains. Within-subject support can be found in the upper-right cell; 59 subjects (44%) were perceived-risk averters in both domains. For this gamble, 60% of the subjects (59 + 21) had consistent perceived-risk attitudes across domains.

Table 5 takes an even closer look at the perceived-risk attitudes for each pattern of economic risk attitudes (from Table 4). For example, the 28 subjects in the upper-left cell of Table 4 appear in the upper-left panel of Table 5. Almost all of these people (21 out of 28) were perceived-risk averters in both domains.

The most interesting panel is the one in the lower left that shows perceived-risk attitudes for people whose choices reflected around the status quo in the familiar way. Of these, 54% had identical perceived-risk attitudes in both domains, and the overwhelming majority (36 of 37) were perceived-risk averters. An additional 30 subjects (45%) had perceived-risk attitudes that resembled their economic risk attitudes; these subjects selected the less risky gamble in the gain domain and the riskier gamble in the loss domain.

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[3]Four subjects who could not be classified because they were indifferent between the gamble and the sure thing have been excluded.

Number of Subjects

Loss \ Gain	RA	RS
RA	28	14
RS	67	24

$N = 133$

Loss \ Gain	PRA	PRS
PRA	59	19
PRS	34	21

$N = 133$

TABLE 4. Numbers of subjects with different economic risk attitudes in the gain and loss domain (RA = risk averse, and RS = risk seeking).

Number of Subjects

RA Loss / Loss \ *RA Gain* / Gain	PRA	PRS
PRA	21	1
PRS	4	2

RA Loss / Loss \ *RS Gain* / Gain	RA	RS
PRA	1	11
PRS	0	2

RS Loss / Loss \ *RA Gain* / Gain	PRA	PRS
PRA	36	0
PRS	30	1

RS Loss / Loss \ *RS Gain* / Gain	RA	RS
PRA	1	7
PRS	0	16

TABLE 5. Numbers of subjects with different *perceived*-risk attitudes in the gain and loss domain for each cell in Table 4.

In summary, why did preferences in our study reflect around the status quo? Preferences reflected for two different reasons. About half of the respondents had perceived-risk attitudes that resembled their economic risk attitudes; these people avoided gambles they perceived as risky in the gain domain, but were attracted to those gambles in the loss domain. The other half of the respondents were perceived-risk averters in both domains. Their taste for risk did not reflect, but their *perceptions* of risk varied around the status quo.

Number of Subjects: Gambles vs. Gambles

Loss \ Gain	RA	RS
RA	28	31
RS	48	24

$N = 131$

Loss \ Gain	PRA	PRS
PRA	68	25
PRS	18	20

$N = 131$

TABLE 6. Numbers of subjects with different economic risk attitudes in the gain and loss domains based on all of the data for gambles vs. gambles.

How robust is this pattern? To answer this question, we classified individuals into one of four patterns of economic risk attitudes using all of their choices. Since reflection has been shown to occur more frequently with gambles versus sure things than with gambles versus gambles (Schneider & Lopes, 1986), we present the two types of comparisons separately. There were 36 gamble-vs.-gamble pairs, and nine gamble-vs.-sure thing pairs. For each individual, we classified each choice in the gain and loss domain according to the four economic risk attitudes. Then we categorized each person based on the most frequently occurring pattern of economic risk attitudes (e.g., RA in the gain domain and RS in the loss domain)[4].

Table 6 shows numbers of subjects with different economic risk attitudes (left-hand panel) and different perceived-risk attitudes (right-hand panel) for the gamble-vs.-gamble comparisons. Although there are many individual differences, the most common pattern of economic risk attitudes was the familiar reflection effect: 48 out of 131 subjects (37%) had risk averse preferences for gains and risk seeking preferences for losses[5]. The right-hand panel shows perceived-risk attitudes. The majority of subjects (67%) had identical perceived-risk attitudes across domains, and the overwhelming majority were perceived-risk averters.

Table 7 shows perceived-risk attitudes for each pattern of economic risk attitudes. One can see that, for those subjects whose preferences reflected in the familiar way (lower-left panel), 29 were perceived-risk averters in both domains and 15 had perceived-risk attitudes that matched their economic risk attitudes. To the perceived-risk averters, the *high* variance gamble was riskier in the gain domain, and the *low* variance gamble was riskier in the loss domain. To the group with different perceived-risk attitudes across domains, the riskier gamble was always the high variance gamble.

Table 8 shows the same analyses as Table 6 for the gamble-vs.-sure thing comparisons, where the reflection effect is usually stronger. In our study, we found that a greater percentage of subjects showed reflection in these comparisons than in

[4]Subject classifications can also be done statistically, as in Weber and Bottom (1989).

[5]Six subjects in the gamble-vs.-gamble comparisons and 25 subjects in the gamble-vs.-sure thing comparisons could not be classified because they had identical numbers of RA or RS choices in one or both domains.

Number of Subjects: Gambles vs. Gambles

		RA Gain Gain PRA	*RA Gain* Gain PRS	*RS Gain* Gain RA	*RS Gain* Gain RS
RA Loss Loss	PRA	23	1	9	19
	PRS	3	1	0	3
RS Loss Loss	PRA	29	4	7	1
	PRS	15	0	0	16

TABLE 7. Numbers of subjects with different perceived-risk attitudes in the gain and loss domains for each cell in Table 6.

Number of Subjects: Gambles vs. Sure Things

		Gain RA	Gain RS	Gain PRA	Gain PRS
Loss	RA	24	8		
	RS	58	22		
	$N = 112$				
Loss	PRA			47	10
	PRS			36	19
	$N = 112$				

TABLE 8. Numbers of subjects with different economic risk attitudes in the gain and loss domains based on all of the data for gambles vs. sure things.

the gamble-vs.-gamble comparisons using both between-subject and within-subject tests. Fifty-two percent of subjects were risk averse in the gain domain and risk seeking in the loss domain. The right-hand panel shows, once again, that the reflecting economic risk attitudes were not perceived to reflect by the majority of subjects. Fifty-nine percent of subjects (47+19) had consistent perceived-risk attitudes across domains, and the majority were perceived-risk averters.

Table 9 presents the same information as Table 7 for gamble-vs.-sure thing comparisons. Perceived-risk attitudes for those subjects whose preferences reflected in the familiar way (lower-left corner) tend to fall into one of two groups. Either

Number of Subjects: Gambles vs. Sure Things

		RA Gain Gain PRA	PRS	*RS Gain* Gain RA	RS
RA Loss Loss	PRA	20	0	0	6
	PRS	3	1	1	1
RS Loss Loss	PRA	25	1	2	3
	PRS	32	0	0	17

TABLE 9. Numbers of subjects with different perceived-risk attitudes in the gain and loss domains for each cell in Table 8.

their perceived-risk attitudes resembled their economic risk attitudes (and they perceived the gamble as riskier in both domains) or they were perceived-risk averters in both domains and their perceptions of risk varied.

These two groups of subjects had the same patterns of choices (risk averse preferences for gains and risk seeking preferences for losses) for two different reasons. For one group (the perceived-risk averters) risk was unattractive. These people selected the option they perceived as less risky in both domains. In the gain domain, the risky option was the gamble, and in the loss domain, the risky option was the sure thing (with a guaranteed loss). For the other group, perceived-risk attitudes paralleled economic risk attitudes. Their risk perceptions were identical across domains; the risky option was always the gamble.

We now focus on the two groups of subjects from Table 7 whose preferences reflected – namely, the 29 subjects who were always perceived-risk averters and the 15 subjects who were perceived-risk averters for gains and perceived-risk seekers for losses. For each group, we derived two sets of preference orders (one for the gain and one for the loss domain) and two sets of riskiness orders over the nine gambles. Preference orders were obtained by counting the number of times the majority of subjects preferred one gamble to the other eight gambles. Riskiness orders were obtained in a similar fashion.

Figure 2 shows preference orders (left panel) and risk orders (right panel) for people with identical perceived-risk attitudes and different risk perceptions. Gambles on the abscissa are ordered from least preferred to most preferred in the gain

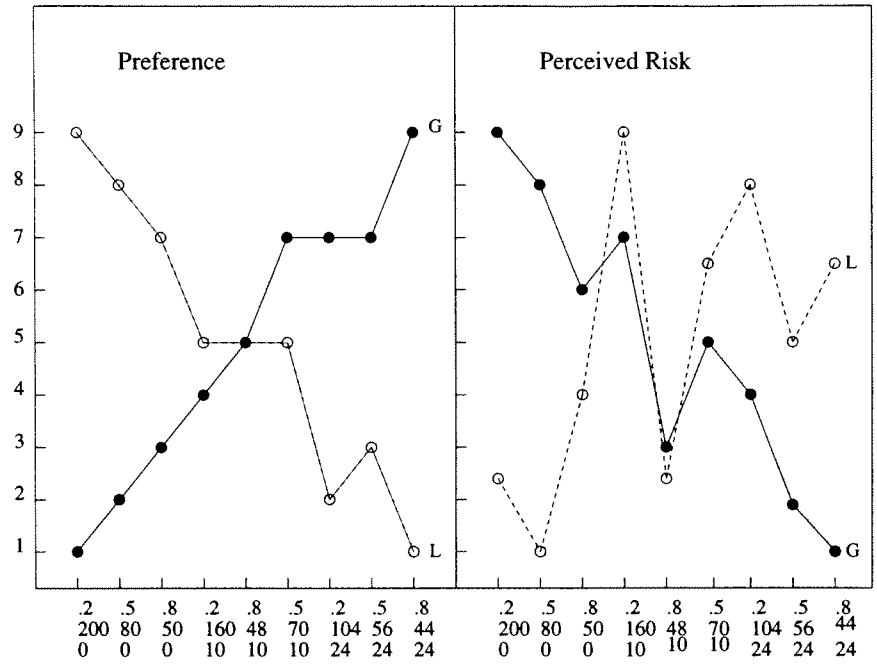

FIGURE 2. Preference orders (left panel) and perceived-risk orders (right panel) plotted against gambles for subjects with reflecting economic risk attitudes who were perceived-risk averse for both gains and losses ($n = 29$). Solid curves labeled "G" are for gains; dashed curves labeled "L" are for losses.

domain. There is a dramatic crossover interaction of preference orders in the gain (G) and loss (L) domains; this is the reflection effect. The correlation between these preference orders was -0.97; what is liked in the gain domain is disliked in the loss domain. Risk perceptions also show a crossover interaction, although not quite so dramatic. Figure 3 plots preference and risk orders for those with different perceived-risk attitudes and identical risk perceptions. Once again, the crossover interaction in the left panel shows the reflection effect. Risk orders in the right panel are almost identical in the gain and loss domains.

Figure 4 replots the information shown in Figures 2 and 3 to highlight additional features of the data. Orders are presented as a function of outcome with a separate curve for each level of the probability of that outcome. Upper panels show preference and risk orders for those people who had different risk perceptions, but identical perceived-risk attitudes. Perceived-risk attitudes can be inferred from comparisons of preference and risk orders within a domain. Correlations were -0.89 and -0.58 for gains and losses, respectively; negative correlations mean that subjects preferred the gambles they perceived as less risky. In both domains, these subjects were perceived-risk averters. The fact that their risk perceptions differed between gains and losses can be seen by comparing the risk orders across domains; this correlation was -0.31.

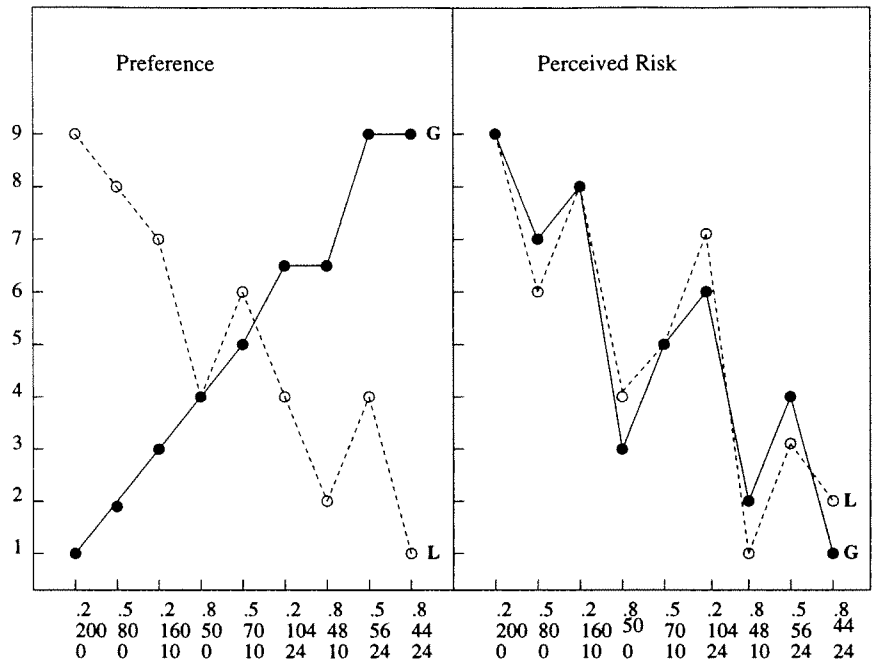

FIGURE 3. Preference orders (left panel) and perceived-risk orders (right panel) plotted against gambles for subjects with reflecting economic risk attitudes and reflecting perceived-risk attitudes (n = 15). Solid curves labeled "G" are for gains; dashed curves labeled "L" are for losses.

Lower panels show preference and risk orders for those individuals with different perceived-risk attitudes and identical risk perceptions (i.e., those for whom perceived-risk attitudes resembled economic risk attitudes). The fact that they had different perceived-risk attitudes can be seen by comparing preference and risk orders within a domain. Correlations were -0.86 and 0.85 for gains and losses, respectively. These individuals disliked perceived risk in the gain domain, but liked it in the loss domain. The fact that their risk perceptions were identical for gains and losses can be seen by comparing risk orders across domains; this correlation was 0.95.

Did perceptions of risk correlate with the a-priori definition of risk as variance for either group? For those whose perceived-risk attitudes resembled their economic risk attitudes, risk perceptions were quite similar to the order derived from the variance of the gambles. Correlations between risk order and variance order were 0.95 and 1.0 for gains and losses, respectively. For those with different risk perceptions across domains, perceived risk correlated with variance in the gain domain (r = 0.90), but not in the loss domain (r = 0.0). In the loss domain, gambles perceived as most risky were those with two negative outcomes, and those with the largest negative outcomes were perceived to be the riskiest. Gambles allowing the

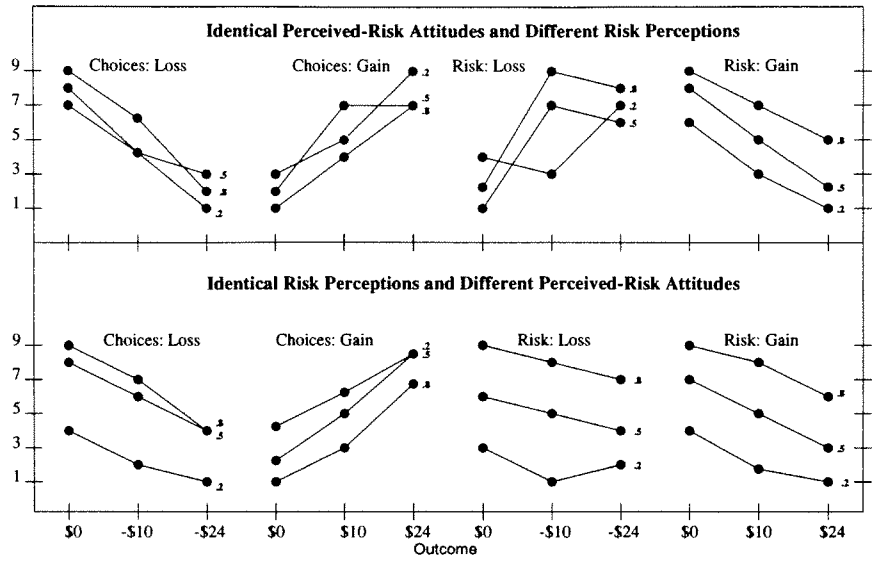

FIGURE 4. This figure replots preference orders and risk orders for the subjects in Figure 2 (upper panels) and Figure 3 (lower panels). Orders are shown as a function of one outcome, with a separate curve for that outcome's probability. The largest differences between the two groups can be seen in their perceptions of risk in the loss domain.

opportunity to break even (i.e., those with one zero outcome) were judged as less risky.

In sum, risk perceptions for the two groups whose choices reflected around the status quo were similar in the gain domain, and those perceptions were well-described by the variance of the gambles. In the loss domain, risk perceptions differed for the two groups. For the perceived-risk seekers, risky gambles were those with greater variance. For the perceived-risk averters, risky gambles were those with lower variance which translated into a guaranteed loss, combined with the threat of an even larger loss.

5. DISCUSSION

A widely-accepted result in the literature on risky choice is that economic risk attitudes reflect around the status quo (Kahneman & Tversky, 1979). When the probabilities of winning and losing are large, people often have risk averse preferences in the gain domain and risk seeking preferences in the loss domain. Weber and Milliman (1997) suggested that this apparent inconsistency in economic risk attitudes might be reduced by treating risk as a psychological variable. They suggested that perceived-risk attitudes, based on people's perceptions of risk, might reveal greater consistency across domains. In our experiment, the most common pattern of economic risk attitudes was reflection – risk aversion for gains and risk

seeking for losses. The reflection effect was stronger for gambles vs. sure things than for gambles vs. gambles, consistent with previous results (Schneider & Lopes, 1986). Furthermore, the majority of subjects (in both types of comparisons) had identical perceived-risk attitudes across domains, and most of these subjects were perceived-risk averters.

A careful look at *only* those people whose preferences reflected around the status quo revealed two groups who made the same choices for quite different reasons. Differences appeared in the loss domain. One group tried to avoid risk, which was perceived as a guaranteed loss, with the potential for an even greater loss. The other group preferred risk. For these people, the riskier option was not synonymous with the "bad" option. Risk was desirable because it offered the chance to break even.

Economic risk attitudes are not an explanation of choice; they provide an a posteriori classification of individuals. Similarly, perceived-risk attitudes are not an explanation; they provide a categorization of people based on the conjunction of choices and perceptions of risk. What is needed is a theory of risky choice and a theory of comparative risk judgment that can simultaneously account for both economic and perceived-risk attitudes, and the individual differences that occur with both. Rank- and sign-dependent theory (Luce, 1991; Luce & Fishburn, 1991) may be a reasonable contender for risky choice[6]. Several theories of risk judgment have been proposed, including conjoint expected risk theory (Luce & Weber, 1986), the bilinear model of risk (Coombs & Lehner, 1984) and the additive model (Mellers & Chang, 1994), but none of these theories directly addresses the individual differences in the loss domain.

In conclusion, we find that economic risk attitudes often reflect around the status quo, but perceived-risk attitudes are more stable and consistent across domains. People tend to avoid what they perceive as risky regardless of the sign of the outcomes, but their perceptions of risk vary for positive and negative outcomes. Results from the present study show that risk perceptions give us a broader, though not entirely simple, picture of the psychology of risky choice.

[6] We constructed a set of predictions based on Tversky and Kahneman's cumulative prospect theory. However, the correlations between choice proportions and binary predictions were quite low for both groups of subjects in the gain and loss domains. Predictions were derived from the parameters given by Tversky and Kahneman (1992). Those were estimated from certainty equivalents rather than choice proportions, and we suspect that the parameters for choice proportions may be quite different.