

DO INVESTMENT RISK TOLERANCE ATTITUDES PREDICT PORTFOLIO RISK?

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ABSTRACT: We investigated a new instrument designed to assess investment risk tolerance, the Risk Tolerance Questionnaire (RTQ). RTQ scores were positively correlated with scores on two other investment risk measures, but were not correlated with a measure of sensation-seeking (Zuckerman, 1994), suggesting that investment risk tolerance is not explainable by a general cross-domain appetite for risk. Importantly, RTQ scores were positively correlated with the riskiness of respondents' actual investment portfolios, meaning that investors with high risk-tolerance score tend to have higher-risk portfolios. Finally, respondents with relatively more investment experience had more risk-tolerant responses and higher-risk portfolios than less experienced investors.

KEY WORDS: risk tolerance; risk aversion; sensation seeking; decision making; investing.

RISK AVERSION AND DECISION MAKING

A longstanding tenet of theories of decision making, dating back to the work of Daniel Bernoulli (1738/1954), is that people are risk-averse, at least for decisions with outcomes in the domain of gains and with mixed outcomes that include both gains and losses. The research literature on behavioral decision making suggests several potential reasons for this observed risk aversion. These potential factors affecting the degree of observed risk aversion include the following. First, as observed by Bernoulli, people seem to exhibit decreasing marginal utility for money in the domain of gains. In other words, a gain of \$10 is less

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important to a rich person than to a poor one. Second, people show *loss aversion*, meaning that a given financial loss has a greater impact than the corresponding amount of gain (Kahneman & Tversky, 1979). Both these general tendencies, well documented in the research literature, can lead to risk aversion in financial decision making.

However, if people are generally risk-averse, it is also clear that individuals vary considerably in the degree of financial risk that they are willing to incur. In Bernoulli's early version of expected utility theory, these differences in risk propensity are ascribed to differences in the wealth of investors, with wealthier investors being willing to incur more risk. More recently, it has been assumed that people have varying risk attitudes that exist independently of their financial circumstances, and that these attitudes affect investment behavior. Various explanations have been advanced for these individual differences in risk attitude. For example, it has been proposed that the trait of risk seeking in the investment domain may be related to a general personality trait, specifically a generalized disposition to tolerate anxiety or seek excitement (Zuckerman, 1994). Alternatively, people may vary in their tendency to focus on potential losses rather than gains, a tendency that Higgins (1997; 2002) has labeled a "prevention focus" as opposed to a "promotion focus". This focus may vary across individuals (i.e., be a trait), but may also vary for an individual across time or situations (i.e., be a dispositional state). Another situational factor or mental disposition that can affect risk aversion is the tendency to aggregate outcomes over occasions, situations, asset classes, etc. Previous research (Benartzi & Thaler, 1999; Gneezy & Potter, 1997; Thaler, Tversky, Kahneman, & Schwartz, 1997) has shown that aggregation of outcomes over longer periods or over more classes tends to reduce risk aversion, a finding that has implications for how financial institutions may choose to present portfolio performance to clients.

Whatever their cause, it is important to be able to assess individual differences in risk attitudes, if financial advisors and financial institutions are to properly serve individual investors. It is more and more widely accepted that individuals' risk attitudes predict their comfort level with different investment strategies, and perhaps their level of unhappiness with unfavorable investment outcomes. As Yook and Everett (2003) argue, modern portfolio theory holds that optimal asset allocation in an investment portfolio must take into account the tradeoff between expected return and risk, and accepts that individual investors have risk preferences that affect this optimization (see also Hallahan, Faff, & McKenzie, 2004). Some investment managers may use questionnaire-derived measures of risk tolerance in a more informal way, using them as tools to engage customers in conversations about their investment goals and risk attitudes. In any case, measuring individual

investors' risk attitudes reliably and validly has become an important goal to many investment professionals.

CONSISTENCY OF PERCEPTION, ATTITUDE AND BEHAVIOR IN FINANCIAL RISK-TAKING

There are some important theoretical issues that must be faced in order to decide how to assess risk tolerance in a meaningful way. The first issue is the consistency of risk attitudes and behavior within a specific domain. In MacCrimmon and Wehrung's (1990) study of managerial risk-taking, they distinguished between three different types of measures of risk propensity, based on: (1) behavior in hypothetical risk situations, (2) revealed risk attitudes inferred from behavior in naturally-occurring risky situations, and (3) self-reported risk attitudes. They found higher correlations within the same type of assessment than across types, and concluded that risk-taking propensity is a multidimensional construct. Weber, Blais, and Betz (2002) have recently argued that it is important to distinguish individual differences in risk *perception* and differences in risk *attitude* (see also Horvath & Zuckerman, 1993; Weber & Milliman, 1997). However, as Weber et al. observe, if the goal is merely to predict future risk behavior of individuals, the degree to which risk propensity is due to perception or due to attitude may not be crucial. Cordell (2001) proposes that investment risk tolerance can be separated into four components: propensity (observed risk behavior in naturally-occurring situations), attitude (willingness to incur monetary risk, for example as measured by responses to hypothetical investment scenarios), capacity (financial capability to incur risk), and knowledge (for example, of risk-return tradeoffs). Risk questionnaires may differ in whether they focus on only the second component, risk attitude, or include items assessing other categories, particularly risk propensity.

RISK ATTITUDES: GENERAL TRAIT OR SITUATION-SPECIFIC ATTITUDE?

It has long been debated in social and organizational psychology whether risk-taking behavior is a situation-specific or a cross-situational disposition. For example, will a person who makes risky personal investments also engage in risky recreational activities? Many researchers have sought such cross-situational consistency in risk attitudes or behaviors. For example, Eysenck & Eysenck (1978) believed that risk-taking was a general personality trait, and attempted to find evidence for common patterns across various risk-taking domains. Zuckerman (1983,

1994) proposed “sensation seeking” as a general personality trait, and claimed that it could predict financial risk-taking behavior, among other things. He defined sensation seeking as “the need for varied, novel, and complex sensations and experiences and the willingness to take physical and social risks for the sake of such experiences”. In a sample of 233 undergraduate students, Wong and Carducci (1991) found that persons with a high level of sensation seeking showed greater risk-taking tendencies in everyday financial decisions.

However, other studies have found no evidence for a general risk-seeking personality trait. For example, Slovic (1964) administered a battery of nine different measures of risk taking in different domains for a group of subjects and found no significant correlations between the various measures. Kogan and Wallach (1964) conducted an extensive study in which they examined the relationships among a wide variety of risk measures, including choice dilemmas, actual betting situation, extremity and confidence in judgment, and choices among lotteries based on motor skill tasks. Their results, like Slovic’s, did not provide evidence of a general risk attitude or propensity across these different criterion domains. Further evidence against cross-situational consistency in risk-seeking was provided by Weber, Blais and Betz (2002). They measured risk taking in five content domains: financial decisions (separately for investing versus gambling), health/safety, recreational, ethical, and social decisions. Respondents rated the likelihood that they would engage in domain-specific risky activities. The results strongly supported the idea that respondents’ degree of risk taking was domain-specific. Results of these studies support the notion that specific measures of investment risk tolerance are needed to accurately assess an individual’s attitudes towards investment risks.

THE RISK TOLERANCE QUESTIONNAIRE (RTQ)

Among the goals of the present study are to describe and report a validation of a new instrument for assessing attitudes and propensities involving investment risks, the Risk Tolerance Questionnaire¹. The Risk Tolerance Questionnaire is designed to assess several of the factors mentioned above as possibly underlying risk aversion in the financial domain, including (1) decreasing marginal utility in the domain of gains,

¹The Risk Tolerance Questionnaire described here was developed based on research by the present authors. The interactive, adaptive version of the RTQ tested in the present study was provided by and is the property of Investment Technologies Inc., 320 E. 72nd St., New York, NY 10021. A simplified self-scoring paper-and-pencil version of the Risk Tolerance Questionnaire has been published in the Wall Street Journal of July 14, 2000. Some validation results using this paper-and-pencil version of the RTQ have been reported by Yook and Everett (2003).

(2) loss aversion (i.e., a larger impact for losses as compared to gains), and (3) a tendency to focus on potential losses rather than gains. Items for the RTQ were developed to tap potential risk aversion arising from several of these sources, although some items may address more than one factor. For example, the first risk-tolerance item in the questionnaire (Q010) explicitly addresses the known tradeoff between risk and return in financial markets, which may tap both the loss aversion and loss focus factors:

Q010. Choose the statement that best describes your interests in an investment program:

[Please check the best answer]

- My primary aim is to achieve high long-term return in the value of my portfolio, even if that means accepting some significant short-term swings in values.
- My primary interest is in stable growth in the value of my portfolio, even if that means somewhat lower returns over time.
- I attach equal value to maximizing long-term returns and minimizing fluctuations in value.

The version of the RTQ used in the present study is an interactive, adaptive computer-implemented instrument. The instrument is adaptive in two ways. First, it uses “wealth scaling”; asking respondents for the total value of their investment portfolio, and using their answer to scale the amounts of money used in later hypothetical investment questions that they are asked to answer. Second, it uses adaptive question selection in one item that seeks to measure the relative risk aversion of the respondent for a risky gain problem. This item is designed to pin down the probability p (expressed as a percentage) that would make the respondent indifferent between the status quo and the following option: A $p\%$ chance of doubling the investment stake, and a $(1-p)\%$ chance of losing the entire investment stake. The value of the investment stake is expressed as an actual dollar amount, equal to 5% of the respondent’s specified net portfolio value.

EMPIRICAL STUDY

An empirical study was designed with several goals in mind. The first goal was to investigate if the RTQ had adequate reliability, and if RTQ scores had convergent validity in the sense of correlating positively and significantly with other existing measures of investment risk tolerance. The other risk attitude measures we chose to evaluate were two

questionnaires obtained from the Web sites of Scudder Kemper (here referred to as RQ2) and the Vanguard Group (RQ3). These instruments were selected on the basis of public availability and because they have been used in actual practice by large reputable investment management firms. More importantly, we also wished to see if investment risk tolerance can predict investment behavior, such as composition of the respondents' investment portfolios. In order to assess if investment risk seeking is domain specific or related to general personality traits, we also administered a general measure of sensation-seeking (Zuckerman, 1994). Finally, we investigated the role of investor experience on risk tolerance attitudes.

METHOD

Subjects

The participants were 63 graduate students in business at a major research university, contacted in public areas near the business school. They were each paid \$10 for their participation. The mean age of MBA students in this population is 27–28 years, and approximately 64% are male. Most have more than four years' work experience.

Procedure

The three risk attitude questionnaires were administered to participants via software installed on a laptop computer. Order of the three risk questionnaires was randomized. Forty-three subjects were also given a paper & pencil version of the Sensation Seeking Scale (Zuckerman, 1994). All subjects completed the instruments in less than an hour.

The RTQ measure includes one item (Q140) assessing the riskiness of the investments in the respondent's current investment portfolio. This item assesses risk-related investing behavior, but is included in the standard questionnaire score on the grounds that it is an indirect indicator of an investor's risk attitudes. For purposes of the present study, this item (portfolio risk, or PR) was split out and used in some analyses below as a criterion measure, in order to assess whether risk attitudes, as measured by the questionnaire's attitude-related items, predicts financial risk-taking behavior. The item asks respondents to indicate the percentages of their investment portfolios that are allocated to various classes. These classes are:

- (.24) futures, hedge funds, naked options
- (.20) equities
- (.16) real estate (excluding personal residences)

- (.12) other
- (.08) long-term (i.e., maturity more than 7 years) bonds
- (.04) medium-term (maturity 1–7 years) bonds
- (.00) cash, money market, short-term bonds (maturity <1 year)

Scoring of this item works as follows, and is based on subjective rankings of these asset classes by several investment professionals as to overall mean level of risk. The classes are listed above ordered by decreasing riskiness, as determined by the results of this procedure. The number in parentheses beside the label for each class is a weight proportional to the ranked riskiness of that asset class. A measure of portfolio risk (PR) for each participant was then calculated using the riskiness weights for each asset class above, specifically by multiplying each class's risk weighting by the percentage of the individual's assets invested in that class, and summing over classes. I.e.,

$$PR = \sum_i r_i p_i,$$

where PR is the overall portfolio risk score, r_i is the risk weighting of the asset class, and p_i is the percentage of the individual's assets invested in that class. A similar measure was used by Morse (1998) to score individual portfolio risk.

This item (Q140) measuring portfolio risk is normally used in computation of the RTQ score. However, for some analyses reported below, RTQ scores were computed without the PR item, so that the correlation of the scale's risk attitude items with this measure of observed risk behavior could be assessed. This corrected version of the risk tolerance score will be referred to as the RTQ* score.

Another specific RTQ item (Q150) is also of special interest for the present analyses. This item assesses participants' relative investing experience by asking respondents to judge their level of experience in financial investing relative to other individual investors, using a 5-point response scale ranging from "little or no experience" to "extremely experienced". Responses to this item were also split out and used in separate analyses looking at the relation of risk attitudes to experience.

RESULTS

Reliability

The internal reliability was calculated for each of the four instruments (the RTQ, the other two risk attitude questionnaires RQ2 and RQ3, and the Sensation-Seeking scale). Cronbach's alpha for the RTQ was .52. The other risk questionnaires had similar levels of reliability, with alpha

equal to .50 for both RQ2 and RQ3. The sensation-seeking scale was more homogeneous, with an alpha of .78. These reliabilities for the risk-tolerance measures are acceptable but not as high as in many psychometric instruments. This may reflect an inherent multidimensional nature of risk attitudes and behaviors, as discussed in the Introduction.

Cross-Questionnaire Consistency

A check of consistency of the risk attitude questionnaires (“convergent validity”) was accomplished by computing the correlations among the total scores of the instruments (see Table 1). Two versions of the RTQ total score were used in the computations, the unmodified total score from the instrument (“RTQ”) and the total score with the investment portfolio risk (PR) measure subtracted (“RTQ*”). The results show that these measures of risk tolerance attitude are highly correlated, lending credence to the idea that all are measuring roughly the same concept.

Correlation of Risk Tolerance and Portfolio Risk

Table 1 also shows the correlation of the risk tolerance measures with the measure of estimated PR derived from the self-reports. As can be seen, all three risk attitude measures were significantly correlated with portfolio risk. This confirms that risk attitudes in the investment domain do predict actual investing behavior. The correlation of PR with the total (unadjusted) RTQ score ($r=.54$) is of course higher than the other correlations of PR with the risk tolerance scores, because the unadjusted RTQ score is computed as a sum of scores of various items, including PR.

Correlation of Risk Tolerance with Sensation Seeking

To assess if investment risk tolerance, as measured by these three instruments, is explainable by a generalized preference for excitement or

Table 1
Correlations of Risk Tolerance Measures (RTQ*=RTQ Score Computed Without the Portfolio Risk Item, PR), for N=43 Subjects Completing all Instruments

	RTQ*	RTQ	RQ2	RQ3
RTQ*	—			
RTQ	.978	—		
RQ2	.559	.581	—	
RQ3	.461	.490	.596	—
Port. Risk	.350	.538	.348	.335

All reported correlations are significant at the .05 level.

cross-domain risk, scores on the three instruments were also correlated with the Sensation-Seeking measure, for the $N=40$ subjects who filled out the latter instrument. For the RTQ measure, the correlation was .106, and for the RTQ* version it was .113. The other risk attitude measures correlated .093 (RQ2) and .114 (RQ3) with the Sensation-seeking scale. None of these correlations was significant at the .05 level. Taking an estimation approach, a correlation of approximately .10 means that only about 1% of the variance of investment risk tolerance might be attributed to a sensation-seeking trait. These results show that investment risk tolerance is not explainable as due to a generalized sensation-seeking personality trait.

The Effects of Experience on Investment Risk Tolerance

Analyses were also conducted to investigate how risk attitudes of more experienced investors differ from those of less experienced investors. Investor experience was assessed by a final self-report item in the questionnaire, Q150 (shown below). The number of subjects responding with each alternative answer is shown in parentheses.

Q150. As an investor in stock and bond markets, how would you rate your degree of experience relative to other individual investors? (Please circle one letter only):

- ($N=3$) A. Extremely experienced
- ($N=20$) B. More than average experience
- ($N=20$) C. Average experience
- ($N=16$) D. Less than average experience
- ($N=4$) E. Little or no experience

Because of the low number of respondents selecting answers A and E, these five alternatives were collapsed into three categories, representing *more than average experience*, *average experience*, and *less than average experience*. Since this question also is scored and used in computation of the total risk tolerance score, another corrected version of the RTQ total score (RTQ**) was computed, by subtracting out the points added by answers to item Q150. Uncorrected and corrected RTQ score means were then computed by investment experience group, and are shown in Table 2. A one-way ANOVA confirmed that corrected risk tolerance scores differed among the three relative investment experience groups, $F(2,60) = 5.388, p < .05$.

More experienced investors exhibited not only more risk-tolerant attitudes, but also more risk-tolerant investment behavior, as indicated by the riskiness of their current investment portfolio (PR), shown in the

Table 2
Mean Risk Tolerance Scores, Uncorrected (RTQ) and Corrected for Q150 (RTQ), by Relative Investment Experience**

		<i>N</i>	RTQ	RTQ**	PR
Investment Experience:	Less than average	23	81.9	77.6	13.4
	Average	20	92.7	82.7	15.0
	More than average	20	107.8	91.8	18.3

Mean observed portfolio risk (PR) is also shown for each group.

last column of Table 2. The mean PR differed significantly among the three experience groups, $F(2,60) = 12.741$, $p < .05$. These differences in portfolio risk level apparently reflect differences among the experience groups in terms of investment goals: A higher proportion (85%) of more experienced investors tended to describe their investment goals as “to achieve high long-term return.. even if that means accepting some significant short-term swings in values”, compared to investors of average experience (70%) or less-experienced investors (48%).

Importantly, the correlation between risk attitude (RTQ*) and portfolio risk is not simply due to the mediating effects of experience (i.e., due to the fact that more experienced investors are both more risk tolerant and have higher-risk portfolios). To show this, an analysis was conducted in which the 23 least-experienced investors were eliminated from the data. In this analysis, the correlation of the RTQ score and the portfolio risk measure barely changed (from $r = .297$ to $r = .292$). This means that as investors became more experienced, their portfolios remain fairly well calibrated to their risk propensities.

SUMMARY AND DISCUSSION

This study found evidence for reliable measurement of risk attitudes by the RTQ, as well as by the other risk attitude instruments tested, those used by Scudder Kemper and Vanguard Group. These instruments correlate highly with each other, establishing convergent validity for the measures. Validity of the risk attitude measures is demonstrated by the significant positive correlation of risk tolerance score with a measure of riskiness of the respondents' actual investment portfolios. The riskiness of one's current investment portfolio is an example of what MacCrimmon and Wehrung (1985, 1990) referred to as risk behavior in naturally occurring situations, and Cordell (2001) termed risk propensity. It is important to demonstrate, as do the present results, that this type of behavioral measure of risk tolerance correlates with questionnaire-derived measures of risk “attitude”, including reactions to hypothetical investment choices.

The present results also replicate and extend the findings of Yook and Everett (2003), who found a significant correlation between the total score of several risk tolerance measures (including a paper-and-pencil version of the RTQ) and the percentage of respondents' actual stock holdings in their portfolios.

Investment experience proved to be an important predictive variable, with more experienced investors showing more risk-tolerant attitudes, as well as more risky investment portfolios. This finding of increased risk tolerance with increasing investment experience in a sample of business graduate students is consistent with Grable's (2000) results showing that risk tolerance increases with investment knowledge (and with age) in a broad sample of university employees. Note, however, that the relationship of age and risk tolerance is not a simple one, and may even become negative in broader samples that include older respondents: McCrimmon and Wehrung (2000) reported that in a sample of top-level executives, older executives showed more risk aversion than their younger peers (see also Hallahan, Faff, & McKenzie, 2004).

The final issue addressed here was the generality of investment risk attitudes. Consistent with other recent findings in the literature (e.g., Weber, Blais, & Betz, 2002), we found evidence that risk-taking behavior is a situation-specific behavior, not a general personality trait. This conclusion was supported by the fact that investment risk tolerance, as measured by RTQ score, was not related to a measure of sensation seeking (Zuckerman, 1994). These null results are consistent with the findings of Morse, 1998, showing no relationship of sensation seeking and investment risk preferences. On the other hand, the null findings seem somewhat at variance with the results of Wong and Carducci (1991) and of Horvath and Zuckerman (1993), who found correlations between sensation seeking and everyday financial risk taking. However, the present study is more narrowly focused on investment risks, and used a sample of graduate students in business. This population may be selected to be relatively high on risk tolerance. It is also possible, though this is speculative, that for this group investment risk taking may be affected by the adoption of specific investment theories or strategies.

This last possibility raises an issue for future research. Note that one factor that may affect relatively sophisticated investors' degree of risk aversion is knowledge of how to calculate expected value (EV) of a risky investment, and their possible adoption of EV-maximization as an explicit strategy. While this phenomenon may have less relevance to real-world investing, where outcome probabilities are sometimes estimated but rarely known with certainty, it may play a large role in people's responses to hypothetical decision problems, especially for relatively sophisticated respondents, such as investment professionals or the current population of business students. This phenomenon could also play a

role in creating a correlation between risk tolerance and experience, if the latter is correlated with investment knowledge, including knowledge of EV principles. Thus, the role of explicit training in calculating expected value, and its possible effect on derived measures of risk tolerance, seems to warrant future investigation.

In summary, results of the present study support the idea that investment risk tolerance is a domain-specific trait that varies across individuals and that reliably predicts investment behavior. These conclusions provide support for the increasingly widespread practice by investment advisors and financial institutions of measuring clients' investment risk attitude, and of taking these preferences into account in designing investment portfolios for these clients.

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