June 28, 2010
DRAFT – DO NOT QUOTE

Investor Attitudes towards Risk and Uncertainty and Reactions to Market Turmoil

James E. Corter
Teachers College, Columbia University
jec34@columbia.edu

Presented at Behavioral Finance Working Group Conference:
Fairness, Trust and Emotions in Finance
July 1-2, 2010
Cass Business School

Address correspondence to:
James E. Corter
Box 118, Teachers College
Columbia University
525 W. 120th St.
New York, NY 10027
Email: jec34@columbia.edu
Tel. 212 678-3843
FAX 212 678-3837

Abstract

In order to assess how individual small investors have reacted to recent adverse events in world financial markets and whether these reactions are mediated by their risk attitudes, a survey was administered to N=120 members of a university community. The survey administered a standard risk tolerance instrument, augmented with questions on specific aspects of attitudes towards risk and uncertainty and with items asking about investing behavior and experience. Other items asked whether respondents had actually suffered investment losses during this time period, whether such events had an emotional impact on them, and whether they had changed their investment strategy as a result of these experiences. Initial analyses confirmed the view that investment risk tolerance is not a unidimensional construct. In particular, attitudes towards risk and towards uncertainty can be distinguished, and both components contribute to improving prediction of the riskiness of an individuals' actual investment portfolio. Importantly, investor experience (both real and self-perceived) correlated positively with the self-report measure of portfolio risk. In order to investigate whether investment risk attitudes mediate reactions to market turmoil and to actual investment gains and losses, a path model was fit to the data. The results confirmed that investment risk tolerance predicts a measure of actual risk of the investor's portfolio; portfolio risk in turn predicted whether or not the investor had suffered significant losses in portfolio value as a result of the recent market disruptions. Self-reported actual portfolio losses correlated positively with negative emotional reactions. Finally, both risk tolerance and negative emotional reactions to losses predicted self-reported changes in investment strategy. Investment risk tolerance (IRT) did not directly influence emotional reactions, nor was it proven to buffer the negative emotional effects of large portfolio losses, though a trend in that direction was observed. This may be due to a double effect of risk tolerance: on the one hand, investors' emotional reactions to losses may be mitigated by higher levels of risk tolerance, but on the other hand higher levels of risk tolerance are associated with riskier portfolios, and thus to higher exposure to actual losses in a market downturn.

Introduction

Risk tolerance measures are being used more and more widely by financial services firms to assess clients' attitudes towards investment risks. Previous validation studies (e.g., Corter & Chen, 2006; Grable, 2000; Hallahan, Faff, & McKenzie, 2004; MacCrimmon & Wehrung, 1985; Morse, 1998; Wong & Carducci, 1991; Yook & Everett, 2003) have established that investment risk attitude measures are sufficiently reliable, and also valid in the sense that they predict more objective measures of the risk associated with an individual's actual investment portfolio, or hypothetical choices among investment portfolios.

But in spite of these psychometric successes in measuring the construct of investment risk attitudes, questions remain about the psychological construct of risk tolerance: Is it truly a unidimensional construct? Does it show cross-domain consistency (e.g., Weber, Blais & Betts, 2002)? Can attitudes towards risk and towards uncertainty be distinguished? Does risk tolerance (or uncertainty tolerance) predict investors' behavioral, emotional, and cognitive reactions to actual gains and losses in the market? The present study is an attempt to address some of these questions.

Components of Risk Tolerance/Risk Aversion

One theoretical issue relevant to defining and measuring investment risk tolerance is the generality of attitudes towards risk. Traditionally, some have researchers argued that people show general traits of risk-seeking or risk-avoidance (Eysenck & Eysenck, 1978; Zuckerman, 1983; Horvath & Zuckerman, 1993). But others have argued that risk tolerance is situation-specific, with little consistency shown across tasks and domains (e.g., Slovic, 1964; Kogan & Wallach, 1964). Weber, Blais & Betz (2002) have argued that risk preferences show consistency across application domains, but that people's perceptions of risk vary considerably across domains. Risk attitudes and perceptions have also been shown to vary cross-culturally (e.g., Weber & Hsee, 1998; Hsee & Weber, 1999)

In behavioral decision making research, an important distinction has been made between decision behavior under risk and under uncertainty. In the present paper, the term "risk" is used to denote situations in which the probabilities of outcomes are known or at least made explicit, and "uncertainty" to denote situations in which the probabilities of outcome are unknown. Knight (1921) was one of the first researchers to point out that risk and uncertainty are different. The Ellsberg paradox (Ellsberg, 1961) is a compelling demonstration of one source of risk aversion in investment decision making: the fact that people show what can be described as uncertainty aversion (or "ambiguity aversion"). That is, people prefer the risk of a known probability to an unknown one, even with equating of the objective risks. However, it has been argued that this uncertainty aversion is displayed only in direct comparison to risk (Fox & Tversky, 1995).

The theoretical position adopted here is that financial risk aversion has a number of causes or affective/cognitive components. Behavioral decision research has identified certain well-documented phenomena that might contribute to an individual's risk aversion in an investing context. The phenomena of uncertainty or ambiguity aversion (Ellsberg, 1961) is one such potential source of risk aversion in investment decisions. Most investment decisions involve uncertainty rather than risk, although obtaining better knowledge can offer at least the illusion of changing some decisions under uncertainty to something more closely resembling risk.

Theoretical models of behavioral decision making have mechanisms that can produce risk aversion. Under Prospect Theory (Kahneman & Tversky, 1979), the dominant theory of behavioral decision making for the past 30 years, risk aversion can be shown to result from two fundamental assumptions of the theory. First, the value (utility) function for gains is concave downwards (see Figure 1), as in Utility Theory (Bernoulli, 1738/195). This curvature of the utility or value function can be shown to lead to risk aversion for prospects involving only gains.

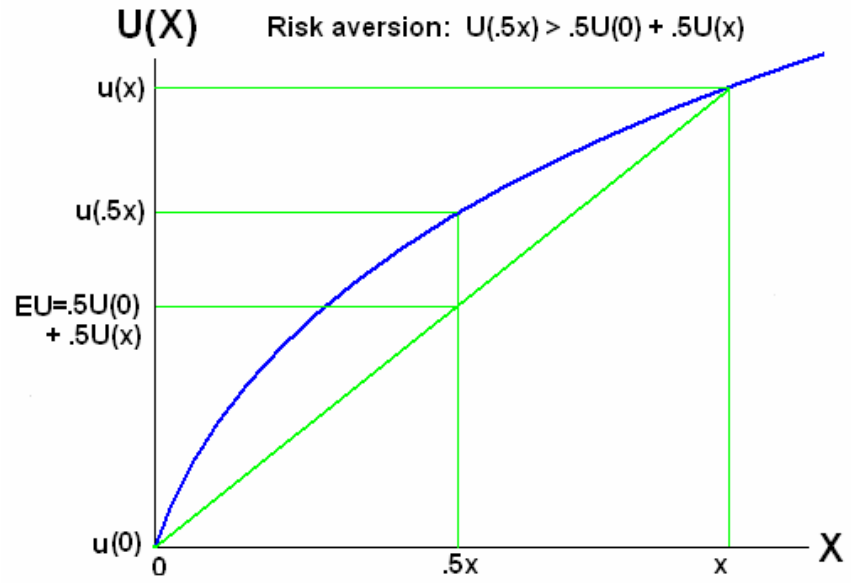


Figure 1. Illustration of how a concave utility (value) function leads to risk aversion.

A second assumption of Prospect Theory that can lead to risk aversion is the relatively steep slope of the value function for losses compared to gains (Figure 2). The steeper slope of the value function for losses means that the value curve is essentially concave downwards in the neighborhood of the origin. This means that for mixed prospects, involving potential gains and losses simultaneously, risk aversion should be observed.

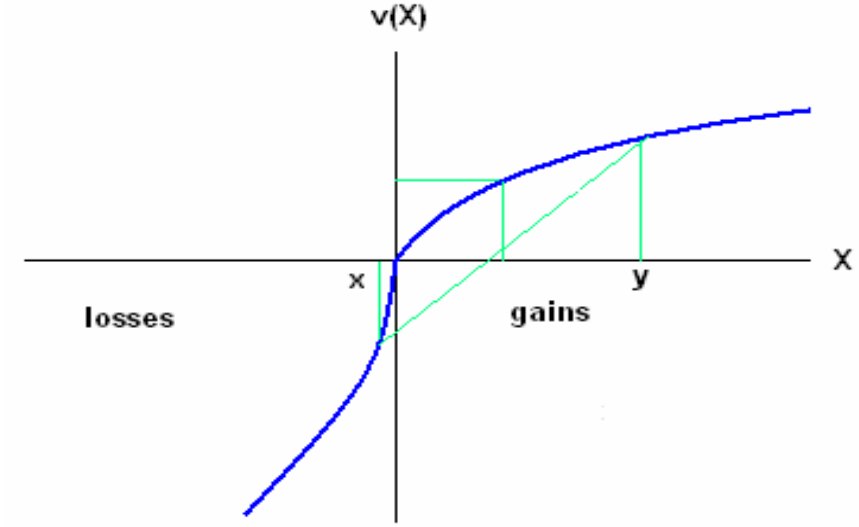


Figure 2. Illustration of how loss aversion leads to risk aversion in Prospect Theory.

Perhaps because risk aversion is so widely observed, much behavioral decision research has ignored individual differences in the fundamental traits underlying risk aversion or tolerance. Some exceptions are represented by related work in personality and social psychology, including Regulatory Focus Theory (Higgins, 2002), which holds that people differ in their tendency to focus on potential gains or losses. The former type of person is said to be promotion-focused, the latter type is prevention-focused. This trait of regulatory focus seems relevant to how people might approach financial decisions, and can be shown to be correlated with measures of financial risk tolerance (Franklin, 2007; Franklin & Corter, 2010).

A final potential source of individual differences in investment decisions is actual experience in investing, and/or feelings of expertise or "self-efficacy" in the investment domain. Both long-term experience (Corter & Chen, 2006) and short-term experience (Chen & Corter, 2010) can be shown to affect risk preferences in financial decisions.

Several of these distinctions and component sources of investment risk tolerance can be illustrated by two sample items from a commercial risk tolerance instrument, the RTQ[1]: The first item cited below, Q04, taps risk aversion arising from curvature of the utility function for gains, while the second item taps more investment-specific behavior, specifically asking about behavioral reactions to a significant market loss.

Q04. Suppose you could make either of two investments with virtually no risk, that offer the following returns over a short period of time (less than a month). Which investment would you prefer?
[Please check one only:]
____ Investment A: a sure gain of $2,000.
____ Investment B: a 40% chance of gaining $10,000.

Q05. Imagine that you have invested several thousand dollars into a stock, and after a period of good performance the stock loses suddenly loses 20% in value without a major change in the company's prospects. What is your reaction most likely to be?
[Please circle the ONE letter corresponding to the answer that best describes your reaction:]
a. buy more of the stock because it's an even better deal now
b. sell it immediately and put the money into something safer
c. sell part of your investment to spread out the risk
d. hold it until the price comes back up to near where you bought it, then sell it
e. hold it (it's still a good company)

Validation of Risk Tolerance Measures

Traditional psychometric criteria for test development have emphasized both reliability and validity. Reliability can be assessed in a number of ways, although Cronbach's alpha is probably the most commonly used statistic to assess the reliability of multi-item tests.

Validity too can be assessed in various ways. Face validity is the simple criteria that items measuring a construct should have content that seems relevant to the contruct. Predictive

[1] source: *Wall Street Journal*, July 14 2000.

validity requires that a test (or a test item) be able to predict important related phenomena. For a test of investment risk tolerance, we should require that the test be able to predict important investrment behavior, such as the investor's portfolio composition, at least in terms of percentage allocated to certain broad categories of investment instruments. For example, Corter and Chen (2006) reported a validation study of a risk tolerance measure, reporting that investment risk tolerance predict investment portfolio composition. Corter and Chen also report that risk tolerance can be measured with adequate reliability (even though it is a multidimensional construct). They found that investment risk tolerance scores were not significantly correlated with a standard measure of sensation seeking (Horvath & Zuckerman, 1993; Zuckerman, 1983), suggesting that it is a domain-specific trait, and reported that risk tolerance scores are positively correlated with investment experience (# of years investing).

As validation, we might also expect that risk tolerance scores be able to predict investor reactions to major market events, such as market downturns. Anecdotal evidence suggests that risk tolerance instruments may fall short in this regard:

> "Add risk tolerance questionnaires to the list of products that didn't work as advertised during the financial crisis. The ubiquitous surveys investors often fill out when they meet with advisers were supposed to provide a good sense of how much risk they could handle... But the forms proved to be overly simplistic, and people couldn't handle the risk that tests said they could. Many sold at the worst possible moment—the bottom." [From *Bloomberg Businessweek*, April 26, 2010.]

Furthermore, investment risk aversion has some characteristics and special challenges that complicate its psychometric measurement properties. One such problem is the presumed multidimensionality of the trait, as described above. Another issue is the fact, well established in behavioral decision research, that the degree of risk aversion/loss aversion displayed in a risky decision may depend on how that problem is framed (Kahneman & Tversky, 1979). Specifically, if the reference point for a decision problem is changed so that a problem involving losses becomes one involving gains, the preferences for specific decision options of a majority of people can change. In the case of multiple repeated decisions, preferences of an investor can change depending on whether the outcomes of individual decisions are aggregated (Benartzi & Thaler, 1999; Gneezy & Potter, 1997; Thaler, Tversky, Kahneman, & Schwartz, 1997; Chen & Corter, 2006). These issues present some special complications that should be kept in mind when designing effective measures of investment risk tolerance. In particular, the following issues can be phrased as questions about the measurement of investment risk tolerance: If investment risk tolerance is multidimensional, can it be measured reliably? How can the validity of IRT measures be established? Can the presumed component dimensions of risk tolerance be measured separately?

EMPIRICAL STUDY

The present study had two major goals. The first was to explore the multidimensional nature of investment risk tolerance. In particular, items were included assessing the four proposed dimensions underlying investment risk tolerance/aversion: decreasing marginal utility for gains, loss aversion, uncertainty aversion, and experience. The grouped items were used to define corresponding subscales measuring these four sources of financial risk aversion. The second goal of the study was to test if risk tolerance scores "predict" (post-hoc) responses to the financial/market crisis of 2008-2009. As the earlier quotation from *Bloomberg Businessweek* suggests, individual investor reactions to a "black swan" market event may not (or may) be predictable from risk tolerance scores. Thus, it seems that empirical evidence from a study

designed for this purpose would be a valuable replacement for current anecdotal evidence.

The financial turmoil in world markets beginning in Fall 2008 can be viewed as providing a natural experiment that can be used to approach the last question listed above, that of the role of risk tolerance in mediating or affecting investors' reactions to market events. In an attempt to assess how individual small investors have reacted to recent adverse events in world markets, and whether these reactions are mediated by their risk attitudes, a survey was administered to N=120 members of a university community.

Method

Participants. The survey respondents (N=120) were volunteers, solicited from classes and via notices posted on campus at a graduate school of education and social sciences. Some participated for course credit, most were paid for their participation.

Materials. The respondents were asked to fill out a questionnaire on investment behavior and risk attitudes. Most of the items were drawn from the IRTI[2], a commercial risk tolerance instrument, supplemented with additional items tapping attitudes towards uncertainty. Additional questions dealt with emotional and behavioral reactions to the recent financial crisis beginning in August 2008. The specific questions assessing reactions to the market turmoil of 2008-2010 are present in the Appendix. Participants were also asked to describe their investment portfolio composition, in terms of the percentage allocated to four broad categories; equities, bond, real estate, and cash/money markets.

Measures. From the survey responses, an overall Risk Tolerance score was defined, as total IRTI score supplemented with 4 additional uncertainty items. In order to separate the hypothesized component dimensions of investment risk tolerance, four RT component subscales were defined:

1) risk aversion for Gains
2) loss aversion
3) uncertainty aversion
4) experience/self-perceived expertise

Each of these subscales was defined so that a higher score meant less risk aversion or higher risk tolerance.

Results

Reliability and unidimensionality:

Overall RT scores (alpha=.67) predicted the objective risk measure defined on self-reported portfolio composition, $r = .38$, $p < .001$ (N=85). Analyses showed that investment risk tolerance is not a unidimensional construct. In particular, attitudes towards risk and towards uncertainty can be distinguished, and both types of component seem to contribute to improving prediction of the riskiness of an individuals' actual investment portfolio. All subscales were positively correlated with objective portfolio risk measure, though these subscale correlations were not significant (see Table 1):

[2] The Investment Risk Tolerance Instrument (IRTI) is the property of Assessment Science Corporation, 250 Mercer St. suite A304, New York, NY 10012.

Table 1. Correlation of subscale scores with a measure of portfolio risk (with reliabilites for subskills).

	_r_	_p_	_ alpha _
Risk tolerance for Gains:	.14	(NS)	.57
Loss tolerance:	.16	(NS)	.55
Uncertainty tolerance:	.29	(NS)	.35
Experience/expertise:	.31	(NS)	.37

Predictive Validity

The second main research question concerned whether and how investment risk attitudes mediate reactions to market turmoil and actual gains and losses in the market. This question was investigated via correlational analysis and causal modeling. Overall RT scores were not correlated with self-reported positive or negative emotional reaction to the financial crisis, r= -.06, (N.S.) Subscale scores showed a divergent pattern of correlations with emotional reaction (Table 1).

Table 2. Correlations of subscale scores with rating of emotional reaction ot market losses:

Risk tolerance for Gains:	r =-.07 (N.S.)
Loss tolerance:	r =-.09 (N.S.)
Uncertainty tolerance:	r =-.07 (N.S.)
Experience/expertise:	r = .31 (N.S.)

But there is a confounding factor in this test of predictive (actually, postdictive) validity: actual experienced portfolio losses. Specifically, if risk tolerance score predicts actual portfolio risk (corresponding roughly to beta), then high-RT individuals may have suffered more actual losses in the downturn, thus be more affected emotionally. How might we untangle this? One possible method is causal modeling (path analysis). Accordingly, two path models were fit to the data. The first model (Figure 3) assumed that investment risk tolerance (risk_tol) influences the riskiness of the participant's actual investment portfolio (Port_risk), which in turn predicts whether the investor suffered major losses in the downturn (Gain_loss). No investors in this sample reported profiting from these events. Losses suffered in the downturn are assumed to influence both self-reported emotional reactions to the possible losses (Emotion), and self-reported changes in investment philosophy or strategy (Strategy). Investment risk tolerance was also assumed to directly influence emotional reactions to losses and changes in investment strategy.

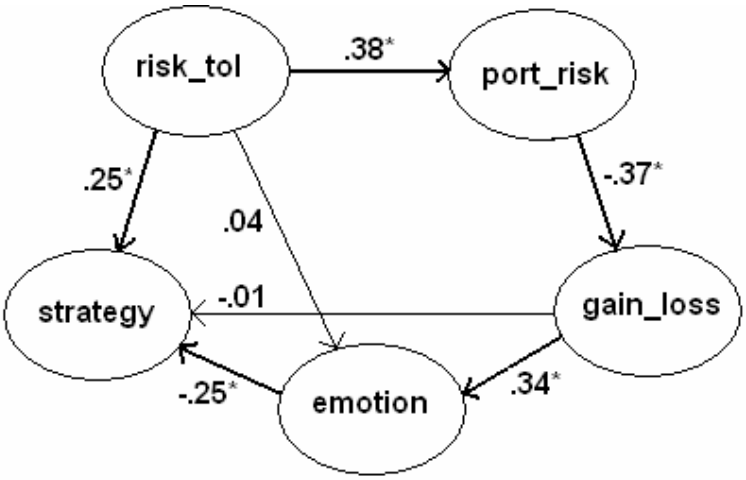


Figure 3. Path Model 1.

Path Model 2 was identical to the first model, except that the assumption was added that risk tolerance mediates the impact of actual losses on emotions (see Figure 4).

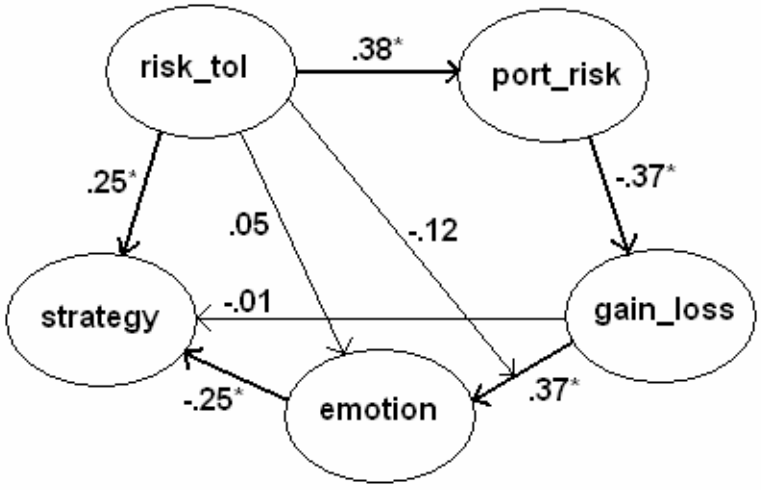


Figure 4. Path Model 2.

The path models were fit to the data using both least-squares and MLE methods. The fitted Path Model 1 confirmed that investment risk tolerance predicts the riskiness of the investor's portfolio. Portfolio risk in turn predicted whether or not the investor had suffered significant losses in portfolio value as a result of the market disruptions. Perhaps not surprisingly, the strongest coefficient in the path model was the link between self-reported actual portfolio losses and negative emotional reactions (p=.63). Finally, negative emotional reactions were the strongest driver of self-reported changes in investment strategy. Investment risk tolerance (IRT) did not directly influence emotional reactions nor strategy changes, nor did it significantly buffer the negative emotional effects of large portfolio losses in Path Model 2, though a trend in that direction was observed.

Discussion

The present results suggest the following conclusions about the measurement and use of risk tolerance measures in an investment context. First, it is confirmed here that Risk Tolerance (RT) does predict investing behavior (as reflected in a measure of portfolio composition risk).

Suggestive evidence is presented here that certain components of risk tolerance can be distinguished, and all contribute to the measurement of risk attitudes. Here, the components of risk aversion that are distinguished include decreasing marginal utility for gains, loss aversion, uncertainty (ambiguity) aversion, and investment experience or self-rated expertise. Analyses suggested that uncertainty aversion and expertise are particularly strong predictors of investment behavior.

Regarding the question of whether risk tolerance questionnaire scores can predict emotional reactions to market downturns as well as portfolio composition, the present study offers inconclusive results. Risk tolerance scores were not significantly correlated with emotional reactions, but showed a (nonsignificant) trend that can bee interpreted as a buffering of higher RT in helping investors to cope with larger losses.

The present study has several limitations, both of them expected to have a conservative effect (i.e, that might be expected to minimize the observed validity of the predictive use of risk tolerance score). First, investment risk tolerance was measured here post-hoc, after the financial/market downturn. This might cause underestimation of the relationship of RT to other variables (if high-RT individuals have "reformed"). However, anecdotal evidence from investment professionals/firms suggests that RT scores have been relatively stable throughout this period, suggesting that this source of bias may be minimal. Furthermore, the fact that the observed buffering effect of risk tolerance was non-significant may be due to a documented confounding factor, namely that relatively high RT have riskier portfolios, leading to more losses AFTER a large market disruption – thus high-RT individuals may wind up as unhappy or more unhappy after a severe and sudden market downturn.

Overall, the present results suggest that risk tolerance and uncertainty tolerance can be distinguished not only theoretically but empirically, and that both types of attitudes affect investing behavior. While higher levels of risk tolerance lead to riskier portfolios, and thus to higher exposure to losses, it seems that investors' emotional reactions to losses are not mitigated by higher levels of risk tolerance. While this is a null result and thus must be treated with caution, it could be taken as a cautionary note for investment advisors, suggesting that a high level of risk tolerance insulates a client from neither the actual nor the emotional consequences of market losses.

REFERENCES

Benartzi, S. & Thaler, R. H. (1999). Risk aversion or myopia: Choices in repeated gambles and retirement investments. Management Science, 45, 364–381.

Bernoulli, D. (1738/1954). Exposition of a new theory on the measurement of risk, translated by Louise Sommer. Econometrica, 22, 22–36.

Chen, Y-J. & Corter, J. E. (2006). When mixed options are preferred in multiple-trial decisions. Journal of Behavioral Decision Making, 19, 17-42.

Chen, Y.-J., & Corter, J. E. (2010). Changes in risk preference over repeated decisions. Under editorial review.

Corter, J. E., & Chen, Y.-J. (2006). Do investment risk tolerance attitudes predict portfolio risk? *Journal of Business and Psychology, 20-3,* 369-381.

Ellsberg, D. (1961). "Risk, ambiguity, and the Savage axioms. Quarterly Journal of Economics, 75(4), 643–669.

Fox, C. R., & Tvsersky, A. (1995). Ambiguity aversion and comparative ignorance. The Quarterly Journal of Economics, 110(3), 585-603.

Franklin, S. C. (2007). Regulatory focus and financial risk aversion. Unpublished Ph.D. dissertation, Columbia University.

Franklin, S. C., & Corter, J. E. (2010). Risk aversion and uncertainty aversion as distinct traits. unpublished paper, Teachers College, Columbia University.

Eysenck, S. B. G. & Eysenck, H. J. (1978). Impulsiveness and venturesomeness: Their position in a dimensional system of personality description. Psychological Reports, 43, 1247–1255.

Gneezy, U. & Potters, J. (1997). An experiment on risk taking and evaluation periods. The Quarterly Journal of Economics, 112, 631–645.

Grable, J. E. (2000). Financial risk tolerance and additional factors that affect risk taking in everyday money matters. Journal of Business and Psychology, 14, 625–630.

Hallahan, T. A., Faff, R. W., & McKenzie, M. D. (2004). An empirical investigation of personal financial risk tolerance. Financial Services Review, 13, 57–78.

Higgins, T. E (2002). How self-regulation creates distinct values: Taste of promotion and prevention decision making. Journal of Consumer Psychology, 12, 177–191.

Horvath, P. & Zuckerman, M. (1993). Sensation seeking, risk appraisal, and risky behavior. Personality and Individual Differences, 14, 41–52.

Hsee, C. K., & Weber, E. U. (1999). Cross-national differences in risk preference and lay predictions. Journal of Behavioral Decision Making.

Johnson, B. B., & Slovic, P. (1995). Presenting uncertainty in health risk assessment: Initial studies of its effects on risk perception and trust. Risk Analysis, 15(4), 485-494.

Kahneman, D. & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. Econometrica, 47, 263–291.

Kogan, N. & Wallach, M. A. (1964). Risk taking: A study in cognition and personality. New York: Holt, Rinehart and Winston.

MacCrimmon, K. R. & Wehrung, D. A. (1985). A portfolio of risk measures. Theory and Decision, 19, 1–29.

Morse, W. C. (1998). Risk taking in personal investments. Journal of Business and Psychology, 13, 281–288.

Slovic, P. (1964). Assessment of risk taking behavior. Psychological Bulletin, 61, 220–233.

Thaler, R., Tversky, A., Kahneman, D., & Schwartz, A. (1997). The effect of myopia and loss aversion on risk taking: An experimental test. Quarterly Journal of Economics, 112, 647–660.

Weber, E. U., Blais, A.-R., & Betz, N. E. (2002). A domain-specific risk-attitude scale: Measuring risk perceptions and risk behaviors. Journal of Behavioral Decision Making, 15, 263–290.

Weber, E. U., & Hsee, C. K. (1998). Cross-cultural differences in risk perception, but cross-cultural similarities in attitudes towards perceived risk. Management Science.

Weber, E. U. & Milliman, R. (1997). Perceived risk attitudes: Relating risk perception to risky choice. *Management Science*, *43*, 122–143.

Wong, A. & Carducci, B. J. (1991). Sensation seeking and financial risk seeking in everyday money matters. Journal of Business and Psychology, 5, 525–530.

Yook, K. C. & Everett, R. (2003). Assessing risk tolerance: Questioning the questionnaire method. *Journal of Financial Planning*, 48–55, August.

Zuckerman, M. (1983). Sensation seeking and sports. Personality and Individual Differences, 4, 285–292.

Appendix:

Questions on portfolio composition and reactions to market turmoil

Self-reported portfolio composition:

Q15. Considering all your investments (excluding personal residences), approximately what percentage is invested in equity-based investments? _____
What percentage is in options or commodities? _____
What percentage is in bonds or bond funds? _____
What percentage is in money market funds or cash? _____

Market turmoil questions:

How has the Fall 2008 turmoil in the financial and credit markets affected you? Specifically,

1. Has your investment/retirement portfolio changed in value since August 1st, 2008?
_____ Yes, it has increased in value
_____ Yes, it has lost value
_____ No, It has stayed roughly constant in value
_____ I have no idea

If yes, by about what percentage has it shrunk (or grown?): _____ %
Don't know exactly _____

2. Has this change in value affected you emotionally? Please rate how much it has affected you, on a scale from -3 to +3, by circling the appropriate number:

Strong Negative Effect			Little or No Effect			Strong Positive Effect
-3	-2	-1	0	1	2	3

3. Have you changed your investment strategy as a result of the turmoil in the markets and the economic downturn?
Yes _____ No _____
If so, please describe briefly
_____

_____