Risk Tolerance, Projection Bias, Vividness, and Equity Prices

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Investors, in general, tend to vacillate in their opinion of the stock market. At some points in time, investors believe that the markets will head higher, while at other times the consensus is that prices will decline. While nearly all financial planners acknowledge that investor sentiment changes (Twibell [2004]), the inputs used to develop asset allocation models are almost always assumed to be static. The four primary asset allocation inputs, according to Trone, Allbright, and Taylor [1996], include a client's (a) asset class preferences, (b) time horizon, (c) expected rate of return, and (d) risk tolerance.

Each input is measurable, but, once measured, the input generally is not believed to fluctuate. Consider each asset allocation model input separately. Choosing asset class preferences involves eliminating inappropriate investments from those available to a client. Some clients may prefer to invest only in guaranteed securities, while others may have a preference for "socially conscious" investments. These types of subjective preferences are assumed to stay constant or vary minutely over time. A client's time horizon is used to determine the split between equities and fixed-income securities in a portfolio. Time horizon is fixed at the date of analysis. Expected rate of return, as an asset-allocation input, guides the level of systematic risk taken in a portfolio. Rate-of-return expectations tend to be static inputs, changing only with revisions to policy objectives.

A client's risk tolerance is also assumed to be unchanging. Rattiner [2004] has stated that risk tolerance is "the most critical component of the investment planning process" (p. 137). Trone and his associates [1996] made two critically important observations in relation to risk tolerance. First, aversion to loss is the most important factor in determining a client's optimal asset allocation, and, second, investors are more likely to abandon an investment strategy because portfolio returns fail to match a client's tolerance for risk than for any other reason. It is canonical that risk tolerance must be accurately measured. What is less well known is that risk tolerance, as a subjective trait, may not be static in the same way as other asset allocation model inputs.

The purpose of this research is to test the assumption that risk tolerance is a static input within an asset allocation framework. The analysis is based on both attitudinal and financial observations. Two hypotheses are tested. First, investor risk tolerance fluctuates in part due to changes in the investment markets, and, second, investors tend to project stock market closing price data into the formation of risk-tolerance attitudes. If confirmed, these hypotheses lead to the conclusion that risk tolerance is not a static subjective trait, but rather a dynamic and changeable factor.

This research is important because the assumption of static risk attitudes permeates the theory of investment model development

processes used in the financial planning industry. If investor risk tolerance does indeed fluctuate, the basis of many investment plans becomes unstable. The instability of an investment plan is most problematic in cases where an investor overestimates his or her risk tolerance only to find that the volatility level chosen in a portfolio exceeds individual willingness to incur a loss because risk tolerance changed. Changing risk attitude can also hurt investors who underestimate their risk tolerance. In these cases, the rate-of-return achieved may be insufficient to meet client financial objectives. In either case, the investment plan developed for the client will fail, making client outcomes problematic.

PROJECTION BIAS

The conceptualization of projection bias is a relatively recent event. Knowledge of projection bias, however, has a long history. Intuitively, most people acknowledge a tendency to project their current situation into the future. Loewenstein, O'Donoghue, and Rabin [2003] documented a general bias in the prediction of future tastes. According to Loewenstein et al., individuals who are subject to projection bias may choose overly warm vacation destinations for the summer when making the decision in the winter. Projection bias also causes "diners to order too much food at the beginning of meals, and people unaddicted to cigarettes to underestimate the power of and drawbacks of addiction" (p. 1210). General acknowledgment of projection bias tendencies may explain why some household words of wisdom make so much common sense. For example, common advice to eat a good meal before grocery shopping or to comparative shop before making a purchase, provide a defense against impulsively assuming that one's current situation will remain constant in the future.

In general, a person who exhibits projection bias will be very sensitive to momentary information and feelings and tend to project current preferences onto future attitudes and behaviors (Gruber [2001]). Clarke and Statman [1998] found projection bias present in the way stock market newsletter writers view the future. They found that past returns and volatility in the stock market affect newsletter writers' sentiment. They concluded, on the other hand, that newsletter writer sentiment did not forecast future stock market returns. Stock prices were found to influence and change the sentiment of market analysts, which was an indication of projection bias.

There is other evidence to suggest that projection bias may play a role in the formation of risk preferences related to investing. MacKillop [2003] reported that "risk tolerance fluctuates with changes in the market. Investors tend to become more aggressive when markets are rising and more conservative when they decline" (p. 64). Could it be that investors "project their current enthusiasm into the future" (Loewenstein et al. [2003], p. 1229) as often happens when people purchase health club memberships with the anticipation of using club facilities even though they probably will not? Investors may do the same thing when evaluating their future preference for risk.

Much of the research involving projection bias has involved consumer durable purchases, addictive behavior, and impulsive shopping. Loewenstein and his associates [2003] found that merchants can manipulate projection bias. They concluded that "if consumers overestimate the longevity of their current feelings, sellers will have an incentive to induce high valuations when people are making buying decisions, via sales hype, enticing displays, or mood-inducing music" (p. 1229). Stock price data, as reported through nationally recognized market indexes throughout the media, are obviously not created by a merchant to sell goods and services. However, in generating enthusiasm or fear within the investing public, the information contained in stock prices may work the same way as a merchant using sales hype to sell a product. Individuals who are subject to projection bias may be more likely to alter their assessment of future stock prices. Extrapolating one's current view of stock prices into the future, via a change in risk preference, would indicate that projection bias may exist and that risk attitudes are not as static as once thought.

VIVIDNESS

Vividness is a concept closely related to projection bias. Vividness refers to "how emotionally interesting or exciting something is" (Plous [1993], p. 126). Research examining the role of vividness in the decision-making process suggests that people are most influenced by particularly vivid stories and events. Consider the events of September 11, 2001. Almost every American saw the dramatic events of that day either live or in newscasts. Within hours of the World Trade Center disaster, people changed the pattern of their lives. Many people stopped flying in the days, weeks, and years to follow. Others refused to enter tall buildings. The vividness of the

terrorist attacks was so great that people's attitudes and behaviors changed.

Two questions are related to the effect of vividness. First, are attitude and behavior changes related to vividness reasonable? Second, are attitudinal and behavioral changes permanent? While the evidence is not conclusive at this point, the answer to the first question is that people change their attitudes and behaviors in a biased way that is not always reasonable. For example, refusing to fly and, instead, driving to a destination, actually increases the probability of accident and death. A person is almost 57 times more likely to be injured or die in a motor vehicle accident than when flying on a commercial airplane flight (Ropeik & Gray [2002]). The feeling of being in control tends to outweigh the statistical probability of risk, which is not purely rational. Empirical evidence suggests that the answer to the second question is also negative. The further removed people are from September 11, 2001, the less vivid the horrific images of that day become. By the summer of 2004, many people had returned to flying for business and pleasure (Rosato [2004]). Hotel room vacancies disappeared, and the fear of doing business in a high-rise building diminished.

These examples point to two conclusions. First, recent vivid events and stories have an influence on short-term attitudes and behaviors. Second, the further removed people become from an event, the less likely they are to change their attitude, opinion, or behavior (Plous [1993]). In other words, vividness appears to create biased, short-term attitudinal change that may not be rational. Little evidence exists linking vividness and risk-tolerance attitudes. It may be possible that investors are influenced by the most recent changes in stock prices when assessing their tolerance for risk. A purpose of this study is to investigate this possibility.

METHODOLOGY

The purpose of this research is to test the assumption that risk tolerance is a static input within an asset-allocation framework. Two hypotheses are tested:

(a) Investor risk tolerance fluctuates in part due to changes in the investment markets, and;
(b) Investors tend to project stock market closing price data into the formation of risk-tolerance attitudes.

Data were collected between September, 2002, and September, 2003. A self-administered Internet survey was used to assess respondents' risk preferences, level and type of asset ownership, and basic demographic characteristics. A description of the sample, variables, and data analysis method follows.

Sample Characteristics

Data for this study were obtained from a university-supported online survey system (www.rce.rutgers.edu/riskquiz/). Anyone with Internet access and knowledge of the site could participate in the survey. Over the course of the study, references to the Web site were provided to potential respondents in textbooks, non-profit national investment programs, newspaper articles, and trade publications of interest to investors. The initial sample included 1,757 individual cases. The sample was decreased to include only respondents who indicated owning investment assets. This reduced the sample size to 1,355 respondents. The average age of those responding was 36.97 years, with a standard deviation of 15.83 years. Approximately 59 percent of respondents were men. 43 percent were married, and almost 55 percent of the sample indicated having a college degree or higher level of education. The typical household income for those included in the analysis ranged from $50,000 to $74,999 per year. While the sample does not represent the general U.S. population, the sample is representative of "Internet savvy" respondents (Smith [2003]), or those with an income, education, and net worth position more similar to investors than non-investors.

Variables

The dependent variable was a respondent's risk-tolerance. Risk-tolerance was measured using a 13-item risk assessment scale (Grable & Lytton [1999]). The risk scale was originally designed to assess personal finance risk attitudes and preferences. Scores ranged from a low of 13 to a high of 47, with a median score of 28. Based on 1,355 cases, the scale showed a 0.80 level of reliability.

Five demographic variables were used as controlling factors. Age was measured on a continuous scale. Gender was dummy coded so that women were coded 1 and men 0. Education was also dummy coded. Those possessing a bachelor's degree or higher level of education were coded 1, otherwise 0. Married individuals were coded 1 and all others 0. Two polynomial variables were included to represent possible curvilinear effects in the data. Age-squared and income-squared were used to account

for possible convex (∩) and concave (∪) relationships between age, income, and risk tolerance.

Interaction variables were created to account for potential moderating effects between and among three demographic variables and risk tolerance. Interaction variables were created to account for potential relationships between income and education (income x education), marital status and education (marital status x education), and marital status and income (marital status x income).

Stock market price data were measured using Dow Jones Industrial average, NASDAQ average, and Standard and Poor's 500 (S&P 500) average weekly closing price data. Data were collected beginning with the closing price of the Dow on August 26, 2002, and ending August 29, 2003. Closing stock market price data were used to predict the following week's risk level among respondents. It was hypothesized that positive weekly changes would result in an increase in risk tolerance, while decreases in weekly prices would result in a decline in risk tolerance. It was also hypothesized, based on arguments presented by Shefrin [2000], that recent changes in market prices would have the greatest impact on changes in risk tolerance.

Three ordinary least squares regression models were developed to test the relationship between stock market price levels and risk tolerance. The demographic variables, two polynomial variables, and three interaction variables were used as controlling factors in the analyses. The primary test was to determine if the previous week's price data could be used to predict the subsequent week's risk tolerance among respondents.

FINDINGS

Exhibit 1 reports findings from the three regression analyses. In each case, the previous week's stock price levels, as measured by the Dow Jones Industrial average (Equation 1), NASDAQ average (Equation 2), and the S&P 500 average (Equation 3), showed a statis-

EXHIBIT 1

Summary of Regression Analysis for Variables Predicting Risk Tolerance (N = 1,355)

Variable	Equation 1 Dow Jones Industrial Average (*B*)	Equation 2 NASDAQ Average (*B*)	Equation 3 S&P 500 Average (*B*)
Age	-.1012**	-.1004**	-.1008**
Gender (1 = Female)	-1.2854**	-1.2986**	-1.3004**
Education (1 = Bachelor's Degree or Higher)	.6917	.6987	.7648
Household Income	1.6909**	1.7018**	1.6747**
Marital Status (1 = Married)	1.4772	1.4489	1.5004
Age x Age	1.3785E-06**	1.3841E-06**	1.3852E-06**
Education x Marital Status	-1.2610*	-1.2760*	-1.2840*
Education x Income	.3448	.3465	.3347
Income x Income	-.1765*	-.1779*	-.1733*
Income x Marital Status	-.1178	-.1126	-.1204
Previous Week's Closing Price	.0011**	.0029**	.0080**

Equation 1: $F = 21.390^*$, $R^2 = .1191$

Equation 2: $F = 21.1082^*$, $R^2 = .1177$

Equation 3: $F = 20.8865^*$, $R^2 = .1166$

*p < .05 ** p < .01

tically significant positive relationship with risk tolerance. These results confirm MacKillop's 2003 report stating that "risk-tolerance fluctuates with the market" (p. 64). The same regression models were run again, but instead of using previous week data, 2-week, 4-week, and 12-week data were used in the analyses. No significant relationships were found between older market data and risk tolerance, holding all other factors constant. These findings confirmed Shefrin's 2000 conclusion that recent market changes have the greatest impact on future risk tolerance.

These results confirm the two research hypotheses posited at the outset of this paper. Investor risk tolerance does appear to fluctuate, in part, based on changes in the investment markets. Risk-tolerance scores were higher after a stock market gain the previous week. Risk-tolerance scores were lower following weeks when stock prices had declined. It appears that investors are biased in projecting previous week closing stock market data into the formation of their risk attitude. These findings point to the possibility that investors are moved by the vividness of current stock prices more so than older stock price information. Findings also suggest that investor risk tolerance is not static, but instead a dynamic and changeable input within asset allocation models.

Other results from the analyses are worth noting as well. Six additional variables were found to be significant predictors of risk tolerance. Age was negatively related to risk tolerance. The polynomial variable—age^2—was also significant. In this case a concave ($\cup$) relationship was noted. This was interpreted to mean that risk tolerance declined with age until a point was reached when risk tolerance began to rise again with age.

Household income was also found to be a significant predictor of risk tolerance. Increasing income was associated with increased tolerance for risk. The income polynomial variable—income^2—was also significant. In this case the relationship was convex ($\cap$). Risk tolerance increased with income up to a point, at which time the relationship turned negative.

Gender was determined to be a significant predictor of risk tolerance. In this study, women were more likely to have lower risk-tolerance scores than men, holding all other factors constant. Marital status was not found to be significant, but the interaction variable of educational status and marital status was significant. The relationship was negative. Those who were both married and holding a college degree or higher level of education were more likely to have lower risk tolerances than others.

DISCUSSION

Mehra and Sah [2002] tested the hypothesis that "small fluctuations in investors' subjective parameters induce large fluctuations in equity prices" (p. 870). They found that investors' subjective parameters (e.g., risk aversion) fluctuate over time. They also determined that individuals behave as if their current subjective parameters persist into the future. In effect, Mehra and Sah confirmed the existence of projection bias in the equity markets.

This research examined projection bias and vividness from a different perspective. Whereas Mehra and Sah assessed the impact of changes in investors' risk aversion on stock prices, this study examined the affect of stock prices on risk tolerance. It was determined that risk tolerance does, on average, change in relation to stock prices. This confirms a finding presented by Loewenstein et al. [2003], who concluded that individual preferences change over time, often due to exogenous factors, and that recent stock market price changes have the greatest impact on subsequent risk-tolerance levels. Projection bias and vividness appear to play a significant role in how investors shape their perception of risk.

This study adds to the projection bias and vividness literature by documenting how individuals systematically exaggerate their level of future tastes by projecting the most recent and vivid stock market data into risk attitudes. Results from this study suggest that individual investors' prediction of future stock prices, based entirely on recent past performance data, influence current and future risk-tolerance attitudes. An increase in a previous week's aggregate stock prices tends to increase risk tolerance levels in the following week. It appears that individual investors, in the aggregate, project current stock price trends into the future. This is reflected in changing risk tolerances.

Several implications for financial practitioners and researchers can be drawn from this research. First, planners ought to use great caution when assessing a client's risk tolerance. Recent Securities and Exchange Commission (SEC) rule changes, clearly, state that firms "must measure the client's level of risk tolerance and then have procedures to ensure that the portfolio doesn't exceed that level" (McGinnis [2004], p. 62). Planners who create asset allocation recommendations based on the *assumption* that risk attitude is a static input into portfolio development models need to reconsider this notion. Risk attitudes appear to fluctuate with the market environment. Bull market trends tend to cause aggregate risk

attitudes to increase, while, on average, bear trends have a dampening effect on risk attitudes. Determining the market environment at the time a client's risk tolerance is measured is certainly a good idea. One should only use the initial measurement of risk attitude as a dynamic point of reference. The SEC may someday find planners accountable if a portfolio is developed based on a static, risk-tolerance input, resulting in portfolio risk that is higher than a client's risk tolerance in a down market. Measuring client risk attitudes periodically and developing a scoring system incorporating market environmental data appears to be one way to address this fiduciary issue.

Second, the practice of dollar-cost averaging (i.e., making regular investment deposits at regular time intervals) should be encouraged. Dollar-cost averaging can be done via payroll deductions for an employer retirement savings plan (e.g., a 401[k] or 403[b] plan) or individually through automatic investment plans for mutual funds, direct purchase plan stocks, and U.S. savings bonds. Not only is dollar-cost averaging convenient, but it takes the emotion out of investing. Investments are made at their regularly scheduled time interval regardless of current economic conditions.

Another way to take the emotion out of investing is to establish a system for periodic asset allocation rebalancing. This prevents investors from having their portfolio over weighted in the asset class that is currently doing well, as happened to many stock investors during the late 1990s. Rebalancing can be done by selling assets that have performed well and/or placing new investment dollars in underweighted asset classes. Portfolio rebalancing overrides projection bias tendencies because investors are literally "going against the market" (i.e., selling assets that are doing well and buying those that are underperforming) to rebalance. Because rebalancing is difficult to do emotionally, it is advisable to establish a periodic system to do it (e.g., once or twice a year or when asset weights shift by a certain percentage). As an example of automated rebalancing, pension giant TIAA-CREF is providing an annual portfolio rebalancing service for its college faculty participants. Participants who sign up for this service establish target weights for each asset class and their portfolio is rebalanced annually on their birthday.

Third, investors should be provided with information about the long-term ineffectiveness of market timing and common behavioral finance errors such as projection bias. Planners can help investors realize that people frequently project current stock price trends into the future and base their risk tolerance on present economic conditions. If investors know this, they may recognize behavioral finance errors in their own financial practices and avoid unwise decisions.

Finally, results from this study are limited in generalizability because the sample was convenient and nonrandom, and some respondents were specifically directed to the site. Replication with a large random sample would provide more conclusive evidence. Continued research in the relationship of current stock prices and investor risk tolerance is needed. Further research should be done on an ongoing basis. Addition studies ought to include investor risk-tolerance scores from both bull (rising) and bear (declining) markets, and measurements of investor sentiment and mood when completing the survey. Data from additional studies can be useful in better understanding how individual investors change attitudes and behaviors as a result of exogenous factors.

ENDNOTES

This paper is the second in a series that examines risk attitudes in relation to stock prices. The first paper was published using a reduced data set from the Rutgers Web survey (Grable, J. E., Lytton, R. H., and O'Neill, B. "Projection Bias and Financial Risk Tolerance." *The Journal of Behavioral Finance*, 5 [2004], pp. 240-245). The current paper uses an expanded data set and incorporates the concept of vividness as a possible explanation for changing risk attitudes.

REFERENCES

Clarke, R. G., and M. Statman. "Bullish or Bearish?" *Financial Analysts Journal*, 54 (May-June, 1998), pp. 63-72.

Grable, J. E., and R. H. Lytton. "Financial Risk Tolerance Revisited: The Development of a Risk Assessment Instrument." *Financial Services Review*, 8 (1999), pp. 163-181.

Gruber, J. (Ed.) *Risky Behavior among Youths: An Economic Analysis*. Chicago: University of Chicago Press, 2001.

Loewenstein, G., T. O'Donoghue, and M. Rabin. "Projection Bias in Predicting Future Utility." *The Quarterly Journal of Economics*, 118 (2003), pp. 1209-1248.

MacKillop, S. "Confidence Builder." *Investment Advisor* (March 2003), pp. 62-64.

McGinnis, S. K. "Cleaning up Dodge." *Financial Planning* (August 2004), pp.62-63.

Mehra, R. and R. Sah. "Mood Fluctuations, Projection Bias, and Volatility of Equity Prices." *Journal of Economic Dynamics and Control*, 26 (2002), pp. 869-887.

Plous, S. *The Psychology of Judgment and Decision Making*. New York: McGraw-Hill, 1993.

Rattiner, J. H. "A Strong Foundation." *Financial Planning* (September 2004), pp. 137-138.

Ropeik, D., & Gray, G. *Risk: A Practical Guide for Deciding What's Really Safe and What's Really Dangerous in the World Around You*. Boston: Houghton Mifflin, 2002.

Rosato, D. "How to Beat the Travel Traffic." *Money*, 148 (August 2004).

Shefrin, H. *Beyond Greed and Fear: Understanding Behavioral Finance and the Psychology of Investing*. Cambridge, MA: Harvard Business School Press, 2000.

Smith, C. B. (2003). Casting the net: Surveying an Internet population. [Online]. Available: http://jcmc.huji.ac.il/vol3/issue1/smith.html

Twibell, D. "Getting Sentimental." *Financial Planning* (September 2004), pp. 141-144.

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