Does the Visual Display of Probability Change Hypothetical Stock Selection?

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Abstract

Prospect theory assumes people are more averse to losses than to gains and indicates the way a question is framed makes a difference in the outcome. However, almost no research has been conducted on the framing effects of prospect theory survey questions, and very little qualitative data have been collected with regard to why people make the decisions they do. This research utilizes primary data collected from 200 residents within five census tracts in southwest Lubbock, Texas. Answers to hypothetical investment scenarios were analyzed to determine if responses change based on how a question is framed. Investment preferences change to the stock with the greatest probability of a gain when probability information is displayed visually. Most investors in this sample indicated the potential gain associated with the investment scenarios was their primary decision making rationale. Investors may be willing to take more financial risks when probability information is displayed visually and when the potential losses are relatively small.

Introduction

Little is known about how visual displays of risk communication change perceived financial risk and the decision-making process. Prospect theory may provide some insights into how risk is perceived. Prospect theory explains that investors are loss averse; they feel the psychological pain of losses twice as much as they feel corresponding gains (Kahneman & Tversky, 1979). Prospect theory was tested using probability word problem scenarios in surveys (Levy & Levy, 2002a; Kahneman & Tversky, 1979). (Levy & Levy, 2002b) Based on these and other studies, the way a question is framed will predictably alter a person's response. This study, the first of its kind, explores subjects' responses to a visual depiction of the probability scenario and obtains qualitative feedback about rationale for selections.

The questions posed in the original prospect theory research were one-sided, meaning either in the form of a direct gain or loss scenario. This new research tests mixed outcome potential, exploring possibilities of gain or loss in one investment scenario. In addition, the scenarios are provided with and without visual display of probability information. In addition, participants are asked to indicate their investment selection decision rationale. Finally, by asking questions with the same statistical dollar outcome, but with varying loss probability and dollar amounts, this research explores if dollar amounts or probability have greater influence on the decision-making process.

Prospect theory suggests respondents usually exhibit a strong preference for investment scenarios in which there is no chance for loss (Kahneman & Tversky, 1979). However, Levy and Levy (2001; 2002b) found only 44% and 51% of participants chose the-no-chance-for-loss option in their surveys. It is important to note the payoffs are exactly the same statistically; both scenarios result in a statistical payout value of positive $750. The Levy and Levy research utilizes a convenience sample of MBA students, college professors, and financial advisors whereas this research randomly sampled households from upper middle class neighborhoods in Lubbock, Texas.

Literature Review

Studies involving the visual depiction of probability with financial behavior are very limited. Barksy, Juster, Kimball and Shapiro (1997) developed hypothetical scenarios to measure a person's financial risk tolerance. This measure has been included in the Health and Retirement Study, a longitudinal panel survey of U.S. residents age 50 and older. The Barksy et al. measure of financial risk tolerance uses a lifetime income

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gamble in which a person must choose between a potential decrease in lifetime income versus a possible increase in lifetime income using a variety of potential gains and losses expressed in a word problem format. Hanna and Lindamood (2004) utilize the Barsky et al. measure of financial risk tolerance and add a graphical depiction of the choices to clarify the impact of the different income choices. Hanna and Lindamood find a significant difference between their graphical depiction of the financial risk tolerance questions and the findings of Barsky et al. The participants in the Hanna and Lindamood have a statistically significant lower risk aversion than the Barsky et al. findings indicate. However, there are a couple of methodological concerns with the Hanna and Lindamood study. Hanna and Lindamood did not ask the income gamble questions in both word problem and graphical form, and their sample was a convenience sample of 152 students.

The field of visual analytics attempts to understand how analytical reasoning can be assisted with visual interactive interfaces; however, little research has been done in the field of financial planning. Rudolph, Savikhin and Ebert (2009) find when consumers are given a tool that displays return, risk and correlation information of potential portfolio selections; consumers make better risk/return decisions when compared with wealth-time plot information. Rudolph, Savikhin and Ebert use computer software to create the visual representations and it has an interactive feature that allows the consumer to modify assumptions, however their research clearly shows increased understanding of the financial information being presented, improved decision making, and increased confidence in the decision when financial information was displayed visually. Bhandari, Hassanein, and Deaves (2008) find decision support aids like graphs and feedback prompts could improve investment decision making by mitigating cognitive bias.

Cognitive limitations and information overload can lead to inferior decision making. Agnew and Szykman (2005) find the financial literacy of a participant influences how often the participant chooses a default allocation for defined contribution plans. Agnew and Szykman find limiting the number of choices in a defined contribution plan helps to reduce the information overload experienced by plan participants with above average financial knowledge; however, those with below-average skills find the investment decision to be overwhelming regardless of how the information was presented. Iyengar, Huberman, and Jiang (2004) find the more mutual fund choices in a 401(k) plan leads to information overload and reduced plan participation rates.

Humans have limited cognitive resources and time in which to make decisions thus experiencing bounded rationality and this leads to the development of shortcuts in decision making commonly referred to as heuristics. Benartzi and Thaler (2001) find a common investment diversification heuristic in which investors allocate their contributions equally among all of the available options regardless of risk. Tversky and Kahneman (1974) find that heuristic decision making can lead to systematic and predictable errors. One of these systematic errors is how an investor views investment gains and losses.

Prospect theory studies generally give respondents two hypothetical investment scenarios and ask which one they would prefer. Investors tend to be risk averse with gains, taking less risk with potential gain scenarios. Investors also are loss averse and become risk seeking to avoid the psychological pain of experiencing a loss resulting in an S-shaped curve.

Levy and Levy conducted research on prospect theory and their results question the validity of the S-shaped function of prospect theory and question the risk aversion characterization of investors (Levy & Levy, 2002a; 2002b; Levy & Levy, 2001; Levy H. , 2006). However, the previous studies rely only on small convenience samples of MBA students, professional money managers, and professors. Levy and Levy (2001) suggest "Kahneman and Tversky's results may be due to the fact that the investment alternatives which they present to their subjects are unrealistic as the outcomes are confined to either only to the positive range or only to the negative range, while the outcomes of actual investments can be both positive or negative. In addition, as they typically compare certain prospects with uncertain prospects, their results may be influenced by the certainty effect" (Levy & Levy, 2001, p.239). Later, Levy and Levy use the results of their study to "reject the prospect theory S-shaped function" (Levy & Levy, 2002b, p. 1347). However, it is possible the use of a convenience sample or other methodological concerns has biased the results of the study. More research may be needed with larger samples that are randomly selected before coming to such a conclusion.

Theoretical Framework

Financial risk can be perceived as feelings. Often investors "feel" uncomfortable with paper losses and sell their investments to ease the emotional pain. Solvic and Peters (2006) describe this as the affect heuristic. Solvic and Peters indicate that risk can have both positive and negative affects. If the benefit is high or the perceived risk is low there would be a positive affect. People would be more likely to support a decision with

positive affect regardless of the underlying probability information. On the other hand, if something has a negative affect, for example nuclear power, then regardless of the low probability of a negative outcome, people would still be opposed to it. Therefore, people use the stated outcome or probability information, as well as feelings, when making their decisions. In addition, time pressure has an impact on the results. Those who experience the pressure to make a decision under time constraints, increase the perceived benefits and risks associated with the gamble (Slovic & Peters).

Probability information can also be ignored. Sunstein (2003) has coined the phrase probability neglect when people become so focused on the outcome as to ignore the likelihood of the event occurring. Therefore, it is possible that some people have a high fear of loss with stock market investing that even when the likelihood of a loss occurring is known, they will not want to participate.

It is possible to overwhelm the brain with too much information at one time forcing it to ignore information or to use heuristic shortcuts. One theory that describes this effect is the limited capacity model of motivated mediated message processing (LC4MP). The limited capacity model of motivated mediated message processing suggests humans have a finite capacity for cognitive processing of information (Lang, 2000). The theory suggests people may not have the resources available to fully absorb a question because they are unfamiliar with a topic, or may simply lack the motivation to devote the energy needed to fully understand the question. In addition, the theory suggests that visual elements tend to draw upon more cognitive resources (Lang, 2000). Therefore, it is possible that people don't encode probability information when presented in a word problem format, and the visual display of the same information increased the likelihood of the data being included in the mental calculation. The additional encoding of the visual display of probability may assist people in understanding and differentiating the alternative scenarios.

Kahneman and Tversky (1979) termed the additional psychological pain experienced with a financial loss as prospect theory. Prospect theory assumes investors are loss averse and will become risk seeking to avoid the psychological pain of experiencing a loss. This pattern of behavior leads to an S-shaped curve where the gain portion of the curve is concave, meaning investors are more likely to be risk averse with gains, taking less risk with potential gain scenarios (Kahneman & Tversky). On the loss portion of the S-shaped curve, investors are more willing to take additional risks to avoid a loss, so the shape of the curve in this area is convex.

Method

The current research uses a survey to present hypothetical investment scenarios and then visually displays the probabilities so subjects have a clear frame of reference regarding the probability of the event. Each participant sees both the word problem format and the visual display format of the hypothetical investment selections, and makes a selection. The results of each selection are compared to determine if the respondent has changed their investment selection or not. Two hypothetical mixed outcome scenarios were presented to participants, a small-dollar-return and a large-dollar-return. In the small-dollar-return scenario the participants see the following versions of the hypothetical investment scenario:

Suppose that you decided to invest $10,000 either in stock **F** or in stock **G**. Which would you choose, **F** or **G**, when it is given that the *dollar gain or loss* one year from now will be as follows:

Stock F		Stock G	
Outcome	Probability	Outcome	Probability
-$500 Loss	1 out of 4 or 25%	$0 Gain	1 out of 2 or 50%
$500 Gain	1 out of 4 or 25%	$1,500 Gain	1 out of 2 or 50%
$1,000 Gain	1 out of 4 or 25%		
$2,000 Gain	1 out of 4 or 25%		

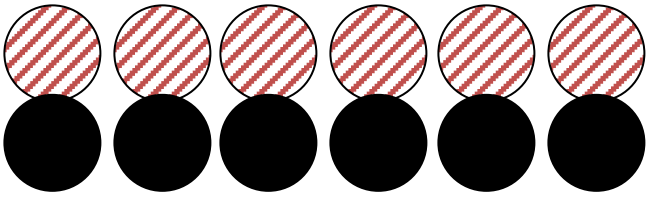
Please circle your preference below:

Stock F Stock G

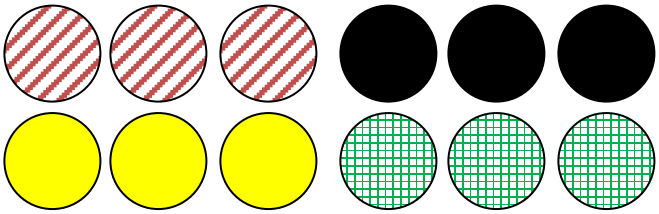
Respondents were also shown the following question:

Suppose that you decided to invest $10,000 either in stock **F** or in stock **G**. Which would you choose, **F** or **G**, when it is given that the *dollar gain or loss* one year from now will be determined as follows:

Stock F dollar gain or loss will by calculated by the following:
Twelve balls are placed in a bag, 6 red and 6 black. One ball will be pulled out of the bag. If a red ball is pulled out of the bag, your investment will lose $0, and if a black ball is pulled out of the bag, your investment will gain $1,500.



Stock G dollar gain or loss will by calculated by the following:
Twelve balls are placed in a bag, 3 red, 3 black, 3 yellow and 3 green. One ball will be pulled out of the bag. If a red ball is pulled out of the bag, your investment will lose $500, and if a black ball is pulled out of the bag, your investment will gain $500. If a yellow ball is pulled out of the bag, your investment will gain $1,000, and if a green ball is pulled out of the bag, your investment will gain $2,000.



Which investment would you prefer? Please circle your preference below:

Stock F Stock G

The second hypothetical investment question (large-dollar-return scenario) is shown below. Some minor differences are present in this study compared to that of Levy and Levy (2002a).
Current Study Question:
Suppose that you decided to invest $10,000 either in stock **F** or in stock **G**. Which would you choose, **F** or **G**, when it is given that the *dollar gain or loss* one year from now will be as follows:

Stock F		Stock G	
Outcome	Probability	Outcome	Probability
-$1,500 Loss	1 out of 2 or 50%	-$3,000 Loss	1 out of 4 or 25%
$4,500 Gain	1 out of 2 or 50%	$3,000 Gain	3 out of 4 or 75%

Please circle your preference below:

Stock F Stock G

Levy and Levy Question:
Suppose that you decided to invest $10,000 either in stock **F** or in Stock **G.** Which
stock would you choose, **F**, or **G**, when it is given that the dollar gain or loss one month from now will be as follows:

F		G	
Gain or Loss	Probability	Gain or Loss	Probability
-1,500	1/2	-3,000	1/4
4,500	1/2	3,000	3/4

Please write F or G:

First, this study attempted to clarify the question by adding the word "outcome" instead of "gain or loss," and adding the words "gain or loss" next to the dollar amount. In this study, the time frame was changed from one month to one year in order to make the investment situation more realistic. Finally, this study added percentages and natural frequencies instead of probability to increase understanding. Borders were added to help convey which outcomes and probabilities referred to Stock F and G.

In addition to the two mixed outcome hypothetical investment scenario questions from Levy and Levy (2002a), two single sided investment scenarios from Kahneman and Tversky (1979) were included. The first hypothetical investment scenario had respondents chose between a sure gain of $3,000 and an 80% chance of a $4,000 gain with a 20% chance of $0 gain. The second hypothetical investment scenario had respondents choose between a sure loss of $3,000 and an 80% chance of a $4,000 loss with a 20% chance of a $0 loss. Both these scenarios were shown in their original format and with the probability displayed visually.

The research question is: Does the way a probability question is framed lead to a change in stock selection? I created a 37-question survey using questions from the Levy and Levy (2001, 2002a, 2002b) studies, displaying the probability information both visually and in the original word problem format. Personal interviews were the primary survey mode. Survey design allowed for randomized survey questions, half of the sample saw the word problem displayed first and half saw the visual depiction question displayed first.

A cluster sample of five census tracts within southwest Lubbock, Texas were chosen as the sample frame. Because this population has a higher percentage of middle-to-upper-income households, they were more likely to own stocks and have experience with hypothetical investment scenarios. A total of 34 blocks were randomly selected; these blocks contained 601 households. The number of completed surveys was 200, for a response rate of 33% collected over seven weeks: October 2 through November 21, 2010. Each household who participated was eligible to receive a $2 bill as an incentive payment for participation.

The dependent variable is whether the respondent selected a different stock when shown a visual display of probability versus the original Levy and Levy (2001) format. The following potentially confounding variables are controlled for in the study: age, education, financial risk tolerance, gender, net worth, and numeracy. To estimate whether stock selection is related to graphical representation of the probability of gains and losses in the scenario, logistic regression analyses were conducted.

Since the dependent variable is binary, logistic regression was selected as the regression method to utilize. Due to the small sample size the analysis was conducted using a parsimonious model of just the most significant variables. The parsimonious model is included to avoid possible over-fitting of the model which Hosmer and Lemeshow (2000) indicates as a common problem with logistic regression analyses.

Parsimonious Model:

Δ Stock Selection = $\beta 0 + \beta 1$ Decision Rationale Probe + $\beta 2$ Financial Risk Tolerance + $\beta 3$*Net Worth + $\beta 4$*Education.

The assumptions for logistic regression were all satisfied, so two logistic regressions were conducted utilizing SPSS.

Results

The sample was more highly educated and had higher income than the average for the region. Table 1 (following this essay) includes the descriptive statistics for the sample. After seeing the visual display of probability information in the small-dollar-return scenario, 65% of respondents preferred Stock F ($500 loss potential), whereas 35% preferred Stock G (no loss potential). Fifty percent of respondents changed stock selection after seeing the visual display of probability in the small-dollar-return scenario. Seventy-five percent of respondents who changed stock selection switched from Stock G (no loss potential) to Stock F ($500 loss potential). In the second mixed outcome scenario respondents have a clear preference for Stock G ($3,000 loss potential) over Stock F ($1,500 loss potential). Sixty-three percent preferred Stock G prior to the visual display

of probability information and 68% preferred Stock G after the probability was visually displayed. Fewer respondents changed their preference in this scenario. Twenty percent, or 39 respondents, changed their stock preference from Stock F ($1,500 loss potential) to Stock G ($3,000 loss potential), whereas 15% (30 respondents) changed their preference from Stock G to Stock F, and 65% (129 respondents) did not change their preference.

A 2 X 2 ANOVA analysis was conducted to determine if there was any order effect to seeing the word problem displayed first. The results of the ANOVA indicate the order of presentation is non-significant as well as the interaction between order of presentation and the stock selected, $F(4,196)=1.38$, $p=.24$. There is a highly significant effect, $F(4,196)=28.26$, $p<.01$, on the type of question (word vs visual) as previously discussed.

After the visual stock scenarios were shown and selections indicated, respondents were asked, "Briefly describe your decision making process for this stock selection." Responses were recorded and then later grouped into five categories of similar responses. In the hypothetical investment scenario, respondents could focus on the dollar amount or the likelihood of the outcome happening, and they could talk in terms of gains or losses. Therefore, four response choices were developed and any response falling outside of one of these four choices was included in a category called "other response".

The qualitative data of stock selection rationale of the small-dollar-return scenario suggests 46.4% of the respondents indicated the decision of stock selection had to do with the potential gains offered, whereas 33.8% of the sample indicated potential losses were the reason behind their selection (refer to Table 2).

Table 2

Answers to Follow-up Question on Small Dollar Return Investment Scenario (n=200)

	Frequency	Percent
75% Chance of Gain	66	33.3%
Smaller Chance of a Loss	22	11.1%
Other Response	12	6.1%
Smallest $ Loss Potential	45	22.7%
Highest $ Potential Gain	26	13.1%
No Response or Refused	29	14.5%

In the small-dollar-return investment scenario, those who chose Stock F (25% chance of a $500 loss, $500 gain, $1,000 gain, or $2,000 gain) tended to focus on the potential gain, whereas those who chose Stock G (50% chance of either $0 loss, or $1,500 gain potential) tended to focus on the no loss outcome. As Table 2 shows, when combining categories, 44.4% of the respondents spoke in terms of percentage or probability of gain or loss, while 35.8% mentioned the absolute dollar value of gain or loss.

The qualitative data of the large-dollar-return scenario suggests 55.6% of the respondents indicated the rationale used to make the decision of stock selection had to do with the potential gains offered by the selection, whereas only 31.3% of the sample indicated potential losses were the reason behind their selection (refer to Table 3).

Table 3

Answers to Follow-up Question on Large Dollar Return Investment Scenario (n=200)

	Frequency	Percent
75% Chance of Gain	89	45.0%
Smaller Chance of a Loss	41	20.7%
Other Response	6	3.0%

Smallest $ Loss Potential	21	10.6%
Highest $ Potential Gain	21	10.6%
No Response or Refused	22	11.0%

In the large-dollar-return investment scenario, those who chose Stock F ($1,500 loss, $4,500 gain potential with a 50% probability of each) tended to focus on the potential loss, whereas those who chose Stock G ($3,000 loss, $3,000 gain potential with a 25% probability of loss, 75% probability of gain) tended to focus on the probability of a gain outcome. As Table 3 shows, when combining categories, the majority of respondents (65.7%) spoke in terms of percentage or probability of gain or loss, while 21.2% mentioned the absolute dollar value of gain or loss.

Table 4 displays the logistic regression results for the small-dollar-return investment scenario. In the regression, people who changed from Stock G to Stock F are compared with the rest of the sample. 74 respondents, or 37% of the sample, changed their investment preference from Stock G to Stock F. The logistic regression results indicate the significant variables are the probe question responses and financial risk tolerance scale. The results indicate those respondents who have lower financial risk tolerance scale scores were less likely to switch from Stock G ($0 loss potential) to Stock F ($500 loss potential). In addition, those respondents who focused on gains, either dollar gain potential or percentage chance of a gain, were far more likely to change from Stock G (75% chance of gain) to Stock F (50% chance of gain).

Table 4

Logistic Regression for Small $ Return Stock G to F Change (Parsimonious Model)

	Coefficient	Odds Ratio	Sig.
Risk Tolerance Scale	**-.114**	**.893**	**.006*** **
Probe Questions (vs Small $ Loss)			
75% Chance of Gain	**2.072**	**7.942**	**.000*** **
Small % Chance Loss	**1.041**	**2.832**	**.077***
Other Answer	-.031	.969	.971
Large $ Gain Potential	**1.168**	**3.215**	**.037** **
Net Worth	-.055	.947	.247
Education (vs High School or Less)			
Some College	-.382	.682	.603
Associate's Degree	-.122	.885	.888
Bachelor's Degree	-.213	.808	.769
Some Graduate School	-.920	.398	.339
Graduate Degree	-1.075	.341	.145

***p<.01, ** p<.05, * p<.10

In the large-dollar-return investment scenario, 39 respondents, or 20% of the sample, changed their investment preference from Stock F (50% chance of loss) to Stock G (25% chance of loss). Of the respondents who changed their selection, 28 or 72%, indicated the reason for making this choice was the greater percentage chance of experiencing a gain on their investement. The logistic regression results indicate no other significant variables.

It is interesting to note the visual display of probability information did not change the number of respondents who preferred the certain outcome (Stock G) in the prospect theory gain question, or the number of respondents who preferred the risky choice (Stock F) in the prospect theory loss question. The responses are very similar to the responses from previous research by Kahneman and Tversky (1979) and Levy and Levy (2002b). Eighty-two percent of the sample preferred Stock G (a sure gain of $3,000), whereas 75% of the sample preferred Stock F (a 20% chance of no loss and an 80% chance of a $4,000 loss).

Discussion

The Levy and Levy (2002a) prospect theory questions were replicated in this study utilizing a cluster random sample and collecting qualitative data about the rationale behind respondent stock choice selection. The results from a randomly selected sample are the opposite of those found in the Levy and Levy (2002a) article. The results from the current study support the S-shaped function of the prospect theory curve by showing that the majority of respondents prefer Stock G over Stock F, when Stock G dominates Stock F by prospect stochastic dominance (see Levy & Levy 2002a). In the large-dollar-return investment scenario, this study finds 63% chose Stock G, whereas in Levy and Levy's (2002a) convenience sample only 23% chose Stock G. Table 5 summarizes the results of the two studies.

Table 5

Comparison of Results

	F	G	Indifferent
Levy & Levy 2002a (n=180)	76%	23%	1%
Griesdorn 2010 (n=200)	37%	63%	0%

In the next question with small-dollar returns, the results are more similar to Levy and Levy's (2002b) findings, although still in the opposite direction. See Table 6 for a summary of the results.

Table 6

Comparison of Results

	F	G	Indifferent
Levy & Levy 2001 (n=194)	54	44	2
Levy & Levy 2002b (n=260)	47	51	2
Griesdorn 2010 (n=200)	40	60	0

These results indicate people are risk averse when given a word problem question and an option that has no potential loss. More than half (60%) of respondents chose the option with no potential loss, consistent with prospect theory.

The study finds a significant difference in hypothetical stock preference when additional probability information is presented in the form of graphical representation. When respondents were shown questions with a visual display of the probability percentages, a majority chose the Stock with a higher percentage chance of a gain. This indicates a willingness to accept some risk for a greater percentage chance of a gain outcome. This study also shows people tend to focus more on possible gains than losses when making initial investment decisions. Seventy-three percent of respondents focused on the percentage chance with each gamble versus 22% of respondents who focused on dollar amounts.

In the small-dollar-return investment scenario, those who chose Stock F ($500 loss, $500 gain, $1,000 gain, $2,000 gain potential with a 25% probability of each) indicated the rationale for their decision was based upon the potential gain, whereas those who chose Stock G ($0 loss, $1,500 gain potential, 50% probability of no loss, 50% probability of gain) said they preferred it due to the no loss outcome. Regardless of the order in which questions were presented, more of the respondents (65%) preferred Stock F when the probability information was visually displayed. This result is contrary to what would have been expected with prospect theory. Since

each outcome has the same value statistically speaking, prospect theory would have suggested a preference for Stock G since it has no loss potential. However, respondents preferred Stock F over Stock G by almost a two to one margin. Respondents were also far more likely to change their stock selection in this scenario with 50% changing their response from their first indicated preference. Of the respondents who changed their preference, 75% changed from Stock G to Stock F, and only 25% changed from Stock F to Stock G. The respondents who changed their mind from Stock G to F indicated the reason for their selection was due to the greater probability of gain associated with Stock G, whereas those who changed their preference to Stock F from G indicated the small dollar amount of loss as the reason for their decision. A $500 loss on a $10,000 investment over a one year period of time would equate to 5% loss, and this value may be close enough to zero for respondents to react like prospect theory suggests. Anecdotally, several of the respondents indicated a $500 loss as being small enough to absorb for a 75% chance of a gain; however, it is impossible to determine the number of respondents who felt that way based on the data available.

Only 17% of the survey respondents indicated they work with a financial planner or advisor when making investment decisions. A recent study by Certified Financial Planner Board indicates that approximately 28% of all Americans used a financial planner or advisor during the 2008 to 2010 timeframe, which was only slightly less than in previous years (Drummond, 2010). The low utilization of financial planners and advisors may be due to the region in which the current survey was conducted. The use of financial advisors and planners has been demonstrated to increase stock allocations (Miller & Montalto, 2001) and this lack of reliance on financial planners may partly explain why portfolio allocations to cash were 40% on average among this sample.

Implications

In the small-dollar-return scenario, when respondents had a choice between Stock F with a 50% chance of no loss or gain and a 50% chance of a $1,500 gain; or Stock G with a 25% of a $500 loss, a 25% chance of a $500 gain, a 25% chance of a $1,000 gain, and a 25% chance of a $2,000 gain; respondents were strongly influenced by the addition of a visual display of probability to the question. In the word problem question format, 60% of respondents were selecting the option with no loss potential as suggested by prospect theory. When the probability was visually displayed, only 35% of respondents preferred this option. The research with the small-dollar-return investment scenario suggests the S-curve shape of prospect theory may not be as steep for losses that are close to zero. Fully 65% of respondents were willing to take a small risk of $500 for a greater likelihood of a gain in their investment. The change in preference could be due the increased attention given to the probability information. The process of encoding the question into memory might have been facilitated by the use of a visual depiction.

This study indicates the criticisms of prospect theory as suggested by Levy and Levy's research may need future study for validation. This research provides evidence which is contrary to the Levy and Levy (2001; 2002a; 2002b; 2006) findings and suggests the need for replication in larger studies with randomly selected samples. Support for prospect theory is indicated by 65% of respondents choosing Stock F which has prospect stochastic dominance over Stock G.

It is interesting to note that neither the subjective numeracy scale nor the financial risk tolerance scale was significant in predicting stock selection in the hypothetical investing scenarios. It is possible that the subjective numeracy scale is subject to a social desirability bias and should not be utilized in a face to face interview mode with a financial topic. A numeracy scale that relies on mathematical computation may be better in these circumstances. The lack of correlation between the financial risk tolerance scale and investor stock preferences indicates the need for enhanced dialogue between financial planners and their clients when determining investment selections. A financial planner cannot simply administer a financial risk tolerance profile questionnaire and assume the results from this profile will be able to help them predict the client's investment preferences. This study indicates some investors with similar financial risk tolerance profile scores would be willing to take some risk of loss for potential investment gains, while others would prefer to have no loss exposure. Clarification of these types of investment scenarios is needed so the expectations between client and financial planner can be clearly established.

Limitations

A number of limitations with regard to the study need to be acknowledged. The sample size is small and fairly homogeneous in nature. Future studies would benefit from a larger sample size that includes respondents randomly chosen from more than one metropolitan area.

It is possible by clarifying the hypothetical investment scenario questions with the word "outcome" instead of "gain or loss" and using both a natural frequency "1 out of 4 or 25%" for probability estimate changed the results. However, if this is the case the Levy and Levy findings are not very robust if minor changes could create a large difference in results. It seems more likely that the use of a random sample versus the convenience sample of students, professors, and practitioners caused the different results.

It is impossible to determine what affect the recent stock market returns and the economic recession has made on respondent decision-making. The availability bias (Thaler & Sunstein, 2008) indicates more recent events or events that are easier to recall have a stronger influence on decision-making than events that are harder to recall. This bias could have influenced the respondent's willingness to take risk in hypothetical investing scenarios versus previous studies utilizing the same questions.

It is possible some interviewer bias and social desirability bias have occurred with the study. In particular, the social desirability of being good with math for the subjective numeracy scale is a concern. The scale has a potential range of 8 to 48, but the sample results range was 25 to 48 with a mean score of 39.4. Perhaps the use of a numeracy scale that asked respondents to calculate answers to mathematical problems would have been a more accurate measure of actual numeracy skills.

When respondents were given a visual representation of probability they tended to talk in terms of probability. Future studies could be improved by asking the same probing questions after the word problem format questions as well. A review of literature reveals a lack of qualitative studies on hypothetical investment scenarios. Researchers ask quantitative hypothetical questions and then go on to infer the respondent motivation that corresponds with their answers. A better way to understand respondent choice and decision-making may be to ask them to explain their decision-making process directly after the answer selection. The addition of open-ended follow-up questions to nationally conducted surveys such as the NLSY79 and Survey of Consumer Finances (SCF) would enable researchers to test additional hypotheses of consumer behavior. Qualitative questions like the one included in this study should be considered for future research in behavioral economics. With additional information about the investment decision-making process, educators and researchers could develop more effective tools to help households make more informed investment decisions.

Table 1

Descriptive Statistics

	Mean	Std. Dev.
Subjective Numeracy Scale (8-48)	39.49	4.84
Risk Tolerance Scale (13-48)	24.85	4.92
Net Worth (1-12) (7=150-200k)	7.29	3.89
Income (1-6) (3=100-125k)	3.08	1.65
Year Born	1958	17.12
Age	52	17.12
% of Investments Currently in Cash	40%	35.58
% of Investments Currently in Bonds	18%	22.77
% of Investments Currently in Stocks	39%	31.31
% of Investments Currently in Other	3%	11.04

	% Meeting Condition
% Who Changed Stock Selection (Large $)	35%
% Who Changed Stock Selection (Small $)	50%
Income Category	
Under $50k	18%
$50k to $75k	27%
$75 to $100k	20%
$100 to $125k	16%
$125 to $150k	4%
Over $150k	16%
Refused/Did Not Answer	2%
Net Worth Category	
$0 or less	5%
Up to $25k	12%
$25k to $50k	7%
$50k to $75k	8%
$75k to $100k	7%
$100k to $150k	6%
$150k to $200k	3%
$200k to $250k	7%
$250k to $300k	5%
$300k to $400k	9%
$400k to $500k	6%
Over $500k	24%
Refused/DK/Did Not Answer	4%
% of Resp. Who Saw Word Problem Format 1st	49%

Table 1 (continued)

Descriptive Statistics

Marital Status	% Meeting Condition
Never Married	8%
Married	82%
Divorced or Separated	3%
Widowed	4%
Significant Other/Partner	3%
Gender	
Male	62%
Female	38%
Educational Attainment	
High School Graduate or Less	7%
Some College	23%
Associates Degree	8%
Bachelor's Degree	26%
Some Graduate School	8%
Graduate Degree	30%
Investment Decision Maker	
I Make the Decisions	41%
Spouse Makes the Decisions	8%
Decisions are Made Jointly	32%
Rely on Professional Advice	17%
There Are No Investment Assets	3%

n=200

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