

# **“Sprechen Sie Bias?” An investigation of cultural differences in behavioral finance biases between Germany and the United States**

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## **Abstract**

Using samples consisting of U.S. and German students, it is investigated whether responses differ in problems involving loss aversion and mental accounting. We also assess whether U.S. and German students respond differently to a cognitive reflection test. The results indicate that the German sample was markedly less biased on questions of economic utility and probabilistic outcomes, and that their responses tended to support expected utility theory. Conversely, it appears that there is little difference between the American and German students in the area of mental accounting. Moreover, the cognitive reflection results indicate that German students are more patient and more reflective in answering the survey.

Keywords: behavioral finance, mental accounting, loss aversion, prospect theory, cognitive reflection

## I. Introduction

Behavioral finance is a relatively new branch of financial research with roots in behavioral economics. The Efficient Market Hypothesis (EMH), an idea conceptualized by Harry Roberts (1967), posits that prices of securities are unbiased, in that the observed price is representative of all public information, and that investors assimilate information perfectly and consistently. Since biases represent interesting, yet anomalous events in the context of the EMH, their application or perceived frequency of occurrence may be over-extrapolated. Furthermore, self-reported behaviors may vary between different groups based on demographic and geographic circumstances and application may be much narrower (broader) than expected.

Behavioral theory acknowledges that individuals do not always behave in their own self-interest. However, classic economic models require that individuals not only maximize personal utility, but that they are Bayesian information processors, that they assess final outcomes over incremental changes, and that they exponentially discount future well-being (Rabin, 2002). Since people make up the market, it is impossible to segregate human behavior from market events. It is difficult however, to apply broad psychological research to financial behavior in specific market settings (Hirshleifer, 2001). Thus, most of the analysis within behavioral finance is staged around suspected biases and observed market events, with mixed results. Behavioral Finance draws from Behavioral Economic Theory and provides explanatory models for commonly observed departures from classic economic theories such as Expected Utility Theory. Daniel Kahneman and Amos Tversky (1979) put forward an alternative to Utility Theory, a rational model of choice under risk, and replaced it with Prospect Theory, an economically irrational, yet observable model of gambling in losses and risk-aversion in gain. Brad Barber and Terence Odean have written extensively on confidence bias, excessive trading, and correlations with factors such as gender (Barber & Odean, 2001) and internet trading vehicles (Barber & Odean, 2001). Richard Thaler (1999) has analyzed the tendency of individuals to assign economic events to mental accounts based on biased value estimates.

Thus, the current body of financial research, though still young by comparison to behavioral psychology or economics, is replete with analysis of application of behavioral bias to investment behavior. Given the limited application of psychology to case-by-case market situations, cross-cultural applications of behavioral finance must require further case analysis. However, economic research has not fully explored the significance of cultural differences in economic decision-making (Levinson & Peng, 2007).

This paper investigates the comparative responses to questions measuring Cognitive Reflection, Prospect Theory, and Mental Accounting among college students surveyed in Florida and Germany. This study tests whether there are any perceived differences in three particular biases across certain demographic and geographic barriers. Results could be the foundation for future investigations of differences across various geographic boundaries and areas of emerging financial markets versus well-established markets. Financial theorists, economists, and institutional investors should want to know which groups tend to manifest certain biases so as to understand possible methods of evaluating, exploiting, and/or controlling for mental accounting, prospect theory, and cognitive reflection in various markets. The results of this study provide useful comparative data on behavioral biases between students of different geographical and cultural influence. Surprisingly, very few studies have to date have investigated the differences in behavioral biases across various cultural and geographic boundaries. However, Justin D. Levinson and Kaiping Peng (2007) have conducted an empirical study in the United States and

China assessing the influence of cultural background on economic decision-making in terms of financial valuation and property ownership rights. Their study found dramatic cultural differences in expression of biases related to framing, morality, and out-group information.

The present research contributes to the existing literature in several ways. First, since these college students will be tomorrow's investors, differences in their biases could affect stock prices in each country and also result in different levels of market efficiency across the two countries. For example, a finding that U.S. students tend to exhibit excessive loss aversion relative to German students could result in higher stock market variability during bear markets in the U.S. versus Germany once these students start investing. Clearly, this would be an important finding for not only domestic investors but also for foreign investors investing in markets exhibiting a high level of a certain bias.

Second, speaking from a global market perspective, an investigation of cultural differences in behavioral biases is also important, as current and future portfolios are increasingly diversified not only within a given country, but relative to the global stock market. A 2004 study by Ahearne, Griever, and Warnock concluded that although foreign securities make up roughly 50% of all traded equity in the world portfolio, only 20% of the equities traded in the U.S. are foreign securities and U.S. investors tend to hold only approximately 12% in foreign assets. However, the Black-Litterman portfolio optimization model recommends weights using a combination of the Capital Asset Pricing Model (CAPM) developed by Markowitz (1959) and subjective analysis of investor risk preferences. Regardless of the portfolio model applied, markets and individual investors are increasingly subject to cross-cultural investor behavior. Consequently, different behavioral biases across countries would have to be aggregated to truly determine whether behavioral biases affect stock markets on a global versus country level. It is possible that behavioral biases are very pronounced in one country but are rendered irrelevant on a global basis once multiple countries are considered. In other words, it is possible that behavioral biases in one country can be diversifiable on a global basis.

Third, identifying differences in behavioral biases across geographic and cultural boundaries can be important from a pedagogical standpoint. If we can identify significant behavioral biases in college students in one country to which virtually all students are prone, then finance courses should be approached with the goal in mind to eliminate those biases from investment behavior. Alternatively, a classroom approach could identify methods to potentially exploit these biases present in the market. When one of our authors taught a finance course in Germany, he asked students in the classroom a set of typical behavioral finance questions aimed at gauging overconfidence. One of the questions typically raised is, "how many of you believe you are above-average drivers?" Usually when this question is raised in U.S. classrooms, far more than half of the students believe they are above-average. Obviously, everyone cannot be above-average. However, when our professor asked the same question of students in Germany, surprisingly, the group responded quite differently than U.S. students typically did. Far less than half raised their hands. This begged the question: can behavioral biases be applied without prejudice to individuals in various markets all over the world?

The remainder of this paper is organized as follows. Section II presents an overview of the related literature in prospect theory, cognitive reflection, and mental accounting. The data and methodology is discussed in Section III. Results are presented in Section IV. Section V concludes.

## II. Literature Review

Prior theoretical and empirical literature on Prospect Theory, Cognitive Reflection, and Mental Accounting addresses the occurrence of apparent biases in behavior of investors around market events. Each of these areas will be discussed next.

Prospect Theory (Kahneman and Tversky, 1979, Tversky and Kahneman, 1992) is an explanatory model which both expands upon and in some ways contradicts Expected Utility Theory (Savage, 1954). While expected utility theory predicts that individuals will choose between risky events in direct relation to their probability of occurrence and return (probability of occurrence multiplied by return), prospect theory explains the preference of individuals for certain events, or the “certainty effect.” For example, when individuals are presented with two outcomes: a 100% chance of winning \$3,000 or an 80% chance of winning \$4,000, they will prefer the certain \$3,000 (Allais, 1953). Although the two choices present the same probability of return, individuals value the certain outcome over the uncertain, yet higher-return outcome. This occurs despite the fact that the second outcome is of a higher economic value: \$3,200.

Additionally, prospect theory implies a tendency of investors to gamble in losses while expressing risk aversion in gains, thus implying an “S” shaped value function. That is, utility is increasing at a decreasing rate for gains and decreasing at a decreasing rate for losses. This value function implies that individuals are loss averse, particularly for small losses. Moreover, as the example above illustrates, unless an individual’s utility increases more for an additional dollar gain than the accompanying increase in uncertainty, the individual will prefer to choose a certain dollar amount over an uncertain amount.

The reference point, the point at which the curve changes from concavity to convexity, the determinants of which have not been adequately proven, seems to be chosen arbitrarily and irrationally (Kahneman and Tversky, 1979). While the reference point is often chosen arbitrarily, a good example of a reference point would be a purchase price for a stock. A study by Thomas J. George and Chuan-Yang Hwang (2004) provides evidence that may suggest that stock market investors anchor against the 52-week high price of a stock.

This “Anchoring effect” associated with the S-shaped value function can be likened to a first impression, or a convenient number which tends to stick beyond rational explanation. Values below this figure are considered losses, values above, gains. For instance, if an investor purchases a stock for \$50 per share, he or she will consider any current stock price above \$50 to be an unrealized gain and any current stock price below \$50 to be an unrealized loss. Even after some time passes wherein these initial first impressions may be adjusted, the values tend to be “sticky,” that is, the first impression is difficult to overcome. Research by Mussweiler and Strack (1999a, 1999b, 2000, 2001b, Strack and Mussweiler, 1997) has suggested that this value stickiness is linked to enhanced availability of anchor-consistent information. The tendency of individuals to choose these values hastily and irrationally has implications for the second bias analyzed in this paper, Cognitive Reflection.

The literature on Cognitive Reflection and the Cognitive Reflection Test (CRT) address two types of decision-making processes: those which are made hastily and those which require deliberation (Epstein, 1994; Sloman, 1996; Chaiken and Trope, 1999; Kahneman and Frederick, 2002). These two types of decision-making processes were termed “System 1” and “System 2” by Stanovich and West (2000). System 1 processes are problem-solving processes which are hasty and involve little if any reflection such as recognizing a friend’s face; System 2 processes are slower and require a moment’s reflection, such as “what is the square root of 19163?”

(Frederick, 2005)” In the second question, there is no doubt that the individual should reflect on the response. However, some questions at first seem simple but are not. Interestingly, some individuals discern that the “obvious answer” is actually incorrect and allow themselves more time to determine the correct answer. System 1 processes have been termed “thin-slicing” by Malcolm Gladwell (2005, 2007) in his best-selling book “Blink.” Essentially, thin-slicing is the use of heuristics to solve problems based on a narrow (as opposed to broad) analysis. It is this process of System 1 decision-making which Shane Frederick has thoroughly analyzed through questions in which a spontaneous response elicits an incorrect answer. Nagin and Pogarsky (2003) subsequently linked inaccurate System 1 decision-making to the tendency to cheat on trivia questions. Such impatience of certain respondents has also been linked to poor subsequent performance on standardized tests (Shoda Mischel, and Peake, 1990).

The final bias discussed in this paper is Mental Accounting, defined by Richard Thaler as “the set of cognitive operations used by individuals and households to organize, evaluate, and keep track of financial activities (1999).” Three aspects of mental accounting dominate the current body of research and are tested for in our survey: how individuals perceive value (or loss) from activities, how broadly or narrowly mental accounts, or “decision frames” are defined, and how frequently individuals evaluate the status of their accounts. The first aspect, the perception of value, is taken from Kahneman and Tversky’s (1979) prospect theory, and utilizes the same ‘s’-shaped value function. Again, the emphasis of this analysis is that losses (gains) are evaluated relative to a chosen reference point, that evaluation reflects diminishing sensitivity in accordance with the Weber-Fechner law, and that loss aversion exceeds yield pleasure, that is, individuals fear losses more than they value gains. Decision frames or ‘mental accounts’ may be determined temporally, geographically, or categorically, and are subject to change (Thaler, 1999). Read, Loewenstein, and Rabin (1999) term the third element ‘choice bracketing,’ and define it as both the temporal context in which accounts are analyzed and the breadth of that analysis.

Behavioral Economics has implications for financial valuation and investing strategies. Prospect theory and confidence bias provide impetus to arguments for momentum investing. Scott, Stump, and Xu (1999) linked overconfidence bias to arbitrage opportunities in certain types of stocks categorized by past performance and future growth prospects. Hersh M. Shefrin and Meir Statman have linked investor preference for dividends to theories about investors’ self-control (Thaler and Shefrin, 1981) and theories of choice under uncertainty (Kahneman and Tversky, 1979). Schlarbaum, Lewellen, and Lease describe prospect theory-supporting behavior in the market as the disposition of investors “to sell the winners and ride the losers” (1978). Shefrin and Statman link prospect theory, mental accounting and framing bias to the reluctance of investors to engage in tax swaps. Constantinides (1983), (1984) has developed a strategy that allows investors to swap one losing stock for another financially identical stock so as to capitalize on the loss in value for tax purposes while still maintaining the same financial position. However, studies have indicated that investors demonstrate an aversion to “closing the account” of the losing stock at a loss despite the stochastic dominance of the tax swap to continuing to hold the loser. Leroy Gross (1982) in his manual for stock brokers, calls the tendency to hold losers “getevenitis” and remarks that many investors irrationally hold losers hoping to recover to some reference point, often the purchase price of the stock. Shefrin and Statman find that the market anomaly known as the “December effect,” or concentration of stock and mutual fund losses in December, is consistent with a combination of tax considerations and the tendency of investors to hold losers and sell winners. Barberis and Thaler (2003) link investor’s preferences for portfolio weighting between T-bills and Stocks to be naively chosen and somewhat

determined by loss-aversion even in the face of a large equity premium. Benartzi and Thaler (1995) called the combination of observed loss aversion and frequent account evaluations *Myopic Loss Aversion* and used it as a possible explanation of the equity premium puzzle put forth by Mehra and Prescott (1985). They use loss-aversion to explain the reluctance of investors to purchase stocks even when faced with a sizable equity premium (Benartzi and Thaler, 1995). Shefrin and Statman (1985) call the tendency to hold losers the “disposition effect” wherein investors are unwilling to sell an asset trading at a loss. This tendency has been documented in the buying and selling behaviors of professional futures traders (Locke and Mann, 1999) and Israeli investors (Shapira and Venezia, 2001). The same tendency has been documented in the housing market by Genesove and Meyer (2001) where homeowners facing a loss tended to set higher reservation prices and transact at higher prices than owners facing a gain. In these cases, owners facing losses actually transacted at a higher price, indicating that loss aversion has implications for price adjustments in the housing market. Reference points do not have to be determined by purchase price. Barber and Odean (1999) in their analysis of over 78,000 households between 1991 and 1996 found that price path may be a source of reference points in addition to purchase price. Mental Accounting and Prospect Theory may work together to influence how investors evaluate decisions; DeGeorge, Patel, and Zeckhauser (1999) found that reference points appear to change over time, often with respect to how a decision is framed. When purchase price is not available, reference points may be determined by 52-week highs. Heath, Huddart, and Lang (1999) found that employees receiving stock options were more likely to exercise options when the stock exercise price was above the previous year’s maximum or the stocks had recently appreciated. Similarly, Grinblatt and Keloharju (2001) found that among all Finnish investors between 1995 and 1996, investors were more likely to sell stocks which had outperformed the market in the last month. Investors also tended to hold losers for longer periods as losses increased. Reference points and perceived gains (losses) have implications not only for holding periods but for risk preferences. Coval and Shumway (2000) found that among professional traders at the Chicago Board of Trade, individuals experiencing losses (profits) by the middle of the trading day tended to demonstrate more risk – taking (risk-averting) behavior in the afternoon. Grinblatt and Han (2001) show how prospect theory translates into asset pricing: investors seek to sell stocks with paper gains and avoid selling stocks with paper losses. This means there is selling pressure on winners, which artificially depresses price and therefore increases post-sell gains, further emphasizing the economic irrationality of the decision. Similarly, investors holding losers place higher initial reservation prices on their sale and therefore increase losses later on. Barberis, Huang, and Santos (2001) find that investors derive utility not only from the consumption of wealth but from the fluctuations in value of financial holdings from day to day. Their 2001 study found asset growth to be only weakly correlated with consumption growth. That is, individuals experience utility and pain from the paper gains and losses they experience, not just the consumption of wealth. Additionally, in the context of a sequence of gains (losses) individuals were found to be less (more) risk averse. The cognitive reflection questions have implications for investor behavior in terms of overconfidence and decision-making. Barber and Odean (2002) have linked access to information with overconfidence and overconfidence with excessive trading (2001). Overtrading has been statistically linked to portfolio losses when compared to less-active trading. Thus, prospect theory, mental accounting, and cognitive reflection all hold meaningful implications for individual and institutional investors and the behavior of the market as a whole.

Cross-cultural behavioral finance and economics research is quite scarce. Cultural Psychologists have developed three broad plains from which they may explain cultural differences: individualism versus collectivism (Hofstede, 1980, Triandis, 1995), independence versus inter-dependence (Markus & Kitayama, 1991), and cognitive processing (Nisbett, Peng, & Choi, 2001). In particular, the 2001 study by Nisbett et al. found that while Westerners tend to make valuations based on analytic cognitive processes, Chinese participants tended to make more holistic assessments of valuation. Morris and Peng (1994) found that when groups of U.S. participants and Chinese participants were asked to describe the movements of simulated fish, the Chinese tended to develop explanatory models based on the group of fish while westerners described only the individual fish in the foreground.

While prior research has analyzed the apparent existence of behavioral biases around certain market events, this paper uses survey questions adapted from previous research to measure differences or similarities between two groups of business students. While social scientific researchers have measured for and found certain style differences in perceptions through cross-cultural studies, we are concerned with differences in responses to objective questioning using the questioning methods employed in past analysis of Prospect Theory (Kahneman & Tversky, 1979), Cognitive Reflection (Frederick, 2005), and Mental Accounting (Thaler, 1999). Even limited evidence of differences in responses to these particular bias-targeting questions may provide a basis for reevaluating the attribution of such biases to the whole population, while they may in fact be unique to a small group.

### **III. Data and Methodology**

To test for different behavioral biases in the areas of prospect theory, cognitive reflection, and mental accounting, we utilized two independent samples from The University of North Florida (UNF) and the Cologne University of Applied Sciences in Germany (CUAS). The sample from UNF consists of 311 general business students, while the sample from CUAS consists of 46 insurance students.

Because this study is designed to test for possible limits to the application of current bias research, it was vital that the problems, questions, and scenarios presented therein be exactly the same as the questions used in previous tests. For that reason, all 44 of the survey questions designed to measure bias were taken from studies on Prospect Theory (Kahneman & Tversky, 1979), Cognitive Reflection (Frederick, 2005), and Mental Accounting (Thaler, 1999). Additionally, ten demographic questions were included to further classify respondents according to age, gender, prior investment experience, and other economic and social characteristics which help us to identify demographic differences in the samples. The U.S. sample was 51.79% male, were mostly full-time students (42.48% taking four classes or more), and 99.35% had completed at least one statistics course. The German sample was 71.11% male, were also considered full-time with 90.91% taking 2 or more classes in the current term. Similarly, 95.46% of the German students had completed at least one statistics course.

The survey was administered at the University of North Florida to two different sections of students, a day class and an evening class, who were enrolled in Financial Management, or FIN 3403 in the spring of 2007. Participation in the survey was optional and students were offered extra credit for completing all or part of the survey. Reward for participation is not unprecedented in such research; most respondents in Shane Frederick's original CRT were paid \$8 to complete the 45-minute survey (Frederick, 2005). The survey was administered via an

electronic web portal which students must access for most of the classes at the university. Answers posted anonymously to the site and students were instructed not to discuss the survey with others. This is mostly a concern on the CRT portion of the test, where a tendency to rush to name correct answers has been linked to cheating (Nagin & Pogarsky, 2003). See Table 1 in the Appendix.

Students were allowed to complete the survey via the electronic site from any computer with internet access, using their unique student passwords. Students had an unlimited amount of time to complete the survey given a two-week interval. To stress the importance of providing nonrandom answers, students were informed that the results would be compared to another school and would be part of an academic study, although the purpose of the study was not revealed to the students.

For the CUAS sample, the survey was first translated into German as a collaborative effort between two students (who were part of the sample) and a German professor. The translated version was then sent back to the US, where it was back-translated into English by a German-speaking professor. The back-translated survey was identical to the original English version in all material aspects.

Students in Germany were given instructions which were identical to the UNF instructions, with two differences. Because the German university does not utilize a web portal, and since German students are not always expected to come to class, we decided to allow students to email the survey results back to the professor. Although this does not result in strict anonymity, students were informed that there was no interest in the relationship between students and their answers. Another difference between the US and German sample is that the German students were not offered extra credit for the completion of the survey, which is very rarely done in Germany. Instead, students were informed that completion of the survey was a general course requirement and expected.

Based on the limited observation of classroom responses to behavioral bias questions, and the previous studies on patience and decision making, we investigate two hypotheses: H1: German students score differently than U.S. students on the CRT and exhibit some difference in biases in Mental Accounting and Prospect Theory (loss aversion and certainty preference). H2: Cognitive Reflection is a significant predictor of less biased decision making.

## Results

### Loss-Aversion and Prospect Theory

In the loss-aversion category, for eight out of fifteen questions, the German sample contradicted the hypotheses of Loss Aversion while the U.S. sample contradicted the hypotheses for only three out of fifteen questions. For question set including number five and six, the respondent is asked whether they would prefer a 50% chance to win a three-week tour in England, France, and Italy or a one-week tour of England, with certainty. As expected, both the U.S. sample and the German sample showed a preference for the certain outcome. However, for the second choice in the set: a 5% chance to win a three-week tour of England, France, and Italy or a 10% chance to win a one-week tour of England, the German sample showed a preference for the one week, England-only option once again. The certainty theory posits that an introduction of risk into the choices will skew the responses negatively by more than the increased risk of the negative outcome (the 90% chance to win nothing which corresponds to that choice). That is, certainty holds a higher utility than is explained economically. See Table 2 in the Appendix.

7. Choose between receiving the following payments and their corresponding chance (probability) of occurring.

a) \$6,000 with a probability of 45% and \$0 with a probability of 55%.

b) \$3,000 with a probability of 90% and \$0 with a probability of 10%.

8. Choose between receiving the following payments and their corresponding chance (probability) of occurring.

a) \$6,000 with probability of 0.1% and \$0 with a probability of 99.9%.

b) \$3,000 with a probability of 0.2% and \$0 with a probability of 99.8%.

The German sample preferred the more risky option in question seven (part a), although the outcomes were economically equal [ $3,000 \times .90 = 2,700$  versus  $6,000 \times .45 = 2,700$ ]. In question eight, the positive outcome is possible but not probable. Prospect theory holds that investors would choose the larger payout option when winning odds are slim, similar to the high buy-in observed when lottery payouts grow larger. For the German sample, the effect was actually the opposite; 84.78% preferred the lower payout of 3,000 with a probability of 0.2%. The US sample, on the other hand reinforced prospect theory; respondents favored the more certain outcomes, choosing the 90% certain value in number seven and preferred the higher dollar amount when winning was highly improbable [ $6,000 \times .001 = 6$  versus  $3,000 \times .002 = 6$ ] in number eight.

Question 9 is designed to assess the Isolation Effect, wherein investors ignore the information which is common to both options and make decisions solely on differences between the two options. Conversely, Rational Economic decision making yields preferences based solely on the probability of final states and their corresponding outcomes. In question 9 respondents were asked the following:

*Consider the following two-stage game. In the first stage, there is a probability of 75% to end the game without winning anything, and a probability of 25% to move into the second stage. If you reach the second stage you have a choice between receiving:*

a) \$4,000 with a probability of 80% and \$0 with a probability of 20%.

b) \$3,000 with certainty.

73.62% of the U.S. respondents chose the certain 3,000, indicating that the first stage of the game, being common to both choices, was eliminated from the decision-making process, a behavior consistent with prospect theory. For the German sample, 65.22% chose the first outcome, a choice consistent with economically rational decision-making. The mathematical calculation for the probable outcomes would be  $0.25 \times 0.80 = .20$ ,  $0.20 \times 4,000 = 800$ . And  $0.25 \times 1.0 = 0.25$ ,  $0.25 \times 3,000 = 750$ . Thus, the 65.22% of the German sample who chose choice a) selected the economically larger probable outcome while 73.62% of the U.S. sample who selected b) clearly expressed decision-making under the isolation and certainty effects.

In questions 10 and 11, the differences in choice when outcomes are represented in the context of recent events:

*10) In addition to whatever you own, you have been given \$1,000. You are now asked to choose between receiving:*

- a) \$1,000 with a probability of 50% and \$0 with a probability of 50%.*
- b) \$500 with certainty.*

*11) In addition to whatever you own, you have been given \$2,000. You are now asked to choose between receiving:*

- a) -\$1,000 with a probability of 50% and \$0 with a probability of 50%.*
- b) -\$500 with certainty.*

This question set tests whether respondents are risk-averse for positive prospects and risk-seeking when faced with losses. Interestingly, the German sample showed a preference for risk in both gains and losses, choosing the riskier, yet economically equal outcome in the context of both a \$1,000 (71.11% chose the risky option) and a \$2,000 gain (62.22% chose the risky option). A slight difference in the responses (8.89%) shows some additional preference for the risky choice in gains.

In questions 14 and 15, choices test whether very low probabilities are over-weighted. When faced with the very small probability of a rare yet possible catastrophe, individuals prefer a sure loss (or an insurance payment) which is economically larger than the probabilistic loss alternative.

*14) Choose between receiving the following payments and their corresponding chance (probability) of occurring.*

- a) \$5,000 with a probability of 0.1% and \$0 with a probability of 99.9%.*
- b) \$5 with certainty.*

*15) Choose between receiving the following payments and their corresponding chance (probability) of occurring.*

- a) -\$5,000 with a probability of 0.1% and \$0 with a probability of 99.9%.*
- b) -\$5 with certainty.*

Of the German sample, 71.74% chose the certain \$5 gain in the first problem while only 44.44% of the U.S. sample chose the sure gain. Additionally, when faced with the small probability of a catastrophic loss, 71.11% of the German sample was willing to take their chances as opposed to

“purchasing the insurance” loss of \$5. Conversely, 64.17% of the U.S. sample chose the sure \$5 loss.

### **Mental Accounting**

To assess mental accounting, respondents are asked questions which are designed to gauge the reliance on frames and decision context when assigning value to economic events. In the first question set, students were asked whether they would drive across town to save \$5 in each of the following situations. See Table 3 in the Appendix.

*1) Imagine that you are about to purchase a jacket for \$125 and a calculator for \$15. The calculator salesman informs you that the calculator you wish to buy is on sale for \$10 at the other branch of the store, located 20 minutes drive away. Would you make the trip to the other store?*

- a) Yes*
- b) No*

*2) Imagine that you are about to purchase a jacket for \$15 and a calculator for \$125. The calculator salesman informs you that the calculator you wish to buy is on sale for \$120 at the other branch of the store, located 20 minutes drive away. Would you make the trip to the other store?*

- a) Yes*
- b) No*

The context of the larger purchase has a tendency to diminish the savings of driving to the other stores. That is, many people look at the value of the savings as a percentage of the entire purchase. Any difference in responses to the two questions within the set indicates that decision frames have an effect on choice. For the U.S. sample, 16.34% would drive across town in scenario 1, while 9.51% would do so in scenario 2. For the German sample, 22.22% would drive across town in scenario 1, and only 8.89% would do so in scenario 2. Thus, the context of a higher purchase had some effect on both groups though both expressed aversion to traveling across town for the savings.

In question 3 and 4 students are asked a maximum purchase price for a beer purchased at a run-down grocery store versus a fancy resort:

*3) You are lying on the beach on a hot day. All you have to drink is ice water. For the last hour you have been thinking about how much you would enjoy a nice cold bottle of your favorite brand of beer. A companion gets up to make a phone call and offers to bring back a beer from the only nearby place where beer is sold (**a fancy resort hotel**). He says that the beer might be expensive and so asks how much you are willing to pay for the beer. He says that he will buy the beer if it costs as much or less than the price you state. But if it costs more than the price you state he will not buy it. You trust your friend, and there is no possibility of bargaining with the bartender. What price do you tell him?*

*4) You are lying on the beach on a hot day. All you have to drink is ice water. For the last hour you have been thinking about how much you would enjoy a nice cold bottle of your favorite*

*brand of beer. A companion gets up to make a phone call and offers to bring back a beer from the only nearby place where beer is sold (a small, run-down grocery store). He says that the beer might be expensive and so asks how much you are willing to pay for the beer. He says that he will buy the beer if it costs as much or less than the price you state. But if it costs more than the price you state he will not buy it. You trust your friend, and there is no possibility of bargaining with the store owner. What price do you tell him?*

Although the beer would be consumed on the beach in both scenarios, the context frame can have an impact on the purchase price. Any difference in price between the two decision frames indicates that context affects utility and the perceived value of consumption. Both the U.S. Sample and the German sample showed framing bias in the response to this question set. The U.S. mean score was **\$3,568 and \$3,608** for the resort and run-down grocery store, respectively. For the U.S. sample, both scenarios had the same median score, \$5, and the standard deviation was **59339.3 and 59975.39** for the resort and grocery store, respectively. The U.S. Sample was allowed an open-ended field to respond to this question. Unfortunately, several students responded, "I have already answered this question," or "same as for the same question asked above," indicating some individuals had not read the question thoroughly enough to note how it differed from the other question in the set. The U.S. sample also contained several nonsensical prankster answers which had to be thrown out. Additionally, a few students responded with extreme values for the price such as \$100,000, which constitute statistical outliers.

Similarly, the German sample had a mean score of €3.978261 and €3.351064 for the resort and grocery store. The median for the resort was €4 while the median for the run-down grocery store was €3. The standard deviations were €1.725484 and €1.837775 for each, respectively. The German Sample contained neither joking remarks nor statistical outliers but did indicate a similar pattern of framing bias between the two contexts.

*Question 6: Suppose you buy a case of Bordeaux futures at \$400 a case. The wine will retail at about \$500 a case when it is shipped. You do not intend to start drinking this wine for a decade. At the time that you acquire this wine which statement more accurately captures your feelings?*

- I feel like I just spent \$400, much as I would feel if I spent \$400 on a weekend getaway.*
- I feel like I made a \$400 investment which I will gradually consume after a period of years.*
- I feel like I just saved \$100, the difference between what the futures cost and what the wine will sell for when delivered.*

There is little difference between the two samples in preference 49.93% of the U.S. sample chose b and 54.76% of the German sample also chose b. This means that both groups see the consumption of the wine as 'free' thus both groups indicate that they are segregating accounts to maximize the utility of consumption.

### **Cognitive Reflection**

To assess cognitive reflection in decision making, students were asked to identify the correct answer to a series of 'brain teasers.' As mentioned in the opening discussion, these questions are designed such that finding the solution requires first rejecting the 'obvious' yet incorrect response. See Table 4 in the Appendix.

*Question 1: A bat and a ball cost \$1.10 in total. The bat costs \$1.00 more than the ball. How much does the ball cost?*

- a) \$1.00
- b) \$0.05 (the correct answer)
- c) \$.10 (the distracting answer)
- d) \$0.01

*Of the U.S. sample, 64.92% chose \$.10, the distracting answer. Of the German sample, 50% chose this response. The correct answer was identified by only 31.15% of the U.S. sample but 47.83% of the German sample, indicating a stronger tendency among the U.S. students to quickly and incorrectly select answers.*

In the second Cognitive Reflection question, there is similar brain teaser with a distracting false answer:

*Question 2: If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?*

- a) 500 minutes
- b) 100 minutes (distracting answer)
- c) 50 minutes
- d) 5 minutes (correct answer)

By this point, it appears that the German students were beginning to catch on that some of the questions were not as easy as they seemed. The answer pattern changes as only 27.27% of the German sample chose the distracting false answer. The U.S. sample did not fair as well, with 66.56% choosing the distracting answer. The correct answer was identified by only 24.26% of the U.S. sample but by 68.18% of the German sample.

*Question 3: In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?*

- a)  $\sqrt{48}$  days
- b) 24 days
- c) 42 days
- d) 47 days

The response pattern to this question was interesting. Of the U.S. sample, 45.93% chose the distracting answer “24” while 24.10% chose  $\sqrt{48}$  days and 23.45% chose the correct answer, 47 days. Of the German sample, 57.78% chose the correct answer while 24.44% chose  $\sqrt{48}$  days. The first three questions of the Cognitive Reflection portion of the survey are intended to form a composite score against which the remaining CRT subjective questions can be compared. In Shane Frederick’s original study, respondents were given a score (0-3) based on the number answered correctly out of the three questions. Based on the descriptive statistics, the mean score for the German sample would be approximately twice that of the U.S. sample. At least half of the German students identified the correct answer in all three questions (the correct response rate was 50%-68.18%), while the correct response rate in the U.S. sample was between 23.45% and 31.15%.

The two samples responded quite differently to some of the questions in the set. Generally, the German sample tended to be more willing to postpone gains in exchange for financial returns. For instance, in question 13, 60.87% of the German students chose €100 every year for 25 years, while 57.65% of the U.S. sample chose the alternative, the immediate \$1,000. When faced with the option to overnight a book or receive it free shipping via standard mail, 60.87% of the German sample would pay a €3 premium to overnight the book while 73.73% of the U.S. sample would pay for the overnight shipping. When faced with having a tooth pulled today or having it pulled in two weeks, 82.61% of the German sample would prefer to have a tooth pulled today while only 66.56% of the U.S. sample would. The final four questions asked the students to rate themselves on a -5 to 5 scale against the average person taking the survey in terms of impulsivity, procrastination, worry about the future, and worry about inflation.

The U.S. and German samples responded quite similarly to the question about impulsivity with the heaviest response rate between ratings of 2 and 4. 52.86% of the U.S. sample and 56.49% of the German sample responded in this range. On procrastination, the German sample ranked themselves as lower than the average person, with 37.20% answering -2 or -3. 49.84% of the U.S. sample ranked themselves between 2 and 4, indicating that a large number of U.S. students believe that they procrastinate more than average. Both groups self-evaluate as thinking more about their future than the average respondent. 76.22% of the U.S. sample were between 3 and 5 on the rating scale and 80.44% of the German sample were between 1 and 5. When asked how much they worried about inflation relative to other respondents, the German sample was strongly centered at 0, with 60.87% estimating that they worried about inflation no more or less than the average person. The U.S. sample had 21.10% of respondents answering zero, while the rest of the responses were fairly evenly distributed. In 2006, inflation rates in the U.S were 2.5% and 1.7% in Germany.

## Conclusions

The purpose of this study was to assess whether there were any differences in behavioral finance biases across two different cultural groups of students. The survey of 54 questions contained elements of three previous studies including Daniel Kahneman and Amos Tversky's 1979 paper, *Prospect Theory: An Analysis of Decision Under Risk*, Richard Thaler's 1999 paper, *Mental Accounting Matters*, and Shane Frederick's 2005 paper, *Cognitive Reflection and Decision Making*. We hypothesized that the German students would answer differently than the U.S. students and that high CRT scores would be a significant indicator of less biased responses to the prospect theory and mental accounting questions. The German sample was markedly less biased in questions of economic utility and probabilistic outcomes. Responses of the German students to the questions assessing loss aversion tended to support Expected Utility Theory. In Mental Accounting, the German Sample differed little from the U.S. sample. Decision frames affected economic choice in the "calculator and jacket" and the "beer on the beach" problems for both samples; the context of a more costly purchase diminished the value of driving across town to save \$5 compared to the same \$5 savings in the context of a less-expensive purchase. In fact, 13.33% more of the German students would drive across town to save \$5 in the cheaper purchase than would do so in the context of a larger purchase (6.83% more of the U.S. students would drive to save \$5 in the context of a less-expensive purchase). The German students appeared to take the "beer on the beach" question more seriously than the U.S. students but displayed the same framing bias in setting different reservation prices depending on the purchase location even

though the beer would be consumed on the beach either way. Thus, the German sample appeared to apply models of valuation somewhat differently than the U.S. sample although most of the biases observed were concentrated in Mental Accounting; in particular, Framing Bias and managing of mental accounts so as to segregate losses and integrate gains were observed. The cognitive reflection responses indicate that the German sample is both more patient and more reflective in answering the survey. The results of this survey raise questions about whether all of the behavioral biases observed in U.S. studies can be applied to global markets or to international groups of investors. In agreement with the findings of Nisbett, Peng, and Choi (2001) cultural differences in valuation may be best explained by differences in mental accounting behavior because of cultural emphasis on individualism versus collectivism. Future analysis should include individual scoring of responses and an analysis of the predictive value of the CRT relative to responses to mental accounting and prospect theory questions.

J B  
S B

## Appendix

Table 1. Descriptive Statistics

<b>Variable</b>	<b>U.S. Sample</b>	<b>German Sample</b>
Age	Mean 23.64 Median 22 Standard deviation 4.01	Mean 23.57 Median 23 Standard Deviation 3.91
Reported Household Income	Mean 43,073 Median 30,000 Standard Deviation: 45,018	Mean 12997 Median 10,500 Standard Deviation 13,354
Male	51.79% Male 48.21% Female	71.11% Male 28.89% Female
Class Rank	Freshman: 0% Sophomore: 1.31% Junior: 66.56% Senior: 30.82% Graduate: .66% Other: .66%	Semester 1-2: 0% Semester 3-4: 56.82% Semester 5-6: 40.91% Semester 6-7: 2.27%
Course Load	One class in the current term: 2.94% Two classes in the current term: 2.09% Three classes in the current term: 16.67% Four classes in the current term: 42.48% Currently five or more classes: 25.82%	One class in the current term: 9.09% Two classes in the current term: 43.18% Three classes in the current term: 31.82% Four classes in the current term: 13.64% Currently five or more classes: 2.27%
Statistics Experience	Never taken a statistics course: 0.33% Enrolled in first statistics course: 0.33% Completed one statistics course: 75.90% Completed 2 or more statistics courses: 23.45% Statistics Majors: 0%	Never taken a statistics course: 0% Enrolled in first statistics course: 4.55% Completed one statistics course: 63.64% Completed 2 or more statistics courses: 25% Statistics Majors: 6.82%
Investment Experience	Never invested in the stock market: 55.70% 0-1 years experience: 8.79% 1-2 years experience: 4.89% 2-3 years experience: 2.61% 3-4 years experience: 0.98% Over 4 years experience: 2.61% Own some stocks but do not actively participate in the investing (have retirement account or similar): 18.75% Have a retirement account or similar but not sure if own any stocks: 5.86%	Never invested in the stock market: 40% 0-1 years experience: 4.44% 1-2 years experience: 2.22% 2-3 years experience: 17.78% 3-4 years experience: 4.44% Over 4 years experience: 31.11% Own some stocks but do not actively participate in the investing (have retirement account or similar): 0% Have a retirement account or similar but not sure if own any stocks: 0%
Occupation Status	Do not work outside of school: 12.01% Part-time job: 45.78% Full-time job: 37.01% Self-employed and work less than 35 hours per week: 4.22% Self-employed and work more than 35 hours per week: 0.97%	Full-time student: 13.33% Full-time student, work for up to ten hours per week: 17.78% Full-time student, work more than ten hours per week: 24.44% Full-time student, self-employed 37.78%

**Table 2. Loss Aversion**

<b>Question/Corresponding Answer</b>	<b>US Sample</b>	<b>German Sample</b>
<p>Question 1: Choose between receiving the following payments and their corresponding chance (probability) of occurrence.</p> <p>a) \$2,500 with a probability of 33%, \$2,400 with a probability of 66%, and \$0 with a probability of 1%</p> <p>b) \$2,400 with certainty.</p>	<p>Answer a) 35.71%</p> <p>Answer b) 64.29%</p>	<p>Answer a) 30.43%</p> <p>Answer b) 69.57%</p>
<p>Question 2: Choose between receiving the following payments and their corresponding chance (probability) of occurrence.</p> <p>c) \$2,500 with a probability of 33% and \$0 with a probability of 67%</p> <p>d) \$2,400 with a probability of 34% and \$0 with a probability of 66%.</p>	<p>Answer c) 63.19%</p> <p>Answer d) 36.81%</p>	<p>Answer c) 62.22%</p> <p>Answer d) 37.78%</p>
<p>Question 3: Choose between receiving the following payments and their corresponding chance (probability) of occurring.</p> <p>a) \$4,000 with a probability of 80% and \$0 with a probability of 20%.</p> <p>b) \$3,000 with certainty.</p>	<p>Answer a) 25.24%</p> <p>Answer b) 74.76%</p>	<p>Answer a) 32.61%</p> <p>Answer b) 67.39%</p>
<p>Question 4: Choose between receiving the following payments and their corresponding chance (probability) of occurring.</p> <p>c) \$4,000 with a probability of 20% and \$0 with a probability of 80%.</p> <p>d) \$3,000 with a probability of 25% and \$0 with a probability of 75%.</p>	<p>Answer c) 51.30%</p> <p>Answer d) 48.70%</p>	<p>Answer c) 63.04%</p> <p>Answer d) 36.96%</p>
<p>Question 5: Choose between</p> <p>a) A 50% chance to win a three-week tour in England, France, and Italy.</p> <p>b) A one-week tour of England, with certainty.</p>	<p>Answer a) 26.95%</p> <p>Answer b) 73.05%</p>	<p>Answer a) 35.56%</p> <p>Answer b) 64.44%</p>
<p>Question 6: Choose between</p> <p>c) A 5% chance to win a three-week tour of England, France, and Italy.</p> <p>d) A 10% chance to win a one-week tour of England.</p>	<p>Answer c) 59.42%</p> <p>Answer d) 40.58%</p>	<p>Answer c) 15.22%</p> <p>Answer d) 84.78%</p>
<p>Question 7: Choose between receiving the following payments and their corresponding chance (probability) of occurring.</p> <p>a) \$6,000 with a probability of 45% and \$0 with a probability of 55%.</p> <p>b) \$3,000 with a probability of 90% and \$0 with a probability of 10%.</p>	<p>Answer a) 12.75%</p> <p>Answer b) 87.25%</p>	<p>Answer a) 77.27%</p> <p>Answer b) 23.73%</p>
<p>Question 8: Choose between receiving the following payments and their corresponding chance (probability) of occurring.</p> <p>c) \$6,000 with probability of 0.1% and \$0 with a probability of 99.9%.</p> <p>d) \$3,000 with a probability of 0.2% and \$0 with a probability of 99.8%.</p>	<p>Answer c) 71.99%</p> <p>Answer d) 28.01%</p>	<p>Answer c) 10.87%</p> <p>Answer d) 89.13%</p>
<p>Question 9: Consider the following two-stage game. In the first stage, there is a probability of 75% to end the game without winning anything, and a probability of 25% to move into the second stage. If you reach the second stage you have a choice between receiving:</p> <p>a) \$4,000 with a probability of 80% and \$0 with a probability of 20%.</p> <p>b) \$3,000 with certainty.</p>	<p>Answer a) 26.38%</p> <p>Answer b) 73.62%</p>	<p>Answer a) 65.22%</p> <p>Answer b) 34.78%</p>

<p>Question 10: In addition to whatever you own, you have been given \$1,000. You are now asked to choose between receiving:</p> <p>a) \$1,000 with a probability of 50% and \$0 with a probability of 50%.                  b) \$500 with certainty.</p>	<p>Answer a) 27.60%                  Answer b) 72.40%</p>	<p>Answer a) 71.11%                  Answer b) 28.89%</p>
<p>Question 11: In addition to whatever you own, you have been given \$2,000. You are now asked to choose between receiving:</p> <p>c)-\$1,000 with a probability of 50% and \$0 with a probability of 50%.                  d)-\$500 with certainty.</p>	<p>Answer c) 49.35%                  Answer d) 50.65%</p>	<p>Answer c) 62.22%                  Answer d) 37.78%</p>
<p>Question 12: Choose between receiving the following payments and their corresponding chance (probability) of occurring.</p> <p>a) \$6,000 with a probability of 25% and \$0 with a probability of 75%.                  b) \$4,000 with a probability of 25%, \$2,000 with a probability of 25%, and \$0 with a probability of 50%.</p>	<p>Answer a) 13.73%                  Answer b) 86.27%</p>	<p>Answer a) 34.78%                  Answer b) 65.22%</p>
<p>Question 13: Choose between receiving the following payments and their corresponding chance (probability) of occurring.</p> <p>c)-\$6,000 with a probability of 25% and \$0 with a probability of 75%.                  d)-\$4,000 with a probability of 25%, -\$2,000 with a probability of 25%, and \$0 with a probability of 50%.</p>	<p>Answer c) 48.69%                  Answer d) 51.31%</p>	<p>Answer c) 20.93%                  Answer d) 79.07%</p>
<p>Question 14: Choose between receiving the following payments and their corresponding chance (probability) of occurring.</p> <p>a) \$5,000 with a probability of 0.1% and \$0 with a probability of 99.9%.                  b) \$5 with certainty.</p>	<p>Answer a) 55.56%                  Answer b) 44.44%</p>	<p>Answer a) 28.26%                  Answer b) 71.74%</p>
<p>Question 15: Choose between receiving the following payments and their corresponding chance (probability) of occurring.</p> <p>c) -\$5,000 with a probability of 0.1% and \$0 with a probability of 99.9%.                  d) -\$5 with certainty.</p>	<p>Answer c) 35.83%                  Answer d) 64.17%</p>	<p>Answer c) 71.11%                  Answer d) 28.89%</p>

**Table 3. Mental Accounting**

<b>Question</b>	<b><u>U.S. Sample</u></b>	<b><u>German Sample</u></b>
<p>Question 1: Imagine that you are about to purchase a jacket for \$125 and a calculator for \$15. The calculator salesman informs you that the calculator you wish to buy is on sale for \$10 at the other branch of the store, located 20 minutes drive away. Would you make the trip to the other store?</p> <p>c) Yes d) No</p>	<p>a) 16.34% b) 83.66%</p>	<p>a) 22.22% b) 77.78%</p>
<p>Question 2: Imagine that you are about to purchase a jacket for \$15 and a calculator for \$125. The calculator salesman informs you that the calculator you wish to buy is on sale for \$120 at the other branch of the store, located 20 minutes drive away. Would you make the trip to the other store?</p> <p>a) Yes b) No</p>	<p>a) 9.51% b) 90.49%</p>	<p>a) 8.89% b) 91.11%</p>
<p>Question 3: You are lying on the beach on a hot day. All you have to drink is ice water. For the last hour you have been thinking about how much you would enjoy a nice cold bottle of your favorite brand of beer. A companion gets up to make a phone call and offers to bring back a beer from the only nearby place where beer is sold (a fancy resort hotel). He says that the beer might be expensive and so asks how much you are willing to pay for the beer. He says that he will buy the beer if it costs as much or less than the price you state. But if it costs more than the price you state he will not buy it. You trust your friend, and there is no possibility of bargaining with the bartender. What price do you tell him?</p>	<p>Mean: \$3,568 Median: \$5 Standard Deviation: \$59,339</p>	<p>Mean: 3.98 Median: 4 Standard Deviation: 1.73</p>
<p>Question 4: You are lying on the beach on a hot day. All you have to drink is ice water. For the last hour you have been thinking about how much you would enjoy a nice cold bottle of your favorite brand of beer. A companion gets up to make a phone call and offers to bring back a beer from the only nearby place where beer is sold (a small, run-down grocery store). He says that the beer might be expensive and so asks how much you are willing to pay for the beer. He says that he will buy the beer if it costs as much or less than the price you state. But if it costs more than the price you state he will not buy it. You trust your friend, and there is no possibility of bargaining with the store owner. What price do you tell him?</p>	<p>Mean: \$3,608 Median: \$5 Standard Deviation: \$59,975.39</p>	<p>Mean: 3.35 Median: 3 Standard Deviation: 1.838</p>

<p>Question 5: Suppose you bought a case of a good 1982 Bordeaux in the futures market for \$20 a bottle. The wine now sells at auction for about \$75 a bottle. You have decided to drink a bottle. Which of the following best captures your feelings of the cost to you of drinking this bottle?</p> <p>a) \$0 b) \$20 c) \$20 plus interest d) \$75 e) -\$55</p>	<p>Answer a) 12.99% Answer b) 23.38% Answer c) 10.06% Answer d) 33.12% Answer e) 20.45%</p>	<p>Answer a) 11.11% Answer b) 33.33% Answer c) 4.44% Answer d) 31.11% Answer e) 20.00%</p>
<p>Question 6: Suppose you buy a case of Bordeaux futures at \$400 a case. The wine will retail at about \$500 a case when it is shipped. You do not intend to start drinking this wine for a decade. At the time that you acquire this wine which statement more accurately captures your feelings?</p> <p>d) I feel like I just spent \$400, much as I would feel if I spent \$400 on a weekend getaway. e) I feel like I made a \$400 investment which I will gradually consume after a period of years. f) I feel like I just saved \$100, the difference between what the futures cost and what the wine will sell for when delivered.</p>	<p>Answer a) 18.57% Answer b) 45.93% Answer c) 35.50%</p>	<p>Answer a) 21.43% Answer b) 54.76% Answer c) 23.81%</p>
<p>Question 7: You have just won \$30. Now choose between</p> <p>a) A 50% chance to gain \$9 and a 50% chance to lose \$9. b) No further gain or loss.</p>	<p>Answer a) 43.65% Answer b) 56.35%</p>	<p>Answer a)43.48% Answer b)56.52%</p>
<p>Question 8: You have just lost \$30. Now choose between</p> <p>a) A 50% chance to gain \$9 and a 50% chance to lose \$9. b) No further gain or loss</p>	<p>Answer a) 29.22% Answer b) 70.78%</p>	<p>Answer a)43.48% Answer b)56.52%</p>
<p>Question 9: You have just lost \$40. Now choose between</p> <p>a) A 33% chance to gain \$40 and a 67% chance to gain nothing. b) A sure \$10.</p>	<p>Answer a) 55.70% Answer b) 44.30%</p>	<p>Answer a) 63.04% Answer b) 36.96%</p>

**Table 4.** Cognitive Reflection

<b>Question/ Corresponding Responses</b>	<b><u>U.S. Sample</u></b>	<b><u>German Sample</u></b>
Question 1: A bat and a ball cost \$1.10 in total. The bat costs \$1.00 more than the ball. How much does the ball cost? a) \$1.00 b) \$0.05 (the correct answer) c) \$.10 d) \$0.01	Answer a) 1.64% Answer b) 31.15% Answer c) 64.92% Answer d) 2.30%	Answer a) 2.17% Answer b) 47.83% Answer c) 50% Answer d) 0%
Question 2: If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? a) 500 minutes b) 100 minutes (distracting answer) c) 50 minutes d) 5 minutes (correct answer)	Answer a) 5.57% Answer b) 66.56% Answer c) 3.61% Answer d) 24.26%	Answer a) 4.55% Answer b) 27.27% Answer c) 0% Answer d) 68.18%
Question 3: In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? e) $\sqrt{48}$ days f) 24 days g) 42 days h) 47 days	Answer a) 24.10% Answer b) 45.93% Answer c) 6.51% Answer d) 23.45%	Answer a) 24.44% Answer b) 15.56% Answer c) 2.22% Answer d) 57.78%
Question 4: Which would you prefer? a) \$100 certain loss b) 75% chance to lose \$200	Answer a) 63.52% Answer b) 36.48%	Answer a) 60.87% Answer b) 39.13%
Question 5: Which would you prefer to gain? a) \$3,400 this month b) \$3,800 next month	Answer a) 19.93% Answer b) 80.07%	Answer a) 8.70% Answer b) 91.30%
Question 6: Which would you prefer to gain? a) \$100 now b) \$140 next year	Answer a) 64.17% Answer b) 35.83%	Answer a) 69.57% Answer b) 30.43%
Question 7: Which would you prefer to receive? a) \$100 now b) \$1,100 in 10 years	Answer a) 50.16% Answer b) 49.84%	Answer a) 43.48% Answer b) 56.52%
Question 8: Which would you prefer to receive? a) \$9 now b) \$100 in 10 years	Answer a) 54.07% Answer b) 45.93%	Answer a) 54.35% Answer b) 45.65%
Question 9: Which would you prefer to receive? a) \$40 immediately b) \$1,000 in 10 years	Answer a) 30.94% Answer b) 69.06%	Answer a) 26.09% Answer b) 73.91%
Question 10: Which would you prefer to receive? a) \$100 now b) \$20 every year for 7 years	Answer a) 85.62% Answer b) 14.38%	Answer a) 82.61% Answer b) 17.39%
Question 12: Which would you prefer to receive? a) \$400 now b) \$100 every year for 10 years	Answer a) 49.84% Answer b) 50.16%	Answer a) 45.65% Answer b) 54.35%
Question 13: Which would you prefer to receive? a) \$1,000 now b) \$100 every year for 25 years	Answer a) 57.65% Answer b) 42.35%	Answer a) 39.13% Answer b) 60.87%
Question 14: Which would you prefer to receive? a) A 30 minute massage in 2 weeks b) A 45 minute massage in November	Answer a) 88.12% Answer b) 11.88%	Answer a) 84.78% Answer b) 15.22%

<p>Question 15: Which would you rather lose?  a) \$1,000 this year  b) \$2,000 next year</p>	<p>Answer a) 86.08%  Answer b) 13.92%</p>	<p>Answer a) 86.96%  Answer b) 13.04%</p>
<p>Question 16: If you were ordering a book via mail from a vendor offering free shipping that would take two weeks to arrive, would you pay an additional \$3 to receive the book overnight?  a)Yes  b)No</p>	<p>Answer a) 72.73%  Answer b) 27.27%</p>	<p>Answer a) 60.87%  Answer b) 39.13%</p>
<p>Question 17: When would you rather have the following dental work done?  a) Tooth pulled today  b) Tooth pulled in 2 weeks</p>	<p>Answer a) 66.56%  Answer b) 33.44%</p>	<p>Answer a) 82.61%  Answer b) 17.39%</p>
<p>Question 18: How impulsive are you on a scale of -5 to +5, with -5 being much less impulsive than the average person taking this test today and +5 being much more impulsive than the average person taking this test today?</p>	<p>-5 scale:2.92%  4 scale:3.90%  3 scale:7.47%  2 scale:7.47%  1 scale:5.19%  0 scale:13.96%  1 scale:13.64%  2 scale:22.08%  3 scale:15.26%  4 scale:15.52%  5 scale:2.60%</p>	<p>-5: 2.33%  4: 2.33%  3: 6.98%  2: 6.98%  1: 0%  0: 18.60%  1: 9.30%  2: 16.28%  3: 20.93%  4:16.28%  5: 0%</p>
<p>Question 19: How much do you tend to procrastinate on a scale of -5 to +5, with -5 meaning you procrastinate much less than the average person taking this test today and +5 meaning you procrastinate much more than the average person taking this test today?</p>	<p>-5 scale:2.93%  4 scale:2.61%  3 scale:6.19%  2 scale:6.19%  1 scale:3.26%  0 scale:10.42%  1 scale:6.51%  2 scale:16.29%  3 scale:18.89%  4 scale:14.66%  5 scale:12.05%</p>	<p>-5: 4.65%  4: 0%  3: 18.60%  2: 18.60%  1: 4.65%  0: 32.56%  1: 4.65%  2: 4.65%  3: 11.63%  4: 0%  5: 0%</p>
<p>Question 20: How much do you think about your future on a scale of -5 to +5, with -5 meaning you think about your future much less than the average person taking this test today and +5 meaning you think about your future much more than the average person taking this test today?</p>	<p>-5 scale:1.30%  4 scale:0.65%  3 scale:1.30%  2 scale:1.95%  1 scale:1.95%  0 scale:3.91%  1 scale:2.93%  2 scale:9.77%  3 scale:23.13%  4 scale:22.80%  5 scale:30.29%</p>	<p>-5: 2.17%  4: 2.17%  3: 2.17%  2: 2.17%  1: 2.17%  0: 8.70%  1:17.39%  2:15.22%  3: 19.57%  4:15.22%  5: 13.04%</p>

Question 21: How much do you worry about inflation on a scale of -5 to +5, with -5 meaning you worry about inflation much less than the average person taking this test today and +5 meaning you worry about inflation much more than the average person taking this test today?	-5 scale:8.44%	-5: 2.17%
	4 scale:7.47%	4: 6.52%
	3 scale:11.36%	3: 4.35%
	2 scale:7.14%	2: 8.70%
	1 scale:5.84%	1: 2.17%
	0 scale:21.10%	0: 60.87%
	1 scale:11.36%	1: 4.35%
	2 scale:12.34%	2: 2.17%
	3 scale:11.69%	3: 6.52%
	4 scale:1.30%	4: 0%
	5 scale:1.95%	5: 2.17%

## References

- Ahearne, Grier, and Warnock (2004) "Information Costs and Home Bias: An Analysis of US Holdings of Foreign Equities," *Journal of International Economics* 62, 313-336.
- Allais, M. (1953). "Le Comportement de l'Homme Rationnel devant le Risque, Critique des Postulats, et Axiomes de l'Ecole Americaine," *Econometrica* 21, 503-546.
- Barber B., and T. Odean. (2001). "The Internet and the Investor," *The Journal of Economic Perspectives*, 15(1) 41-54.
- Barber and Odean (November/December 1999). "The Courage of Misguided Conviction: Trading Behavior of Individual Investors," *Financial Analysts Journal*.
- Barberis, N., M.Huang, and T. Santos, (February 2001). "Prospect Theory and Asset Prices." *Quarterly Journal of Economics* 116(1) 73-92.
- Barberis, N., and R. Thaler, (Amsterdam: North-Holland, 2003), "A Survey of Behavioral Finance." From George Constantinides, Milton Harris, and Rene Stulz, eds. *Handbook of the Economics of Finance*, Vol. 1B, "Financial Markets and Asset Pricing" 1051-1121.
- Benartzi S., and Thaler, R.H., (February 1995). "Myopic Loss Aversion and the Equity Premium Puzzle," *Quarterly Journal of Economics* 110,173-92.
- Chaiken S. and Y. Trope. (1999). "Dual-Process Theories in Social Psychology." New York: Guilford Press.
- Constantinides, G.M. (May 1983). "Capital Market Equilibrium with Personal Tax." *Econometrica* 51 611-36.
- Constantinides, G.M. (March 1984). "Optimal Stock Trading with Personal Taxes: Implications for Prices and the Abnormal January Returns." *Journal of Financial Economics* 13, 65-89.
- Coval, J., and T. Shumway, (2000) "Do Behavioral Biases Affect Prices?" Working Paper, University of Michigan.
- DeGeorge, F., J. Patel, and R. Zeckhauser, (1999). "Earnings Management to Exceed Thresholds," *Journal of Business* 72,1-34.
- Epstein, L., and T. Wang, Intertemporal Asset Pricing Under Knightian Uncertainty, *Econometrica* 62 (1994) 283-322.
- Frederick, S, (Fall 2005). "Cognitive Reflection and Decision Making," *Journal of Economic Perspectives* 19(4) 25-42.
- Genesove D., and C. Mayer, (2001). "Loss Aversion and Seller Behavior: Evidence from the Housing Market." *Quarterly Journal of Economics* 116, 1233-60.
- George. T.J., and Chuan-Yang Hwang, (2004). "The 52-Week High and Momentum Investing." *The Journal of Finance* LIX, 5.

- Gladwell, M., (2005, 2007). "Blink: The Power of Thinking without Thinking." Little, Brown and Company.
- Grinblatt, M. and B. Han, (2001). "The Disposition Effect and Momentum," Working Paper, University of California, Los Angeles.
- Grinnblatt, M. and M. Keloharju, (2001). "How Distance, Language, and Culture Influence Stockholdings and Trades," *Journal of Finance* 56, 1053-73.
- Gross, L., (1982). "The Art of Selling Intangibles: How to Make your Million(\$) by Investing Other People's Money." New York Institute of Finance, New York.
- Heath, C., S. Huddart, and M. Lang, (1999). "Psychological Factors and Security Option Exercise." *Quarterly Journal of Economics* 114, 601-27.
- Hirschleifer, D., (2001). "Investor Psychology and Asset Pricing," *Journal of Finance* 56, 1533-97.
- Hofstede, G., (1980). "Culture's Consequences: International Differences in Work-Related Values," Sage Publications, Beverly Hills.
- Kahneman and Frederick, (2002). "Representativeness Revisited: Attribute Substitution in Intuitive Judgement."
- Kahneman, D. and A. Tversky, (March 1979). "Prospect Theory: An Analysis of Decision under Risk." *Econometrica* 47, 263-91.
- Levinson, Justin D. and Kaiping Peng, (2007). "Valuing Cultural Differences in Behavioral Economics." *The ICFAI Journal of Behavioral Finance* 4(1)32-47.
- Locke, P. and S. Mann, (1999), "Do Professional Traders Exhibit Loss Realization Aversion?" Working Paper, Texas Christian University.
- Markowitz, H., (1959). "The Utility of Wealth," *Journal of Political Economy*, 60,151-158.
- Markus H.R, and S. Kitayama (1991). Culture and the Self: Implications for Cognition, Emotion, and Motivation, *Psychological Review* 98, 224-253.
- Mehra, R. and E. Prescott (1985). "The Equity Premium: a Puzzle." *Journal of Monetary Economics* 15, 145-61.
- Morris, M.W., and K. Peng. (1994) "Culture and Cause: American and Chinese Attributions for Social and Physical Events," *Journal of Personality and Social Psychology*, 67, 949-971.
- Mussweiler, T and F. Strack, (1999a). "Comparing is Believing: A Selective Accessibility Model of Judgemental Anchoring." In W. Stroebe &M. Hewstone (Eds.), *European Review of Social Psychology* 10,135-167. Chichester, England: Wiley.
- Mussweiler, T and F. Strack, (1999b). "Hypothesis-Consistent Testing and Semantic Priming in the Anchoring Paradigm: A Selective Accessibility Model. *Journal of Experimental Social Psychology* 35, 136-164.
- Mussweiler, T and F. Strack, (2000). "The use of Category and Exemplar Knowledge in the Solution of Anchoring Tasks." *Journal of Personality and Social Psychology* 78,1038-1052.
- Mussweiler, T and F. Strack, (2001b). "Considering the Impossible: Explaining the Effects of Implausible Anchors." *Social Cognition* 19,145-160.
- Nagin, D.S., and G. Pogarsky (2003). "An Experimental Study of Deterrence: Cheating, Self-Serving Bias and Impulsivity." *Criminology* 41(1) 501-27.
- Nisbett, R.E., K. Peng, and I. Choi, (2001). "Culture and Systems of Thought: Holistic Versus Analytic Cognition," *Psychological Review* 108, 291-310.
- Rabin, M., (February 2, 2002). "A Perspective on Psychology and Economics." Economics Department, University of California, Berkeley, Working Paper E02-313.

- Read, D., G. Loewenstein, and M. Rabin (1998). "Choice Bracketing." *Journal of Risk and Uncertainty* (1999).
- Roberts, H.V., (1967). "Statistical versus Clinical Prediction of the Stock Market," Unpublished Paper Presented to the Seminar on the Analysis of Security Prices, University of Chicago.
- Schlarbaum, G., W.G. Lewellen, and R. Lease. (April 1978). "Realized Returns on Common Stock Investments: the Experience of Individual Investors." *Journal of Business* 299-325.
- Scott, J., M. Stump, and P. Xu, (1999). "Behavioral Bias, Valuation, and Active Management." *Financial Analysts Journal* 55(4)49-57.
- Shapira, Z. and I. Venezia, (2001). "Patterns of Behavior of Professionally Managed and Independent Investors." *Journal at Banking and Finance* 25, 1573-87.
- Shefrin, H.M. and M. Statman, (June 1984). "Explaining Investor Preference for Cash Dividends." *Journal of Financial Economics* 13, 253-82.
- Shoda, Y., W. Mischel, and P.K. Peake, (1990). "Predicting Adolescent Cognitive and Self-Regulatory Competencies from Preschool Delay of Gratification: Identifying Diagnostic Conditions." *Developmental Psychology* 26(6)978-86.
- Savage, L., "The Foundations of Statistics." New York: Wiley, 1954.
- Sloman, S. A. (1996). "The empirical case for two systems of reasoning." *Psychological Bulletin* 119(1), 3-22.
- Stanovich, K. and R.F. West, (2000). "Individual Differences in Reasoning: Implications for the Rationality Debate?" *Behavioral and Brain Sciences* 22(5)645-726.
- Strack, F. and T. Mussweiler (1997). "Explaining the Enigmatic Anchoring Effect: Mechanisms of Selective Accessibility." *Journal of Personality and Social Psychology* 73, 437-446.
- Thaler, R. and H. Shefrin. (April 1981). "An Economic Theory of Self-Control." *Journal of Political Economy* 89, 392-410.
- Thaler, R., (September 1999). "Mental Accounting Matters." *Journal of Behavioral Decision Making* 12(3)183-206.
- Triandis, H.C. "Individualism and Collectivism," Westview Press, Boulder: 1995.
- Tversky, A. and D. Kahneman, (1992). "Advances in Prospect Theory: Cumulative Representation of Uncertainty." *Journal of Risk and Uncertainty* 5, 297-323.