Impact of Risk Perception and Risk Tolerance on Investment Portfolio Decisions

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Abstract

Average individual investor returns drastically underperform standard investment benchmarks, with common attributing factors including relying on instincts and overconfidence in trading ability. Neural processing, financial risk, risk perception, and risk tolerance literature show how instinctual reactions form and how those reactions affect risk decision-making under Prospect theory. Examining the effect of neural processing and risk framing on subjective risk perception allows a measurement of the indirect impact on risk tolerance. The stable factors of risk tolerance directly impact investment risk decisions. There are implications of accurately assessing risk tolerance in a client/advisor relationship. Advisor application of a proper risk tolerance assessment in individual client relationships may aid financial and emotional success.

keywords: individual investors, risk perception, risk tolerance, investment decisions, financial advisors

Impact of Risk Perception and Risk Tolerance on Investment Portfolio Decisions

People cannot eliminate risk in their lives; they learn to evaluate, mitigate, and decide between shifting alternatives (Aven, 2016). People from different schools of thought study how humans evaluate and process decisions when faced with various outcomes or possibilities of loss, otherwise known as risk decisions (Grable, 2016; Paek & Hove, 2017). Within classical economics, proponents of the Expected Utility theory regard risk evaluation as stable and objective, with humans making consistent, rational risk decisions (Grable, 2016). From a differing viewpoint, proponents of Prospect theory propose that people's perception of risk, and thus decision regarding risk, shifts based on the presentation of the risk (Thaler et al., 1997). Under Prospect theory, instead of rational thought, the "fast-thinking" subconscious part of the brain summarizes and reacts to a risk decision in seconds, causing cognitive biases to occur, and creating faulty risk perception (Mohr et al., 2010). Risk perception, in turn, affects people's risk tolerance, the amount of uncertainty they are willing to endure (Nguyen et al., 2019).

Risk tolerance, composed of behavioral, demographic, and social factors, directly impacts investment portfolio construction decisions (Fisher, 2020; Rahman, 2020). Those with a higher risk tolerance often have higher risk allocations, potentially leading to greater investment returns (Fisher & Yao, 2017; Nur Aini & Lutfi, 2019). Nguyen et al. (2019) showed that the risk level of investment portfolios should align with the risk tolerance of the individual, as well as his or her financial goals. Fisher and Yao (2017) recommended that financial advisors understand risk tolerance, and the impact of risk perception on risk tolerance, to build appropriate investment portfolios for their clients. Even within an appropriately constructed portfolio, each segment of clients within risk tolerance classifications faces cognitive biases that advisors must help to identify and mitigate (Dickason & Ferreira, 2018). Financial advisors must accurately assess

their clients' risk tolerance, and identify and mitigate their clients' cognitive biases, to construct a portfolio aligned with their clients' true risk tolerance and financial goals.

Definition of Risk

Every day, people encounter risk in varying degrees, whether driving, working, or making a financial decision (Aven, 2016). Definitions of risk include the "variability of outcomes," "possibility of loss," or the probability of experiencing something negative or harmful (Byrne, 2013, p. 8; Paek & Hove, 2017; Pligt, 2006, p. 34). People willingly choose some risks; others result from external factors and chance. Economists and psychologists propose various theories on how humans evaluate risk and uncertainty to decide a course of action.

Theories on Risk Decisions

In 1947, Von Neumann and Morgenstern advanced the Expected Utility theory based on classical economics. Grable (2006) wrote that this theory assumed people act rationally, making "the same choice in terms of riskiness regardless of the situation or event" (p. 22). Consumers would decide which option to pick based on the choice with the highest expected utility, or satisfaction. Researchers proposed that risk preferences remain constant and are dependent upon personality. Markowitz constructed his Modern Portfolio theory based on the Expected Utility theory, assuming that investors are risk-averse, and created a portfolio that maximized utility for a given level of risk. Economists tend to favor these theories with the assumption that humans are rational, but other studies do not hold to this belief.

Irrational Investor Decisions

In the Dalbar study, researchers tracked financial indexes and the return of average investors: from 1994-2013, the S&P 500 had an 11.1% return, compared with the average

investor's 3.7% (Chhabra, 2015). In terms of bonds, the index returned 7.7%, compared to investor's 0.7%. Inflation grew at 2.8%, so the recommended 60/40 portfolio, under the individual investor's control, did not even beat inflation. On average, investors lost 9% per trade, calculated as the difference in returns between the one stock they sold and the one stock they purchased to replace the original. To many, this seems as though the investors had incomplete information or lacked skilled in investing. However, Barber and Odean (2000) established that investors following their instincts, also known as subconscious decisions, was the source of the underperformance. Investors often sold their holdings before an upswing or bought at highs, the opposite of rational investor choices. Overconfidence in knowledge and prospects caused these investors to overtrade, dropping their averages significantly lower than other investors and the index.

Prospect Theory

Multiple psychologists and behavioral scientists challenged the notion that humans act entirely rationally. If those investors had the relevant, objective knowledge, why did the investors act so irrationally? The psychologists and behavioral scientists deemed the Expected Utility theory assumption that "risk is an immutable attribute of a decision alternative that is perceived the same way by different decision makers" as faulty (Weber & Milliman, 1997, p. 129). Rather, humans act differently than anticipated under classical economics because they do not process decisions on a purely rational basis. For example, investors' reactions are not appropriate for a given outcome: they overreact to slight changes yet underreact to events with highly probable outcomes. Psychologists Tversky, Kahneman, and Thaler studied why humans act differently than economics supposes and what factors impact human decisions. Their resulting work, Prospect theory, became the foundation for behavioral finance (Thaler et al.,

1997). Prospect theory examined the heuristics, meaning rules of thumb, and the cognitive errors the brain routinely makes. The exploration into the interplay between conscious and subconscious thinking provided new insight into how humans make decisions when faced with risk or uncertainty.

Neurological Processes: Fast and Slow Thinking

For all human history**,** people identified and evaluated risk to decide courses of action. Slovic (2019) proposed that with the ability to evaluate and alter their environment, humans can evade and create risk, affecting their chances of survival. Survival also demands the ability to learn from past experiences to make decisions faster in a repeat situation. In the brain, two neural processes work together, or compete, to decide actions in risky situations. Various researchers have coined these systems as fast thinking and slow thinking (Croskerry, 2014; Slovic, 2019). Fast thinking utilizes the subconscious, often called a "hunch" or a "gut reaction" in everyday language. The brain quickly sizes up images and feelings (Morse, 2006). These emotional, gut reactions play a significant role in the decision-making process in response to risk as the subconscious processes a plethora of information in a blink of an eye. In certain situations, this ability enables the individual to respond quickly and avoid risk. On the other hand, slow thinking, also known as the cognitive portion of the decision-making process, utilizes logic, data, and formal tools of reasoning to make decisions (Fuster, 2001). When time is of the essence, this method does not yield as accurate decisions as the subconscious, but when given time, slow thinking produces powerful results in the form of objective decisions.

Fast Thinking

Distinct parts of the brain influence risk perception and fast thinking. According to McFadyen (2019), the amygdala, located in a region of the brain responsible for emotions, reacts

to risk by igniting a sensation of fear. When individuals see threats such as snakes, storms, and untrustworthy faces, the amygdala immediately flares, producing a subconscious feeling of fear (Ressler, 2010). Morse (2006) found that with a flash of a picture, the subconscious identified and reacted to risk through the amygdala fear response, but when questioned, people, and their conscious portion of the brain, could not report the specific image they just viewed. Intangible or unimaginable risks, such as future events or unexperienced disasters, do not produce the same risk reaction. Over time, Fox and Shackman (2019) discovered that the amygdala learns additional scenarios or stimuli to elicit fear based on past experiences and helps create defenses to the threat recognized.

Humans also use the anterior insula, imbedded in the reward seeking circuitry of the brain, to avoid risk (Morse, 2006). It activates when confronted with the anticipation of pain or shock. The greater the activity in this portion of the brain, the more risk-averse behavior experimental participants show. Thus, loss avoidance occurs naturally in the brain, as the brain quickly assesses the loss potential of a stimulus and immediately prepares an action to avoid this loss. This fear instinct aids survival and quick decisions, but sometimes this fear response is out of proportion or unrelated to the actual risk involved. According to Miedl et al. (2020), when the perceived risk does not equal the actual risk, it may lead to risk avoidant behaviors when the situation does not require them. The thalamus also plays a part in fast thinking, as it stimulates the feeling of regret before the individual has taken any action, spurring greater loss aversion (Morse, 2006). Therefore, fast thinking identifies, evaluates, and reacts to risks, especially present and tangible ones, to survive.

Slow Thinking

The prefrontal cortex, the command center of the brain and the powerhouse of slow thinking, connects with many different inputs and outputs. According to Fuster (2001), it receives information, processes a decision, and sends out the commands necessary to implement the decision. One of its main duties is the "regulation of the internal environment, control of drives, and emotional behavior" (Fuster, 2001, pg. 11969). The prefrontal cortex also organizes behavior in a sequential manner, forming a linear plan and executing it in a timely manner. This portion of the brain works to control drives, often called self-control; delayed gratification rather than instant gratification originates here. Widge at al. (2019) concluded that the prefrontal cortex creates personal goals and steps to reach them.

However, the prefrontal cortex does not normally handle routine behavior, as lower, subconscious, parts of the brain control routine. When approached by novel experiences, the subconscious will try to fit that circumstance in one of the previous categories, while the prefrontal cortex will focus and evaluate the unfamiliar information. According to Kannengiesser and Gero (2019), conscious, cognitive evaluation requires substantially more effort than the subconscious portion of the brain. Because of the effort and focus involved, the cognitive portion of the brain can only handle a few pieces of information at once, compared to the thousands of pieces of information the subconscious routinely processes instantly. However, the cognitive portion better performs linear thought processes, deals with objective factors, and forms logical decisions.

Neurological Processes: Interaction of Fast and Slow

In general, the subconscious and conscious portions of the brain are in constant communication regarding decisions, using each other to form a more complete response.

However, in brain scanning studies, when participants face risk, emotions, particularly fear and anger, as well as the possibility of loss, heavily influence risk decisions. According to Mohr et al. (2010), these factors can overwhelm the cognitive reasoning, which contributes to people making subconscious, rather than conscious, rational decisions. Mahoney (2003) showed that the subconscious makes as many as 95% of decisions, meaning intuition often leads people to a decision, followed by a logical justification. Instead of examining the rationality of the decision made in the subconscious, the slow thinking portion of the brain tends to accept the decision to avoid exerting additional effort (De Neys & Pennycook, 2019).

Adolescents represent a magnified example of the subconscious brain controlling decisions. Their limbic system, which controls the risk-reward portion of the brain in the subconscious, functions fully, but the prefrontal cortex, which performs cognitive reasoning and self-control, will not develop until their mid-twenties (Institute of Medicine, 2011; Onge & Floresco, 2009). Adolescents tend to take more risks because the subconscious portion of the brain overwhelms their underdeveloped cognitive reasoning. The subconscious portions of the brain send powerful signals to the prefrontal cortex to aid in the decision-making process; however, they can overwhelm the prefrontal cortex and override logical decisions (Mohr et al., 2010).

Fast Thinking: Strengths and Weaknesses

Rather than dismiss the reactions of fast thinking and work to eliminate it from the decision-making process, researchers sought to understand the value of the subconscious. Fast thinking plays a vital role regarding survival with its quick assessment of harmful circumstances, but its instantaneous evaluation can lead to biases and faulty impressions, leading to suboptimal or harmful decisions.

Strengths

Morse (2006) found that the subconscious can notice elements and form conclusions before slow thinking can, as evidenced by a series of card game experiments. The basic game in the series included good and bad decks of cards, meaning that certain decks provided more wins and others created more losses. Due to the loss aversion stimulated by the anterior insula, participants only needed ten rounds for their subconscious to notice the bad deck, revealed by their palms sweating due to stress from selecting the bad deck before researchers revealed the card. In this instance, participants' "gut reaction" was correct. On the other hand, it took eighty rounds for the participants to explain what was wrong with a deck consciously. Participants formed a correct subconscious intuition significantly earlier than conscious cognitive reasoning, and participants would benefit if they relied on their fast thinking.

In another study, Onge and Floresco (2009) discovered that patients with damage to the lobe of the brain responsible for emotional response had difficulty making routine life decisions, such as where to put their clothes or whether they should eat out. This damage to the fast-thinking decision pathway constricted their ability to make unimportant but quick decisions (Morse, 2006). It also slowed their ability to detect the bad deck in the experimental card game. Since the intuition can process thousands of pieces of information at once, it efficiently makes split-second decisions. This system takes little effort and can also deal effectively with elevated levels of uncertainty, as well as using nonquantifiable factors. Comparatively, according to Harris (2015), the cognitive portion can only process three to four pieces of information because the mind is actively focusing on them.

Weaknesses: Biases

While the intuitive portion of the brain is helpful in a variety of situations, it also creates danger, as it causes people to not fully evaluate the risk (Brown, 2014). With limited cognitive resources, the brain works to conserve these resources, often taking shortcuts in processing (Wilke & Mata, 2012). Instead of reevaluating each set of decisions, Croskerry (2014) realized that the intuitive portion of the brain utilizes pathways constructed over years of experience, whether accurate or inaccurate experience, to judge within seconds. While this speeds processing time and helps humans make thousands of decisions a day, it creates biases due to past actions and experiences. However, these deviations from rationality are often predictable, and labelled as cognitive biases, meaning systematic and flawed patterns of processing.

One example of these biases is the confirmation bias. Confirmation bias encourages people to filter, interpret, and accept information that supports their previous conclusions, rather than considering each piece of information for validity (Kaplan & Mikes, 2012). As a result, they can hold onto incorrect or even harmful beliefs. When people experience a negative response to their previous conclusions, they "escalate commitment," and stay on their course, even when facts and experience point the other way (Kaplan & Mikes, 2012, para. 5). Since these biases cause people to deviate from rational thought, they can affect risk perception and decision-making. Confirmation bias exhibits one of many ways biases affect rational decision making, and more biases will be discussed later in this essay in relation to risk tolerance classifications.

Neurological Processes Impact on Risk Perception

Recent research on cognitive processing reveals new insights on objective and subjective risk analysis. Risk perception, another term for these subjective views of risk, refers to an individual's "beliefs, attitudes, judgements and feelings of the risk attributes" (Nguyen, 2019, p.

750). Nur Aini and Lutfi (2019) observed that risk perception is highly dependent on both environmental cues and psychological characteristics of the individual. Due to its subjective nature, risk perceptions can differ from objective risk, resulting in a disparity between perceived risk and objective risk. While this disparity can stem from lack of knowledge, researchers have shown that risk perception gap primarily occurs due to emotions, such as fear or regret, and cognitive errors in processing. This causes people to minimize risks they should address or generate excessive fear about a safe event (Brown, 2014). With the recent literature on brain processing, the reasons behind irrational investor behavior become clearer. Investors do not rely solely on their prefrontal cortex to make rational decisions, but their subconscious influences their decisions, particularly when facing risk.

Cognitive Biases: Loss Aversion and Risk Framing

Based on new understanding of the interaction of slow and fast thinking, psychologists have identified numerous ways that the subconscious influences risk perception and risk decisions. One main area of study involves cognitive biases that affect risk perception and can lead individuals to change risk decisions; two prevalent cognitive biases are loss aversion and risk framing.

Loss Aversion

Proponents of the theory of loss aversion, which entails increased sensitivity towards losses but not gains, claim that losses hold psychological weights twice that of gains in human minds (Osimani, 2013; Thaler et al., 1997; See Appendix A for graph). Therefore, people tend to be risk averse in terms of gains, choosing the sure value over the gamble, but risk-seeking in terms of losses, going for the gamble to avoid a sure loss (Roszkowski & Snelbecker, 1990). This difference in psychological weights challenges the immutable perception of risk under the

Expected Utility theory, which holds that people perceive the risk to be objectively the same if the risk entails the same magnitude of volatility, regardless of direction. This imbalance in weighted value, a cognitive bias, affects decision-making, particularly when framed in reference to gains or losses, even if the gain is equal in magnitude to the loss.

Risk Framing

Risk framing refers to how the set-up of a problem affects decisions. The basis of risk framing postulates that the presentation of facts can influence perceptions and behaviors. According to Paek and Hove (2017), risk framing includes "selecting and highlighting some facets of events or issues and making connections among them so as to promote a particular interpretation, evaluation, and/or solution," (para. 15). Risk framing impacts risk perception, even though the risk remained quantitatively the same. For example, presenting the same statistic as either mortality or survival rates will significantly influence risk perception. If researchers use the mortality rate, people are more likely to experience fear and dread, increasing the severity of the risk in their minds. On the other hand, Slovic (1987) found that participants will view the risk positively if researchers speak in terms of the survival rate. This psychological weight of losses over gains, in addition to the enhanced positive or negative feeling based on the phrasing, leads the same people to choose different outcomes based solely on the framing.

Gains and Losses

Due to the difference in psychological weights of gains and losses, a change in frame, emphasizing either a gain or a loss, can lead to a change in decision (Jordan et al., 2019). For example, consider the situations in Figure 1 below (Jordan et al., 2019, p. 248).

Figure 1

Example of gain and loss frames with identical expected values

Scenario One. Suppose we give you $1,000. You have the following choices:

a. You can receive another $500 for sure.

b. You can flip a fair coin. If the coin flip comes up heads, you get another $1,000, but if it comes up tails, you get nothing.

Scenario Two. Suppose we give you $2,000. You have the following choices:

a. You can lose $500 for sure.

b. You can flip a fair coin. If the coin flip comes up heads, you lose $1,000, but if it comes up tails, you lose nothing.

When presented with scenario one, a gain frame, most subjects chose the sure $1,500 rather than the gamble, classifying them as risk-averse in terms of gains. However, according to Jordan et al. (2019), when faced with a sure loss, most subjects changed their answer and took the gamble, making them risk-seeking in terms of losses. Kahneman and Tversky use this example to show that risk framing changes individuals' risk decisions. Roszkowski & Snelbecker (1990) observed that 75% of subjects chose the sure gain rather than the gamble when presented in the gain frame. In the loss frame, 80% of the subjects from the same study chose the gamble. Most of the participants in the study changed their decision within a brief time window based on the framing alone. Therefore, their risk decisions are flexible and not immutable but are directly affected by perceived risk through framing.

Comparison of Options

Another element of risk framing relates to the comparison of options. According to Vlaev (2009), risk and loss aversion are relative to other options, not absolute, in human minds. When given three options, ranging from low to substantial risk (A, B, C), consumers predictably picked the middle choice (B). When researchers removed the least risky option (A) and replaced it with

the highest risk option (D), consumers shifted their decision and choose C, as it was now in the middle of the three options on the risk range. Once again, perception of the risk changed the risk decision and the willingness of the individual to endure a given risk.

Scope: Narrow and Broad

Another framing impact on risk perception includes narrow and broad frames, which includes analyzing single securities versus the whole portfolio, and shorter time frames versus longer time frames. Byrne (2013) found that in finance, individuals often focus heavily on one investment or stock, while ignoring the comprehensive view of their finances. However, the narrower the frame, the more short-term and risk-averse the investor's decisions become (Thaler et al., 1997). This narrow view motivates loss averse decisions by increasing the feeling of loss.

Thaler, Tversky, Kahneman, and Schwartz (1997) conducted an experiment to evaluate the effects of narrow framing. By evaluating security by security, rather than a portfolio, investors focused primarily on the short-term, and made more risk-averse decisions. This narrow frame changed how much risk the investors chose to endure. Timing of feedback or frequency of evaluation of the portfolio also affects decision-making. The investors that reviewed their investments monthly, rather than yearly, became the most risk averse. They chose safer investments, leading to a lower return compared to those that evaluated their investments on a yearly basis. Those with broader, longer-term, frames performed better throughout the experiment, measured by ending investment returns. Therefore, a broad, long-term frame leads to a lower risk perception and more risk-seeking decisions, while a narrow frame pressures individuals towards more risk-averse decisions through a higher risk perception.

Summation of Cognitive Biases

Loss aversion, the greater psychological weight of losses relative to gains, spurs individuals to become risk-seeking in terms of losses but risk-averse when evaluating potential gains (Osimani, 2013). Paek and Hove (2017) concluded that risk framing, the presentation of alternatives, can impact risk decisions, causing many individuals to choose differently, even though the results remain objectively the same. Loss versus gain frames can change decisions within a single experiment (Jordan et al., 2019; Roszkowski & Snelbecker, 1990). Vlaev et al. (2009) found that comparison of risky options prompts individuals to choose the middle option in a set of three choices, even if it changes the amount of risk they are willing to endure. Finally, scope in terms of securities and time horizons changes risk exposure decisions, as broader scopes lead to more risk-tolerant decisions (Byrne, 2013; Thaler et al., 1997). When individuals perceived higher risk, they tend to make risk-averse decisions; on the other hand, when they perceive an investment to be minimal risk, they tend to choose more risk exposure (Thaler et al., 1997). Therefore, the perception of risk, often influenced through risk framing, impacts the amount of risk individuals decide to tolerate.

Relation between Risk Perception and Risk Tolerance

While risk perception is the subjective interpretation of a given risk, risk tolerance measures how well an investor handles variability of outcomes or possible loss. Fisher and Yao (2017) defined risk tolerance as “the level of discomfort that an individual is willing to accept while risking current wealth for future growth,” (p. 195); inversely, Grable (2016) defined risk aversion as the individual choosing the promised amount of money rather than a chance with the same expected value. In terms of financial investment portfolios, risk tolerance describes an

"individual's willingness to accept negative changes in the value of investment or an adverse outcome that is different than the expected one" (Kannadhasan, 2015, p. 179).

Risk perception and risk tolerance both shape risk decisions, but they are not mutually exclusive, as they impact each other. Nguyen et al. (2019) found that risk tolerance was negatively correlated with risk perception, as those who were high risk tolerant had lower levels of risk perception, and risk-averse people had high perceptions of risk. Risk-averse individuals often overestimated risk, while risk-seeking individuals tended to underestimate the risk. Logically, these researchers concluded that those who did not perceive the risk to be high were more willing to expose themselves to that risk. In a study of financial investment portfolios, conducted by Nguyen et al. (2019), risk perception, through its impact on risk tolerance, accounted for up to 40% of asset allocation decisions. Risk tolerance itself accounted for up to 60% of asset allocation decisions, showing the powerful effect of both risk perception and risk tolerance in final asset allocation determinations.

Long et al. (2018) discovered that when researchers presented a company in a manner that made it difficult for participants to understand, participants rated the risk as higher than the easy-to-understand company. When given the task to construct a portfolio for a risk-seeking client, more participants allocated investments into the difficult company, perceived to be higher risk. On the other side, more participants assigned the easy-to-understand company, the perceived low-risk company, to risk-averse investor portfolios. Even though the risk was quantifiably the same, both the perceived risk by the participants and the risk tolerance of the clients impacted investment portfolio allocations.

Factors of Risk Tolerance

While risk perception can cause fluctuations in risk decisions, researchers can identify and measure more stable indicators of risk tolerance. These include behavioral factors, such as sensation seeking and propensity for regret, as well as demographic and socioeconomic factors, such as age, net worth, and education (Fisher, 2020; Rahman, 2020).

Behavioral Factors

Rahman (2020) established five behavioral factors that influence risk tolerance. These five factors included propensity for regret, propensity for trust, happiness in life, propensity to attribute success to luck, and propensity for overconfidence. Each of the factors were positively correlated with a risk tolerance, except for happiness in life, meaning that when the presence of a factor was high, the individual exhibited higher risk tolerance. Happiness in life was negatively correlated with financial risk tolerance.

Rahman (2020) defined propensity for regret as "accusing oneself of taking personal responsibility for making mistakes" (p. 263). Psychologists have paid great attention to the emotion of regret and its effect on decision making, particularly under uncertainty. However, Rahman (2020) showed that regret can cause risk tolerance to decrease or increase, depending on what the subject regrets most. Sometimes, regret causes individuals to make safer decisions, fearing the feeling of regret if they sustain a loss. However, in other individuals, propensity to regret directs risker choices, showing a fear of missing the gains. Propensity for trust, "the intention to accept vulnerability based on positive expectations of the actions or behavior of another," also increases the individual's risk tolerance (p. 272). Pan and Statman (2012) concluded that this factor can influence individuals engaged with trustworthy financial professionals, leading them to have higher risk tolerances. Both a propensity to attribute success

to luck, through past experiences, and a propensity for overconfidence, “overestimating the probability of favorable outcomes,” display higher risk tolerances in individuals, as they view their rates of failure as low, causing the risk taken to seem less dangerous (Rahman, 2020, p. 277). Each of these behavioral factors influences the risk tolerance of individuals.

Two other behavioral traits influence risk tolerance: sensation-seeking traits and internal locus of control. According to Wong and Carducci (2016), “sensation seekers often take risks to seek thrill” in both life and financial matters, as they love the thrill of the risk itself. The relationship between risk tolerance and sensation seeking tendency appears the strongest of studied factors, as gender, GPA, and age cannot mitigate the effects. Another finding of their study was that perceived locus of control, “the ability to control outcomes or whether they are largely attributable to luck,” strongly affects risk tolerance (p. 35). Internal control often leads to a higher risk tolerance; however, internal control only affected males’ risk tolerance, and this finding was mainly in upper classman subgroups. Researchers link locus of control to confidence in abilities, as both subgroups believe they can control the risk or beat the odds. Wong and Carducci (2016) also found that Type A individuals, “characterized by hard-driving and competitive traits, take more risk than Type B individuals” (p. 37). Factors that did not influence risk tolerance include ambiguity tolerance and financial dishonesty. Individual investors must be aware of and account for these behavioral factors that influence risk tolerance.

Demographic and Socioeconomic Factors

In addition to behavioral factors, demographic and socioeconomic factors also impact an individual’s risk tolerance (See appendix B for complete list). Fisher (2020) proposed that age tends to impact risk tolerance, as younger people have higher tolerances, often due to their longer investment horizons. A negative relationship exists between risk tolerance and the number of

dependents, meaning that the more dependents in a family, the more risk averse the financial decisions. Income uncertainty also decreases risk tolerance, as expected, as those without stable income or with greater fear of uncertainty would choose to risk less money, as they might need it in the near future. On the other end of the spectrum, Fang et al. (2021) found that higher incomes and greater household wealth increase risk tolerance, as those households can afford to risk money now for increased returns in the future. Higher levels of education are also associated with higher risk tolerances, particularly financial knowledge, as they better understand the risk-return trade-off (Fisher, 2020). When individuals have a financial planner, their risk tolerance increases, and they consequently increase the risk in their retirement portfolios. Many demographic and socioeconomic factors influence risk tolerance, and researchers can quantify them more accurately than shifting risk perception.

Risk tolerance also varies by gender and marital status. As women tend to be more risk-averse than men, researchers ranked unmarried men as the most risk tolerant, couples in the middle, and single women with the lowest risk tolerance (Fisher & Yao, 2017). With this difference in mind, financial professionals tend to underestimate women's risk tolerance and overestimate men's risk tolerance, leading to portfolios too conservative for the female clients and too aggressive for the male clients. This presents an additional problem as women live longer and need more funds for retirement. However, underlying factors that differ between men and women, particularly net worth and income uncertainty, are responsible for most of the differences in risk tolerance, rather than gender alone. "Gender differences in risk tolerance accounted for 10% of the gender difference in accumulated wealth" (p. 7); the factors affecting risk tolerance between genders represents a significant opportunity to bridge the gap between accumulated wealth differences. Researchers, individuals, and advisors must account for

demographic and socioeconomic factors that influence risk tolerance to create the most accurate risk tolerance assessment or understanding.

Risk Tolerance Models

While risk perception can influence risk tolerance and risk decisions, researchers can measure more stable behavioral traits and demographic factors. In the field today, there is not one widely accepted metric for risk tolerance evaluation. In searching for an accurate model, the model must account for risk framing and loss aversion biases to truly measure behavioral and demographic factors.

Cordell RiskPACK Model

Cordell (2001) created a four-factor risk tolerance model based on various inputs that affect risk tolerance. These four factors include risk propensity, risk attitude, risk capacity, and risk knowledge. Risk propensity (P) represents the investor's past and current investment decisions concerning risk, including an evaluation of his or her current holdings. Risk attitude (A) is the amount of risk chosen to incur, including comfort levels of that risk. Risk capacity (C) refers to the amount of risk an individual can take, dependent on income, net worth, and investment horizon. Finally, risk knowledge (K) measures investor understanding of risk and return. While this was the most thorough model to date, with each risk tolerance factor backed with additional psychological research, it failed to account for cognitive biases under Prospect theory and faultily assumed that investors make decisions based on rational utility.

RiskTRACK Model

Another model, RiskTRACK, takes Cordell's risk tolerance model based on the Expected Utility theory and adjusts it to account for cognitive biases identified under Prospect theory (Holzhauer et al., 2016). Researchers crafted the questionnaire to control for overreaction or

underreaction based on probability, loss aversion, the isolation effect, and the certainty effect. The acronym TRACK breaks down into five components: traditional risk factor, reflective risk factor, allocation risk factor, capacity risk factor, and knowledge risk factor. The authors likened the allocation factor to the risk propensity factor in Cordell's model, including past behavioral factors, but breaks down Cordell's attitude factor into traditional and reflective. The traditional risk factor uses only hypothetical gains, while the reflective factor analyzes the effect of hypothetical losses. This allows the researchers to determine the impact of loss aversion and cognitive bias on the individual's decisions. The capacity risk factor and knowledge risk factor utilize various socioeconomic and demographic factors discussed previously. These models present a sturdy foundation for analyzing an individual's risk tolerance while measuring the effects of cognitive bias.

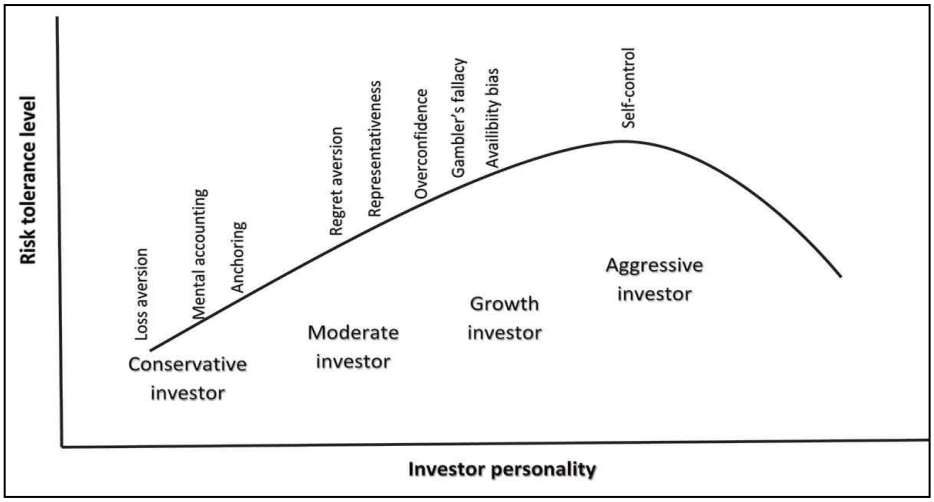
Risk Tolerance Classifications

Based on risk tolerance assessments through an appropriate model, such as the RiskTRACK model, Dickason and Ferreira (2018) grouped investors within four major classifications, including conservative (low risk tolerance), moderate (medium risk tolerance), growth (medium-high risk tolerance), and aggressive (high risk tolerance). Individuals within each of these classifications tend to share various traits, although someone can have a certain risk tolerance and not fit all the characteristics of the stereotypical category. While the model evaluates the more stable risk tolerance factors, it does not remove the possibility of faulty risk perception and susceptibility to subconscious biases, as discussed previously in the neural processing section of this essay. Biases form because of the brain working to conserve resources, thus taking shortcuts in processing, rather than invoking the time and energy consuming use of slow thinking (Croskerry, 2014; Wilke & Mata, 2012). As a result, particular cognitive biases

accompany each respective risk tolerance category, as shown in Figure 2 (Dickason & Ferreira, 2018). Therefore, investors within the classifications should be aware of their potential biases.

Figure 2

Graph of risk tolerance levels, investor personality, and common cognitive biases per category



Conservative Investor/Low-Risk Tolerance

The typical conservative investor places immense value on financial security and preventing capital loss. As a result, most conservative investors are low-risk tolerant and low-risk capacity, however, people with high-risk capacity might still have low risk tolerance (Dickason & Ferreira, 2018). When faced with uncertainty, these investors might make decisions slowly. To avoid risk, investments might occur outside of the financial market, such as in education or home ownership. These investors may grow or maintain wealth through inheritances or low-risk investments. Due to their minimal risk tolerance and low risk asset allocation, they might experience low returns, hurting their chances of meeting financial goals and saving adequately for retirement.

The behavioral and cognitive biases most at work in conservative investors are mental accounting and loss aversion bias. Pompian (2012) wrote that mental accounting, a cognitive

bias, results when investors "code, categorize, and evaluate economic outcomes by grouping their assets into any number of non-fungible (non-interchangeable) mental accounts" (p. 119). They make different risk decisions based on source of the money or its intended use, instead of treating every dollar as equal. In terms of loss aversion, instead of evaluating the portfolio return, these investors "keep investments that yield negative returns while hoping to reduce losses by taking on more risk," to catch up to their goals (Dickason & Ferreira, 2018, para. 22). They might make poor holistic decisions, avoiding realizing a loss on a poor performing security and selling their best securities instead (Pompian, 2012). Giving in to these biases can lead to suboptimal portfolio returns.

Moderate Investor/Medium-Risk Tolerance

Investors within this category might lack investment knowledge or follow along with trends. When investors may try to increase returns, Dickason and Ferreira (2018) found that they may overestimate their risk tolerance and risk knowledge and not consult with a professional. These investors tend to migrate towards popular investments and do not explore additional options due to lack of interest in investing. Moderate investors should seek outside advice to find additional investments that could help them reach their financial goals better in the long run.

The anchoring bias often hinders more conservative members of this group, as they are slow to incorporate the latest information (Dickason & Ferreira, 2018). Anchoring bias systematically skews people's future estimates or expectations based on a previous number, called the anchor (Lieder et al., 2017). In investing, investors may make a certain estimate or piece of information the anchor, failing to fully adjust to incorporate current information. According to Jain et al. (2015), 81% of participants were subject to the anchoring bias, showing that nonprofessional investors "cling" to that information (p. 14).

More moderate members of this group will fall into the regret aversion bias, focusing on avoiding the regret of the past, whether that was from a significant loss or missing a large gain (Dickason & Ferreira, 2018). For regret aversion bias, regret, defined as a "negative emotion evoked by the knowledge that a different choice would have led to a better outcome," drives investment decisions (Jain et al., 2015, p. 17). This regret can push investors two different directions: choosing minimal risk investments to avoid a loss or electing elevated risk options in fear of missing large gains. In either case, these investors may find it easier to follow the herd of the market, trapping them in a buy high and sell low cycle. These investors must avoid focusing on latest information or group mentality, but continually, objectively, evaluate the breadth of available information.

Growth Investor/Medium-High-Risk Tolerance

Growth investors often gravitate towards medium to high risk tolerance because of their independent and strong-willed nature. These self-assured individuals often trust their intuition and are not apt to consult with others (Dickason & Ferreira, 2018). They enjoy risk and investing and attempt to outperform the market. These investors experience a plethora of cognitive biases, such as representativeness, overconfidence, gambler's fallacy, and availability bias. The representative bias leads investors to believe causal forces and patterns are behind a random set of events, as well as base judgments based on similar circumstances or stereotypes (Jain et al., 2015; Jordan et al., 2019). This bias prompts investors to expect future performance based on past performance, even if circumstances have changed.

Another bias relates to overconfidence because of overestimation occurring in different areas, such as "one's actual ability, performance, level of control, or chance of success" (Raut et al., 2018, p. 823). Overconfidence appears in many areas of life; even though statistically it is

impossible for over 50% of people to be above average, 65% of people rated themselves above average in intelligence and 80% rated themselves as above average drivers (Heck, 2018; Kim et al., 2017; McCormick, 1986). People overestimate their ability to control or influence events, even when chance determines those events. In forecasting, Kaplan and Mikes (2012) established that people tend to overestimate the accuracy of their intuition and underestimate the variance of outcomes. Investors pay dearly for this overconfidence, as Barber and Odean (2000) found that overconfidence, in the form of frequent trading, accounted for the difference between individual investor returns at 11.4% and the market returns of 17.9% during the period of 1991-1996. Overconfidence also stems from self-attribution bias where individuals will credit themselves with a positive outcome but blame luck for negative outcomes (Czaja & Röder, 2020). This reinforcing cycle inflates a person's overconfidence in their own abilities because they are taking credit only for the successes.

The gambler's fallacy occurs when investors believe that when events deviate from the law of averages based on the long run, the deviation will correct itself in the short run (Jordan et al., 2019). Kovic and Kristiansen (2017) explained the gambler's fallacy as when investors "estimate the probability of an event as being conditional on past occurrences of that event, even though all events in the sequence of events are independent and identically distributed" (p. 292). Investors subject to the gambler's fallacy tend to sell securities when the market is increasing, as they are expecting a correction, and buy securities when the market is down trending (Wijayanti et al., 2019). They expect the trend to return to its long-term average in the short-term. The availability bias places more weight on information easily attained and less weight on difficult to obtain information (Jordan et al., 2019). The human mind regards easily attainable information as true, regardless of the amount of evidence. This can occur through both ease of recall of

information and the ease of understanding information (Jain et al., 2015). These investors are subject to a unique set of cognitive biases because of their independence and trust in their instinctual, fast thinking portion of their processing.

Aggressive Investor/High-Risk Tolerance

Researchers characterize aggressive investors by their high-risk tolerance, but this investor segment often brings overconfidence with them. This group places the greatest weight on their own abilities to outperform the market, undertaking substantial risk for above average returns (Dickason & Ferreira, 2018). These investors often frequently alter their portfolios with abrupt decisions. Not only are these investors affected by the overconfidence bias, but they are also subject to the self-control bias. Pompian (2012) found that the self-control bias causes investors to make choices today that sacrifice their benefit in the long run, caused by lack of self-discipline. The self-control bias often creates an asset allocation imbalance and investors tend to leave their disciplined approach to investing behind, such as compounding of interest and dollar-cost averaging. Instead of discipline, these investors may chase after significant risk for more returns, but they risk their future in the process. These investors must be aware of their cognitive biases to meet their long-term goals.

Impact of Risk Tolerance on Investment Results

Risk plays a crucial role in the evaluation investment allocations and the amount of risk taken has a drastic impact on the ending portfolio value (Kannadhasan, 2015). Risk tolerance significantly affects risk decision-making regarding asset allocation, and security selection (Kannadhasan et al., 2016; Nur Aini & Lutfi, 2019). Investors with higher risk holdings stand to benefit from higher returns, particularly over the long run (Kannadhasan, 2015). High-risk tolerant investors tend to place their money into riskier assets, such as stocks, which tend to

outperform safer investments over an extended time (Fisher & Yao, 2017; Nur Aini & Lutfi, 2019). On the other hand, investors with low-risk tolerances tend to have low risk investment allocations. Since risk is correlated with return in investment portfolios, Fisher and Yao (2017) concluded that risk-averse households may not build adequate retirement wealth or reach other financial goals due to the low growth of their investments.

When portfolios do not match an individual's risk tolerance, the portfolio may experience suboptimal returns (Nguyen et al., 2019). For low-risk tolerance investors with high-risk portfolios, they may sell their holdings too early after a period of volatility, realizing losses instead of patiently holding for expected gains. On the other hand, high tolerant investors with low-risk portfolios are not fully capitalizing on high-risk assets; they could potentially be earning more by electing to allocate more to risky assets. Either of these situations could create investor disappointment (Kannadhasan, 2015).

Application for Financial Advisors

To make recommendations in the best interest of the client, the advisor must fully understand both the client's situation and the client's risk tolerance (Kannadhasan et al., 2016). According to Cordell (2001), "few planners understand the basic issues involved in risk tolerance assessment" (p. 38); Roszkowski and Grable (2005) reported only "a 0.41 correlation between advisors' estimates of their clients' risk tolerance levels and their actual measured risk tolerance levels," showing a strong disconnect between clients and advisors (p. 187). This creates a problem for advisors, as mismatching individual risk tolerance and risk levels of portfolios leads to suboptimal investment results and client disappointment. Advisors must improve in their ability to gauge client risk tolerance, using an appropriate model, particularly since risk tolerance directly impacts household wealth through portfolio allocation (Fisher & Yao, 2017). Therefore,

for best client results in terms of investment satisfaction, meeting financial goals, and client-advisor relationships, it is imperative for advisors to properly identify client's risk tolerance to contrast an ideal portfolio (Nguyen et al., 2016). Properly understanding and working with a client's risk tolerance can improve the client experience, uphold fiduciary regulations, and improve a client's abilities to meet financial goals.

Advisor Response to Risk Frames

In addition to assessing risk tolerance, advisors must be aware of the impact of risk perception on investment choices. One area previously discussed was the impact of risk framing on risk choices. Framing affected choices when viewed in terms of narrow versus broad frames, comparison frames, and loss versus gain frames (Roszkowski & Snelbecker, 1990; Thaler et al., 1997; Vlaev et al., 2009). As broad frames led to the best long-term risk decisions, advisors should remind clients of the broad view of their wealth, including a comprehensive view of all their assets and the long-term perspective, so that clients can calmly tolerate times of volatility (Thaler et al., 1997). Additionally, this helps them in the long run, as many investors sacrifice returns unknowingly due to their fear sells or excitement purchases. Timeframe heavily influences decisions, as Vlaev et al. (2009) showed that people will choose more risk when presented with a long-term picture compared to the short-term. By adjusting the scope of the presentation of options, professionals can lead clients to choosing more beneficial decisions of their own free will and tolerate risk more easily.

Advisor Response to Biases

In addition to correctly assessing risk tolerance and addressing risk framing, advisors can also help investors avoid the cognitive and behavioral biases to which they are most susceptible. By understanding how different investors make their decisions, Dickason and Ferreira (2018)

suggested that advisors can provide new ways to look at information or guide investors towards a more appropriate choice. For example, conservative investors, due to their mental accounting and loss aversion biases, might hold on to poorly performing investments to get even. Advisors can help guide them to better performing investments and sell the old ones, which the investors might not have been able to do on their own. For moderate and growth investors subject to the anchoring, representativeness, overconfidence, regret aversion bias, and gambler's fallacy, financial advisors can help evaluate present and past information in a non-biased manner and provide an appropriate reference point, keeping investors from anchoring on one piece of information. Finally, with aggressive investors, financial advisors can help them use self-control through disciplined approaches or automatic investing to overcome their self-control bias and overconfidence.

In each situation, the financial advisor must accurately determine clients' risk tolerance, frame risks broadly, and identify cognitive biases to properly construct a portfolio for the long-term and guide them throughout the duration of the investment (Kannadhasan et al., 2016). When financial advisors implement proper risk tolerance modeling, portfolio construction that aligns with a client's risk tolerance, and account for risk framing and cognitive biases, clients may see more satisfactory investment performance and enhanced ability to meet financial goals. Overall, this aids the advisors in creating value for clients and improves the client-advisor relationship.

Conclusion

People cannot eliminate risk in their lives, including their financial investments, but instead must evaluate the variability of outcomes and decide between shifting alternatives (Aven, 2016). Proponents of the Expected Utility theory believe that people make these decisions

objectively based on measured satisfaction; however, even when investors have adequate knowledge and the ability to make objective decisions, many individual investors succumb to psychological biases (Chhabra, 2015; Grable, 2016). Thaler et al (1997) and Mohr et al. (2010) analyzed these biases, finding that the subconscious processes of the brain often overrun cognitive, objective thought, altering an individual's perception of the risk presented, creating the foundation of Prospect theory. Such biases include loss aversion, which places greater psychological weight on losses, systematically leading individuals to act risk-seeking in terms of losses and risk-averse in terms of gains (Thaler et al., 1997). Paek and Hove (2017) concluded that risk framing, another cognitive error, triggers individuals to make inconsistent risk decisions when researchers changed frames from broad to narrow or altered the set of alternatives. These cognitive errors, caused by the brain's subconscious processing, affect an individual's perception of the risk, which shifts their risk tolerance, their willingness to endure or their desire to avoid the presented risk (Nguyen et al., 2019).

Apart from the effects of risk perception, Rahman (2020) established that two main sets of factors shape an individual's risk tolerance: behavioral and demographic/social. Analyzing these factors through models that adjust for risk perception biases, such as the RiskTRACK model, can lead to more accurate measures of an individual's risk tolerance (Holzhauer et al., 2016). Dickason and Ferreira (2018) found that an accurate understanding of risk tolerance allows researchers and advisors alike to place individuals into the appropriate risk tolerance category, providing guidance on the types of investments that are best suited to their tolerance. Fisher and Yao (2017) proposed that matching risk tolerance with the level of risk in portfolios helps the individual hold the investments throughout volatile time periods, as well as achieve optimal potential for return for a given level of risk.

Financials advisors, as they design and construct investment portfolios for a variety of clients, must understand how to properly determine their clients' risk tolerances, as well as identify the risk perception biases to which the clients might succumb (Nguyen et al., 2019). Because clients of certain risk tolerances yield to particular cognitive biases, advisors must understand how to identify, mitigate, and correct these biases when present (Dickason & Ferreira, 2018). They also must comprehend the effects of risk framing and adjust it as appropriate to encourage beneficial long-term risk decisions (Paek & Hove, 2017). As trusted guides, financial advisors can help clients achieve their financial goals by using proper risk tolerance models to construct an appropriate portfolio and addressing cognitive biases throughout the client and advisor relationship.

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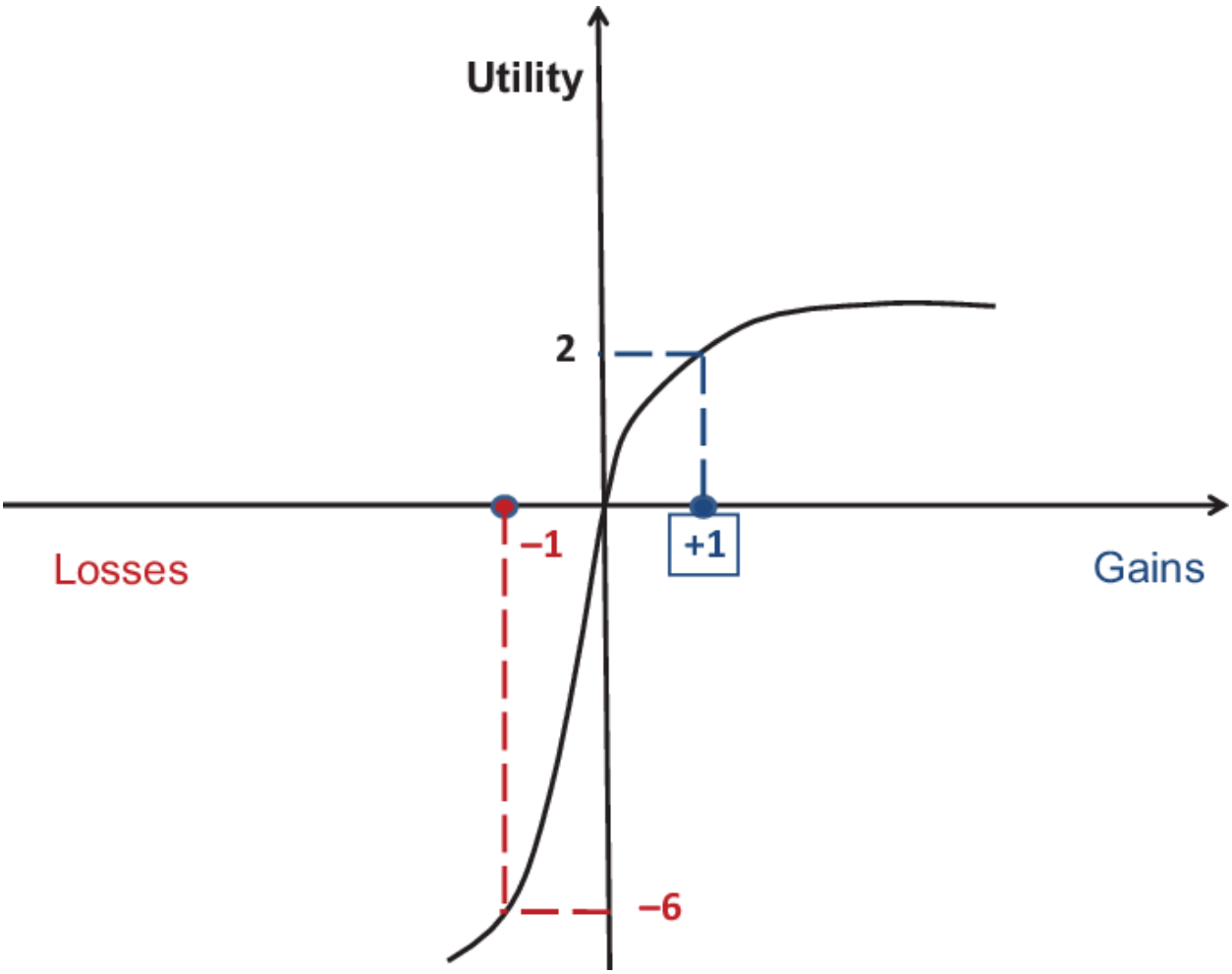
Appendix A: Loss Aversion Graph



(Osimani, 2013)

Appendix B: Factors Associated with Financial Risk Tolerance

Individual characteristic	Assumed to be more risk tolerant	Level of support in the literature
Gender	Male	High
Age	Younger	Moderate
Marital status	Single	Moderate
Marital/Gender interaction	Single male	High
Ethnicity	Non-Hispanic white	Moderate
Income	High	Moderate
Net worth	High	High
Financial satisfaction	High	High
Financial knowledge	High	High
Education	Bachelor's degree or higher	Moderate
Employment status	Employed full-time	Moderate
Occupation	Professional	Moderate
Income source	Business owner	High
Income variability	Stable and predictable	High
Household size	Large	Moderate
Homeownership	Owner	Low
Religiosity	Less religious	Moderate
Self-esteem	High	High
Locus of control	Internal	Low
Personality	Type A	High
Sensation seeking	High	High
Mood	Happy	High

(Grable, 2016)