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LOSS HELPS PEOPLE MAKE MORE RATIONAL DECISIONS

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Xinhao Yu   (name of student)

ABSTRACT

Biases often arise when people make choices and evaluate outcomes, leading them astray from optimal decision-making based on economic theories. Although researchers have proposed cognitive and motivational interventions to de-bias people, few interventions can address multiple biases simultaneously. This research aims to achieve this goal by examining people's tendencies to exhibit or avoid decision-making biases after they experience losses or gains. I argue that people experiencing losses tend to avoid certain decision-making biases as they become more cautious or process information more deliberately. Three experiments tested the effects of experienced losses on the three most prevalent biases when people make and reflect on decisions (sunk cost bias, default bias, and outcome bias). The results indicated that a loss manipulation significantly reduced the three biases, with effect sizes approximately halving compared to a gain manipulation. These findings are consistent with the idea that losses promote more analytical thinking that helps people make more rational decisions.

Keywords: gain or loss, heuristics and bias, decision-making, processing style

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Over the past two years, I have navigated a whirlwind of highs and lows. Each peak and trough has brought its own mix of gains and losses, accumulating a vast treasure of experiences that now enrich my research endeavors. Committed to my dream, I will persist as a scholarly seeker of extensive knowledge, striving to conduct research that makes a significant impact.

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CHAPTER 1: INTRODUCTION

In the past few decades, the judgment and decision-making (JDM) literature has witnessed a proliferation of research on decision-making biases in various contexts (Kahneman, 2011). These biases, often resulting from cognitive heuristics and insufficient cognitive processing, can lead to suboptimal decision-making and impaired judgment (Tversky & Kahneman, 1974). For example, one of the best-known biases, the sunk cost fallacy, documents people's tendency to continue an endeavor once an investment has been made, even though rational decision-makers should ignore the irrecoverable costs (Arkes & Ayton, 1999; Arkes & Blumer, 1985; Thaler, 1999). Similarly, the status quo bias refers to people's tendency to choose the default option even if it is suboptimal (Samuelson & Zeckhauser, 1988). Besides committing biases when making choices, people also commit biases when evaluating outcomes. For example, outcome bias refers to people's tendency to judge a decision based on its outcome rather than on the quality of the decision at the time it was made (Baron & Hershey, 1988). This bias can hinder learning from past decisions, as individuals feel that the errors they made could have been avoided even when the information they had at the time of the decision did not allow for a better choice.

Cognitive biases have traditionally been attributed to different causes, each with its own idiosyncratic explanation (Hsee et al., 2019). Past research has suggested multiple cognitive and motivational strategies to reduce specific biases (Milkman et al., 2009). These strategies include taking an outsider's perspective (Kahneman & Lovallo, 1993), considering the opposite decision (Lord et al., 1984; Mussweiler et al., 2000; Soll & Klayman, 2004), providing attractive incentives (Camerer & Hogarth, 1999), and making individuals accountable for their choices (Lerner & Tetlock, 1999). Only a few strategies identified can help mitigate multiple biases

simultaneously (Fischoff, 1982). For example, manipulating the relevance of salient pieces of information can eliminate or even reverse several biases, including sunk cost bias, non-regressive prediction, anchoring bias, and base rate neglect (Hsee et al., 2019). Moreover, manipulating the choice architecture by offering choices simultaneously instead of sequentially encourages deeper cognitive processing and more rational decisions (Basu & Savani, 2017, 2019). However, a shortcoming of relevance manipulation is that a third party needs to determine what the relevant information is and then make that information salient. This is probably not feasible in everyday life. Instead, the present research seeks to identify a de-biasing strategy that can address multiple biases by examining people's tendency to commit or avoid biases when they experience gains or losses.

In decision-making and behavioral economics, gains and losses have been extensively studied and emerged as critical factors shaping decision-making. One of the foundational works in this area is Prospect Theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992), which posits that people are more risk-averse when choosing among gains but are more risk-seeking when choosing among losses. Additionally, when the same options are framed as gains or losses, people are more risk-averse when options are framed as gains but more risk-seeking when options are framed as losses (Tversky & Kahneman, 1981). However, little research explores the impact of gains or losses beyond risk-taking. Past research has focused on either expected gains and losses or options framed as gains and losses, not on the contextual gains and losses a decision-maker has experienced before making decisions. Every day, the constant ebb and flow of losses and gains can shape people's perceptions, motivations, and reactions. People are influenced not only when they are thinking about losses and gains but also when their experienced losses are working in the background even before they make certain decisions.

In this research, I investigate how experienced gains or losses affect decision-making biases. I argue that people tend to avoid certain decision-making biases after experiencing losses. I tested the hypotheses through three between-subjects experiments that assessed the three most common biases in decision-making: the sunk cost bias, the default bias, and the outcome bias. Two lines of research shed light on how experienced losses reduce decision-making biases. First, losses induce negative affect, and people with negative affect are more likely to engage in deliberative System 2 processing (Forgas, 1995; Isbell, 2004; Isbell et al., 2013). Second, losses induce a prevention focus (Higgins, 1998), so that people become more cautious in decision-making to avoid more losses.

This research has substantial theoretical and practical implications. First, it contributes to the literature on gains and losses in decision-making (Kahneman & Tversky, 1979; Tversky & Kahneman, 1981) by documenting that experienced gains or losses can affect subsequent decision qualities even though the decision options themselves are not specified or framed as gains or losses. Second, it contributes to the literature on de-biasing people (Milkman et al., 2009) by documenting how people tend to avoid sunk cost bias, default bias, and outcome bias after experiencing losses. Practically, this research can suggest strategies that managers and organizations can use to mitigate decision-making biases.

In Chapter 2, I will review the literature about de-biasing strategies, gains, and losses in decision-making. In Chapter 3, I will discuss the methodology and present the results from the four experiments conducted based on two different samples. In Chapter 4, I will further discuss the research findings, potential mechanisms, implications, limitations, and future research directions.

CHAPTER 2: THEORY DEVELOPMENT

Heuristics, Biases, and De-bias

Heuristics are mental shortcuts, or rules of thumb, that simplify decision-making processes. They are beneficial under conditions of uncertainty or complexity, where information is incomplete or overwhelming (Gigerenzer & Gaissmaier, 2011). However, relying on heuristics can also lead to systematic errors or biases, which may result in suboptimal decisions (Tversky & Kahneman, 1974). Overcoming decision-making biases is essential for making well-informed choices (Lilienfeld et al., 2009) and achieving desirable outcomes (Bazerman & Moore, 2012).

Many biases occur when people make decisions. For example, the sunk cost fallacy describes the inclination to continue investing in a judgment or project based on the number of resources already committed rather than evaluating the current and future value of the investment (Arkes & Ayton, 1999; Arkes & Blumer, 1985). This bias can lead individuals to prioritize the avoidance of perceived losses over the potential gains of a more beneficial alternative (Staw, 1976). The sunk cost bias is associated with mental accounting and the misuse of the "waste-not" heuristic (Arkes & Ayton, 1999; Arkes & Blumer, 1985; Thaler, 1999). Previous studies have shown that sunk costs affect user engagement (Goli et al., 2022). Another famous bias is the default bias, also known as the status quo bias. It refers to individuals' tendency to stick with their current or default situation instead of changing, even when change might be beneficial (Samuelson & Zeckhauser, 1988). Default bias is related to loss aversion because the perceived costs of departing from the status quo often outweigh the benefits of changes (Tversky & Kahneman, 1992). The default bias has been found to affect organ donation rates (Johnson & Goldstein, 2003), saving behavior (Madrian & Shea, 2001), and patient inertia (Suri et al., 2013). Biases also emerge when individuals evaluate their decisions retrospectively. For example,

outcome bias refers to judging a decision by its outcome instead of based on the quality of the decision at the time it was made (Baron & Hershey, 1988). This bias can hinder learning from past decisions and foster a blame culture, as successful and risky decisions are overly rewarded while unsuccessful but sound decisions are penalized. For example, people judge behavior as more unethical when it leads to a negative rather than a positive outcome, and they become more likely to punish (Cushman, 2008).

Past research has uncovered promising strategies for overcoming specific cognitive biases by shifting decision-makers from intuitive to deliberative thinking (Milkman et al., 2009). One mental approach encourages people to take an outsider's perspective and consider alternative viewpoints. Seeking out alternative views removes one mentally from a specific situation to consider diverse decision choices to which the current problem belongs (Kahneman & Lovallo, 1993). A study introduced the concept of the inside and outside views, demonstrating that adopting an exterior view can reduce overconfidence and alleviate the anchoring of plans and forecasts (Kahneman & Lovallo, 1993). Other research found that the role of perspective-taking in negotiation led to reduced egocentric bias and more remarkable collective negotiation outcomes (Galinsky et al., 2008). Asking a genuine outsider's opinion may also improve judgment because it brings new insights regarding a decision.

Another successful strategy that mitigates biases involves considering the opposite decision (Milkman et al., 2009). In a study of the hypothesis-consistent testing strategy, researchers demonstrated that actively considering contrasting information can reduce anchoring bias and improve judgment accuracy (Mussweiler et al., 2000). In another study of attitude change, researchers found that assuming the opposite can mitigate biased assimilation and encourage more balanced evaluations (Lord et al., 1984). Other researchers provided a

"considering the opposite" variation to reduce overconfidence in subjective probability estimates (Soll & Klayman, 2004). When participants offer a range of estimates they believe has an 80% chance of containing the actual value, those ranges end up holding the truth only 30–40% of the time. However, having participants generate their 10th and 90th percentile estimates in two separate stages leads to hit rates of nearly 60% as they think about different justifications for the low and high ends of the range. "Considering the opposite" works because it shifts attention to contrary evidence that would not otherwise be considered (Larrick, 2004).

Apart from adopting cognitive strategies to reduce decision-making biases, researchers have documented the use of motivational strategies and training interventions (Larrick, 2004). For instance, providing attractive incentives will encourage individuals to spend more effort on deliberation and improve their mean decision performance (Camerer & Hogarth, 1999). However, decision-makers must possess the necessary cognitive capabilities to apply them with effort. Another motivational strategy for reducing biases involves making individuals responsible for their choices by creating the expectation that they will need to justify their decisions to others later. The accountability paradigm is beneficial in conditioning decision-makers' characteristics and task environments (Lerner & Tetlock, 1999). Lastly, researchers found that launching a de-biasing training program to uncover the cognitive mechanisms behind multiple biases led to significant reductions in biases post-training (Morewedge et al., 2015).

Although extensive research has suggested targeted interventions to mitigate specific biases, only a few strategies identified can help reduce multiple biases at a time (Fischoff, 1982). For example, studies on choice architecture found that participants favored the dominating options when the options were presented simultaneously rather than sequentially (Basu & Savani, 2017, 2019). Other research identified the insensitivity to the relevance of some given

information as a common underlying mechanism of the sunk cost fallacy, non-regressive prediction, anchoring bias, and base rate neglect (Hsee et al., 2019). However, a shortcoming of relevance manipulation is that a third party needs to determine what the relevant information is and then make that information salient. Instead, the present research seeks to identify a strategy that helps the decision-maker avoid multiple biases by examining their tendencies to commit or avoid bias after experiencing gains or losses.

Influence of Gains and Losses on Decision-Making

In psychology and behavioral economics, the influence of gains and losses on decision-making has emerged as a major theme, offering crucial insights into the mechanics of human choice. The Prospect Theory, the framing effect, and the newly proposed experienced gains and losses provide a framework for understanding the impact of gains and losses on decision-making.

Prospect Theory is a descriptive theory of risky decision-making that argues that people make asymmetric decisions between losses and gains—they are risk-seeking for losses but risk-averse for gains (Kahneman & Tversky, 1979). This theory contrasts with the prescriptive Expected Utility Theory, which posits that humans are rational actors who make decisions by considering all possible outcomes (Tversky & Kahneman, 1992). Prospect Theory introduces two main concepts: loss aversion and value function. Loss aversion implies that losses are psychologically more potent than equivalent gains (Tversky & Kahneman, 1991). For instance, the dissatisfaction experienced from losing $100 is more intense than the pleasure of gaining $100. This asymmetry between the power of positive and negative expectations or experiences significantly influences individuals' behavior (Barberis, 2013; Novemsky & Kahneman, 2005). The value function, defined for gains and losses, is ordinarily concave for gains, convex for losses, and steeper for losses than for gains. It implies that individuals are risk-averse in the

domain of gains and risk-seeking in the domain of losses (Tversky & Kahneman, 1992). The

implications of Prospect Theory are far-reaching, affecting areas such as investment decisions

(Tan & Zhang, 2021; van Bilsen et al., 2020), consumer behavior (Brenner et al., 2007; Hu &

Nasiry, 2018; Thaler, 1985), and management (Alessandri et al., 2021; Ballard et al., 2016;

Bammens et al., 2022).

The framing effect, another prominent concept, refers to the phenomenon where people's

decisions are influenced by how information is presented. The framing effect has implications

for understanding biases and the design of choice environments. Tversky and Kahneman (1981)

demonstrated that when a choice is framed in terms of a certain gain vs. a probabilistic gain of

equal expected value, people tend to select the certain option, revealing risk aversion.

Conversely, when the same choice is framed as a certain loss vs. a probabilistic loss of equal

expected value, people tend to select the probabilistic option, displaying risk-seeking behavior.

The impact of gain-loss framing has been explored in various contexts, such as healthcare

(McNeil et al., 1982) and environmental policy (Hardisty et al., 2010). For example, in health

communication, loss framing encourages preventive behavior (Rothman & Salovey, 1997) and

vaccination (Altay & Mercier, 2020). In advertisements, framing strategies are examined to

increase the purchase of cross-category bundles (Goh & Bockstedt, 2013; Khan & Dhar, 2010)

and higher-priced products (Allard et al., 2019). In management, framing uncertainty as an

opportunity increases managers' control, whereas framing uncertainty as a threat increases their

preference for prediction (Smit, 2023).

Despite these two lines of research that study gains and losses as risky choices and

information presentation, little research explores the impact of experienced gains or losses on

decision-making. This is a significant gap because the flow of gains or losses constantly shapes

people's perceptions, motivations, and reactions (Kahneman & Tversky, 1979; Tversky & Kahneman, 1991, 1992). Consider an investor who just experienced substantial gains from a high-risk, high-return investment. Encouraged by the recent success, they might develop a sense of gain, which may influence their decision-making for subsequent investments. Consequently, they might be more inclined to invest in high-risk ventures, believing they can repeat their previous success. This inclination could lead to an overconfidence bias, which might not always result in the best investment outcomes. Another investor who experienced a significant loss in a high-risk investment may trigger a sense of loss, leading the investor to become more risk-averse in subsequent decisions. They might choose safer, lower-return investments to diversify their investment portfolio. In both cases, the experienced gains or losses triggered by the initial investment outcomes influenced subsequent investment decisions (Thaler & Johnson, 1990).

Additionally, the effect of the experienced gains or losses may not be restricted in the same decision context (e.g., Alessandri et al., 2021; Baldacchino et al., 2023; Cerar et al., 2023). Consider a board of directors overseeing a company performing exceptionally well, exceeding targets, and showing strong growth and profitability. The board members' experience with the company's success triggered a sense of gain. As a result, they may be more inclined to approve ambitious strategies, such as expanding into new markets, investing in new product development, or approving significant capital expenditures. In contrast, if the company had been underperforming, with declining profits and a shrinking market share, it could trigger a sense of loss among the board members. They may become cautious in their decision-making, opting for cost-cutting strategies, focusing on the core business, or deferring significant capital expenditures. This example illustrates how experienced gains or losses may influence various strategic decisions widely.

After experiencing gains or losses, individuals may develop a sense of gain or loss, even before they have encountered or considered the options for another decision. As our mental state can influence our perception and decision-making (Schwarz, 2000), the experienced gains or losses would lead to different decision-making patterns. This perspective could open the door to new interventions to help individuals and organizations attenuate biases and make better decisions.

In this research, I test whether experiencing losses will help people avoid sunk cost bias, default bias, and outcome bias. Although there is no overarching framework of biases in the JDM literature, I selected these three biases because they frequently appear when people make decisions and evaluate past decisions, respectively. Specifically, I propose:

Hypothesis 1: The sunk cost bias will be stronger in the gain condition than in the loss condition**.**

Hypothesis 2: The default bias will be stronger in the gain condition than in the loss condition**.**

Hypothesis 3: The outcome bias will be stronger in the gain condition than in the loss condition**.**

CHAPTER 3: METHODOLOGY

I conducted three experiments to test the hypotheses regarding sunk cost bias (Study 1), default bias (Study 2), and outcome bias (Study 3). All studies adopted a between-subjects design based on a board meeting scenario (see Appendices 1 to 3 for sample scenarios). Participants will assume the role of corporate board members attending a board meeting. The board will start by reviewing the company's last-quarter financial performance and then make the strategic decisions described in each bias manipulation scenario.

The following sections will introduce each study's research design, procedure, and results. Across the three studies, I sought full-time managers with at least one subordinate on Prolific. I expected participants with managerial experience could make sense of the board meeting scenarios and make informed decisions. Participants who did not finish the studies were dropped from the analyses in any experiment. I report all numbers with two significant digits after the decimal point.

Study 1

This study tested the impact of experienced gains or losses on participants' propensity to exhibit sunk cost bias. I implemented a 2 (gain vs. loss) × 2 (sunk cost vs. control) between-subject design to test hypothesis 1.

Method

Participants. I sought 200 full-time managers with at least one subordinate on Prolific (99 women, 100 men, 1 unreported; M_{age} = 43.38 years, SD = 12.47). Across all studies, participants were randomly assigned to one of the four experimental conditions.

Procedure. I manipulated the experienced gain or loss by the company's increasing or decreasing last quarter's financial performance. I justified the financial performance with specific reasons (e.g., "massive increase in consumer air travel") and made parallel modifications for the gain or loss conditions. I also bolded the words or phrases and provided a clear end-of-manipulation message (e.g., the company's "finances are very strong") to indicate the company's financial status. The gain and loss conditions were manipulated using similar approaches across the three studies (detailed wording can be found in the appendix).

Using the standard radar-blank plane scenario, I measured the sunk cost bias (Arkes & Blumer, 1985). Participants were asked whether they would support developing an inferior radar-blank plane either when they had not spent the allocated funds (control condition) or after they had spent 90% of the allocated funds (sunk cost condition). Participants rated their willingness to support from 0 to 10 (0 = "strongly support canceling the radar-blank plane project and using the remaining research funds for something else"; 10 = "strongly support using the remaining research funds to complete the radar-blank plane project").

Results

The dependent variable (ranging from 0 to 10) was the extent to which participants were willing to support investing in the radar-blank plane. A two-way ANOVA was conducted to examine the effects of the gain or loss and sunk cost on the dependent variable. There was a significant main effect of sunk cost ($F(1,193) = 40.92$, $p < .001$, $\eta^2 = .17$), indicating that participants in the sunk cost condition ($M = 5.54$, 95% CI [4.83, 6.26], $SD = 3.62$) scored higher on the dependent variable compared to those in the control condition ($M = 2.56$, 95% CI [1.93, 3.18], $SD = 3.14$). The main effect of the gain or loss was significant ($F(1,196) = 4.23$, $p = .04$, $\eta^2 = .02$). The

interaction effect between sunk cost and gain or loss was also significant (F (1,196) = 4.71, p =.03, η² =.02).

Figure 1. Willingness to Support the Radar-blank Plane Project in the Study 1 Sunk Cost Bias Scenario
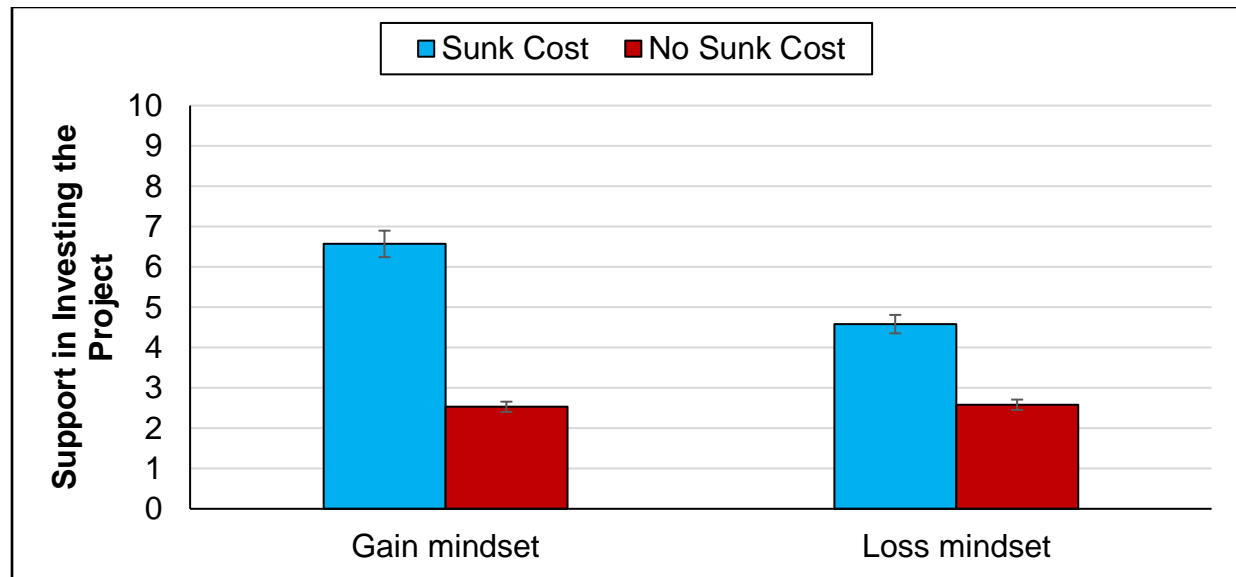
In the gain condition (N = 100), there was a significant difference between the sunk cost (M = 6.57, 95% CI [5.53, 7.61], SD = 3.63) and control (M = 2.53, 95% CI [1.65, 3.41], SD = 3.14) groups, t (98) = 5.96, p <.001, Cohen's d = 1.19. In the loss condition (N = 100), there was a significant difference between the sunk cost (M = 4.58, 95% CI [3.64, 5.51], SD = 3.37) and control (M = 2.58, 95% CI [1.66, 3.51], SD = 3.18) groups (t (98) = 3.04, p =.003, Cohen's d =.61). As shown in Figure 1, the effect size of the sunk cost bias was significantly attenuated in the loss condition compared to the gain condition.

To ensure the effectiveness of the experimental manipulations, I conducted the following manipulation checks: First, participants were asked, "How was the company's financial performance in the last quarter?" They chose between increasing or decreasing profits. An

independent sample t-test revealed that manipulation of gain or loss was successful: t (198) = 35.61, p <.001, Cohen's d = 5.04.

Thus, Study 1 found that the loss reduced the extent to which participants exhibited sunk cost bias. The effect size of the sunk cost bias was approximately cut in half in the loss condition compared to the gain condition.

Study 2

Study 2 tested the impact of gain and loss on participants' propensity to exhibit the default bias. I implemented a 2 (gain vs. loss) × 2 (high-risk asset vs. low-risk asset) between-subjects design to test hypothesis 2.

Method

Participants. I sought 201 full-time managers with at least one subordinate on Prolific (98 women, 100 men, 2 unreported; M_{age} = 42.52 years, SD = 11.70).

Procedure. The gain or loss conditions were manipulated similarly to those in Study 1. I measured the default bias using a corporate investment scenario (Samuelson & Zeckhauser, 1988). Participants were asked whether they would move their company's investment funds from a high-risk asset to a low-risk asset or vice versa. Participants chose from one of the six investment options with various risk levels (6 = high-risk Company A, 5 = moderate-risk Company B, 4 = low-risk Company C, 3 = corporate bonds, 2 = municipal bonds, and 1 = Treasury bills).

Results

The dependent variable (ranging from 1 to 6) is the investment option the participants finally choose. A higher score in the dependent variable indicates that participants chose riskier investment options. A two-way ANOVA revealed a significant main effect of default asset (F $(1,197) = 40.57$, $p < .001$, $\eta^2 = .17$), indicating that participants in the high-risk asset condition ($M = 3.98$, 95% CI [3.59, 4.53], SD = 1.62) chose riskier investment options whereas participants in the low-risk asset condition ($M = 2.68$, 95% CI [3.64, 5.51], SD = 1.32) chose less risky options. The main effect of the gain or loss was not significant. The interaction between default assets and the gain or loss manipulation was significant (F $(1,197) = 6.20$, $p = .01$, $\eta^2 = .03$).

In the gain condition (N = 103), there was a significant difference between the high-risk asset ($M = 4.05$, 95% CI [3.59, 4.53], SD = 1.70) and the low-risk asset ($M = 2.24$, 95% CI [1.91, 2.57], SD = 1.17) groups, t $(101) = 6.27$, $p < .001$, Cohen's d = 1.24. In the loss condition (N = 98), there was also a significant difference between the high-risk asset ($M = 3.89$, 95% CI [3.43, 4.35], SD = 1.54) and the low-risk asset ($M = 3.10$, 95% CI [2.73, 3.47], SD = 1.33) groups (t $(96) = 2.74$, $p = .007$, Cohen's d = .56).

I conducted the following manipulation checks: First, participants were asked a similar manipulation check question for the gain-loss manipulation. An independent sample t-test revealed that the gain-loss manipulation was successful: t $(199) = 56.87$, $p < .001$, Cohen's d = 8.03. Second, participants were asked, "What was the composition of the company's previous investment portfolio?" They chose from the six investment options in the scenario. The result showed that manipulating the default bias was successful: t $(199) = 21.33$, $p < .001$, Cohen's d = 3.01. As shown in Figure 2, the effect size of the default bias was significantly attenuated in the loss condition compared to the gain condition.

Figure 2. Risk in the Investment Options Participants Chose in the Default Bias Scenario
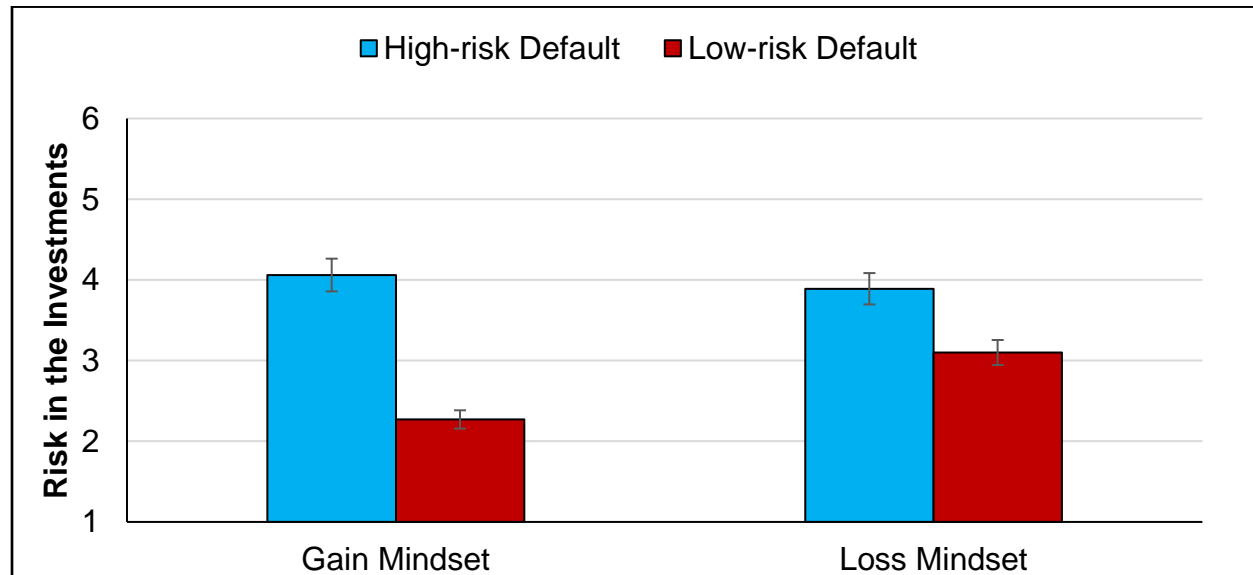
Thus, Study 2 found that the loss reduced the extent to which participants exhibited default bias. The effect size of the default bias was similarly cut in half in the loss condition compared to the gain condition.

Study 3

Study 3 tested the impact of gain and loss on participants' propensity to exhibit outcome bias. I implemented a 2 (gain vs. loss) × 2 (positive outcome vs. negative outcome) between-subjects design to test hypothesis 3.

Method

Participants. I sought 200 full-time managers with at least one subordinate on Prolific (101 women, 99 men; $M_{age} = 42.60$ years, SD = 11.42).

Procedure. Using a corporate decision-making scenario, I measured the outcome bias (Baron & Hershey, 1988). Specifically, participants were asked whether they would punish an executive for a risky decision depending on whether a chance outcome was positive or negative.

Participants rated their propensity to punish the executive's risky decision from 1 to 7. (1 = "The CTO should definitely NOT be punished for not recalling all EVs"; 7 = "The CTO should definitely be punished for not recalling all EVs").

Results

The dependent variable (ranging from 1 to 7) is the extent to which the participants support punishing the executive's risky decision. A higher score in the dependent variable indicates that participants strongly support punishing the executive. A two-way ANOVA revealed a significant main effect of the outcome ($F(1,196) = 59.55$, $p < .001$, $\eta^2 = .23$), indicating that participants in the negative outcome condition ($M = 4.72$, 95% CI [4.36, 5.08], $SD = 1.84$) scored higher on the dependent variable compared to those in the positive outcome condition ($M = 2.81$, 95% CI [2.48, 3.15], $SD = 1.67$). The main effect of the gain or loss was not significant. The interaction effect between outcome and gain or loss was significant ($F(1,196) = 5.60$, $p = .02$, $\eta^2 = .03$).

In the gain condition ($N = 100$), there was a significant difference between the negative outcome ($N = 51$, $M = 5.04$, 95% CI [4.54, 5.54], $SD = 1.77$) and the positive outcome ($N = 49$, $M = 2.55$, 95% CI [2.11, 2.99], $SD = 1.54$) groups ($t(98) = 7.49$, $p < .001$, Cohen's $d = 1.50$). In the loss condition ($N = 100$), there was also a significant difference between the negative outcome ($N = 52$, $M = 4.40$, 95% CI [3.88, 4.93], $SD = 1.88$) and the positive outcome ($N = 48$, $M = 3.08$, 95% CI [2.57, 3.59], $SD = 1.76$) groups ($t(98) = 3.61$, $p < .001$, Cohen's $d = .72$). As shown in Figure 3, the effect size of the outcome bias was significantly attenuated in the loss condition compared to the gain condition.

Figure 3. Willingness to Punish the CTO in the Study 3 Outcome Bias Scenario
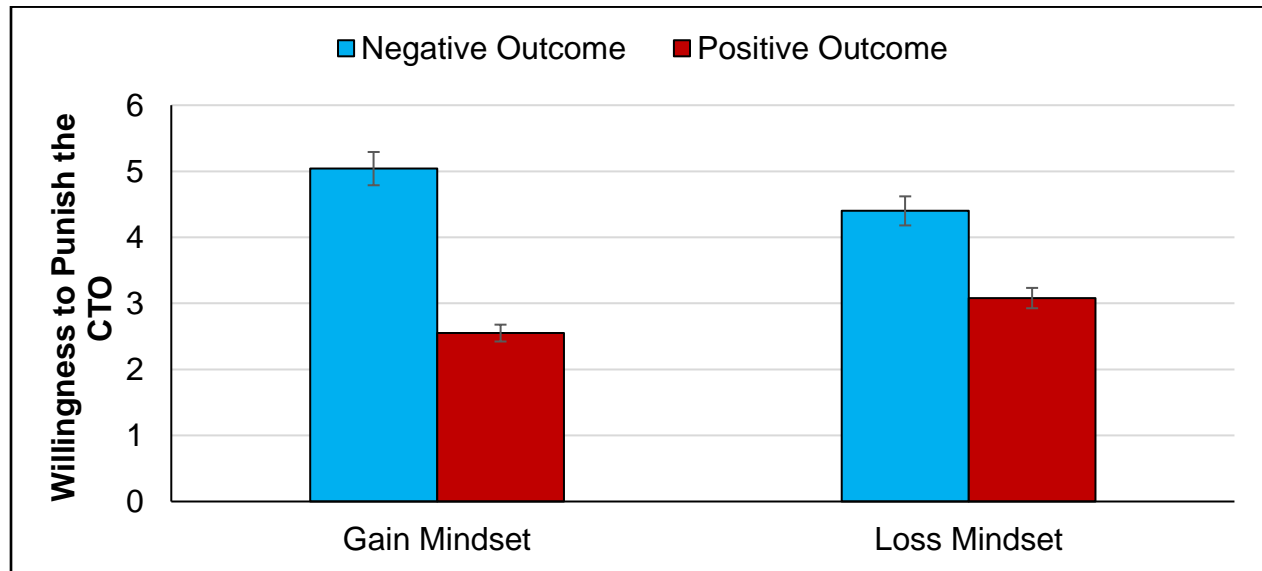
I conducted the following manipulation checks. First, similar gain-loss manipulation was successful, t (198) = 22.81, p < .001, Cohen's d = 3.23). Second, participants were asked, "Did any fire incident happen after the CTO made the decision six months ago?" They chose from. The result showed that manipulating the default bias was successful, t (198) = 18.19, p < .001, Cohen's d = 2.57.

Thus, Study 3 showed that the loss reduced the extent to which participants exhibited outcome bias. The effect size of the outcome bias was approximately cut in half in the loss condition compared to the gain condition.

CHAPTER 4: DISCUSSION AND CONCLUSION

In my thesis, I tested the general hypothesis that experienced losses help people reduce decision-making biases and make more rational decisions. In three studies based on the US full-time manager sample, I found that people tend to avoid the sunk cost bias, default bias, and outcome bias after they experience losses. The effect sizes of the decision-making biases were, on average, cut in half in the loss condition compared to the gain condition. In the following sections, I will further discuss the potential mechanisms, research implications, limitations, and future studies.

Potential Mechanisms

The Prospect Theory posits that losses lead people to take excessive risks, while gains lead people to be risk-averse (Kahneman & Tversky, 1979). Therefore, the Prospect Theory would predict the main effect of the loss condition on greater risk-taking but not the interaction effect between gain or loss and bias manipulation. In the sunk cost study (Study 1), people are likely to perceive completing the planned project as less risky than canceling the project and spending money on something presently unknown. The assumed risk perception should hold in both the sunk cost present and absent conditions. As I found people in the loss condition were more likely to support canceling the project, the Study 1 result matches the prediction that the loss condition leads to more risk-taking. However, this argument does not explain the interaction between the gain or loss and the sunk cost bias manipulation. In the default bias study (Study 2), the most risky investment was the default in one condition, and in the other, the least risky. Thus, the default action was uncorrelated with the level of risk associated with the investment options. Similarly, the risk is irrelevant in the outcome bias study because participants were evaluating a past decision of an executive that already happened. In sum, the Prospect Theory predicts the

impact of gain or loss on risk-taking but not the interaction effect between the gain or loss and bias manipulation I examined in three studies.

The affect and decision-making literature provides avenues for potential mechanisms (Forgas, 1995; Isbell, 2004; Isbell et al., 2013). Negative emotions like fear or sadness typically arise in response to perceived threats or problems. The affect-as-information theory argues that affective experiences serve a signaling function that guides behavior and "directs one's cognitive processing by providing information about one's psychological environment" (Isbell et al., 2013). Negative emotions like fear or sadness typically arise in response to perceived threats or problems. The affect-as-information theory argues that affective experiences serve a signaling function that guides behavior and "directs one's cognitive processing by providing information about one's psychological environment" (Isbell et al., 2013). For example, people in positive moods are more likely to exhibit "fundamental attribution error" (Forgas, 1998), perform poorly in deductive reasoning tasks (Oaksford et al., 1996), and demonstrate intransitive preferences (Fiedler, 1988). Negative moods were found to increase the care of information processing in persuasion (Bless et al., 1990; Sinclair et al., 1994), decrease the reliance on general knowledge structures (Bless et al., 1990; Bodenhausen et al., 1994), and attenuate false memories (Storbeck & Clore, 2005). The affect-as-information theory posits that the impact of affect on decision-making is not straightforward but contingent on the individual's current mode of processing (Isbell et al., 2013). In this view, positive affective cues serve as the "go" signal that reinforces the processing styles with which they are associated, and negative affective cues serve as the "stop" signals that inhibit using this style (Isbell et al., 2013). For instance, if people are engaged in intuitive, automatic, and fast System 1 thinking, the positive affect will encourage them to continue relying on this mode. Conversely, if people are engaged in System 1 processing and

experience negative affect, they are more likely to transition to deliberate, systematic, and slow System 2 thinking. In summary, the influence of affect on decision-making is not a direct main effect but rather depends on the interaction between the individual's emotional state and their current cognitive processing mode. In my studies, if people are generally in System 1 processing mode and the loss condition induces negative affect, then the affect-as-information model would lead to the prediction that the switch from System 1 to System 2 in the loss condition helps people avoid decision biases.

Competing hypotheses can also be derived from the Regulatory Focus Theory (Higgins, 1998). The theory posits that a promotion focus is an orientation toward acquiring gains, whereas a prevention focus is an orientation toward avoiding losses. Studies on regulatory focus have tested mindsets on decisions people make that involve sunk costs (Barsky & Zyphur, 2016; Molden & Hui, 2011) and default effects (Craciun, 2018; Roese et al., 1999). Drawing on people's regulatory focus as a potential mechanism, one prediction is that losses induce prevention focus (i.e., people want to avoid more losses) and gains induce promotion focus (i.e., people want to acquire even more gains). However, gains and losses may influence people's motivational focus in opposite ways. When faced with losses, individuals tend to adopt a promotion focus, becoming more willing to take risks in pursuit of potential gains that could offset their losses. This tendency is demonstrated by the "break-even effect" (Thaler & Johnson, 1990). Conversely, when experiencing gains, people tend to shift towards a prevention focus, becoming more risk-averse to protect and maintain their newly acquired gains. The phenomenon has been supported by research in strategic management (Mannor et al., 2016), suggesting top executives often become more cautious and defensive in their decision-making to preserve their advantageous position. Future studies are needed to test the potential mechanisms indicated by

the affect-as-information theory and regulatory focus theory.

Implications

      My study contributes to the literature in several ways. First, I examined people's tendencies to avoid certain biases after they have experienced losses. In previous studies, many de-biasing strategies focused on mitigating specific biases one at a time (Milkman et al., 2009). My study contributes to the debiasing literature by demonstrating in what conditions people make high-quality decisions. The findings suggest that when people have experienced losses, they tend to be less likely to commit sunk cost bias, default bias, and outcome bias. Researchers can design general interventions that remind people of losses to encourage more systematic processing and avoid certain biases.

      Second, this study contributes to our understanding of how experiences of gains and losses influence decision-making. Previous studies on Prospect Theory and Framing Effect laid the foundation for understanding how people make decisions under uncertainty and how they perceive gains and losses differently (Kanehman & Tversky, 1979). This study extends their work by showing that gains and losses can influence a wide range of decisions, even when the decision options themselves are not explicitly framed as gains or losses. This finding suggests that the impact of gains and losses on decision-making is more pervasive than previously thought. This contribution broadens our understanding of the far-reaching effects of gains and losses on human decision-making processes.

      This research can potentially inform strategies for mitigating biases in various contexts. If the hypotheses hold, inducing a loss mindset could serve as a comprehensive strategy for reducing a range of biases, providing a more flexible approach than strategies targeting specific biases. This could be particularly useful in business and policy-making, where decision-making

biases can have significant ramifications. Moreover, understanding how losses can lead to more systematic processing could help managers design interventions to improve decision-making in resource-constrained environments and areas that require a high level of diligence.

Limitations and Future Research

While the present study provides valuable insights into how people make decisions in the gain or loss context, it is not without limitations.

First, I did not test the potential mechanisms through which the losses would help people avoid certain biases. As discussed earlier, one possible explanation informed by the affect-as-information theory is that losses induce negative emotions, prompting people to shift to deliberate System 2 processing and avoid certain decision-making biases. The other explanation is informed by the Regulatory Focus Theory, which states that people may modify their motivational focus after experiencing gains or losses. To examine which mechanism works, future studies can test the cognitive mechanism using a dual-task paradigm (Savani & Wadhwa, 2024) by manipulating whether people's cognitive resources are constrained (e.g., participants work on the main study and a distractor task simultaneously). If the underlying mechanism is non-cognitive (e.g., regulatory focus), the effect of gains and losses should persist in the dual task condition. If the mechanism is cognitive, then the effect of gains and losses should be attenuated in the dual-task condition.

Second, my study did not assess whether gain or loss manipulation could have induced a sense of gain or loss in participants' minds. Across the studies, participants reviewed the financial performance and made strategic decisions for the same company. Therefore, information on whether the company's financial performance is going well or poorly influences decision-making in a similar context at the company level. To assess whether the gain or loss

manipulation could have induced a mindset, future studies can ask participants to imagine sitting on the boards of two companies. After learning about the financial performance information of one company, participants will make decisions for another company in an unrelated industry. Another drawback of the gain or loss manipulation is that participants only learned about the company's gains or losses in financial performance, but they may not perceive this information as personally experienced gains or losses. For example, a founder's board member would be more likely to perceive the company's increasing or decreasing financial performance as gains or losses than an independent board member. Future studies could test whether personally experienced gains or losses will influence decisions made on behalf of an organization.

Third, the research design can be further enhanced by including a neutral control condition. The current study only incorporates two conditions for the gain or loss manipulation. However, it is unclear whether the gain information exaggerates biases or the loss information reduces them. Future studies can compare the effect of a loss condition to a neutral control condition to map out the effect of gain or loss manipulation.

Fourth, while the present study focuses on three specific decision-making biases (sunk cost bias, default bias, and outcome bias), other biases may not be addressed by experienced gains or losses. The three biases tested in the current study share a common theme of being influenced by past investments, default options, or outcomes. These biases often lead individuals to make decisions that deviate from rational choice theory, as they are swayed by factors that should not logically affect their decisions. In contrast, confirmation bias, which is the tendency to seek out, interpret, and recall information in a way that confirms one's preexisting beliefs or hypotheses (Nickerson, 1998), may not be directly addressed by the gain-or-loss mindset. Future research should explore a broader range of cognitive biases to determine the scope and boundary

conditions for the impact of experienced gains or losses on decision-making. This investigation could help identify the types of biases that are most susceptible to the influence of gain or loss and those that may require alternative debiasing strategies.

Lastly, the present study focuses on the impact of the gains or losses on individual decision-making. Future research could extend this investigation to group and organizational decision-making contexts. Examining how the gain or loss mindset influences decision-making dynamics in teams and how it interacts with organizational culture and structure could provide valuable insights for managers and policymakers seeking to optimize decision-making processes in their respective domains.

In conclusion, while the present study offers novel insights into the relationship between experienced gains or losses and decision-making biases, it also highlights several avenues for future research. By addressing these limitations and expanding the scope of investigation, future studies can contribute to a more comprehensive understanding of how gains or losses influence decision-making processes and outcomes across various contexts.

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Appendix 1. The Scenario of Study 1 – Sunk Cost Bias

Imagine you are a member of the board of directors of Tangenti Inc., an aircraft manufacturer. You are attending a formal meeting of the board members, which has been called to make an important decision. The board starts by reviewing the company's performance in the last quarter.

[Gain condition]
Despite increasing economic uncertainty around the world, Tangenti's profits in the last quarter have increased by 41% compared to last year. This is because, given the massive increase in consumer air travel this year, airlines around the world have gone on an aircraft purchasing spree. This means that Tangenti's commercial aircraft division has seen huge demand and increased profits.

Additionally, given the war in Ukraine, Tangenti's military aircraft division has also seen huge demand and increased profits. Many countries have been donating military equipment, including aircraft to Ukraine. Additionally, given the war, many countries are buying military aircraft for their own protection.

This means that Tangenti's finances are very strong.

[Loss condition]
Given increasing economic uncertainty around the world, Tangenti's profits in the last quarter have decreased by 41% compared to last year. This is because, given the massive decrease in consumer air travel during the pandemic, airlines around the world have canceled their aircraft purchases. This means that Tangenti's commercial aircraft division has seen a huge reduction in demand and decreased profits.

Additionally, given the war in Ukraine, Tangenti's military aircraft division has also seen reduced demand and profits. Given the economic crisis spurred by the war, many countries have focused on energy security and combatting inflation, which means they have reduced their expenditure on defense.

This means that Tangenti's finances are very weak.

[Sunk cost present condition]
The board then proceeds to discuss the key decision at hand today. The company has invested $10 billion of the company's money into the research project. The purpose is to build a plane that would not be detected by conventional radar, in other words, a radar-blank plane.

When the project is 90% completed, another firm begins marketing a plane that cannot be detected by radar. Also, it is apparent that their plane is much faster and far more economical than the plane your company is building. The board has to decide whether to invest the last $1 billion of the research funds to finish your radar-blank plane (which is likely inferior to the competitor's offering) or not.

Would you support investing the last $1 billion of the research funds in building the radar-blank plane (which is likely inferior to the competitor's offering)?

[Sunk cost absent condition]
The board then proceeds to discuss a research project. The company is considering investing the last $1 billion of the company's money into the research project. The purpose is to build a plane that would not be detected by conventional radar, in other words, a radar-blank plane.

Tangenti hasn't started working on this project yet. However, another firm begins marketing a plane that cannot be detected by radar. Also, it is apparent that their plane is much faster and far more economical than the plane your company could build. The board has to decide whether to invest the last $1 billion of the research funds in building the radar-blank plane or not.

Would you support investing the last $1 billion of the research funds in building the radar-blank plane (which is likely inferior to the competitor's offering)?

Appendix 2. The Scenario of Study 2 – Default Bias

Imagine that you are a member of the Board of Directors of Winzoto Inc., an international retail banking conglomerate. You are attending a formal meeting of the board members, which has been called to make an important decision. The board meeting begings with a review of the company's performance in the last quarter.

[Gain condition]
Despite increasing economic uncertainty around the world, Winzoto's profits in the last quarter have increased by 19% compared to previous year. This is because given the increase in interest rates, there has been a 7% increase in deposits. Additionally, given the continued return to normalcy from Covid-related restrictions around the world, there has been a 9% increase in loans given to small businesses and startups. Winzoto has managed to seize these opportunities.

Additionally, Winzoto had put considerable effort into increasing its fee and commission income through account pricing strategies, raising service fees, and pushing commission-driven businesses, such as various types of insurance. As a result, its total operating income increased by 17%.

This means that Winzoto's finances are very strong.

[Loss condition]
Given continued economic uncertainty worldwide, Winzoto's profits in the last quarter have decreased by 19% compared to the previous year. This is because, given the increase in interest rates and associated economic slowdown, there was a 7% reduction in deposits. Additionally, given the economic uncertainty, there has been a 9% decrease in loans given to small businesses and startups. Winzoto's business has suffered from the downturn caused by higher interest rates.

Additionally, unlike its competitors, Winzoto failed to increase its fee and commission income through account pricing strategies, raising service fees, and pushing commission-driven businesses, such as various types of insurance. As a result, its total operating income decreased by 17%.

This means that Winzoto's finances are very weak.

[High-risk Asset Condition]
After reviewing Saferion's financial performance, the board proceeds to discuss the key decision at hand today. Winzoto's assets are invested in a number of different financial instruments. A substantial chunk of assets is invested in a high-risk Company A. The board is deliberating whether to leave the portfolio intact or to change it by investing in other securities (The tax and broker commissions of any change are insignificant).

The Chief Financial Office suggests six investment options. The board needs to decide which option to invest the bulk of the funds in. Which option would you support?

- Option 1: Maintain the current investment in high-risk Company A. Over a year, the stock has a 50% chance of doubling in value, a 20% chance of declining 20% in value, and a 30% chance of declining 40% in value.
- Option 2: Switch to moderate-risk Company B. Over a year, the stock has a 30% chance of increasing 30% in value, a 40% chance of increasing 15% in value, and a 30% chance of declining 20% in value.
- Option 3: Invest in low-risk Company C. Over a year, the stock has a 15% chance of increasing 20% in value, a 40% chance of increasing 10% in value, and a 40% chance of declining 10% in value.
- Option 4: Invest in corporate bonds. Over a year, they will yield a return of approximately 5 to 6%. There is a small risk that the issuing companies would default on their bonds.
- Option 5: Invest in municipal bonds. Over a year, they will yield a tax-free return of around 4%. There is a very small but non-zero risk of municipal governments defaulting on their bonds.
- Option 6: Invest in treasury bills. Over a year, these will yield a nearly certain return of 3.5 to 4%. There is no risk of the Federal government defaulting on its bonds.

[Low-risk Asset Condition]
After reviewing Saferion's financial performance, the board proceeds to discuss the key decision at hand today. Winzoto's assets are invested in a number of different financial instruments. A substantial chunk of assets is invested in US treasury bills. The board is deliberating whether to leave the portfolio intact or to change it by investing in other securities (The tax and broker commissions of any change are insignificant).

The Chief Financial Office suggests six investment options. The board needs to decide which option to invest the bulk of the funds in. Which option would you support?

- Option 1: Maintain the current investment in treasury bills. Over a year, these will yield a nearly certain return of 3.5 to 4%. There is no risk of the Federal government defaulting on its bonds.
- Option 2: Invest in municipal bonds. Over a year, they will yield a tax-free return of around 4%. There is a very small but non-zero risk of municipal governments defaulting on their bonds.
- Option 3: Invest in corporate bonds. Over a year, they will yield a return of approximately 5 to 6%. There is a small risk that the issuing companies would default on their bonds.
- Option 4: Invest in low-risk Company C. Over a year, the stock has a 15% chance of increasing 20% in value, a 40% chance of increasing 10% in value, and a 40% chance of declining 10% in value.
- Option 5: Switch to moderate-risk Company B. Over a year, the stock has a 30% chance of increasing 30% in value, a 40% chance of increasing 15% in value, and a 30% chance of declining 20% in value.
- Option 6: Switch to high-risk Company A. Over a year, the stock has a 50% chance of doubling in value, a 20% chance of declining 20% in value, and a 30% chance of declining 40% in value.

Appendix 3. The Scenario of Study 3 – Outcome Bias

Imagine you are a member of the Board of Directors of Saferion Inc., a multinational automotive manufacturer. You are attending a formal meeting of the board members, which has been called to make an important decision. The board meeting begins with a review of the company's performance in the last quarter.

[Gain condition]
Despite increasing economic uncertainty around the world, Saferion's profits in the last quarter have increased by 26% compared to the previous year. This is because, given the continued return to normalcy from Covid-related restrictions, there has been a 17% increase in the number of vehicles sold across developed and emerging markets. In addition, Saferion introduced a new electric vehicle (EV) that was a little cheaper and had a more extended range than EVs offered by major competitors. This EV significantly contributed to a growth in profits.

Additionally, Saferion has put considerable effort into marketing and advertising through TV, social media, subscriptions, and add-on features. As a result, its total operating income increased by 27%.

This means that Saferion's finances are very strong.

[Loss condition]

Given increasing economic uncertainty around the world, Saferion's profits in the last quarter have decreased by 23% compared to the previous year. This is because, given the high-interest rates on car loans, there has been a 17% decrease in the number of vehicles sold across developed and emerging markets. In addition, Saferion introduced a new electric vehicle (EV) that was a little cheaper than EVs offered by major competitors but had a smaller range. However, given the price reduction by major competitors, this EV did not sell well.

Additionally, Saferion failed to improve its marketing and advertising reach in TV and social media and did not introduce any new subscription add-on features. As a result, its total operating income decreased by 27%.

This means that Saferion's finances are very weak.

[Electric Vehicle Scenario]
After reviewing Saferion's financial performance, the board proceeds to discuss the key decision at hand today. There was a safety incident six months ago. A Saferion EV spontaneously caught fire while being charged by a customer at their home. Fortunately, no one was inside, and the charging station was outdoors, so there was no damage to the customer's house.

The exact cause of the fire is unknown, but it could be due to either a fault in the customer's charging station or a fault in the new high-capacity battery that Saferion installed. The electricians who investigated the fire were unable to identify the exact cause. Saferion's engineers said that a battery fault could be an explanation.

Nevertheless, the incident has been widely reported in the media, and doubts have been cast on Saferion EVs' safety. A repeat of this incident would be devastating. Based on the engineers' report, the company's Chief Technological Officer (CTO) had to decide how to handle this incident.

The inexpensive option was to issue a notice to all EV customers, recommending them to ensure that their charging station was in perfect working condition. The expensive option was to recall all EVs and check their batteries. This would be expensive and force the company to cut research, development, and other discretionary expenses.

[Positive Outcome Condition]

In the end, the CTO decided only to issue a notice to all EV customers. In the following six months, there have been no additional fire incidents involving Saferion EVs. At this point, the board of directors has been asked to evaluate the CTO's decision.

Do you think the board should punish the CTO for not recalling all EVs to check their batteries?

[Negative Outcome Condition]

In the end, the CTO decided only to issue a notice to all EV customers. Six months later, another similar fire incident involving a Saferion EV led to widespread negative news coverage and a plunge in sales. At this point, the board of directors has been asked to evaluate the CTO's decision.

Do you think the board should punish the CTO for not recalling all EVs to check their batteries?