MYOPIC LOSS AVERSION: DO EVALUATION PERIODS AND PRESENTATION MODES MATTER?

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TABLE OF CONTENTS

SUMMARY

This study has employed principles of behavioral economics, primarily that of Myopic Loss Aversion (MLA), in an attempt to understand the gambling behavior of individuals playing slot machines and to perhaps shape regulation towards excessive behaviour or addiction.

Individuals are often myopic in evaluating sequences and gambling opportunities. A decision-maker with loss aversion exhibits preference reversal, that is, the acceptance of a series of the same gambling game that would otherwise have been rejected if asked to bet once. It has been suggested that this reversal is caused by myopia. The literature suggests that both the Evaluation Period (EP) and the Presentation Mode (PM) matter, and that they are due to myopia. Both a longer EP and an aggregated PM increase the attractiveness of a series of bets. In this study, we argue that the relationship between a longer EP and an aggregated PM may not be generalized as suggested by earlier works, for it depends on specific parameters of the bets. We introduce the concept of MLA and specifically analyze the causal mechanisms through which EP and PM affect the decision-maker gambling with a high probability of trivial losses, for example, slot machines or 'one-arm bandit' machines.

The theoretical analysis predicts that as more returns are evaluated frequently, the

more risk aversion individuals will have, resulting in a lower acceptance rate once the overall distribution is displayed. Thus, a longer EP cannot be treated the same as an aggregated PM for this type of bet. The theoretical postulations are supported by experimental evidence.

All slot machines have odds with a high probability for trivial losses. While the losses may be small, they do add up quite a bit. In many private clubs, contributions from slot machines form a sizeable source of revenue. The impending Casino-cum-Integrated Resorts at Sentosa and Marina Bay will no doubt increase accessibility to "small gambling" and we need to study closely this type of gambling behavior. The way information is provided and processed can have a strong influence on choice.

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

Introduction

1.1 Gambling and Attitudes to Risk

Is the acceptance of a single play of a game of chance the same as the acceptance of repeated plays of the same game? We make many such decisions in our daily lives, i.e. discrete choice (one-time purchase of a bottle of vodka) versus continuous choice (how frequent we consume the vodka). While the occasional glass of vodka is negligible, a lifetime of frequent consumption on a daily and weekly basis will lead to a negative impact on health. The choice to smoke an occasional cigarette or cigar in a pub is different from addiction to nicotine. Not putting the seatbelt on a single trip to the supermarket is not as risky as consistently not putting on a seatbelt for every trip. The individual who goes to the casino to gamble as an entertainment activity and is in control of his actions is on safe ground, but one who *needs* to gamble is the individual we should be concerned about. Betting is gambling no matter how big or small the amount bet! The issue seems that many people are motivated by risk loving considerations and are willing to sacrifice pecuniary gains to the out-of-control level, but is this possible if individuals are making decisions under the strain of gambling?

Previous studies have focused on repeated decisions that are identically distributed and draw reference from the frequently quoted example by Samuelson (1963), in which a colleague decided to reject a simple bet with a fair chance of winning $200 or losing $100, but was willing to accept a series of 100 such bets. Samuelson made an induction statement to prove an inconsistency theorem, which asserts that assuming his colleague was a utility maximiser, he should have refused the opportunity of a series of bets if he had refused a single bet. In other words, no utility function can demonstrate this inconsistent behaviour. This has led to a series of works on repeated gambling followed by normative analyses of risk aversion within an Expected Utility framework. Works by Lopes (1981), Tversky and Bar-Hille (1983), and Shoemaker and Hershey (1996) suggest a failure of Expected Utility Theory to explain the phenomenon. Other studies (Lippman & Mamer, 1988; Nielsen, 1985; Ross, 1999) show that the Expected Utility maximiser may end up making a choice similar to that of Samuelson's colleague and that risk attitude alone is sufficient to explain this behaviour.

1.2 Theoretical Background

A second stream of literature, central to this thesis, analyzes the phenomenon from an experimental perspective. Benartzi and Thaler (1995) introduced the term, Myopic Loss Aversion (MLA), to explain preference reversal. Individuals faced with multiple plays of a game of chance decline the opportunity to play a single game owing to reverse preferences when shown a distribution of the same game. MLA combines two aspects of behavioral theory, that of "loss aversion" and "mental accounting", to explain the phenomenon. Loss aversion (Allais, 1979; Benartzi & Thaler, 1995; Kahneman & Tversky, 1979; Kahneman & Tversky, 1992) occurs when individuals weigh losses greater than gains. Mental accounting (Thaler, 1985) describes the dynamic aggregation rules that individuals follow to code and evaluate risky outcomes. The MLA concept was introduced to explain the equity premium puzzle[1]. It has been suggested that the volatile return of a stock investment looks considerably unattractive in a myopic evaluation[2]. Therefore, longer-horizon investors should tolerate more risks because they can more easily diversify risks over time by recouping intermediary losses with future chances of winning (Gollier, 1996).

Thaler et al. (1997) and Gneezy and Potters (1997) provided explicit tests of the interdependence between the evaluation period and risk-taking behavior through experimental studies. By manipulating the evaluation period of the subjects' sequencing of mixed gambling, a significant impact on acceptance was observed as proposed by MLA. Gneezy, Kapteyn and Potters (2003) confirmed MLA in an experimental competitive environment. When a shorter evaluation period was induced, observed equilibrium prices for the assets were lower. Haigh and List (2005) found that professional traders exhibit behavior consistent with MLA to a larger

[1] This was a term coined by Mehra and Prescott in 1985, and it is based on the observation that individuals are more willing to hold government bonds than stocks with a much higher return.
[2] In the studies of investment decisions, employees are presented with the characteristics of 1-year return distributions, and then the simulated distributions of 3-year returns. The 1-year return is deemed as myopic evaluation.

extent than students.

Benartzi and Thaler (1999) confirmed the relationship between the degree of myopia and the presentation mode i.e. if an explicit distribution of repeated plays is given, subjects are more willing to accept multiple plays. This finding is typical of Kahneman and Lovallo's (1993) argument that individuals tend to consider problems as unique rather than aggregate them into a portfolio, which they call "narrow framing"[3]. Redelmeier and Tversky (1992) explicitly tested the influence of presentation modes on the attractiveness of multiple plays, and showed that individuals tend to segregate multiple prospects, isolating each prospect from a larger ensemble. They have suggested that the tendency to segregate prospects depends on the representation of the problem. The concern regarding the attractiveness of the aggregated presentation mode has since been consistently raised.

However, Langer and Weber (2001) looked at a specific type of lottery with a low probability for high losses and found that an aggregated presentation mode for this type of lottery could decrease the players' willingness to accept prospects, which means that an aggregated evaluation could have either a positive or a negative effect on them depending on the specific parameters, and that the above phenomenon is not as straightforward as the literature suggests. Langer and Weber (2005) extended

[3] The concept of framing is important in mental accounting analysis. In framing, individuals alter their perspectives according to the surrounding circumstances that they face (Pompian, 2006). Narrow framing means considering gambling activities or investments one at a time rather than aggregating them into a portfolio.

MLA to Myopic Prospect Theory to incorporate general cases in any economic scenario. Pure loss aversion does not fully capture the empirically observed attitude towards risk. With diminishing sensitivity in both domains of gain and loss, myopia does not decrease the attractiveness of a lottery sequence in general.

1.3 Objectives

As indicated above, most studies attempt to explain the impact of myopia. All have indicated that the effects of a long evaluation period are similar to that of an aggregated presentation mode, which means that either a longer evaluation period or an aggregated presentation mode would lead to a riskier choice being made more attractive, i.e., a shorter evaluation period and a segregated presentation mode would reduce the acceptance of repeated plays. However, do these two factors always affect decision-makers in the same way?

The current research aims to advance our understanding of MLA in gambling that has a high probability of trivial losses but which, in aggregate, could lead to a sizable amount of losses over time. Evaluation periods and presentation modes are two significant factors in MLA, and the player's decision is a result of interplay cased by them. However, they may not simultaneously affect the weight the players attach to losses, which depends on several "special" parameters. To gain a closer understanding of MLA in this type of gambling, we look at different mechanisms of the evaluation period and the presentation mode and assess their impact on decisions.

We address gambling with a high probability for trivial losses because of its worldwide popularity with large numbers of gamblers, who are increasingly spending much time and money on slot machines[4]. Most of them lose money, and although they resolve not to play again, they are usually not able to keep their resolution as these machines are easily accessible and inexpensive to play. Gambling games become more attractive when presented in a segregated mode. In some amusement arcades, it is required by law that gambling machines should be turned off automatically after an hour of continuous gambling (Traub, 1999) and exchanging credits or monies with machines or in any form strictly prohibited (Blaszczynski, Sharpe, & Walker, 2003; Turner & Horbay, 2004). One reasonable explanation for such mandatory measures is that people in the midst of playing slot machines often suspend judgment and produce infrequent assessment of financial losses. Consequently, we observe that given a longer evaluation period, individuals may put more money into gambling machines. In this example, a long evaluation period and an aggregated presentation mode influence the decision-maker in opposite directions. The former makes people more risk-loving in playing slot machines, but the latter increase aversion to such gambling games.

[4] Slot machines generally have three or more reels displaying symbols such as lemons, cherries, lucky sevens and diamonds (Dickerson, 1996; Turner & Horbay, 2004).

To proceed towards a more complete understanding of the conditions under which aggregated presentation modes and frequent evaluation periods decrease a gambler's willingness to accept multiple prospects of gambling with a high probability for trivial losses, it is vital to gain a deeper perception into the nature of the underlying causal mechanisms. The key research question addressed in this thesis is: *What are the causal mechanisms through which the evaluation period and the presentation mode affect decision-makers' weight they attach to losses when they play gambling games with a high probability for trivial losses?* We investigate this question by employing and adapting two experimental methods introduced by Benartzi and Thaler (1995) and Gneezy and Potters (1997). The answer to this question has significant implications for understanding gambling behavior.

1.4 Overview

The remainder of this study is structured as follows. Chapter 2 gives a brief background of MLA, followed by a theoretical analysis to address the specific type of gambling, and defines different mechanisms through which the evaluation period and the presentation mode work. Chapter 3 presents research hypotheses and reports the results of experimental studies. Chapter 4 presents the practical relevance of this study and concludes with a short discussion on the usefulness of the study.

CHAPTER 2

The Impact of Myopia

2.1 Myopic Loss Aversion

Myopic Loss Aversion (MLA) is an aspect of behavioral theory that combines loss aversion and mental accounting. Benartzi and Thaler (1995) use this term to describe the preference reversal of a decision-maker contemplating a single game of chance versus repeated plays of that game. When evaluating multiple plays of a simple game of chance, say a fair chance to win x or lose y [5], individuals show sensitivity to the amount y that can be lost with a one-time play. If the distribution of returns for the portfolio is held constant, gamblers are more likely to increase the acceptance of repeated plays; that is, intuitively, they display MLA, excessively concerned about short-term losses.

The interplay between a single play and repeated plays of gambling games has fascinated individuals since Samuelson's observation (1963). A colleague was offered a chance to win $200 if the flip of a coin yielded heads and a loss of $100 if the coin did not yield heads. The colleague declined this single game of chance, but at the same time expressed a willingness to accept a series of 100 such games. Samuelson termed the fallacy of large numbers to describe this inconsistent choice,

[5] x and y respectively denote the amount of money to win and to lose.

which asserts that if this colleague would reject a single play at the level of wealth obtained from playing 99 times already, he should not then accept multiple plays of the same game. Applying backward induction, the colleague should reject playing the first game of the multiple plays from the very beginning. Samuelson concluded that his colleague's behavior was irrational within the Expected Utility framework.

Nielsen (1985) , Lippman & Mamer (1988), Ross (1999) and Aloysius (1999) have shown that risk aversion alone can adequately explain the phenomenon of refusing a single bet while accepting a series of independent bets[6]. Experimental methods offer a different perspective[7]. Experimental models build upon the complexity of individuals' decisions which maximizing expected utility cannot explain[8]. While many studies (Edwards, 1954; Markowitz, 1952) emphasize the fact that individuals tend to perceive and evaluate change of wealth rather than final wealth, this has been made clearer with the introduction of Prospect Theory[9] (Kahneman & Tversky, 1979). Employing the central concepts of Prospect Theory and extensions, Benartzi and Thaler (1995) have proposed a new concept, MLA, to explain the behavior of Samuelson's colleague.

Benartzi and Thaler consider a decision-maker with a value function of the form:

[6] For a detailed survey, see Ross (1999).

[7] Theories of choice under uncertainty are broadly categorized as normative and descriptive. Normative theories are based on the notion that preferences should in some sense be consistent across different choice problems, which are typically presented in an axiomatic form. Expected Utility is the most prominent normative theory of choice under uncertainty, proposed by von Neumann and Morgenstern in 1944.

[8] The most fundamental criticisms were made in the early 1950s by Allais. "Allais paradox" induced even staunch advocates of Expected Utility.

[9] Details would be discussed at a later part of this chapter.

$$v(x) = \begin{cases} x, & \text{if } x \geq 0 \\ 2.5(x), & \text{if } x < 0 \end{cases}, \tag{1}$$

where x is a change in wealth relative to the current status. This function means that gains are treated differently from losses at the reference point, e.g. current wealth. Adapting Kahneman and Tversky's (1979) Prospect Theory, there is a tendency by individuals to weigh value losses 2.5 times more than gains.

Drawing from Samuelson's original gambling game as an illustration, the above function can be illustrated as follows:

$$\text{S} \begin{cases} 0.5 & \$200 \\ 0.5 & -\$100. \end{cases}$$

The above illustration would be rejected by Samuelson's colleague since a loss outweighs the higher gain ($0.5 \times 200 + 2.5 \times 0.5 \times (-100) < 0$). However, if he were faced with a succession of two independent draws of S, his decision would depend on the "bracketing of the problem" (Read, Loewenstein, & Rabin, 1999). Given his myopia, he should evaluate and dislike each of the games. However, if he were to perceive the games in aggregate:

$$\text{S+S} \begin{cases} 0.25 & \$400 \\ 0.5 & \$100 \\ 0.25 & -\$200, \end{cases}$$

the overall distribution might become acceptable ($0.25 \times 400 + 0.5 \times 100 + 2.5 \times 0.25 \times (-200)$ >0). Therefore, the gambling game becomes more attractive through repetition of the single game evaluated in aggregate.

Benartzi and Thaler describe mental accounting as the dynamic aggregation rules that individuals follow and propose that the attractiveness of the gambling game depends on the evaluation period of the game. Individuals are averse to losses at an irrationally short horizon due to the behavioral bias that they are too anxious to evaluate on a short-term basis. Gollier (1996) analyzes the effects of the existence of options for gambling in the future and attempts to ascertain an optimal dynamic strategy towards repeated gambling. An undesirable gambling game can be made desirable by offering the opportunity to replay the same game[10].

2.2 Prospect Theory

Life is full of uncertainty and unknowns, and individuals have to function within such a context and make decisions all the time. There is much work being done on making judgment and choice under uncertainty. Standard economic theory of choice under uncertainty differs from other disciplines in its treatment of normative and experimental models of behavior, that is, models that attempt to predict and explain the role of rationality in human behavior. Normative theories are based on the notion that preferences should in some sense be consistent across different choice sets, which are typically presented in an axiomatic form. Normative theories assume that human behavior is rational self-interested. A rational Expected Utility maximizer epitomizes the typical decision-maker (von Neumann and Morgenstern 1944). Expected Utility Theory (EUT) has since dominated analysis of choice under

[10] The gambling games are independent and identically distributed.

uncertainty, but it is not without critics.

The most fundamental criticisms were made in the early 1950s by Allais. "Allais paradox"[11] suggests that subjects tend to systematically violate the axiom of EUT. Numerous experiments have been designed to test the empirical validity of EUT. The experiments suggest that the predictions of EUT have been violated in various ways subject to a wide range of experimental violations. Experimental models are motivated by the desire to understand these "paradoxes" or "choice anomalies". The distinction between normative and experimental theory is not as clear-cut as it seems. The majority of experimental models essentially retain certain valuable properties of EUT. Prospect Theory (PT) (Kahneman & Tversky, 1979; 1992) is fundamentally a modification of EUT and differs on a very basic assumption, which explains some anomalies of EUT (Camerer & Thaler, 1995) by three elements: nonlinear weighting of probabilities (departing from the linear weighing as in EUT), reflection effects (outcome are evaluated not in absolute term, but rather compared with a reference point), and loss-aversion (losses compared with the reference point loom larger than gains). Moreover. There are two phases in the decision problem. In the first phase, the problem is "edited" in a certain frame (narrow or broad). Second, maximizing prospective value function the agent takes his decision. Usually, people called first phase as mental accounting.

[11] See the details in the discussion in Allais (1979) and Slovic & Tversky (1974).

2.2.1 A Probability Weighting Function

In a typical EUT setting, gambling that yields risky outcomes x_i with probability p_i is valued according to $\sum p_i u(x_i)$, where $u(x)$ is utility function. In PT, it is valued by $\sum \pi(p_i) v(x_i - r)$, where $\pi(p)$ is weight function. The weight function $\pi(p)$ maps stated probabilities to decision weights nonlinearly, but in reverse S-shaped (see Figure1).

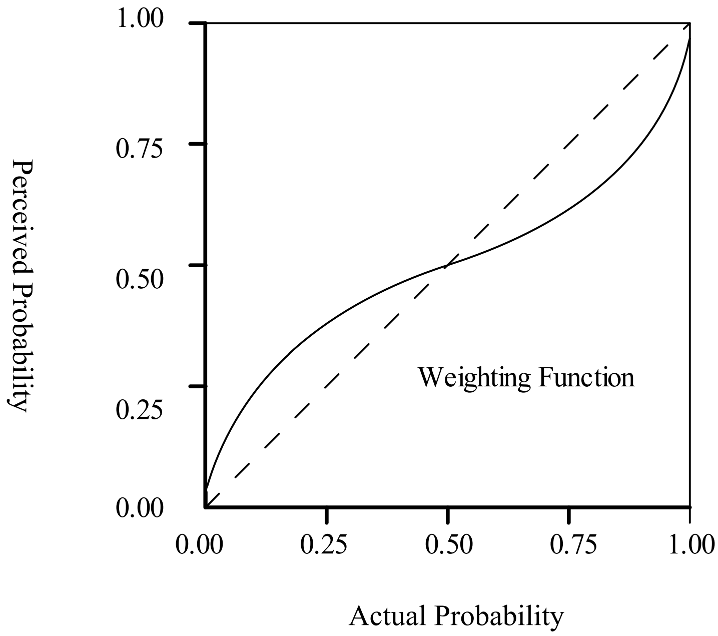

Figure 1: A Probability Weighting Function

This shape of line demonstrates probability misperception. Low probabilities are over-weighted and high probabilities are under-weighted. Subsequent works (Kahneman & Tversky, 1992; Luce & Fishburn, 1991) replaced weights on individual probabilities by a transformation of the cumulative distribution function.

2.2.2 The Reflection Effect

The main assertion was the claim that "the carriers of value or utility are changes of wealth, rather than final asset positions that include current wealth" ((Kahneman & Tversky, 1979, p.273). Hence, the value function $v(x-r)$ "should be treated as a function in two arguments: the asset position that serves as the reference point, and the magnitude of the change (positive or negative) from that reference point" (see Figure 2).

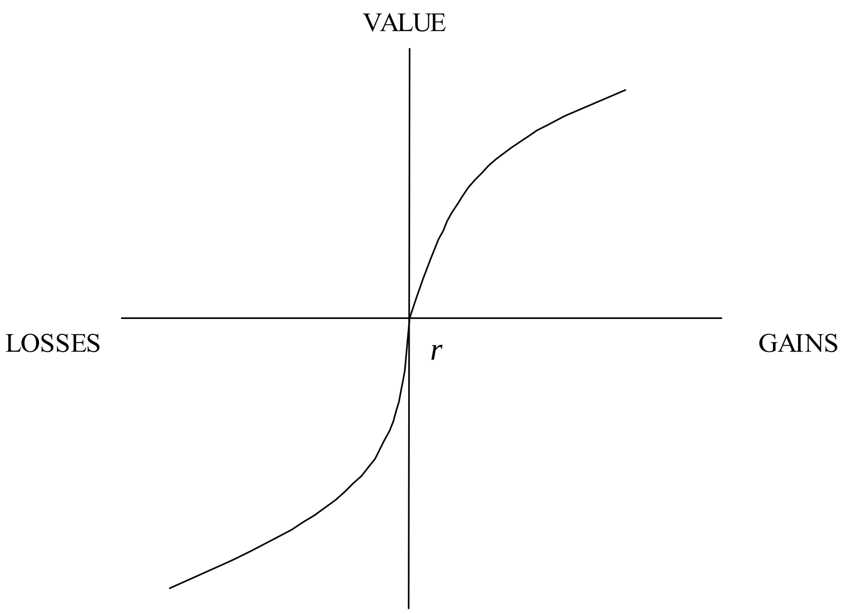

Figure 2: A Hypothetical Value Function
(Source from Kahneman & Tversky (1979) Figure 3)

The value function also exhibits loss-aversion which means the effect of losses outweighs gains in the equal-sized value. Kahneman and Tversky (1979, 1992) proposed the following functional form for the value function:

$$v(x) = \begin{cases} x^{\alpha} & \text{if } x \geq 0 \\ -\lambda(-x)^{\beta} & \text{if } x < 0 \end{cases} \quad (2)$$

where $\lambda \geq 1$ is the degree of loss-aversion and $\alpha, \beta \leq 1$ measures the degree of diminishing sensitivity. Kahneman and Tversky (1992) estimated λ to be 2.25 as the median values, and x is the change from the reference point.

The value function in PT is generally concave in the domain of gains and generally convex in the domain of losses. This attribute of the value functions is called the reflection effect around the reference point (Kahneman & Tversky, 1979), which postulates that the risk aversion exhibited by choices when outcomes are gains will be transformed into a preference for risk when outcomes are losses. Accordingly, the value function has to be concave above the reference point $\partial^2 v(x)/\partial x^2 < 0$ for $x > 0$, and convex below $\partial^2 v(x)/\partial x^2 > 0$ for $x < 0$. Kahneman and Tversky (1979, 1992) regard this value function as having the feature of diminishing sensitivity because of concavity in gains and convexity in losses, which implies that the marginal utility of gains and losses decreases with their absolute size. Evaluating changes is not independent of the reference level.

Suppose there is a decision-maker contemplating a gambling game that has a probability of p to win x and a probability of q to lose y, he or she will evaluate the prospects and make a decision as to whether to play it or not. The overall value is obtained by the equation

$$V(x, p; y, q) = \pi(p)v(x) + \pi(q)v(y) \quad (3)$$

where, either $p+q<1$ or $p+q=1$, the probability weighting function denotes $\pi(0)=0$ and $\pi(1)=1$, and the value function denotes $v(r)=0$ [12].

It has been shown that if individuals do not accept a fair game $(a, 0.5; -a, 0.5)$, their aversion to symmetric bets will increase with an increasing size of the stake (Heren, 1997; Tversky & Simonson, 1993). Now consider $x > y \geq 0$, according to the equation, we should have $v(y)+v(-y) > v(x)+v(-x)$ or $v(-y)-v(-x) > v(x)-v(y)$. When $y=r$, we obtain $v(x) < -v(-x)$. Hence, the value function has to be steeper for losses than for gains, which is called Loss Aversion (Kahneman & Tversky, 1979).

2.2.3 Loss Aversion

Loss Aversion refers to losses being weighed higher than equivalent gains at the reference point, which is generally the current level of wealth. Individuals respond differently to losses from gains. They overvalue losses relative to comparable gains. Both experimental and empirical evidence clearly certifies the asymmetry in an individual's evaluation of losses and gains.

Kahneman and Tversky's (1979) strong experimental evidence for Loss Aversion uses hypothetical payoffs, which raises the problem of whether loss aversion will

[12] r denotes reference point, which is current wealth here.

persist with economic incentives[13]. The design involves taking all gains in a choice pair and making decisions around them. Subjects tend to underweigh opportunity costs (foregone gains) relative to out-of-pocket costs (losses). Individuals generally feel a stronger impulse to avoid losses than to acquire gains.

There are two important implications of reference point and loss aversion: endowment effect (Thaler, 1980), an over-evaluation of current possessions, and status quo bias (Samuelson & Zeckhauser, 1988), an adoration of stability. The term *status quo bias* refers to the hypothesis that decision-makers exhibit a significant bias towards the status quo alternative. In simple words, the current state is favored over change.

In economic theory, we assume a well-defined set of known alternatives from which individuals have to choose one. While real word seldom provides for an additional option: to do nothing or to keep the current state, the status quo option is an indispensable part of most decisions or situations (Tversky & Kahneman, 1991).

Numerous experiments and field studies have demonstrated the existence of the status quo bias. In a very simple experiment conducted by Knetsch (1992), subjects were given either a mug or a pen (being of equal value). If the subjects would like to exchange their endowments, they would get an additional offer with a financial

[13] Subjects would be strongly affected by the use of high economic incentives in the laboratory, compared with hypothetical payoffs.

incentive of 5 cents. However, the majority of both mug holders and pen holders kept what they had already received.

Status quo bias can be seen as regret avoidance in real life. The idea behind regret avoidance is that individuals tend to stick to the current state because of past experience, which seems to suggest that options based on information apparently favorable at that point in time tend to lead to a less favorable outcome than previously assumed (Samuelson & Zeckhauser, 1988). Furthermore, regret is higher for a bad outcome resulting from having made an active decision than for a bad outcome resulting from not having made a decision at all (Kahneman & Tversky, 1982). Regret avoidance is associated with emotional costs, which arise from the uncertainty of what could happen with the decision moved away from the status quo. Basically, the pain of regret is associated with the fear of poor decision-making. Regret avoidance causes decision-makers to anticipate and feel the pain of regret that comes with a loss incurred (Pompian, 2006).

2.2.4 Mental Accounting

Mental accounting, a term coined by Thaler (1980), is a phenomenon in which decision-makers set reference points for the accounts that determine gains and losses. Decision-making is an evolutionary process of preference construction rather than static preference revelation, and this process is contingent on the frame adopted within the decision process. Framing can be considered the same as setting reference points. In general, the current asset position is assumed to be the reference point. However, "there are situations in which gains and losses are coded relative to an expectation or aspiration level that differs from the status quo" (Kahneman & Tversky, 1979, p. 286).

Here lies the discrepancy between the reference point and the status quo if one does not adapt to recent changes. Human beings have to adopt certain strategies in order to get along with circumstances, which is the basic concept of the frame. One striking example of framing effects is offered by Tversky and Kahneman (1986), where the only difference in the problem of choice faced by the two groups in their experiments was the framing of the same outcome in different terms. This method has been duplicated in many other experimental studies (McNeil, Pauker, Sox, & Tversky, 1982; Tversky & Kahneman, 1986). It has been demonstrated that a change in frame can result in a change in preferences despite the fact that all key parameters of the problem of choice remain the same.

Numerous experimental studies have suggested that individuals prefer narrow framing when doing their mental accounting. Narrow framing means decision-makers paying attention to narrowly-framed gains and losses, which could reflect a concern for non-consumption sources of utility (Grinblatt & Han, 2005), such as regret. If individuals play slot machines and keep losing for quite a while, they may experience a sense of regret over the decision to continue playing. In other words, previous gains and losses can be carriers of utility in their own right, and decision-makers take this into account when making decisions.

In this thesis, we study the behavior towards gambling games with a high probability for trivial losses, as exemplified in the following game:

$$M \quad \begin{cases} 0.04 & \$140 \\ 0.96 & -\$10. \end{cases}$$

We assume that decision makers are averse to loss and are subject to narrow framing in their mental accounting. We consider two impacts of myopia, that of the evaluation period and the presentation mode on individuals' decisions, to investigate the causal mechanisms.

2.3 The Impact of Myopia

Myopia Loss Aversion (MLA), which combines Prospect Theory and Mental Accounting, is employed to understand the effects of a decision-maker's willingness to gamble. In the previous section, decision-makers with MLA treat attractive multiple plays as unattractive.

Benartzi and Thaler (1995) argue that MLA might be responsible for the fact that individuals are willing to invest in bonds despite a long evaluation horizon. Thaler et al. (1997), Gneezy and Potters (1997), Gneezy, Kapteyn and Potters (2003), and

Haigh and List (2005) provided experimental tests that confirm the evaluation period as one impact of myopia. By manipulating the investment horizon, they have found a significant increase in the subjects' willingness to diversify their portfolios. Benartzi and Thaler (1999) explored the impact of myopia by using different presentation modes. When shown explicit distribution of multiple plays, the subjects displayed an increased willingness to gamble. However, Langer and Weber (2001) pointed out that the relation between presentation modes and myopia is not as simple as that presented by Benartzi and Thaler (1999); it depends on special parameters. The presentation mode is another important impact on myopia.

2.3.1 Evaluation Periods

Individuals who reject a single gambling game with a fair chance to win $200 and lose $100 are characterized by loss aversion and have a negative value of Expected Utility to one gambling game[14] (Benartzi & Thaler, 1995). The same individuals, however, will have a higher tendency to accept two games if given the following option: ${}^{1}/4(400)+{}^{1}/2(100)+{}^{1}/4(-500)>0$. That being the case, individuals who evaluate their portfolios often tend to revise their investments of low mean and low risk and be drawn to government bonds as these become more attractive. Merton (1969) and Samuelson (1963) concluded that individuals near retirement dislike risky investments such as equities. The intuition comes from the notion that when

[14] Suppose a value function as equation (1) $v(x)=\begin{cases}x, & \text{if } x\geq 0\\ 2.5(x), & \text{if } x<0\end{cases}$.

evaluation periods decrease, there would be considerable shortfalls from stocks investment, while over long evaluation periods, the probability that the gain on stocks will exceed the gain on bonds increases substantially.

The net probability of winning for multiple plays is perceived to be higher. For a simple example, the net probability of losing twice is only one-fourth while the net probability of losing once is one-half. Individuals would pay more attention to the probability of loss. Consequently, when individuals do not evaluate investment decisions often, they are more willing to accept riskier asset allocations. Benartzi and Thaler (1995) assert that the attractiveness of a risky investment relative to the less risky bonds largely depends on the time horizon of the investor and on the frequency of his evaluating his portfolio. The longer the investor wishes to hold on to stocks, the more attractive they become, as long as the evaluation of the investment is not updated on a regular basis. Loss aversion together with a frequent evaluation period of risky investment increases risk aversion.

2.3.1.1 The Model

This section analyzes Loss Aversion and Mental Accounting (LA / MA) within long and short evaluation periods. The LA/MA model was first proposed by Barberis, Huang, and Santos (2001) to explain low correlation between stock returns and stock consumption growth. In their model, the investor derives direct utility not only from consumption but also from changes in the value of his financial wealth. We note that there are some following theorems similar to theirs, as Gabaixm et al (2006), Fielding and Stracca (2007), Cuthbertson, Nitzsche and Hyde (2007) etc. In this study, their model is simplified to analyze the player with loss aversion over fluctuations. The framework here is used in a more uncomplicated economic scenario than asset markets. A more basic difference is that they assume a substantial level of risk aversion in their model while our model draws more on the degree of loss aversion in psychology literature. We now provide a simple theorem.

In particular, at time t an agent chooses C_t consumption and an allocation s_t to the gamble[15] to maximize utility

$$U(C_t, s_t) = E\left\{\rho^t \frac{C_t^{1-\gamma}}{1-\gamma} + \rho^{t+1} v\left[x_{t+h}, s_t, s_t - z_t\left(C_t\right)\right]\right\} \tag{4}$$

ρ is the time discount factor

$\gamma > 0$ controls the curvature of utility over consumption, for $\gamma = 1$, $C_t^{1-\gamma}/(1-\gamma)$ is replayed by $\log C_t$

x_{t+h} measures returns at time $t+h$, where h is the evaluation time horizon

z_t measures the player's gains or losses on the gamble prior to evaluation period t, and is a function of consumption level C_t to the gamble[16]

In this preference specification, the first term C_t, utility over consumption, is not

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[15] In Benartzi and Thaler (1995), gambling could be regarded as stocks and bonds. In Benartzi and Thaler (1999), it has been substituted as retirement investments. In this thesis, it is the game of gambling machines.

[16] Z(t) depends on current consumption level C(t), because if the player kept losing in gambling, z(t) is easily equal to C(t). And the same time the gain from gambling also can be transferred as linear function of consumption level.

required in the framework. However, it is necessary to considering the co-variability with consumption rather just focusing on the prospects for returns. Barberis and Huang (2001). The second term is the focus of this model, which describes the idea that Loss Aversion changes over previous gains and losses. The variable z_t is the "historical benchmark level", adopted in this study as the player's reference point based on an earlier outcome. When $s_t - z_t(C_t) > 0$, the player has accumulated prior gains on playing gambling. When $s_t - z_t(C_t) < 0$, the player has had past losses.

This allows us to capture experimental demonstration that prior playing performance affects the way subsequent outcomes are experienced by introducing the variable z_t. The value function v proposed by (Fielding and Stracca, 2007) can be defined in the following way.

When $s_t = z_t(C_t)$

$$v[x_{t+h}, s_t, s_t - z_t(C_t)] = \begin{cases} x_{t+h} & \text{for } x_{t+h} \geq 0 \\ \lambda x_{t+h} & \text{for } x_{t+h} < 0 \end{cases}, \tag{5}$$

where $\lambda > 1$. For $s_t - z_t(C_t) > 0$,

$$v[x_{t+h}, s_t, s_t - z_t(C_t)] = \begin{cases} x_{t+h} & \text{for } x_{t+h} \geq 0 \\ s_t - z_t(C_t) + \lambda x_{t+h} & \text{for } x_{t+h} < 0 \end{cases}, \tag{6}$$

and for $s_t - z_t(C_t) < 0$,

$$v[x_{t+h}, s_t, s_t - z_t(C_t)] = \begin{cases} x_{t+h} & \text{for } x_{t+h} \geq 0 \\ \lambda(s_t, s_t - z_t(C_t)) x_{t+h} & \text{for } x_{t+h} < 0 \end{cases}, \tag{7}$$

where

$$\lambda[s_t, s_t - z_t(C_t)] = \lambda + k \quad , \tag{8}$$

and $k > 0$.

It is much easier to comprehend these equations graphically. In Figure 3, the solid line is for $s_t = z_t(C_t)$, the dash-dot line for $s_t - z_t(C_t) > 0$, and the dashed line for $s_t - z_t(C_t) < 0$. When $s_t = z_t(C_t)$, the case where the players do not have either prior gains or losses, v is a simple linear function with a slope of one in the positive domain and a slope $\lambda > 1$ in the negative domain.

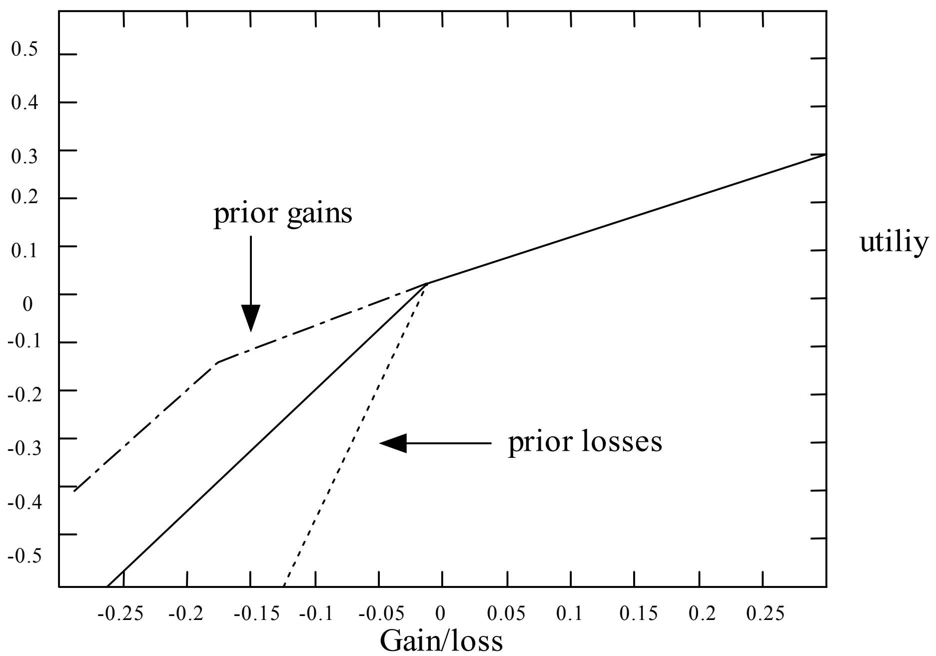


Figure 3: Utility of Gains and Losses

Source from Barberis and Huang (2001), Figure 1

When $s_t - z_t(C_t) > 0$, players have accumulated prior gains. The form of this case is quite similar to the previous one except that the kink is not at the origin but to the left; with the distance to the left being dependent on the size of prior gains

$s_t - z_t(C_t)$. This line captures the concept that prior gains may buffer later losses, and it shows that players treat small losses at the gentle rate of one, rather than λ: because prior gains cushion these losses, they are less painful.

The last case when $s_t - z_t(C_t) < 0$, individuals are losing in the game. The line has a kink at the original just like the first case, but losses are penalized at a high rate compared with λ. This is the idea that it is much more painful when losses come after other losses. The degree of loss aversion is demonstrated by equation (8). The implication of equation (8) is an assumption that the evolution of degree of loss aversion $\lambda[s_t, s_t - z_t(C_t)]$ is affected not only affected by prior outcomes but also the current situation of the game.

Although we have similar question with Barberis, Huang, and Santos' (2001), we do not intend to replicate the result of LA/MA model, and there are two main respects differing from theirs. First, excess returns on gambling games rather than on its absolute return is defined in our value function, where excess returns represent the price paid for gambling games. We wish to focus specifically on the characteristics of this price and what it reveals about attitudes towards losses. Second, our aim is to find out the evaluation time horizon h with value function as in (4), and given a value of λ, is different from $\lambda[s_t, s_t - z_t(C_t)]$. We look at the combinations $\{\lambda[s_t, s_t - z_t(C_t)], h\}$ to find what happens to loss aversion degree if h is assumed differently. This sensitivity analysis is the main objective of this study, which has a significant psychological effect on people's choice and we analyze this effect in the next section.

2.3.1.2 Gambling Variations of the Model

Scenario 1

The example discussed in Samuelson's (1963) conveys the sense that different criteria may apply to decisions made about single and multiple plays. For example, the net probability of winning bets twice:

$$S \begin{cases} 0.5 & \$200 \\ 0.5 & -\$100 \end{cases}$$

rises to 0.75 (0.5+0.25). The net probability of winning in such gambling would rise along with the number of repeated times. People show greater sensitivity to the amount lost when they play once than when they play more than once as in the latter, losses are spread out over the number of repeated times by a raised net probability of winning. As a consequence, such risky gambling, whose net probability of winning in multiple playing is acceptably high, becomes more attractive in a longer evaluation period (Lopes, 1981). The betting game, which has a probability of 2/3 of losing the amount bet and a probability of 1/3 of winning two and a half times the amount bet in some experimental settings (Gneezy et al., 2003; Gneezy & Potters, 1997; Haigh & List, 2005) both belongs to this type.

Compared with frequent evaluation, infrequent evaluation would tend to cushion the potential of losses. As most studies suggest, longer evaluation periods make individuals willing to gamble. With reference to our model, we will be analyzing equation (5). Individuals could have a higher risk portfolio. Where the gambling has a high probability for trivial losses as discussed in this study, and if the net probability of winning in multiple plays is considerably low, the outcome would be different, and equation (6) should be utilized.

Scenario 2

Equation (6) will be utilized if we assume that accumulated prior losses on gambling are important. Most gamblers who play slot machines know the high probability for trivial losses and are past losers. The last case in the model implies that prior losses have an effect on subsequent decisions. We attempt to identify the causal mechanisms through which evaluation periods make individuals more willing to accept subsequent games. A difference in the evaluation frequency will influence and change the degree of aversion λ. To illustrate, let us consider a slot machine player with an initial endowment of $200 as his reference point. He plays $50 in the first round. After a few minutes, he loses $50. If he is risk-seeking in the domain of losses, he will continue to play until his endowment is gone.

A short break, on the other hand, could induce the gambler to ponder the loss of the initial $50 and adjust his reference point. Now let us assume that after inserting $5, he is allowed to adjust his reference point as soon as he loses the money. If after he inserts 4 times and loses $20, his new reference point will be adjusted downwards. Since further losses have a more marked effect, the gambler is expected to exhibit an increasing degree of risk aversion and eventually quit (Traub, 1999, p51). To put it another way, we think it reasonable to interpret degree of risk aversion changes with the losses that one might face.

The different degrees of loss aversion caused by distinct evaluation periods for this type of gambling allow us to state the following:

PROPOSITION 1. *For gambling with a high probability for trivial losses, increasing evaluation frequency leads to greater dissatisfaction, which will mediate the effect of prospect framing on decision makers' willingness to accept multiple prospects.*

Despite the simplicity of the argument, an experiment has been designed to test the above proposition. Central to this proposition is the dependence on the individual's reference point. If gamblers' reference points are high, different evaluation periods will not have an impact.

2.3.2 Presentation Modes

Benartzi and Thaler (1999) found that aversion to short-term losses can be overcome by providing explicit distribution of potential outcomes. Explicit distribution could be treated as a particular case of "narrow framing" (Kahneman & Lovallo, 1993) effect. An aggregated presentation mode makes the portfolio more attractive.

However, Langer and Weber (2001) found that the impact arising from the greater attractiveness of the aggregated presentation mode cannot be generalized as previous literature seems to suggest. It was found that for gambling with a low probability for high losses, a lower acceptance rate would result even when the overall distribution was displayed. We now discuss specific types of gambling with a high probability for trivial losses and the influence of aggregated or segregated presentation modes on the acceptance rate.

2.3.2.1 The Lottery Space

The Lottery Space (Langer & Weber, 2001) is a very useful method for discussing various types of probability and size of loss. Langer and Weber exclusively consider mixed two-outcome gambling:

$$\begin{cases} 1-p & g \\ p & l \end{cases}$$

Defining Δ as a fixed difference between two outcomes – loss and gain, a pair (p, l) of loss probability and loss size can describe any mixed gambling with fixed Δ. In this study, we assume Δ to be 150, i.e., $g = l + 150$ because we want the gambling game

$$\begin{cases} 0.5 & \$100 \\ 0.5 & -\$50 \end{cases}$$

used in the study of Benartzi and Thaler (1999) to be included in our analysis. Given the Δ restriction, our general lottery space can be denoted as

$\Re 150 := \{(p,l) | l \in [-150, 0], p \in [0,1]\}$. The gambling games in $\Re_{150}$ can be shown in a (p,l) coordinate system (see Figure 4).

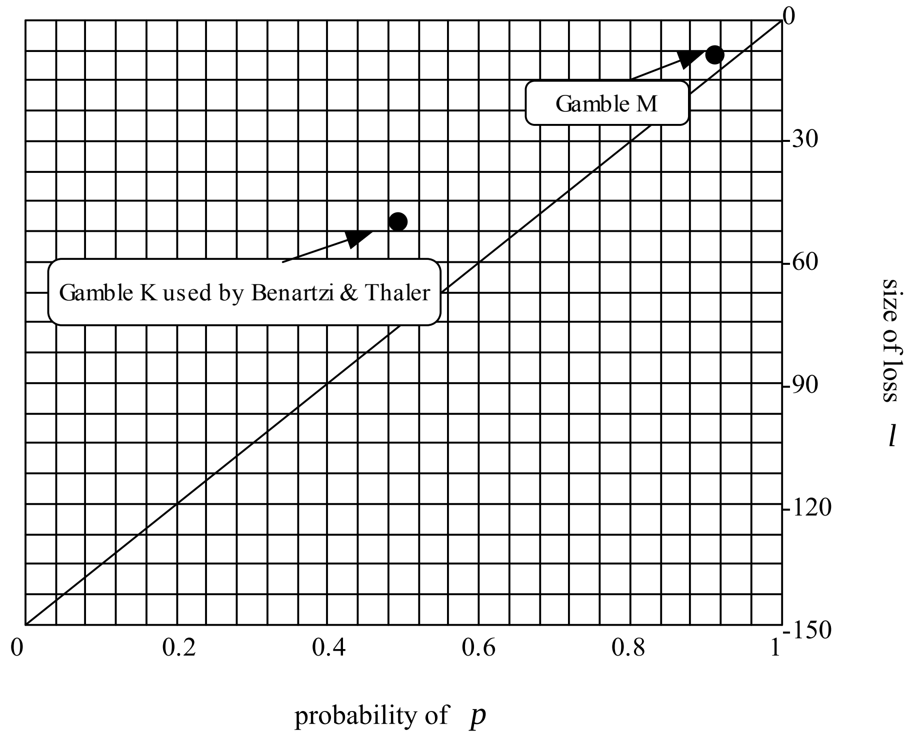


Figure 4: The Lottery Space $\Re_{150}$ [17]

Each point within the rectangle corresponds exactly to one lottery in $\Re_{150}$. The bets with sure gains and losses are respectively located at the left and right boundary. The expected value increases by moving up and to the left. The point K = (0.5, -50) corresponds to the gambling game used by Benartzi and Thaler. The point M = (0.96, -10), denoting the gamble:

$$M \begin{cases} 0.04 & \$140 \\ 0.96 & -\$10. \end{cases}$$

is an example of gambling with a high loss probability and a trivial loss size, which

[17] Adjustment of Figure 3.1 in Langer and Weber (2001).

is a typical type of gambling game carried out on gambling machines.

2.3.2.2 Differences in Aggregated and Segregated Evaluation

In the aggregated presentation mode of a portfolio consisting of two games (p,l), there are three outcomes $2l$, $l+g$, and $2g$. The values of these outcomes are respectively given as A_L, A_G, and A_M, where

$A_L = v(2l)$, $A_G = v(2g)$, and $A_M = v(l+g)$.

As such p_L, p_G, and p_M are used to denote the probabilities for the pure loss, the pure gain, and the mixed case. The value of aggregated presentation mode is given as:

$$A = p_L \cdot A_L + p_M \cdot A_M + p_G \cdot A_G . \tag{9}$$

It is easy to deduce the value of the segregated presentation mode:

$$S = 2[p \cdot v(l) + (1-p) \cdot v(g)] \tag{10}$$

Defining $S_L = 2 \cdot v(l)$, $S_G = 2 \cdot v(g)$, and $S_M = v(l) + v(g)$, equation (10) can be rewritten as:

$$S = p_L \cdot S_L + p_G \cdot S_G + p_M \cdot S_M . \tag{11}$$

Here, we obtain the total difference D between these two evaluation modes:

$$D = A - S = p_L \cdot D_L + p_G \cdot D_G + p_M \cdot D_M , \tag{12}$$

where, $D_L = A_L - S_L = v(2 \cdot l) - 2 \cdot v(l)$,

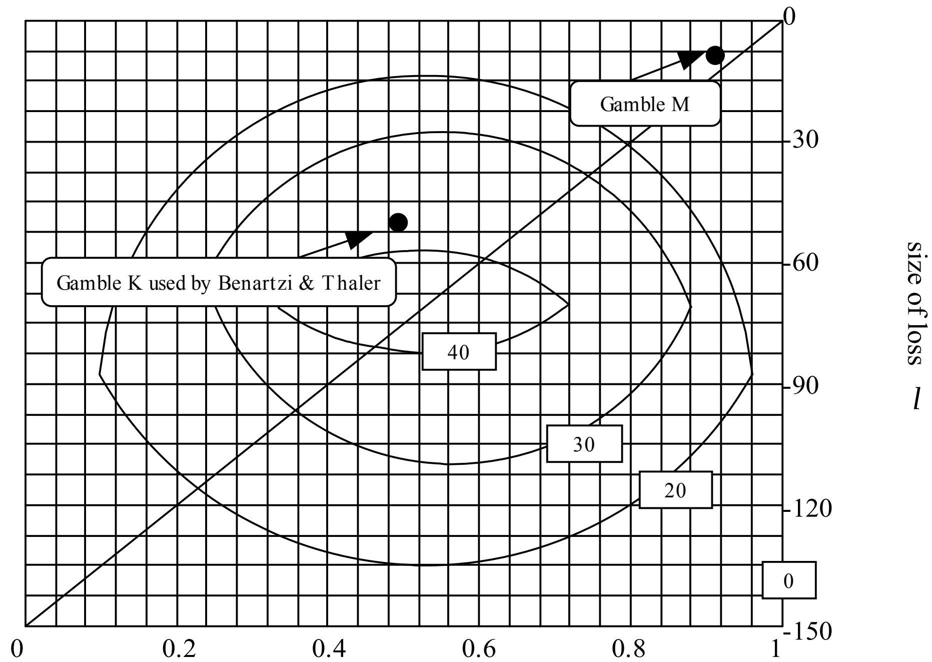
$D_G = A_G - S_G = v(2 \cdot g) - 2 \cdot v(g)$

$D_M = A_M - S_M = v(l+g) - v(l) - v(g)$

Assuming a value function as equation (1):

$$v(x)=\begin{cases} x, & \text{if } x \geq 0 \\ 2.5(x), & \text{if } x < 0 \end{cases}$$

Langer and Weber (2001) proved for all gambling in the interior of $\Re_{150}$, D is always positive, because $D_L = v(2\cdot l) - 2\cdot v(l) = 0$, $D_G = v(2\cdot g) - 2\cdot v(g) = 0$ and $D_M = v(l+g) - v(l) - v(g) = 1.5\cdot \min\{g, |l|\}$. Neither the loss part nor the gain part contributes to the overall evaluation difference while the mixed part is positive for all lotteries in the interior of $\Re_{150}$. Their proof is consistent with Benartzi and Thaler's (1999) assertion that the aggregated presentation mode is more attractive than the segregated one. In Figure 5, we present Iso-D lines in a (p, l) coordinate system in the space $\Re_{150}$. It is clear that D is always positive everywhere and converges to 0 only at the boundaries of the space, where pure gain or loss in gambling is located.



probability of loss p

Figure 5: Iso-D Lines in the Lottery Space $\Re 150$ [18]

Returning to the special gambling (high probability for trivial loss), we need to re-prove this problem.

2.3.2.3 The Case of Gambling with High Probability for Trivial Loss

For this special gambling, the value function in the segregated presentation mode is different from that in the aggregated one. Because the loss is trivial, individuals would not consider the expectation of the loss when they gamble only once, although the odds for winning are quite small. The expectation value in the segregated presentation mode is always positive. In other words, individuals indifferently pay a small amount to gamble, given the chance of winning something and as long as there is hope of winning.

However, in the aggregated presentation, we cannot simply ignore the expected values of losses. The total losses would not be trivial for gamblers with a low reference point. The aggregated evaluation process does not change. The total difference between these two modes for this special gambling is given by:

$$D = P_L \cdot A_L + P_G \cdot (A_G - S_G) + P_M A_M \quad (13)$$

Equation (13) is different from equation (12). A_L is always negative, thus leading to Proposition 2:

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[18] Adjustment of Figure 3.3 in Langer and Weber (2001).

Proposition 2: *For gambling with a high probability for trivial losses, there exists repeated* n *times of gambling in* $\Re$ *with a negative evaluation difference* D*, i.e., with a higher segregated than aggregated evaluation. The larger* n *is, the less attractiveness there is for aggregated evaluation.*

This is an intuitive result. Repeated plays are independent of each other. If the odds for winning are quite small, the later two parts in the above equation would be very small with the increase in repeated times. At the same time, increasing the size of the amount lost would have a greater effect on evaluation. If n is not big enough, the size and valuation of loss will not have an effect on loss aversion.

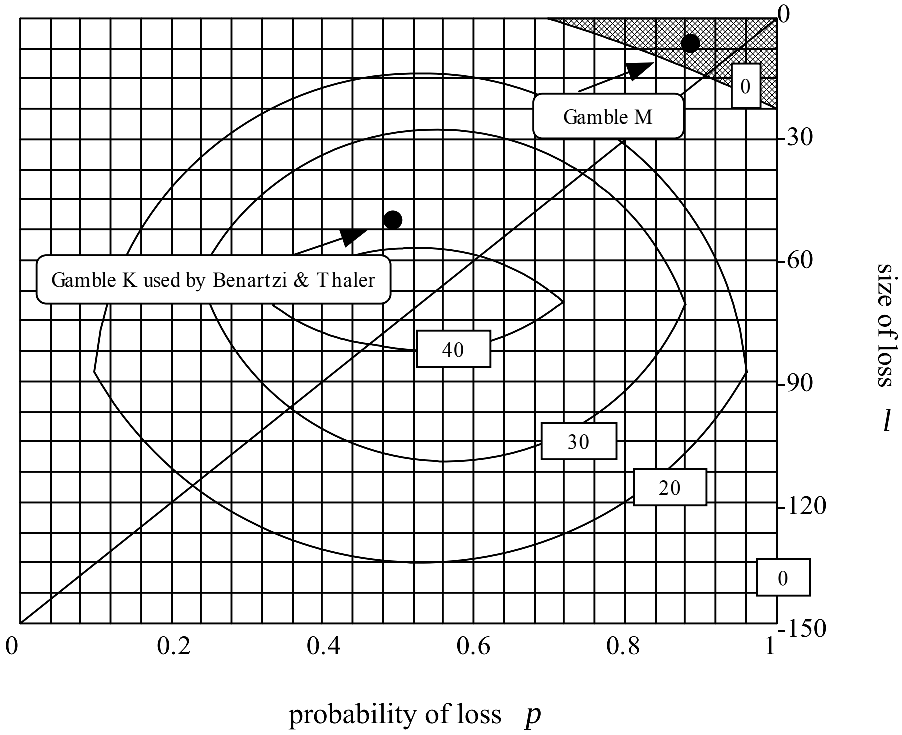

Figure 6: Iso-D lines in the Lottery Space $\Re_{150}$ **for Gambles with High Probability for**

Trivial Loss

While these thoughts are informal, an Iso-D diagram can clarify the point (see Figure 6). The isoline for D=0 is the boundary between D>0 and D<0. All gambling with D<0 in the $\Re$ space should thus look more attractive in a segregated evaluation. In this figure, we assume that individuals think $50 is inexpensive[19].

2.3.2.4 Extension

If we generalize the value function to reflect diminishing sensitivity together with loss aversion, we can still separate D into L, G and M. Using the value function proposed by Kahneman and Tversky (1992):

$$v(x) = \begin{cases} x^{\alpha} & \text{if } x \geq 0 \\ -\lambda(-x)^{\beta} & \text{if } x < 0 \end{cases}.$$

Assuming $\alpha = \beta$, $k \geq 1$ and $\alpha, \beta \leq 1$, the two-parameter form v_k^{α} demonstrates how the two concepts (loss aversion and diminishing sensitivity) influence the overall evaluation difference. Tversky and Kahneman (1992) estimated the parameters α, β and k and identified $\alpha = \beta = 0.88$ and $k = 2.25$ as median values. We will use these parameters for our calculations.

Because of the concavity in gains and the convexity in losses, the components $D_L = v(2 \cdot l) - 2 \cdot v(l)$ and $D_G = v(2 \cdot g) - 2 \cdot v(g) = v(2l + 300) - 2 \cdot v(l + 150)$ are

[19] The Iso-line depends on how much money individuals think that they indifferently pay to play or win a chance, e.g. if individuals think it is expensive to play more than $30, Iso-line will stop at the loss of $15.

decreasing function in l (see Figure 6). Langer and Weber (2001) proved that mixed gambling in $\Re$ exists with a negative evaluation difference D, which means that a segregated evaluation is more attractive than an aggregated one.

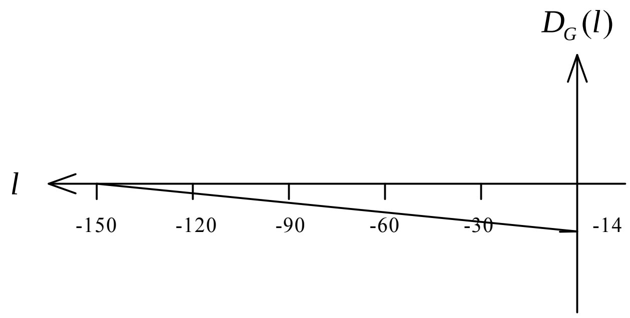

Figure 7: $D_G(l)$ **for** $k = 2.25$ **and** $\alpha = \beta = 0.88$ [20]

However, current methodology does not shed light on this type of gambling as we need to assume an increase in the gambling. It is still possible to separate the evaluation difference D as in the previous part, but this is very complex. Because of the complexity of each value component, a detailed formal analysis is not presented in this thesis. We will only visualize the effect of increasing the portfolio size in Iso-D diagrams.

In the previous section, we ignore the mixed M-part of the evaluation difference D and only focus on the term D_{LG}. Langer and Weber (2001) have formalized the notion in an aggregated evaluation mode. We limit ourselves to describing the essential structure. Here, we only need to know that a certain range D_M has negative value. The consequence of increasing loss aversion is given in Figure 8.

[20] Adjustment of Figure 3.4 in Langer and Weber (2001).

The proportion of the lottery space $\Re$ with a negative evaluation difference D increases with diminishing sensitivity.

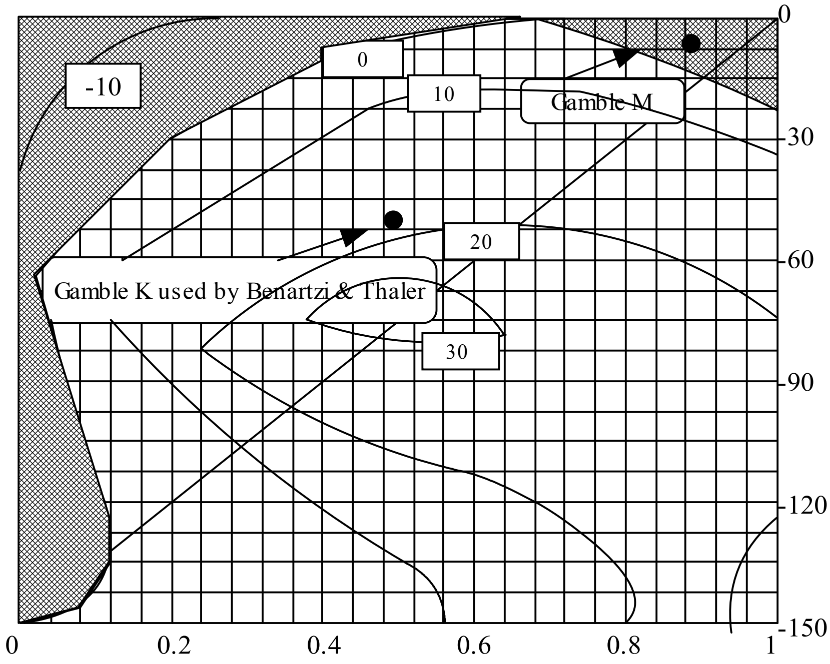

Figure 8: $\Re_{150}$ with Iso-D lines for gambles with High Probability for Trivial Loss for $k = 2.25$ and $\alpha = \beta = 0.88$

2.3.2.5 Probability Weighting

Probability Weighting Function refers to the assignment of high weights to low probabilities and low weights to high probabilities. In the case of the gambling discussed in this study, the aversion to an aggregated evaluation of repeated gambling is weakened if probability weighting is incorporated. That is because the small probability of a win is over-weighted and the high probability of a loss is under-weighted. Some gamblers even expect the probability of winning to increase with the length of an ongoing run of losses (Wagenaar, 1988). Cumulative Prospect Theory cannot be used to compute the probabilities. It can at best be summarized as overconfidence and an unwarranted faith in one's intuitive reasoning, judgments and cognitive abilities (Pompian, 2006). Thus, individuals with such probability weighting would not reduce the acceptance rate when provided with aggregated information.

CHAPTER 3

Experimental Study

This chapter describes two experiments devised to explore whether the evaluation period and the presentation mode make a difference in an individual's willingness to accept mixed gambling with a high probability for trivial losses. The next section reports Study 1 which investigates risk-taking behavior with different evaluation periods, and Study 2 which describes an experiment on single and repeated gambling in two presentation modes.

3.1 Study 1: Risk Taking and Evaluation Periods

3.1.1 Design and Procedure

3.1.1.1 Design

To ascertain whether an individual's behaviour towards gambling with a high probability for trivial losses is consistent with the MLA conjecture, a straightforward 2×2 experimental design was used (see Table Ⅰ) as another important goal of our research is to explore whether status quo bias makes more treatment effect, i.e. the difference between Treatment F and Treatment I. Using a between-person experimental design, we included both subjects with money given before the games (Status quo Group) and subjects with money exchanged after the games (Endowment

Group) in two distinct treatments: Treatment F (denoting frequent feedback) and Treatment I (denoting infrequent feedback). To ensure comparability with extant literature, we followed Gneezy and Potters (1997) when crafting our experimental protocol, and only changed the parameters of the type of gambling. The approach with two subject types is duplicated from Haigh and List (2005).

Table I: Experiment Design of Study 1[21]

Subject Type	Treatment F	Treatment I
Students (Status quo Group)	30	30
Students (Endowment Group)	30	30

We designed the experiment to investigate the following hypotheses:

HYPOTHESIS 1. *For both the Status quo Group and the Endowment Group, subjects in Treatment I will bet more than subjects in Treatment F.*

HYPOTHESIS 2. *The Treatment effect, i.e. the difference between Treatment I and Treatment F, among the Status quo Group is more pronounced than that among the Endowment Group.*

[21] Numbers represent sample sizes. Treatment F had subjects placing bets in nine rounds; after each round, the subjects were informed of the outcome. Treatment I was identical except that the subjects placed bets for three rounds at a time rather than for each round. The Status quo Group received money before they placed their bets, while the Endowment Group exchanged cents for money after they placed their bets.

In the experiment[22], the subjects were confronted with a sequence of twelve identical but independent rounds of a betting game. For the Status quo Group, at the beginning of the experiment, every subject received an envelope with 45 CNY (Chinese Yuan) inside. They were told that they had to use the money given to bet[23] and that the amount given would not be their final earnings as the latter would depend on their decisions in the experiment. In each of the first nine rounds (Part 1 of the experiment), subjects had to decide how much they wanted to bet in the game. The amounts x_t were restricted as $0 \le x_t \le 100$ ($t = 1,2,...,9$). For the Endowment Group, the subjects were endowed with 100 cents per first nine rounds and they decided what portion of this endowment [0,100][24] they desired to bet. At the end of the experiment, the cents subjects gained from betting game would be exchange into money[25]. The game has a probability of 12/13 of losing the amount bet and a probability of 1/13 of winning 10 times the amount bet.

We do believe that the difference between these two groups could make a deviation from what they bet in gambling games. Since in Status quo Group, the money to be distributed for the players before playing is like their properties when using it in the game. Facing losses of their owe properties, people get more aversion. Oppositely, in Endowment Group, the money to be paid after the game, subjects consider it “manna from heaven”, and it seems rather uncontroversial to assume that people feel pain

[22] Detailed experimental instructions are contained in Appendix A.
[23] At the time of the experiment, 1 CNY was exchanged for 20 cents. Thus, they had 900 cents to bet.
[24] It is important to stress that the subjects could not bet using the money accumulated in previous rounds.
[25] At the time of the experiment, 100 cents exchanged for 5.00 CNY.

when losing.

As illustrated in the experimental instructions contained in Appendix A, the subjects were made aware of the probabilities, payoffs, and the fact that the game would be played after all the subjects had made their choice for that round. It is important to stress that the subjects could not bet any amount bigger than 100 cents. In round 10 through 12 (Part 2 of the experiment), the subjects were no longer under any restrictions. They had to make bets from the money earned in Part 1.

The main feature of the design is that there were two different treatments: Treatment F (frequent feedback) and Treatment I (infrequent feedback). In Treatment F, the subjects played the rounds one by one. In each of the rounds, they had to choose how much to bet. They were then informed about the realization of the game in that round. Only then could they decide how much to bet for the next round. In Treatment I, the subjects placed their bets in blocks of three. Rather than placing their round bet and realizing the round outcome before proceeding to the next round, in Treatment I, the subjects decided in rounds 1, 4 and 7. Duplicating Gneezy and Potters (1997), these bets were considered homogeneous across the three rounds. Most importantly, after the subjects placed their bets, they were informed about the combined realization of the three rounds. This differs from our assignment of gains and losses after each round in Treatment F which provides heterogeneity in the evaluation period. Hence, the subjects in Treatment I were supplied with less freedom and less information than those in Treatment F. In Part 2, Treatment I made one decision only at round 10.

The basic idea behind the two treatments of this design is to manipulate the evaluation period. In Treatment I, the frequency of decision and information feedback was lower than in Treatment F. Previous results have shown remarkable effects on betting behavior with this simple framing change. To cite an example, using Dutch undergraduate students, Gneezy and Potters (1997) found that the average percentage of the endowment bet is significantly higher in the low frequency feedback treatment compared to the high frequency feedback treatment: 67.4% versus 50.5%. Haigh and List (2005) proved that both students and professional traders exhibit behavior that is consistent with MLA, and the effect observed among traders is much more pronounced than among students.

3.1.1.2 Procedure

As summarized in Table Ⅰ, we recruited 60 undergraduate students from Hubei University in China as the Status quo Group. Another 60 students from Shanghai Jiaotong University were recruited as the Endowment Group. In these two universities, we had six experimental sessions, three for each of the two treatments. An announcement in the university bulletins solicited participants for a decision-making experiment of about 40 minutes, with a reward that would depend on their decisions, but which was likely to be somewhere between 20 and 30 CNY.

For each session, 12 subjects were invited, 10 of whom would participate in the betting games, one would act as an assistant, and another would be held in reserve in the event of a no-show.

The experiment was administrated by pen and paper, and held in a seminar room with the subjects seated far apart to ensure that decisions remained anonymous and independent. Communication between the subjects was prohibited and they could not observe another individual's decisions and payoffs. After entering the room, a short standard-type introduction was read to the subjects by the experimenter. The subjects were informed that the experiment consisted of two parts. After the introduction, each subject unfolded the paper on the table. Ten forms were numbered Registration Forms for the experiment; one form had "assistant" printed on it, and another was a blank form[26]. The assistant was told that he would receive a payment equal to the average earnings of the other participants. The subject who drew the blank form was paid 25 CNY for appearing and was asked to leave the room.

The ten subjects were then required to record their first bets. The gambling game was carried out by the assistant. Whether participants won or lost in any given round of the game depended on their personal winning card. Participants won if their winning card matched the round card that was drawn by the assistant, and lost if their winning card did not match the round card. Every subject has his or her own

[26] This form was removed when only eleven subjects showed up.

"winning card" which was indicated on the Registration Form. The outcome of the random events (the round card drawn) was announced publicly, and the subjects were aware only of their own bets and whether they had won or lost. Since there were thirteen poker cards from A to K in the box from which only one would match a subject's winning card, the probability of winning in any round was 1/13, and the probability of losing was 12/13.

In Treatment I, the subjects fixed their bets for three rounds, which were conducted by the assistant. In order to provide a combined realization of the three rounds, the assistant used three boxes labeled A, B, and C, with each containing 13 poker cards from A to K. The assistant first showed the contents of each box to the subjects, and then shook the boxes and randomly took one card out of each box. The three cards drawn (one for each round) were then simultaneously given to the subjects.

After each round (three rounds in Treatment I), the subjects calculated and recorded their own earnings on their Registration Form. We examined these calculations to make certain that they understood the procedure, and that they did not cheat. Then the subjects recorded their bets for the next round (next three rounds in Treatment I).

3.1.2 Results of Study 1

Our key comparative static result is an examination of behavioral differences across frequent and infrequent treatments; simultaneously we compared the treatment effect between subject types. To maintain consistency with previous literature, we compared betting levels in Figure 9 since MLA predicts that the average bet in Treatment I should be more than the average bet in Treatment F.

The gambling behavior summarized in Figure 9 is consistent with MLA. In both groups, the subjects in Treatment I placed more in betting, which are homological with previous empirical findings (Gneezy & Potters, 1997; Haigh & List, 2005). In Treatment F, the subjects in the Status quo Group bet on average 20.42 units versus 40.51 units for the same group in Treatment I. The subjects in the Endowment Group put on average 24.46 units into betting in Treatment F while they bet nearly 38 units in Treatment I. Figure 9 also indicates that the effect among Status quo Group is more remarkable than that among the Endowment Group.

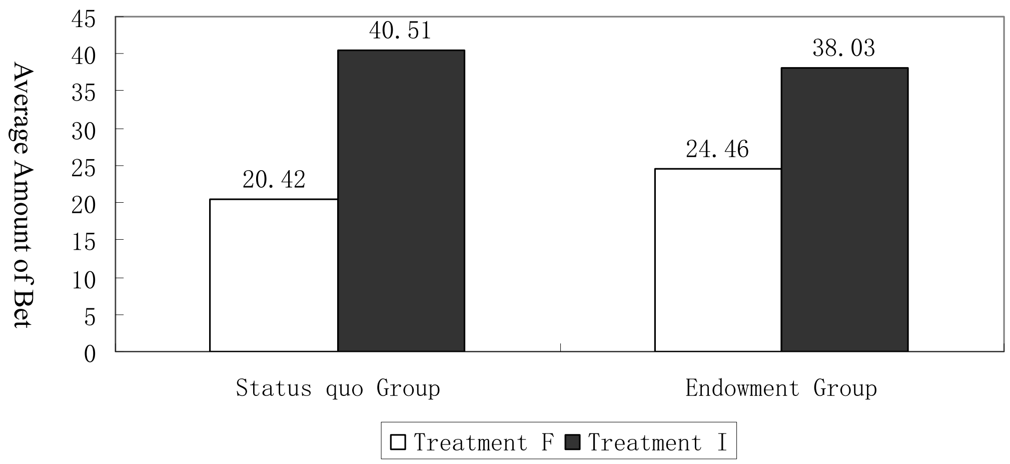

Figure 9: Comparing Betting Patterns

After a comparison of the raw data, we analyzed the empirical results in Table Ⅱ.

Following Gneezy and Potters (1997), we took the average amount in blocks of three rounds to avoid data-dependency problems and to ease comparison with the data in Treatment I. To determine the significance of the differences, we used a nonparametric Mann-Whitney statistical test[27].

Table II: Data Summary of Study 1

	Average Bet			
	Status quo Group Treatment F[a]	**Status quo Group Treatment I[a]**	**Endowment Group Treatment F[a]**	**Endowment Group Treatment I[a]**
Rounds 1-3	18.63(7.46)	42.37(24.56)	21.85(8.24)	40.15(24.48)
Rounds 4-6	18.57(9..01)	41.97(20.68)	22.88(9.69)	39.12(21.29)
Rounds 7-9	20.42(9.32)	40.58(16.23)	24.15(10.12)	37.85(20.49)
Rounds 10-12	24.08(8.09)	37.07(26.88)	28.95(10.52)	35.05(22.57)
Rounds 1-9	19.20(8.64)	41.64(20.37)	22.96(9.54)	39.04(22.18)

	Mann-Whitney z-Statistics	
	Status quo Group Treatment F versus Treatment I[b]	**Endowment Group Treatment F versus Treatment I[b]**
Rounds 1-3	-4.24(0.000)	-3.87(0.000)
Rounds 4-6	-4.08(0.000)	-3.02(0.003)
Rounds 7-9	-3.44(0.001)	-1.93(0.048)
Rounds 10-12	-1.74(0.081)	-1.49(0.152)
Rounds 1-9	-3.89(0.000)	-2.84(0.057)

a. #obs. =61(62) for Treatment F(I). Standard deviations are in parentheses.

b. One-tail significance levels (p -values) are in brackets.

[27] Because the observations in our experiment were not from a normal distribution by using Kolmogorov-Smirnov test, we were not able to use the parametric t -test.

Columns 1-4 in the upper panel summarize the Status quo Group and the Endowment Group's betting behavior over all the rounds. Columns in the lower panel present Mann-Whitney tests on the differences in behavior across the different treatment types. We reported one-tail significance levels at the $p < 0.05$ with this test. For every block of three rounds, average bets are larger for Treatment I.

However, this pattern in the result was not as significant as other rounds in Rounds 10-12 (Part 2 in experimental setting). This phenomenon might be caused by the fact that the subjects knew that the betting games would be over after this part, and therefore those who were not unduly concerned about what they had already earned in Part 1 would put all they had into the betting and those who wanted to bring something back from the experiment exhibited more aversion to risk and only bet little or even nothing. Thus, the observations in Part 2 were cancelled when average bets across all rounds (only Rounds 1-9) were discussed. Table Ⅱ demonstrates an insight: The Status quo Group exhibits greater treatment effect than the Endowment Group. This result is consistent with our theory analysis.

The Status quo Group received 45 CNY before taking part in the experiment while the Endowment Group could only exchange the cents they gained from the experiment for money after the experiment. The Status quo Group predicts exhibiting regret avoidance. Thus the degree of loss aversion should be different. It seems that the design is effective in changing the subjects' degree of loss aversion between different groups. This would also suggest another hypothesis that experiencing losses affects risk behavior. Using a backward-looking hypothesis, it was expected that the treatment effect would be stronger in the final rounds than in the first rounds. No support for this is observed in the data. However, the significantly different treatment effects between different groups support Proposition 1. Table III provides a robustness analysis. A panel data regression model was used to regress the individual bet on a dummy variable for subject pool and a dummy variable for treatment. It is a simple Tobit regression model[28]. The dependent variable is the individual bet. "Status quo Group" is the omitted subject category and therefore represents the baseline group. *Endowment Group* ∗ *Treatment F* is the Endowment Group indicator variable that interacts with the frequent feedback treatment variable.

Table III: Regression Results

Variable	**Constant**	**Endowment Group**	**Treatment F**	**Endowment Group ∗ Treatment F**	R^2	χ^2 (3 d.f.)	N
Tobit Model	51.74* (2.89)	-10.73 (3.63)	-24.98* (4.57)	9.87* (3.63)	0.34	70.48*	1080

Notes: The χ^2 values provide evidence of the explanatory power of the model. Standard errors are in parentheses beneath coefficient estimates.

* Denotes significance at the $p < 0.05$ level.

Our regression results further support the conclusions from the raw data. For

28 Details are discussed in Haigh & List (2005) and Long (1997). The Tobit model is sometimes referred to as the censored regression model. The Tobit model uses all of the information, including information about the censoring. In this study, we censored the treatment effect in the Endowment Group comparing it with the Status quo Group as baseline group.

example, we find that in the Status quo Group, the subjects in Treatment F bet 24.98 fewer units than those in Treatment I, and this difference is significant at the $p < 0.01$ level. The difference is weaker for the Endowment Group where Treatment F subjects bet approximately 15(9.87-24.98) fewer units than Treatment I subjects, which is significant evidence. This finding could be found from the coefficient estimate of the *Endowment Group* ∗ *Treatment F* interaction term in Table Ⅲ, which is significant at the $p < 0.05$ level.

From the results of Study 1, our data support Hypothesis 1 and Hypothesis 2. For both the Status quo Group and the Endowment Group, the subjects in Treatment F bet less than those in Treatment I owing to different evaluation periods. Furthermore, the difference between Treatment F and Treatment I within the Status quo Group was more obvious than that within the Endowment Group. This observation may be caused by status quo bias when real money is put to the task.

3.2 Study 2: Repeated Gambling and Presentation Modes

3.2.1 Design of Study 2

To determine whether individuals have preference reversal when they are faced with different presentation modes, a comparison of acceptance rates was used (Redelmeier & Tversky, 1992). We can easily hypothesize how the sign of the difference in acceptance rates should depend on the risk profiles of the gambling involved. It is a major strength of this method that subjects are confronted with very simple choice situations and are not unduly influenced by coding or other framing effects. This method was set up to verify the basic predictions of our theoretical analysis for presentation modes. A 2×3 design was chosen as presented in Table Ⅳ.

Table IV: The 2×3 Design of Study 2[29]

Portfolio / Type of bet	Single	Segregated mode	Aggregated mode
$M\ \frac{4\% \quad +\$140}{96\% \quad -\$10}$	X	X	X
$V\ \frac{7\% \quad +80}{93\% \quad -\$10.32}$	X	X	X

To investigate the role of Myopic Loss Aversion, two gambling games that have approximately the same expected value but different components were constructed. The entry M/Single is a type of game M with 4% probability to win $140[30] and 96% probability to lose $10. The entry M/Segregated mode is a portfolio consisting of 10 times of game M while M/Aggregated mode is a portfolio providing an overall distribution of 10 times of game M. The entry of row V is the same as row M. For these two types of gambling games, we predict:

Hypothesis 3. *The acceptance rate for playing game M or V ten times will be lower*

[29] The expected value of M and V is exactly the same ane equal to $4.
[30] For participants in China, the amount was changed to ￥140, the following accordingly.

compared with the acceptance rate for playing only once.

HYPOTHESIS 4. *The acceptance rate for playing game M or V ten times will be lower if the overall distribution of the final outcomes is explicitly mentioned.*

HYPOTHESIS 5. *Subjects overestimate the probability of losing money in repeated plays and overestimate the amount of gain in single play.*

The subjects were asked to complete a questionnaire in this computerized experiment, which contained six problems of choice. The subjects were asked whether they were (hypothetically) willing to accept a single play of a gambling game. They were also asked whether they were willing to accept a series of 10 such games. After these two choices, the subjects were presented in the distributional format of the 10-time game and made decisions whether to accept it. Typical questions were of the form[31], "Are you willing to accept the game …?". The main purpose of such successive questions was to see whether the subjects that elected to accept the multiple-play game would change their minds when the explicit distribution of overall outcomes was provided.

There were 164 subjects (68 advanced economics undergraduate students and 36 other postgraduate students from the National University of Singapore and 60

[31] The complete questionnaire is available at Appendix B.

engineering undergraduate students from Shanghai Jiaotong University) taking part in this computerized experiment. Both undergraduate students from the two universities were recruited within a classroom lecture, and postgraduate students who majored in different areas were recruited through an experimental emailing list. All the subjects in this study did not get any monetary incentives[32].

For each game type (M and V), there were three decisions to be made by all subjects (single, segregated mode, and aggregated mode). Questions in two different orders were presented to control for order effects. Therefore, within-subject information concerning the different presentation modes could be collected.

3.2.2 Results of Study 2

Table V: Acceptance Rate of Gambling Games

Game M		Game V	
Portfolio	Acceptance Rate (%)	Portfolio	Acceptance Rate (%)
Single	51.2	Single	38.4
Segregated mode	26.2**	Segregated mode	23.8*
Aggregated mode	7.9**	Aggregated mode	17.1*

**Significant at the 0.01 level. *Significant at the 0.05 level.

32 Our participants were not given any economic incentive when responding to the hypothetical question, which would cause fear that they participants would not think carefully about question and would respond more or less at random. We must admit this shortcoming, however the effect is moderate still significant.

Two types of game, M and V, both with a high probability for trivial losses but with comparably small losses and small gains, were used. Comparing the acceptance rates between a 10-time game in a segregated presentation mode and the same in an aggregated presentation mode, we found that for both M and V, the rates became lower, thus supporting our hypotheses. The acceptance rates are summarized in Table Ⅴ.

Nearly fifty-one percent of the subjects were willing to accept a single game M. Ten independent plays of M were accepted by 26.2% of the subjects when they were presented as a repeated trial (segregated presentation mode), and by only 7.9% of the subjects when they were displayed as aggregated distribution. The situation of game V is similar. Hence, a higher attractiveness of segregated evaluation can be noted for both games M and V. A paired-sample t test shows the difference of the acceptance rates to be significant at the 5% level. This is well in line with our assumption about the coding of the repeated trial presentation.

Let us explore more about type M and type V. We find that although both the acceptance rates for these two types of game are reduced if the overall distribution of the sequence is explicitly mentioned, M produces a more significant effect than V. At the same time, we find that many more subjects accepted a single play of M, which could be explained by the hope to win. This observation confirms the latter part of Hypothesis 5. A similar situation can be found in the case of the segregated mode, but the acceptance rate is not as distinct as that in the single one. The subjects still wanted to win at a higher price, but rational individuals would think more about losing. In the case of the aggregated mode, the acceptance rate for M declined sharply. This might be due to the subjects paying special attention to the overall probabilities of losses and less to the outcome sizes(Lopes, 1996). Because 50% is especially salient, the pure loss probability for M is 66.5% and V is 48%. Thus, the former part of Hypothesis 5 is confirmed.

If individuals have to evaluate a portfolio or a sequence of gambling games, their judgment is influenced by the portfolio presentation mode. A tendency for a narrow framing of the decision problem causes individuals to neglect the portfolio context if the overall outcome distribution is not explicitly mentioned.

Table Ⅴ evidently supports Hypothesis 3, Hypothesis 4, and Hypothesis 5. For the type of gambling with a high probability for trivial losses, the highest acceptance rate was playing single time. The acceptance rate for a 10-time play in the segregated presentation mode was much lower than that for playing once. The number of subjects who would accept playing the game 10 times when given aggregated information was the lowest. Comparing the acceptance rates for 10 times playing M and V in aggregated presentation modes, we come to the conclusion that subjects pay special attention to the overall probability of losses. The higher acceptance rate for single M and 10 times playing M in segregated presentation mode can be explained as the incentive of a big winning prize.

3.3 Concluding Remarks

Two behavioral concepts, loss aversion and mental accounting, have been combined to provide a theoretical explanation for preference reversal in multiple gambling and single gambling. Manipulating the evaluation periods and presenting portfolios in different modes have been intended to find the impact of myopia. Our results show that the longer evaluation period cannot equal the aggregated mode. These two impacts have their own mechanisms which affect decision-makers when they are faced with multiple gambling with a high probability of trivial losses.

Study 1 presents a direct experimental test of the impact of evaluation periods on loss aversion. In this design, through manipulating the evaluation period of certain subjects by giving them less information feedback and less freedom of adjustment than other subjects, a significant treatment effect is observed as in previous empirical tests (Gneezy et al., 2003; Gneezy & Potters, 1997; Haigh & List, 2005; Thaler et al., 1997). However, treatment effects among the Status quo Group and the Endowment Group are also noted here. The group effect in this study indicates that the degree of aversion to special types of gambling changes when subjects are in different situations. In our setting, the Status quo Group received money before they started making decisions. As they wanted to keep the money they had been given, they showed more loss aversion. These observations support our theory prediction for this special type of gamble, that the evaluation period has their own particular mechanism to affect willingness.

In Study 2, it is observed that judgment is influenced by the presentation mode. The results show that portfolios of mixed gambling with a higher segregated evaluation exist. A series of gambling with a high probability for rather small losses should appear less attractive to decision-makers if an aggregated evaluation is performed. This type of gambling can be largely found in slot machines.

A few implications naturally follow. First, these findings have a positive sense on strategies for conducting public gambling activities. Slot machines are the easiest type of gambling capable of sustained growth in the long run (McGowan, 1994), thus governments prefer to introduce them as another source of revenue. This is what critics of the current explosion in gambling activities object to in their discussion. A short break on slot machines and prohibiting credits on gambling machines could induce gamblers to realize the losses and to adjust their activities (Traub, 1999). Moreover, presenting outcomes in the aggregated mode could be a useful method to help individuals recognize the harm of gambling machines. More of this will be discussed in the next chapter.

Of course, this experiment is highly stylized, and real-world decision-makers could not simply face risk, which is known probabilities of possible outcomes. These features are a cause for caution in extrapolating the results. They also suggest lines along which further experimental work may be pursued.

CHAPTER 4

Discussion and Conclusion

4.1 Practical Relevance

4.1.1 Gambling as a Worldwide Phenomenon

Rising incomes in advanced economies and rising demand for leisure have generated an increased demand for gambling products. Gambling now is worldwide industry, not only as leisure, but also as a fund-raiser for governments (Wangenheim, 2004). The decision has been made; Singapore will go ahead with her plans to build two Integrated Resorts, one on Marina Bay and the other on Sentosa. The casinos will induce more expenditure on gambling activities. However, relevant rules to manage gambling have to be established in order to pre-empt sociological problems, such as ascending crime by problem gamblers (Abt & McGurrin, 1992).

Any visitor to a contemporary casino would be surprised if they found that there were no gambling machines available to play. As early as 2005[33], there were 1902 slot machines in Singapore, and the government has accrued more than 200 million dollars of tax from them. With the construction of casinos, there will also be a parallel growth in the market for gambling machines.

[33] The source could be obtained from the Internet: http://www.zaobao.com/special/newspapers/2005/05/xmrb050501f.html.

Slot machines and other electronic gambling machines are gambling devices that offer a variety of games. They are inexpensive to run, which makes it possible for casinos to offer low-stakes betting to a large number of customers. There is a general view that gambling machines are the most “addictive” form of gambling, in that they contribute more to the problems of gambling than any other gambling activity (Dowling, Smith, & Thomas, 2004).

Problem gamblers may have a wide variety of erroneous beliefs about winning (Turner, 2000). Most of these errors are based on a fundamental misunderstanding of the independence of random events. Many problem gamblers, for example, believe that, if an event has not come up recently, it is due to come up independently at random. Players underestimate the chances of repeated numbers, sequences, or other patterns occurring. Faced with an unusual event such as tossing up 10 heads in a row, many individuals will believe that the coin has a bias. Often these errors are due to a misunderstanding of the nature of long-term outcomes (Wagenaar, 1988). Varying the probability of different pictures on the slot machines means that they can have virtually any possible prize structure, including many small to medium prizes with rare huge jackpots (Dowling et al., 2004). Before a machine is licensed, its mathematical properties are tested across millions of simulated bets in order to prove (within a very small margin of error) to the casino operators that the machine will make money across players (McGowan, 1994). But the chance of any specific player winning in the long term never drops to zero. Some individuals need to be convinced that they cannot win. For them if such research is conducted, it might lead to recommendations that could reduce the potential harm of these games.

4.1.2 The Strategic Management of Gambling Machines

The Singapore government has announced some rules[34] that might be used to organize casinos in the future, one of which is replacing credit displays with cash displays and limiting cash size. This rule could be thought of as one of the methods to manipulate the evaluation periods for decisions on gambling machines. We hope the government will encourage other organizations to also provide aggregated results of playing gambling machines which will discourage more individuals from indulging in gambling machines.

We should admit that our study has its limitations in practical relevance. However, our purpose is not to let problem gamblers quit their addiction. We try to prevent rational agents from getting addicted to gambling machines by providing them with information that they can obtain. The standard version of rational-choice explanation of behavior is set out in Figure 10. An action is rational if it satisfies three optimality conditions, represented by the unblocked arrows[35]. In this mechanism, available information is very important. The action has to be made by realizing the agent's desires and beliefs, whose formation must not be distorted by mistakes in

[34] Source from a local newspaper The Straits Times (Koh, 2005).
[35] A detailed explanation can be found at Elster (1999).

information processing or motivational biases (Elster, 1999). Thus, the amount of information gives the agent prior beliefs about the costs and benefits of information acquisition and the importance of the decision to him.

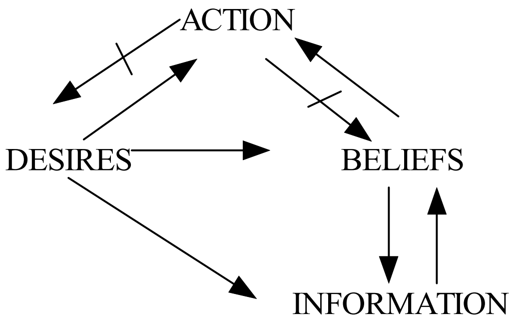

Figure 10: Rational Choice Mechanism

Source from Elster (1986).

Our findings attempt to suggest to the government to provide accurate information to gambling machines players. For most players, when they enter the casino, they have an unconscious wish to lose (Dickerson, 1993; Walters, 1994). However, some of them may lose self-control because those who stand to gain from gambling activities hinder self-monitoring cues. For instance, “it is impossible to see outside from inside a casino (the few windows and doors are often blacked out), so that it is impossible to tell whether it is day or night. There are no clocks on the wall” (Baumeister, Heatherton, & Tice, 1994). Thus, an automatic short break on gambling machines or prohibiting credits on gambling machines could either increase their evaluation frequency or reduce the possibility of losing self-control. Our findings might be useful for guiding those individuals who occasionally gamble and do so moderately when they are triggered by a desire for entertainment and a hope for monetary gain.

The popularity of gambling behavior does not take place in a social vacuum. Individual activities are social products and individual decisions are directly and indirectly influenced by the social system (Abrams & Niaura, 1987). People's attention is often drawn towards huge logos which present gambling machines as inexpensive price and large amount of wining prize, and towards the continuous rattling of money because of the grouping together of many slot machines (Wagenaar, 1988). From our findings, providing the public with aggregated information of gambling machines may cause the popularity of gambling machines to go down more easily than up. However, once a high-consumption culture has become established, it may not be easily removed by political measures (Elster, 1999).

Whether these rules would really help individuals to form a correct attitude towards gambling will take a quite a long time to prove. However, we hope further research in the experimental examination can make our society safe and harmonious.

4.2 Conclusion

This thesis investigated the causal mechanisms underlying the effects of evaluation periods and presentation modes of multiple prospects on decision-makers' willingness to accept the prospects. The key research question addressed by the current study is whether a longer evaluation period and an aggregated presentation mode always affect decision-makers' willingness in the same way. To investigate this question, we extended a theoretical discussion of Myopia Loss Aversion, in particular on the impact of myopia: evaluation periods and presentation modes. For special types of gambling with a high probability for trivial losses, a longer evaluation period cannot be equated to an aggregated presentation mode.

In the theoretical part of this study, we extended the loss-aversion explanation with Loss Aversion and Mental Accounting (LA/MA) model (Barberis & Huang, 2001; Barberis et al., 2001). We formally analyzed the evaluation period of the various types of gambling. It turned out that although for both types of gambling, individuals would place more in betting, the mediational role of mental accounting was distinct and separate. Introducing lottery space (Langer & Weber, 2001) to analyze presentation modes, we found that portfolios of mixed prospects with a higher segregated evaluation exist. A portfolio of gambling with a high probability for rather low losses should appear more attractive to decision-makers if a segregated evaluation is performed.

The different theoretical predictions were finally investigated in two experimental studies. Study 1 examined the difference caused by two treatments: frequent feedback and infrequent feedback. The average percentage allocated in betting with a longer evaluation period was significantly higher than with a shorter one, which might be caused by different degrees of loss aversion. Study 2 examined participants' willingness to accept a multiple prospect consisting of a bundle of 10 plays of a single game with a high probability for trivial losses. The proportion of participants willing to accept this prospect was significantly lower when it was framed in an aggregated mode with the overall distribution of outcomes presented. A summary of all five hypotheses is presented in Table Ⅵ.

Table VI: Summary of Hypotheses

Hypothesis	Outcome and Result	Comparison with Other Studies
Subject in Treatment I will bet more in betting game than Treatment F.	The significant treatment effect was found both in Status quo Group and Endowment Group. The manipulation of evaluation periods made different attitude toward the same risky gamble.	The treatment effect has been already observed in Thaler et al. (1997), Gneezy and Potters (1997), Gneezy et al (2003) and Haigh and List (2005), but they all did not discuss such type of gambling we used in experiment, with a high probability for trivial losses.
Treatment effect within Status quo Group will be more significant than among Endowment Group.	The difference between Treat-ment F and Treatment I was more pronounced among Status quo Group. This might be caused by Status quo Bias, which made different degree of loss aversion among subjects.	For those gambles with high probability for trivial loss, evaluation period affects attr-activeness though changing degree of loss aversion. However, evaluation period made risky option with positive expected return in previous works more attractive by cushioning subsequent losses by prior gains.
The acceptance rate for 10 repetitions of the gamble with high probability for trivial loss would be higher than single one.	People always hope to win, although it is very hard to gain. Thus the single time trial was much higher than repeated playing.	This procedure was replicated from Benartzi and Thaler (1999), but the measurement was not our focus.
The acceptance rate for 10 repetitions of the gamble with high probability for trivial loss in aggregated mode would be lower than segregated mode.	Aggregated presentation mode made people pay more attent-ion to loss amount and loss pro-bability. Therefore, segregated presentation mode let such gambles more attractive.	Although Langer and Weber (2001) assert that the higher attractiveness of aggregated preset-ation mode is not a general phenomenon. They only discussed the gamble with low pro-bability to high loss size. We extend their discussion to trivial loss gamble.
Subjects overestimate the probability of losing money in repeated plays and overestimate the amount of gain in single trial.	Two gambles with the same expected value, the one which are much more welcome for single playing was rejected by more subjects when explicitly mentioned outcomes of 10 repetitions of the gamble.	This confirmed the conjecture in Lopes (1996) that people have different criteria when evaluating single and repeated gamble. For trivial loss gamble, people pay attention to the amount of gain if they want to try playing once. However, they would care more about loss probability when repeated playing.

The current study has contributed to a better understanding of the mechanisms underlying evaluation periods and presentation modes, and of the effects of prospect framing on gambling machines, which have a high probability for trivial losses. This study has important implications for policy-making. Manipulating the evaluation period could increase the degree of loss aversion for gamblers playing slot machines, and presenting aggregated possible outcomes of gambling machines would eliminate belief-based departures from rational choice (Fox & See, 2003). The latter one is more important when individuals do not make their decisions to play gambling games. When individuals lack strong prior opinions, the opposite situation occurs – they are at the mercy of the way information is presented. Subtle changes in the way risks are expressed can have a major impact on perceptions and decisions (Eadington, 1999).

Gambling activities cannot be seen only as investing behavior, such as buying stocks to win back money. Gamblers playing gambling machines may be subject to different motivations and, more generally, psychological processes (Elster, 1999). Thus, further experimental research is needed to be able to make reliable predictions of individual behavior in more complex real-world decision situations.

APPENDIX A

Experimental Instructions for Study 1[36]

A.1 Introduction

A.1.1 Introduction for the Status quo Group

Welcome to our experimental study of gambling behaviour. The experiment will last for 40 minutes. The instructions for the experiment are simple, and if you follow them carefully, you may earn a considerable amount of money. Now the envelope on your desk has 45 CNY inside. This is not your final earnings from your participation. You might earn more or less than this amount based on your decisions in this experiment.

The experiment will consist of two parts. The instructions for the second part will be distributed to you after the first part is completed. Before we start the experiment, however, you should fill in the Registration Form on your desk. This form will be used to register your decisions and earnings. One of you, however, will find the label "assistant" on the form. This person will assist me during the experiment, and will receive a payment that is equal to the average earnings of the other participants in the experiment.

[36] Chinese translation of full instructions is available upon request.

In this experiment, 1 CNY exchanges for 20 cents. Thus, all of you have 900 cents in hand now. Part 1 of the experiment consists of 9 successive rounds, where you must decide in each round how much of this amount you wish to bet. One important thing is that in each round the maximum amount of bet you can place is 100 cents and the minimum amount is 0 cent. At the end of the experiment, at an exchange rate of 100 cents = 5.00 CNY, you should get extra money if you win in the bet and you should hand in money if you lose in the bet.

If you have questions, please raise your hand.

A.1.2 Introduction for the Endowment Group

Welcome to our experimental study of gambling behaviour. The experiment will last for 40 minutes. The instructions for the experiment are simple, and if you follow them carefully, you may earn a considerable amount of money. All the money you earn is yours to keep, and will be paid to you in cash, privately and immediately after the experiment.

The experiment consists of two parts. The instructions for the second part will be distributed to you after the first part is completed. Before we start the experiment, however, you should fill in the Registration Form on your desk. This form will be used to register your decisions and earnings. One of you, however, will find the label “assistant” on the form. This person will assist me during the experiment, and will receive a payment that is equal to the average earnings of the other participants in the experiment.

Part 1 consists of 9 successive rounds. In each round, you will start with an amount of 100 cents. You must decide how much of this amount (between 0 cent and 100 cents) you wish to place in the bet. At the end of the experiment, we will exchange the cents you have earned for money at an exchange rate of 1 cent equal to 0.05 CNY.

If you have questions, please raise your hand.

A.2 Instructions for Part 1

A.2.1 Instructions for Part 1 in Treatment F

As mentioned in the introduction, you will play 9 successive rounds. In each round, you can only place a bet ranging from 0 cent to 100 cents.

> You have a chance of 1/13 to win ten times the amount you bet, and a 12/13 chance to lose the amount you bet.

You are requested to record your choice on the Registration Form. Suppose you decide to bet an amount of X cents (0≤X≤100) in this game. You must fill in the amount X in the column with the heading *Amount in Gambling*, in the row with the number of the present round.

Whether you win or lose in the game partly depends on your personal winning card. This card is indicated on top of your individual sheet. Your winning card can be A to K, and is the same for all nine rounds. In any rounds, you win in the game if your winning card matches the round card that will be drawn by the assistant, and you lose if your winning card does not match the round card.

The round card is determined as follows. After you have recorded your bet in the gambling for the round, the assistant will, in a random manner, pick one card from a box containing 13 cards: A to K. The card drawn is the round card for that round. If the round card matches your winning card, you win; otherwise, you lose. Since there are 13 cards of which one will match your winning card, the chance of wining in the game is 1/13.

Hence, your earnings in the game for the three rounds are determined as follows. If you have decided to put an amount of X cents (0≤X≤100) in the game, then your earnings in the game are equal to –X for each round card that does not match your winning card (you lose the amount bet for that round) and equal to +10X for each round card that matches your winning card (you win ten times the amount bet for that round).

The round card will be shown to you by the assistant. You are requested to record this card in the column *Round Cards*, under *Win* or *Lose*, depending on whether the round card does or does not match your winning card. You are also requested to record your earnings in the column *Earnings from Gambling*. Your total earnings for that round are equal to 100 cents (your starting amount) plus your earnings in the game. These earnings are recorded in the column *Total earnings*, in the row of the corresponding round. Each time we will come by to check your registration form for errors in calculation.

After that, you are requested to record your choice for the next round. Again you choose the amount (from 0 cent to 100 cents) you want to bet in the gambling. The same procedure as described above determines your earnings for this round. It is to be noted that your private winning card remains the same, but that for each round, a new card is drawn by the assistant. All subsequent rounds will also proceed in the same manner. At the end of the last round, your earnings in all the rounds will be summed up. This amount determines your total earnings for Part 1 of the experiment. After Part 1, the instructions for Part 2 of the experiment will be announced.

A.2.2 Instructions for Part 1 in Treatment I

As mentioned in the introduction, you will play 9 successive rounds. In each round, you can only place a bet ranging from 0 cent to 100 cents.

> You have a chance of 1/13 to win ten times the amount you bet, and a 12/13 chance to lose the amount you bet.

You are requested to record your choice on the Registration Form. Suppose you decide to bet an amount of X cents (0≤X≤100) in this game. You must fill in the amount X in the column with the heading *Amount in Gambling*. Please note that you fix your choice for the next three rounds. Thus, if you decide to bet an amount X in the game for round 1, then you must also bet an amount X in the game for rounds 2 and 3. Therefore, the three consecutive rounds are bundled together on the Registration Form.

Whether you win or lose in the game partly depends on your personal winning card. This card is indicated on top of your individual sheet. Your winning card can be A to K, and it is the same for all nine rounds. In any rounds, you win in the game if your winning card matches the round card that will be drawn by the assistant, and you lose if your winning card does not match the round card.

The round card is determined as follows. After you have recorded your bet in the game for the next three rounds, the assistant will, in a random manner, for each of the next three rounds pick a card from a box containing 13 cards: A to K. For each of the three rounds, a card is drawn from a different box. The three cards drawn are the round cards for the present three rounds. If the round card matches your winning card, you win; otherwise, you lose. Since there are 13 cards of which one will match your winning card, the chance of wining in the gambling is 1/13.

Hence, your earnings in the game for the three rounds are determined as follows. If you have decided to put an amount of X cents ($0 \leq X \leq 100$) in the game, then your earnings in the game are equal to –X for each round card that does not match your winning card (you lose the amount bet for the round) and equal to +10X for each round card that matches your winning card (you win ten times the amount bet for the round).

The three round cards will be shown to you by the assistant. You need to record these cards in the column *Round Cards*, under *Win* or *Lose*, depending on whether the round card does or does not match your winning card. You are also requested to record your earnings in the column *Earnings from Gambling*. Your total earnings for the round are equal to 300 cents (your starting amount) plus your earnings in the game. These earnings are recorded in the column *Total earnings*, in the row of the corresponding rounds. Each time we will come by to check your registration form for errors in calculation.

After that, you are requested to record your choice for the next three rounds (4-6). Again you choose the amount (from 0 cent to 100 cents) you want to bet in the game. The same procedure as described above determines your earnings for these three rounds. It is noted that your private winning card remains the same, but that for each round, a new card is drawn by the assistant. All subsequent three rounds (7-9) will also proceed in the same manner. After the last round has been completed, your earnings in all the rounds will be summed up. This amount determines your total earnings for Part 1 of the experiment. After Part I,, the instructions for Part 2 of the experiment will be announced.

A.3 Instructions for Part 2

A.3.1 Instructions for Part 2 in Treatment F

Part 2 of the experiment is almost identical to Part 1, but differs in two respects. First, Part 2 consists of three rounds (instead of nine rounds). Second, in Part 2 you play with the cents that you have earned in Part 1. To that purpose, we first divide your earnings in Part 1 into three amounts. The resulting amount is your starting amount S for each of the three rounds. Again you are asked how much of this amount (from 0 to S) you wish to bet in the same game as Part 1. One important thing you should remember is that, in this Part, the maximum amount you can place is S and the minimum is 0.

The same procedure as described in Part 1 determines your earnings. You make three decisions in this Part. After that, your earnings in this part will be added. This amount determines your total earnings in Part 1 and Part 2 of the experiment.

A.3.2 Instructions for Part 2 in Treatment I

Part 2 of the experiment is almost identical to Part 1, but differs in two respects. First, Part 2 consists of three rounds (instead of nine rounds). Second, in Part 2 you play with the cents that you have earned in Part 1. To that purpose, we first divide your earnings in Part 1 into three amounts. The resulting amount is your starting amount S for each of the three rounds. Again you are asked how much of this amount (from 0 to S) you wish to bet in the same game as Part 1. One important thing you should remember is that, in this Part, the maximum amount you can place is S and the minimum is 0.

The same procedure as described in Part 1 determines your earnings. You make one decision in this Part. After that, your earnings in this part will be added. This amount determines your total earnings in Part 1 and Part 2 of the experiment.

APPENDIX B

Questionnaire for Study 2

The gambling game choice worksheet show several decisions. You are required to make a decision “yes” or “no”. Many thanks to you for participating in this questionnaire.

1. Imagine that you have the opportunity to play a gambling game that offers a 4% chance to win 140 SGD[37] and a 96% chance to lose 10 SGD. Would you play the game?

2. Suppose you have the opportunity to play the above game 10 times, not just once. Would you play it 10 times?

3. Imagine that you are offered an opportunity to play the following game. The probabilities and outcomes of the game are listed below:

   66.48% chance to lose 100SGD

   2.77% chance to win 50SGD

   0.12% chance to win 200SGD

   0.0048% chance to win 350SGD

[37] For participants in China, the unit changes to CNY.

0.00002% chance to win 500SGD

0.0000008% chance to win 650SGD

Would you play this game?

4. Imagine that you have the opportunity to play a game that offers a 7% chance to win 80 SGD and a 93% to lose 10.32 SGD. Would you play the game?

5. Suppose you have the opportunity to play the above game 10 times, not just once. Would you play it 10 times?

6. Imagine that you are offered an opportunity to play the following game. The probabilities and outcomes of the game are given below:

   48.39% chance to lose 103,2SGD

   3.64% chance to lose 12.88SGD

   0.274% chance to win 77.44SGD

   0.021% chance to win 167,76GD

   0.002% chance to win 258.08SGD

   0.0001% chance to win 348.4SGD

   0.00008% chance to win 438.72SGD

   0.000006% chance to win 529.04SGD

   Would you play this game?

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