EFFECTS OF GENDER AND AGE ON RISK PREFERENCES

by

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KESAN JANTINA DAN UMUR ATAS PENGUTAMAAN RISIKO

ABSTRAK

Wanita biasanya dianggap sebagai lebih cenderung mengelak risiko berbanding dengan lelaki dalam membuat keputusan kewangan. Golongan muda dipercayai lebih cenderung mengambil risiko lebih daripada golongan tua. Kajian ini hendak mengenal pasti kesan jantina dan umur terhadap pengutamaan risiko. Kajian ini menerangkan kelakuan subjek sebagai pengambil risiko atau mengambil risiko dalam keputusan risiko melalui tiga aspek, persamaan kepastian; Fungsi Pemberat Kebarangkalian; dan Fungsi Nilai. Dengan melihat penilaian kebarangkalian subjek, kami mengetahui tingkah laku seseorang individu melalui penilaian ringan atau penilaian berat terhadap kebarangkalian. Penilaian terhadap ganjaran membantu kita untuk menentukan sama ada seseorang menilai ganjaran lebih tinggi atau lebih rendah daripada ganjaran yang dijangka. Kajian ini telah menjalankan kajian lapangan dengan mengambil orang dewasa yang sedang bekerja dari jantina dan kumpulan umur yang berbeza. Mereka diminta untuk membuat keputusan mengenai loteri dan data yang dikumpul digunakan untuk menganggar dan plot Fungsi Pemberat Kebarangkalian dan Fungsi Nilai. Dapatan kajian menunjukkan bahawa wanita lebih cenderung mengelak risiko daripada lelaki kerana mereka menilai berat kebarangkalian kecil kurang (lebih) dan menilai rendah kebarangkalian besar lebih (kurang) daripada lelaki dalam domain keuntungan (kerugian). Pada masa yang sama, golongan tua didapati lebih cenderung mengelak risiko dalam domain keuntungan tetapi lebih mengambil risiko berbanding dengan golongan muda dalam domain kerugian.

EFFECTS OF GENDER AND AGE ON RISK PREFERENCES

ABSTRACT

Women are commonly stereotyped as more risk averse than men in financial decision. Young age group are believed to be more willing to take more risk than elder age group. The present study intended to look into the effects of gender and age on risk preference. This study explained why a subject behaved as risk taker or risk averse in risk decision through three aspects, certainty equivalent; Probability Weighting Function; and Value Function. By looking on how a subject evaluated probability, we knew his or her risk behavior through the underweighting or overweighing of probability. Payoff valuation helped us to determine whether a subject valued a payoff higher or lower than the expected payoff. The study conducted a field study by recruiting working adults from different gender and different age groups. They were asked to make decision on lotteries and the data collected were used to estimate and plot Probability Weighting Functions and Value Functions. The findings showed that women were more risk averse than men as they overweighed small probabilities less (more) and underweighted large probabilities more (less) than men in gain (loss) domain. At the same time, elder adults were found to be more risk averse in gain domain but more risk seeking than young adults in loss domain.

CHAPTER 1 INTRODUCTION

1.1 Introduction

It is a general assumption that women are more risk averse than men. Numerous Psychology and Sociology research have found strong gender-specific differences especially in non-financial or physical risks, such as Byrnes *et al*. (1999), Spigner *et al*. (1993), and Flynn *et al*. (1994). There are few studies which based on field data and laboratory experiment found that women were more risk averse than men when financial risks were involved. Study such as Eckel & Grossman (2003) revealed that women were less risk tolerance than men in field data. In laboratory experimental studies, it has been shown that women were more risk averse than men, such as Schubert *et al*. (2000), Levin *et al*. (1988), and Powell & Ansic (1997). However, what was left unexplored is the investigation on reasons why women are more risk averse than men. What could be more interesting is to investigate how genders evaluate a risky prospect differently, particularly how the probability or payoff of the risky prospect is evaluated before a decision is made.

Other than gender effect, it is also a common belief that people become more risk averse and more cautious as they get older. Studies on financial behavior revealed the relationship between age and risk preferences. Halek and Eisenhauer (2001) found that older individuals were more risk averse in life insurance coverage compared to younger individuals. Similarly in investment decision, study also found that older investors tended to own less risky stocks than younger investors and had smaller proportion of their assets in risky investment (Morin & Suarez, 1983). However, Wang and Hanna (1997) showed in their study that when the element of

retirement status was controlled, older individuals tended to have higher proportion of their net worth invested in risky assets.

There are also some studies attempted to examine age differences on risk preferences in a controlled lab environment but did not find significant differences in risk behavior between older and younger individuals. For example, when subjects were faced with decision between making decisions about medical treatment or career planning or asked to select between aggressive and conservative options, older and younger individuals' decisions showed similar level of risk seeking (Botwinick, 1969 and Chou *et al*., 2007). Lauriola and Levin (2001) found that, when subjects were asked to make a series of choices between option pairs with equivalent expected values, older individuals were more risk averse than younger individuals when deciding between two potential gains but were more risk seeking when deciding between two potential losses.

Existing literature presented mixed findings concerning age differences on risk preferences. Older adults were found to be more risk seeking in some studies but also as risk seeking as young adults in other studies. These findings could be due to interaction of age and gender, in which old male adults could be more risk seeking than young female adults or old female adults could be more risk averse than young male adults. Present study intends to examine the effect of the interaction of age and genders on risk preferences. The study intends to explore how different age groups between genders evaluate probability and payoff of a risky prospect using probability weighting function and value function in Prospect Theory (Kahneman & Tversky, 1979).

1.2 Problem Statement

Most of the past studies showed that women were more risk averse than men, but they did not explain clearly the reason behind it, especially on how probability and payoff (outcome) of a risky prospect was evaluated. Some studies explained that women were more risk averse than men because they were more sensitive or more emotionally attached to the potential gain or loss, but there has been very few studies so far investigating how genders evaluate probability and payoff (outcome) of a risky prospect differently.

In addition, there are many studies about the impacts of age differences and gender differences on financial risks, but those studies only covered either age differences or gender differences separately. They did not study the interaction effect of both differences on risk preferences.

Present study conducted field experiment with lottery game to investigate the effects of gender and age on risk preferences. The sample of the survey involved working adults in Penang, Malaysia. The sample was divided into 7 categories of different age group. The break down followed the demographic break down of overall Malaysian population according to age and gender.

1.3 Research questions

The study aims to answer a few questions as the following using field economic experiment:

i. Is the evaluation of probability weighting function different among men (women) from different age groups?
ii. Do men (women) from the same age group evaluate probability differently?
iii. Do men (women) from different age groups evaluate payoff differently?
iv. Do men (women) from the same age group evaluate payoff differently?

1.4 Objective of the study

The main objective of present study is to examine the role of age differences in influencing the evaluation of probability weighting function and value function between genders. In order to achieve the purpose of this study, the following objectives are derived:

i. To identify whether men and women from different age group evaluate probability differently, and
ii. To examine whether men and women from different age group evaluate payoff differently

1.5 Significance of the study

The purpose of this study is to determine whether gender and differences in age can influence risk preferences. We investigate the relationship between gender differences from different age group and risk tolerance among working adults in Penang, Malaysia. Most of the studies on risk preferences recruited students as subjects in the analysis. Yang (2004) investigated the risk preferences of young

adults through a questionnaire and suggested the importance of investment experiences and knowledge in risk preferences. Besides that, Chen and Volpe (1998) also revealed that college students were not knowledgeable about personal finance, which might limit their ability to make decisions. Thus, the sample used in a study may affect the results as well. Therefore, using working adults as sample will provide better and more accurate results because working adults have more experiences and knowledge on financial risk than students.

Past studies did not state clearly the reason why gender made different risk decision, especially on how they evaluated probability of winning/losing and the impact of payoff on risk preferences. Incorporating these concerns into the analysis will provide better understanding on how both individuals evaluated risk. The method used in past studies by just looking on how subjects made choices on lotteries or scenarios, such as Eckel and Grossman (2002), Harris *et al.* (2006) and Niederle and Vesterlund (2007), could not explain the risk behavior of a prospect. Present study attempts to provide better explanation and clearer reason to support the findings through probability and payoff evaluation.

1.6 Conclusion

The main purpose of present study is to examine the risk behavior of working adults through the evaluation of probability and payoff. We intend to study the effect of the interaction of age and gender on risk preference in a lottery game.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

This section reviews previous works on the effects of gender and age differences on risky decision. The review is separated into two sections for a clearer picture of past findings: gender effect and age differences.

2.2 Studies of Gender Effect in Risk Decision

Many researchers have studied risk decision making between genders. Studies have shown that women were more risk averse than men. A lottery game involving gain and loss domain was done by Fehr H. *et.al* (2004). They framed two different environment conditions: subjects were confronted with abstract gamble choices in the abstract environment, while the same lotteries were framed as investment and insurance decisions in the contextual environment. Result of the experiment revealed that women were sensitive to changes in probability and led to higher risk aversion. Eckel and Grossman (2002) conducted a laboratory gamble choices experiment and in one of the loss or no-loss treatments, result showed that women were consistently more risk averse than men on average. Besides, Levin *et.al* (1988) investigated that men were more likely to gamble compared to women. Hence, women were more risk averse towards gambles.

The experimental results shown above have been supported by researches who investigated tolerance of risk level in financial market context between genders. In portfolio holding, for example, Jianakoplos and Bernasek (1998) found that women had less risky assets portfolios than men and Barsky *et.al* (1997) showed that women were less willing to accept financial risk. In a setting designed to mimic

investment behavior in laboratory experiment by Powell and Ansic (1997), showed that women were more risk averse than men. Levy *et.al* (1999) also compared the investment decisions of female and male MBA students over several weeks and also found that women showed greater risk aversion which consequently lowered their earnings relative to men. In addition, Niederle and Vesterlund (2007) carried out a laboratory experiment to investigate whether men and women of the same ability differed in their selection through a real task solving under a competitive tournament incentive scheme. The result showed that men were more confident and more risk seeking in the tournament.

In a field study that involved questionnaire on large number of subjects, such as by Byrnes *et al.* (1999) analyzed the risk-taking tendencies of male and female participants. It involved over 100,000 participants in total. They categorized the studies by the type of task (e.g., self-reported behaviors versus observed behaviors), task content (e.g., smoking versus sex). Results showed that in 14 out of 16 tasks, males were more risk taking than females. Arch (1993) reviewed 50 studies and reported again that women were more risk averse than men. She explained this phenomenon by claiming that males were more likely to see a risky situation as a challenge while females perceived it as threat that encouraged them to avoid risk. Bernasek and Shwiff (2001) did a survey on pension investments among universities faculty employees and once again they showed that women tend to be more risk averse. Hinz *et al.* (1997) did another survey involving participants in the federal government's Thrift Savings Plan. They found that women invested their pension assets more conservatively than men. A large percentage of women invested in the minimum-risk portfolio available to them under controlled economic and demographic variables.

Several studies found the risk perception was domain specific. In an abstract lottery choice, Schubert *et al.* (1999) framed choices as either potential gains or as potential losses. They found that women were more risk averse than men in the gain-domain frame, consistent with the evidence presented earlier. However, this result was reversed in the loss-domain gambles: men were more risk averse than women. Moore and Eckel (2003) also found mixed evidence; in gain domain, women were more risk averse than men, as well as significantly more averse to weak ambiguity. However, when gambles were framed as decision to purchase insurance this difference reversed and men were more risk averse.

Most of the past studies pointed to the fact that women were more risk averse than men in gain domain, but risk seeking in loss domain. This behavior may be due to difference in evaluation of a risky prospect especially on its outcome and probability. Present study intends to explore this area; looking into the differences of evaluation patterns between genders.

2.3 Studies of the Effect of Age Differences on Risk Decision

So far, the findings about the effect of age on risk preferences were mixed. Halek and Eisenhauer (2001) found that older individuals were more risk averse in their purchase of life insurance coverage than younger individuals. Another study found that younger investors tended to own more risky stocks than older investors (Hunter & Kemp, 2004). Morin and Suarez (1983) investigated the effect of age on risky assets holding and found that older investors had smaller proportion of their assets in risky investment compared to younger investors. Thus, they concluded that on average risk aversion increased with age.

Another study by Jianakoplos and Bernasek (1998) studied age group over 65 years old and found that those over 65 years old were significantly more risk seeking than those who were younger. Riley and Chow (1992) found, in their study on asset allocation and individual risk aversion in a sample of U.S household, that risk aversion decreased with age until 65 and increased significantly. Other studies also found that older people tended to have larger proportion of their net worth invested in risky assets (Wang & Hanna, 1997).

McInish *et al.* (1993) investigated the effect of age on the holding of risky assets based on U.S financial diary panel data. The result showed that individuals older than 35 years old tended to show higher risk tolerance when net worth increased than individuals who were younger than 35 years old.

In experimental studies, Chou *et al.* (2007) found that older and younger adults showed similar risk seeking level when they were asked to choose between aggressive and conservative option in a hypothetical life dilemma such as making decision about medical treatment or career planning. In another study by Dror *et al.* (1998) asked younger and older adults to play a risky card game "Black Jack" and the result showed that both younger and older adults' were not significantly different in taking additional card. In a gambling task involving choosing which decks of cards were most advantageous in the long run, older adults usually learned to avoid "bad" decks which had higher average gains but also occasional large losses (Bechara *et al*., 1997). Same response also happened in younger adults (Wood *et al*., 2005).

In contrast to the findings mentioned above, Lauriola and Levin (2001) found that older adults were more risk averse than younger adults when deciding between two potential gains but more risk seeking when deciding between two

potential losses. Weller (2011) used Cups task that relied on choices between a certain outcome and an uncertain outcome revealed age differences in risk seeking. When the choices were between a sure gain and a larger but uncertain gain, risk seeking decreased with age. However, risk seeking increased with age when the choices were between a sure loss and a larger but uncertain loss.

In addition, there are some studies that examined age differences in choices with guaranteed options. Study by Holliday (1988) which involved only 12 subjects in each age group found no significant age differences. Another study revealed that older adults were less likely to choose sure-thing options in choices involving losses compared to younger adults whereas there were no significant differences for choices involving gains (Weber *et al*., 2004). However, it is found that those considered "older adults" were MBA students and size was small.

2.4 Conclusion

Most of the findings in the literature showed that men were more risk seeking than women. Besides, previous studies also found that elder age group were more risk averse than young age group. This study provides different method in explaining the risk behavior of subjects. Present study examines the risk behavior of subjects through their evaluation of probability and payoff which could provide clearer reason on why men are more risk seeking than women. At the same time, this study also involves the interaction between gender and age differences which is not done in previous literature before.

CHAPTER 3 THEORETICAL FRAMEWORK

3.1 Introduction

This chapter explains Prospect Theory and violations of expected utility theory. It focuses on the theory of evaluation of probability and outcome/payoff of a choice prospect. The theory is used to investigate risk behaviors between different genders and age groups.

3.2 Expected Utility

Expected utility is a decision theory, where the utility of an outcome is weighted by its probability. For example, given a simple choice prospect (*x, p; y, 1-p*) which offers probability p to win $x and probability 1-p to win $y, expected utility of this choice is $p*u(x) + (1-p)*u(y)$; where "u" is the utility function of the payoff. There are two different conditions for risk: uncertainty, where the outcome probabilities are not completely known and certainty, where the outcome probabilities are known and equal to either 1 or 0. Expected utility theory states that individuals always try to maximize their expected utility in making choices between risky options by weighting the outcome and choosing the option with the highest weighted sum (Luce & Raiffa, 1957, Ch. 2). The theory has been widely used to explain individuals' risk aversion and risk-seeking. Given a two-option choice, one offering a certain outcome of utility x and a gamble offering an equivalent expected utility x, risk-averse individual will choose certain outcome over gamble and risk-seeking individual will choose the gamble over certain outcome. For example, between two options with one offering certain outcome of $150 and the gamble with ($300, 0.6; $50, 0.4), i.e 0.6 chance of winning $300 and 0.4 chance of winning $50,

risk aversive people will choose $150 for sure over the gamble, although the expected payoff of the gamble is $200, (0.6*u(300)+0.4*u(50)), and risk-seeking happens when people choose the gamble with lower expected payoff ($200) over the sure outcome although the payoff from the sure outcome is more than $200.

3.3 Prospect Theory

Much of the choice literature had shown violation of expected utility theory in their empirical results. One of the most notable observations was the fourfold patterns of risk attitude: risk seeking over low-probability gains, risk aversion over low-probability losses, risk aversion over high-probability gains, and risk seeking over high-probability losses (see, for examples, Tversky & Wakker, 1995; Tversky & Kahneman, 1992; Gonzalez & Wu, 1999; Holt & Laury, 2002; Kilka & Weber, 2001; and Bleichrodt & Pinto, 2000). Fourfold patterns of risk attitude suggests that individuals do not treat probability linearly, as in Expected Utility Theory. The probability weighing function as explained in Kahneman & Tversky (1979), showed that the weighting function was determined by the nonlinear distortion of probability by weight (w) and by subjective value (v) during decision making.

3.3.1 The Four-Fold Patterns of Risk Attitude

Four-fold patterns of risk attitude was observed by Tversky and Kahneman (1992) and was pertinent in the explanations on evaluation of probability and payoff. Two effects play important roles, namely, possibility effect and certainty effect. An example for possibility effect is the change of 0% probability to 5% probability which causes high outcomes to be weighted more heavily than they deserve. This is why people who buy lottery tickets are willing to pay so much money for very small

winning chance. Certainty effect can be illustrated through the change from 95% probability to 100% probability, which less weight is given to near certain outcomes than their probability justifies. Tversky and Kahneman (1986) illustrated the certainty effect with the following examples.

Choice A: Sure win RM100

Choice B: 70% chance to win RM160; 30% chance to win RM0

From the experimental result, most people preferred option A, even the expected payoff of option B (0.7 x RM160 = RM112) was more than option A which had expected payoff of RM100. This problem showed strong preference for certainty over uncertainty. This caused people to evaluate option B less likely to happen although the probability of winning RM160 was 70%.

Fourfold pattern of risk preferences is often called the reflection effect because preferences flip or "reflect" when outcomes change from gains to losses. There are four patterns of risk preferences: (1) risk aversion for medium to large probability of gains, (2) risk seeking for small probability of gains, (3) risk seeking for medium to large probability of losses, and (4) risk aversion for small probability of losses. Table 3.1 provides a simple example to explain these patterns.

Table 3.1 Fourfold pattern of risk preferences

	Gains	**Losses**
High Probability (Certainty effect)	**Risk Averse** 95% Chance to win $10,000	**Risk Seeking** 95% Chance to loss $10,000
Low Probability (Possibility effect)	**Risk Seeking** 5% Chance to win $10,000	**Risk Averse** 5% Chance to loss $10,000

In the second row in the column “Gains” in Table 3.1, subjects in the experiment would perceive probability of winning $10,000 less than the objective probability 95%. This would cause subjects to choose choice with guaranteed but lower payoff. When translated to loss domain as shown in same row in the column “Losses”, subjects would perceive chance of losing lesser than 95%, and become risk seekers. This situation happened when people made unwise decision to participate in reckless gambles. These people who were risk seeking often hoped to avoid loss although the chance of losing a huge amount was high (Harbaugh *et al*., 2009).

Distortion of probability could also be observed in low probability scenario. As shown in third row in the column “Gains” in Table 3.1, the objective probability of winning a lottery with payoff $10,000 was 5%, but risk seekers would perceive chance of winning was higher than 5%. People buy lottery tickets hoping for a sudden large gain although they are fully aware that the chance of winning the lottery is low. But this distortion of probability will cause subjects to be risk averse when the probability of losing is small as shown in third row in the column “Losses”. They fear of large loss although the probability of such situations to happen, such as aviation accident or burglary, is not that high after all.

3.3.2 Value Function

In Prospect Theory, both values “v” and the weights “w” measure the outcome and the impact of probability of a prospect, respectively. For value function “v”, there are three characters to reflect the behavioral patterns: 1) value function shifts according to a reference point; 2) it is generally concave for gains which reflects risk aversion in gains domain and convex for losses which reflects risk

seeking in losses domain; and 3) value function in loss domain has steeper curve than in gain domain. Deviation of a reference point causes the value function to deviate accordingly. Taken an example from Kahneman (1979), imagine a person who had lost $2000 in business and now facing a choice between a sure gain of $1000 and an even chance to gain $2000 or nothing. He or she would code the situation as a choice between (-$2000, 0.5) and (-$1000) rather than a choice between ($2000, 0.5) and ($1000).

Value function "v" is determined by the distance from the reference point, i.e. the further the value from the reference point, the smaller the impact to the subject. In a gain domain, the change of gain from $10 to $15 has more impact than the change from $400 to $405. In a loss domain, it is symmetrically applied. The change of sensitivity along the function is called diminishing sensitivity and it explains the marginal impact of value and value diminishes with distance from a reference point. This explains why the value function is concave above the reference point ($v''(x) < 0$ for $x > 0$), and then convex below the reference point ($v''(x) > 0$ for $x < 0$). Diminishing sensitivity of value also results in S-shaped value function.

Most of the people do not favor symmetric gambles. For instance, in a gamble with choices (x, 0.5; -x, 0.5) and (y, 0.5; -y, 0.5), and if $x > y \geq 0$, then the latter is more preferred to the first. Thus, $[v(y) + v(-y)] > [v(x) + v(-x)]$. Setting $y = 0$, we have $v(x) < -v(x)$, and letting y approaches x, we have $v'(x) < v'(-x)$, as long as v is differentiable. Therefore, the curvature of loss domain is steeper than the curvature of gain domain as shown in Figure 3.1.

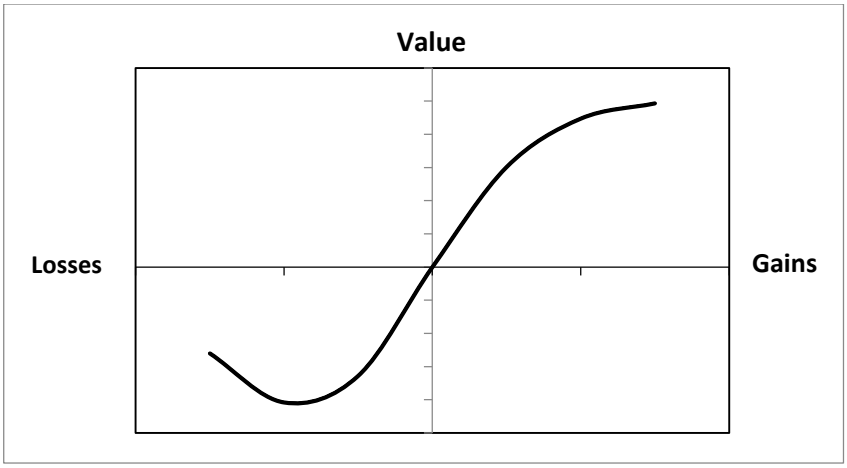

Figure 3.1: The value function of gain and loss domains

3.3.3 Probability Weighting Function

Probability weighting function is a nonlinear probability weighting function. Gonzalez and Wu (1999) interpreted the weighting function based on two features, discriminability and attractiveness. Tversky and Kahneman (1992) introduced diminishing sensitivity which was similar to discriminability.

Prospect theory suggested that probability weighting function is nonlinear. For example, considering a choice problem in study by Tversky and Kahneman (1979) with option A (0.001, 5000) and option B (1, 5), most of the people preferred to choose option A although the expected value for both options were the same [(5000)(0.001) = 5]. In another example of gamble choice with option C (0.01, -5000) and option D (1, -5), most of the people preferred option D. In the first situation, the change of probability from 0 to 0.001 gave large impact. People chose option A as they overweighed small probability. On the other hand, people valued loss (option C) bigger than option D even though the probability of loss (option C) was small (0.01). This case shows that people evaluate the probability nonlinearly.

Attractiveness of a probability weighting function explained the underweighting and overweighting of a probability relative to the objective probability (Gonzalez & Wu, 1999). In a gamble with 0.5 probability to win a prospect with $50 between two individuals, if one individual has a weighting function of w(0.5) = 0.7 and the another weighs it as w(0.5) =0.4, we say the first person evaluates the gamble as more attractive than the second person as he puts more weight on the probability. This feature determines the elevation of the function.

Individuals evaluate probability differently when it moves away from reference point. In the probability scale, from 0 to 1, 0 serves as "certainly will not occur" and 1 serves as "certainly will happen". The principle of diminishing sensitivity suggests that people become less sensitive when the changes are near the middle of the scale but are sensitive to the changes near the two reference points. For example, the psychological effect of the change from 0 to 0.01 is seen more dramatic than the change from 0.44 to 0.45, because the chance of winning changes from impossible (0) to possible (1). This would mean the sensitivity to changes in probability become less as probability moved away from the reference point of 0 or away from the reference point of 1 (Gonzalez & Wu, 1999).

The property that people are more sensitive to the changes of probability near the reference points (i.e. 0 and 1), and the way they evaluate probability by overweighing small probability and underweighting large probability explains the fourfold risk pattern. People are sensitive to the change of probability from 0 to 0.05 (small probability) and overweigh the chances of winning (losing) a gamble in a gain (loss) domain. Therefore, this causes risk-seeking in gain domain and risk-averse in loss domain. However, when the probability is large, people are sensitive to changes from 1 to 0.95 and underweight the chances of winning (losing) a gamble

in gain (loss) domain. Hence, people tend to be risk-averse (risk-seeking) in the gain (loss) domain, when the probability is large. This suggests the probability weighing function "w" has an inverted S-shaped (Figure 3.2). It is first concave when the probability is small and convex when the probability is large. Inverted-S-shaped weighting function was shown in the research by Camerer and Ho (1994), Tversky and Kahneman(1992), Wu and Gonzalez(1996) and Abdellaoui (2000).

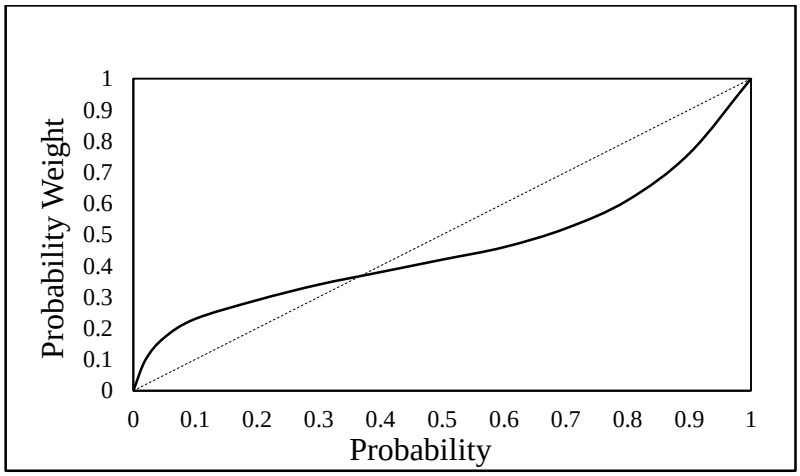

Figure 3.2: The probability weighting function w(p) that is inverse S-shaped, concave for small probability and convex for medium to large probability.

Noted: The diagonal line is objective probability. Diminishing sensitivity indicates that, when probabilities are small, people give more weight than the value they expected to receive. Therefore, the w(p) function is concave as people overweighing the small probabilities. On the contrary, when probabilities are medium and large, people give less weight than the value they expected to receive. Therefore, the w(p) function is convex as people underweighting the medium and large probabilities.

3.4 Conclusion

All theories mentioned in this chapter are very useful in aiding us to understand probability and payoff evaluation patterns among different age groups between genders. The study uses these method to investigate the risk behaviors of subjects in the experiments.

CHAPTER 4 RESEARCH METHODOLOGY

4.1 Introduction

This chapter explains how the data was collected and analyzed. There are four sections in this chapter, i) Participants, ii) Survey Design and Data Collection, iii) Data Analysis Techniques, and iv) Research Hypotheses.

4.2 Participants

A total number of 300 working adults in Malaysia were targeted to take part in a field experiment. These 300 working adults consisted of 150 men and 150 women ranging from 20 years old to 54 years old. An average of 30 minutes was spent to explain and guide each subject during the experiment. Every subject had the chance to receive a minimum payoff ranging from RM10 to RM30, depending on their performance during the experiment. At the end of approximately 6 weeks of field work, a total number of 289 subjects (144 males and 145 females) had taken part in the experiment. The targeted number of subjects from each ethnicity who took part in this experiment had been calculated according to the latest breakdown of ethnic groups in Malaysia as shown in Table 4.1. From the sample size, the subjects were grouped according to age; 20-24 years old, 25-29 years old, 30-34 years old, 35-39 years old, 40-44 years old, 45-49 years old and 50-54 years old.

Table 4.1 Malaysia's Demographic Statistic

Age	Malay	Chinese	Indian	Percentage of the total population
20-24	50.70%	18.64%	6.16%	9.78%
25-29	47.50%	18.50%	6.38%	9.58%
30-34	45.38%	19.73%	6.51%	8.81%
35-39	45.14%	22.94%	6.94%	6.88%
40-44	45.68%	24.52%	6.93%	6.29%
45-49	46.71%	26.34%	7.35%	5.75%
50-54	47.49%	27.76%	7.91%	5.11%

Table 4.1 shows the latest breakdown of each ethnic group according to age in Malaysia which were taken from the Department of Statistics Malaysia (2014). The 289 sample size in this study followed the percentage of each ethnic group.

Table 4.2 Final Demographic Breakdown of Subjects

Age	Malay	Chinese	Indian	Total
20-24	37	14	4	55
25-29	36	22	5	63
30-34	29	13	4	46
35-39	23	12	4	39
40-44	17	11	2	30
45-49	15	8	4	27
50-54	15	12	2	29
Total	172	92	25	289

Table 4.2 shows the 289 subjects who had participated in this experiment. They were 172 Malays, 92 Chinese and 25 Indians.

4.3 Experimental Design and Data Collection

Thirty two-outcomes lotteries were designed to elicit the risk preference of the subjects, 15 lotteries were in gain domain and 15 lotteries were in loss domain. Each lottery had two options; option A comprised of lotteries with probabilities 5,

20, 50, 80 and 90% of winning or losing an amount of money, whereas option B was a riskless option with guaranteed payoff. These guaranteed payoffs were arranged in numerical descending order, starting with a larger gamble outcome and descending in equal steps towards the smaller gamble outcome. An example of the lottery designs for gain domain is shown in Table 4.3. Subjects were asked to make decision to all the 30 lotteries (Refer to Appendix for all the lotteries used in the field work from page 102).

Table 4.3 Lottery in Gain Domain

1	Option A	Your Choice		Option B (Guaranteed payoff amounting to)
		A	B	RM
1	Profit of RM10 with probability 5% and profit of RM0 with probability 95%			10
2				9.5
3				9
4				8.5
5				8
6				7.5
7				7
8				6.5
9				6
10				5.5
11				5
12				4.5
13				4
14				3.5
15				3
16				2.5
17				2
18				1.5
19				1
20				0.5

Note: The lottery is in gain domain. For each of the 20 choices in the table, subjects had to decide whether he/she preferred option A (the lottery), or option B (the guaranteed payoff) for the choices from 1 to 20. Suppose a subject chooses option B from RM10 to RM 4 and then switches to option A for the remaining choices. The certainty equivalent amount in this situation is RM3.75 ([RM4 + RM3.5] / 2).

During the experiment, subjects were allowed to switch from option B to option A (or vice versa) only once. If a subject exhibited inconsistent choices, in which he or she switched between option A and option B for more than once, the subject would be removed in the analysis. For example, if a subject chose option B at first when the guaranteed payoff was RM10 and switched his choice to option A when the guaranteed payoff was RM9, but after that he switched back to option B when the guaranteed payoff was RM4 the choice was considered illogic. Based on the previous choice, the subject showed that he was willing to take risk when the guaranteed payoff was RM9, but when the guaranteed payoff was RM4, it was impossible for a normal and logical person for not willing to take risk since the payoff of RM4 was less than RM9. If he was willing to take risk when the guaranteed payoff was RM9, he should take risk as well for all the guaranteed payoffs that were lesser than RM9. Hence, subjects who violated this requirement were removed from the analysis. Besides that, since the guaranteed payoff for the first choice in the gain domain was RM10, which was a sure income, compared to option A which had only 5% possibilities to win RM10, logically, subjects must choose option B instead of option A. Therefore, subjects who chose option A instead of option B for the first choice in the gain domain were removed from the analysis. There were 11 subjects who violated these two requirements and therefore their answers to the lotteries were removed from the analysis.

Payoff Calculation

After the subjects had made choices for all 30 lotteries, they were asked to fill out a demographic questionnaire with some socioeconomic variables, such as gender, race, age, education level, income, marital status and net worth (see

Appendix 2). After the subjects had completed the questionnaire, one of their lottery choices was randomly selected for final payoff, each from gain and loss domains. After that, two random numbers between 1 and 20 were generated to decide which option in both of the lotteries would be selected. The random number was generated by a phone application called "Random Number Generator". The explanation in the following shows the steps involved in the payoff calculation;

STEP 1: Generated random number to decide on which lottery to be chosen (one from gain and one from loss domain)

Generated random number (twice) from 1 to 15 to determine which lottery to be chosen. If the generated number was number 3, Lottery 3 from the gain domain was chosen. If the second generated number was number 9, Lottery 9 from the loss domain was chosen.

STEP 2: Generated random number to decide on which choice in the chosen lotteries in step 1.

Generated random number (twice) from 1 to 20 to determine one of the choices in a lottery chosen from Step 1. If the first generated number was 15, the choice number 15 in lottery 3 was chosen. If the second generated number was 4, the choice number 4 in lottery 9 was chosen.

STEP 3: If the choices in the two lotteries were option B (guaranteed amount)

If the subject chose option B in the choice number 15 in lottery 3, he or she would be paid the guaranteed amount as stated in the lottery. In the loss domain, if the subject chose option B in choice number 4 in lottery 9, the subject earned the

negative payoff. For example, the guaranteed payoff in option B in lottery 3 for choice number 15 was RM9, and guaranteed negative payoff in lottery 9 was RM25.5. The subject earned RM9 in gain domain and lost RM25.5 in loss domain.

STEP 4: If the choices in the two lotteries were option A (risky choice)

Option A in all lotteries involved risk. Choice number 15 option A in lottery 3 carried a probability of 5% of winning RM30 and probability 95% of winning RM0. Choice number 4 in lottery 9 had probability 50% of losing RM30 and 50% of losing RM0. To decide on payoff in the risky choice, the experimenter would generate a random number (twice) from 1 to 100. If the first generated number was between 1 to 5, the subject would earn RM30, and if the number generated was 6 to 100, the subject would earn RM10. If the second generated number was between 1 to 50 the subject would lose RM30 and 51 to 100 he would lose nothing.

STEP 5: Final payoff calculation

The final payoff of the subjects was calculated based on the difference between positive payoff in gain domain and negative payoff from the loss domain.

From the above example, suppose option B was chosen in both lotteries, then the final payoff was "RM9 + (-25.50) = -RM16.50". In circumstances when the final payoff was less than RM10, the subject was paid a minimum payoff of RM10. This condition was not revealed to the subjects in the beginning of the experiment to make sure the responses from the subjects were at the highest accuracy.