Effects of Culture and Language on Financial Risk Tolerance across Age: Risk Perception and Risk Attitude as Underlying Mechanism

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Abstract

The examination of factors influencing individual financial risk tolerance (FRT) has been heavily researched in the literature because of the importance of effectively assessing an individual's risk-taking behaviour. Noticeably in recent years, FRT is no longer examined exclusively, yet an increasing attention has also been paid to risk perception (RP) and risk attitude (RAtt). These two constructs are examined as potential mechanisms through which differences in FRT occur. It is argued that an acknowledgement of the underlying process of one's FRT formation can be used not only for predictive purposes but also for altering one's risk tolerance level. This study contributes to the body of knowledge by extending insights into two important determinants of FRT, namely, age and culture, as well as investigating the language one speaks as its new determinant. In addition to the consideration of these determinants of FRT, an examination of the underlying mechanisms (RP and RAtt) through which they operate is subsequently conducted. The study employs survey responses of 1,889 respondents from five different cultural and linguistic milieus: the US, the UK, Singapore, China and Vietnam. The evidence suggests that older individuals are less risk tolerant than younger individuals (lower FRT), not because they are more risk averse (similar RAtt), but mainly because they perceive the same investment as riskier (higher RP). Intriguingly, age does not only affect FRT directly, but also significantly influences the effect of culture on FRT. Particularly, although more collectivistic individuals are more risk tolerant than their individualistic counterparts, the increased level of FRT declines with age. However, this moderating effect of age does not operate through either RP or RAtt. Lastly, the study found that language influences one's FRT. Particularly, individuals speaking weak-future languages, such as Chinese, exhibit higher level of risk tolerance when compared to individuals speaking strong-future languages, such as English and Vietnamese. Additionally, the cross-linguistic difference in FRT is found to operate mainly through the cross-linguistic difference in RP but not RAtt. Overall, the study obtained a consistent finding with the majority of preceding studies supporting that individual risk attitude (RAtt) is a stable personality trait, which is constant across individuals and is not influenced by external factors.

Acknowledgement

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Table of Contents

List of Tables

List of Figures

List of Abbreviations

Abbreviation	Meaning
CNY	Chinese Yuan
COE	Carry-over Effect
DOSPERT	Domain-Specific Risk-Taking Scale
EUT	Expected Utility Theory
EV	Expected Value
FRT	Financial Risk Tolerance
FuturePerspective	Future Time Perspective
GBP	Pound Sterling
GDP	Gross Domestic Product
GMM	Generalized Method of Moment
MPT	Modern Portfolio Theory
OLS	Ordinary Least Square
PPP	Purchasing Power Parity
PRAM	The Perceived Risk-attitude Model
RAtt	Risk Attitude
RP	Risk Perception
SCS	Self-construal measurement
SD	Standard Deviation
SEM	Structural Equation Modelling
SGD	Singaporean Dollar
SRA	Self-reported Risk Aversion
Strong-future	Strong Future Time Reference
The UK	The United Kingdom
The US	The United States

TRAM.....The Traditional Risk-attitude Model

USD .....US Dollar

VAR.....Variance

VIF.....Variance Inflation Factor

VND .....Vietnamese Dong

Weak-future.....Weak Future Time Reference

WTP.....Willingness to Pay

Chapter One:
Introduction

1.1 Preface

Understanding the nature of risk taking behaviour is a fundamental topic within economic and finance fields. Conventionally, many standard economic theories and models have been developed to study and forecast human financial risk taking in terms of decision-making process. According to traditional finance, individuals are purely logical, rational, and predictable, who consistently seek to maximise their own well-being. This 'rationality' paradigm suggests that as soon as agents receive new information, they fully and instantly, in a normative way, update their beliefs and preferences. Consequently, their choices are always consistent through which their expected utility is maximised (Barberis and Thaler, 2003).

However, in recent decades, an increasing amount of empirical evidences have shown that the 'rationality' expected utility maximisation assumption cannot be sustained in the real world. Indeed, by relaxing this assumption, many investor's risk-taking behaviours could be understood more easily. Consequently, academics have increasingly raised their concerns and focuses on the behavioural branch of finance. The field inclines researchers to construct a more insightful picture about human actions in the 'non-ideal' financial world. Following the essence of the debate, the main focus of this thesis is to discover some unsolved problems of the risk-taking related topic through the behavioural finance stream.

In many undeveloped and developing countries, social security for old age has never been a sufficient source for a comfortable and satisfactory financial life in retirement. It would not be a surprise if the security in some countries cannot cover the basic necessity or is not available at all. Besides, East Asian nations are recently exposed to another issue such that the retirement financial support they usually have from the younger family members has declined, whilst the support from state remains unavailable or trivial. Nowadays, even in developed countries, such as the US and the UK, a promised adequate life-time income source after the conclusion of one's career is virtually a thing of the past for most households. Overtime, without any creation of a new pension plan, more defined benefit plans are being terminated and replaced with defined contribution plans (Byrne, 2005). As a result, the responsibility of saving and investing has been shifting to the shoulders of households and individuals, producing intense challenges that have not been faced before, especially in the current era of increasing longevity. Suddenly, many people have awakened to an awareness of the accountability for the outcome of each and every single financial choice that they make. Unfortunately, it has been proven that households

are not well adapted to such financial self-accountability and they often fail to take proper care of themselves financially (Gathergood, 2012). In the midst of the heavier responsibilities that individuals are forced to carry in making long-term and major risky financial decisions, it is vital to obtain more insight into their willingness to take financial risk, which is consistently defined in this thesis as individual's financial risk tolerance (FRT)[1]. Therefore, the main aim of the current thesis is to provide better understanding about factors that influence individual's FRT as well as the underlying process of these influences. More details related to the aims and objectives of this thesis will be explained subsequently.

1.2 Aim and Scope of the Study

This thesis is developed by drawing on and uniting contributions from a range of diverse fields, including finance, economics, linguistics, psychology, and sociology. Its main purpose is to elaborate possible differences in individual financial risk tolerance (FRT) with respect to age, cultural background and the language individuals speak. An additional interest in this context is to explore whether any observed differences arise through two specific mechanisms: risk perception (RP) and risk attitude (RAtt). At the heart of the research agenda is a desire to better understand factors that drive investors' risk appetite, and hence, how their financial decisions, as responses to different level of risk, are made across age. The current investigation targets five diverse cultural and linguistic milieus. These are the United States, Great Britain, China, Singapore, and Vietnam.

1.3 Motivations and justifications for the study

As the results of the current transformation of retirement systems in many countries, the financial accountability has been gradually shifted to the shoulders of individuals. Consequently, more individuals are involuntarily transformed into independent investors leading to the increasing importance of self-management of wealth. As almost all investments are associated with some levels of risk, individuals are actually wagering on their future financial lives. To make a rational and sound investment decision, individual investors are required to possess not only complete access to information but also sufficient financial knowledge to process and understand those information. Nonetheless, these requirements are practically impossible missions for unsophisticated investors, indeed, even for professional investors. In this ever-progressively, evolving and complex financial world, investors are drowned by a tsunami of information and swiped away by the confluence of a number of unprecedented financial turbulences and dramatic unfavourable variations in the global political and economic conditions. Consequently, an increasing numbers of unsophisticated investors

[1] More detailed definition of FRT will be provided in Chapter 2.

are turning to investment managers (or financial advisers or financial planners) for professional assistance. This apparent trend has accelerated the need for high quality and superior personal financial advice services.

One of the fundamental obligatory inputs for investment managers to efficiently assist each individual client in determining the optimal portfolio allocation is that they must be aware of the level of financial risk tolerance (FRT) of their clients, to avoid the disappointment of clients. Furthermore, Jacob and Levy (1996) stated that investment funds can be effectively tailor-made and heterogeneously constructed across individuals only if investor's FRT is precisely determined. Given the importance of the input in determining the quality of the services, many professional service providers, with an extensive assistance from academy, are constantly making an effort to effectively identify their clients' FRT. Consequently, to achieve a more effective assessment and better matching process of risk appetite with investments, research conducted on identifying factors that influence individual FRT is imperative. Albeit a myriad of research has studied the determinants of individual FRT, many fundamental aspects are still ambiguous and have not yet been uncovered.

Although studies on factors influencing FRT are relevant, they can only be used for predictive purposes. This provides no room for intervention to alter one's contemporary risk tolerance level. Understanding investors' risk perception (RP) and risk attitude (RAtt) as determinants of FRT is expected to allow professionals to see the prevailing risk perceived and felt by investors, and thus to change their risk tolerance by adjusting RP and/or RAtt. Specifically, if investors exhibit low levels of FRT because of their perceptions of high level of investment riskiness, financial advisors could try to intervene in their cognition (Weber and Hsee, 1998). Investigation could be conducted on how the investors' RP are formed, including how they define risk and what information they use. On the other hand, if RAtt is the driving force of investors' FRT. The focus could be paid on their general psychological states and affective responses toward their RP (Weber and Hsee, 1998).

To offer such intervention in practice, academia must first attempt to understand and gain insights into the underlying psychological processes by which FRT is formed. Carrying this understanding onward, potential real-world relevance can be examined more in detailed so that professional financial practitioners can apply academic work into real-world practice in the most effective way. For these reasons, the current research investigates a number of factors (age, culture, and language) that affect individual FRT, as well as justifying the two underlying mechanisms: RP and RAtt.

The investigations of these influences on FRT have implications regarding two aspects: aging and globalisation. Amid concerns of the impact of global population aging on the world's economies and financial markets, a deeper and wider understanding of age-related responses to willingness to taking risk through RP and RAtt is pertinent and valuable at aggregate economic level and individual level.

At the aggregate economic level, implications are drawn on the impact of the current demographic structure on a national economy and capital market prices, along with remedies to tackle problems imposed on the financial markets by demographic changes. Particularly, the reduction in FRT influences the attractiveness of high risk capital, thus causing a surge in the cost of capital for productive investment and subsequently, a slowdown of economic growth. According to the World Population Aging report 1950-2050, by the year 2050, the proportion of the above-60 years old population will increase to one-fifth of the whole world population. Concurrently, the proportion of the working group aged from 15 to 59 will experience a slight fall from 60% to 58% in 2050. If the age-risk relationship is consistent with the life-cycle risk aversion theory. This indicates that one's FRT reduces with age, investors would require a considerably higher premium to hold risky assets than they should (Friend and Blume, 1975). Consequently, the global aging population imposes challenges on the economy and the financial market. On the other hand, at individual level, the successful prevention of conservative investment behaviours may improve individual welfare.

Concurrently, in light of the globalization and liberalization of labour markets, financial markets, and associated increases in international capital flows, cross-border trade, and sensitivity to foreign prices, cross-cultural and cross-linguistic studies are essential at the national level as well as the global level. Financial practitioners can provide better services to improve the use of financial advisors by culturally diverse clients, who speak different languages. Considering China, the number of Chinese immigrants have significantly surged to more than 2 million people in 2013 in the US, nearly 0.9 million in Canada, 0.7 million in South Korea, 0.65 million in Japan. Furthermore, it is found that in 2013 roughly 62% of Chinese immigrants reported limited proficiency in English and only 10% of them speak English at home (Migrationpolicy.org, 2015). By identifying the perceived needs of clients from different cultural backgrounds, financial advisors and investment managers can tailor financial plan and construct customised investment portfolio that are essential and appealing to specific groups. An inaccurate, inappropriate advice may prevent certain cultural and language-speaking groups from seeking for professional advisors, which will impose a huge loss for the financial service market.

1.4 Research overview

Financial risk tolerance (FRT) is a popular concept in both academy and practice. It measures a person's willingness to engage in risky financial activities. Practically, FRT is used to infer one's risk appetite, and hence their behaviour in financial context. However, a precise assessment of an individual's FRT is a challenging and time-consuming process. Supporting practitioners in this case, academic researchers have attempted to determine factors that influence FRT. These factors can then be employed as proxies of FRT. For example, if academy found that male is significantly more willing to engage in risky investments (higher FRT) than female, practitioners (e.g. financial advisers) can use the finding to predict the risk appetite of clients based on their genders.

Recently, the academic body has extended the FRT topic to a new research stream. An increasing number of researches do not investigate *exclusively* the factors that influence FRT, but they also examine the underlying mechanisms of these influences. Two mechanisms have particularly received extensive attention: risk perception (RP) and risk attitude (RAtt). More precisely, these studies are interested in *why* individuals have different willingness to engage in risky financial activities (different FRT): *"Is it because they see the riskiness of those activities differently (RP) and/or they like financial risk to different extent (RAtt)?"* This extension of FRT topic to the understanding of RP and RAtt provides room for intervention in an individual's risk appetite (FRT) through either or both of these channels[2]. For illustration, if FRT is formed through RP, individual FRT can be altered if their perception on financial risk (RP) changes by, for example, financial training and education, reading more about financial investments and their risks.

Overall, the whole thesis focuses on three main concepts: financial risk tolerance (FRT), risk perception (RP), and risk attitude (RAtt). Insights of these three main terms with regards to their definitions will be provided in Chapter 2. In this thesis, there are three main empirical studies, which will be discussed in detailed in their own empirical chapters (Chapters 4 to 6). The next

[2] To better understand the two mechanisms (RP and RAtt) and the intervention property, let consider a simple non-financial scenario in our daily lives. Imagine that you used to eat potato chips a lot (high willingness to eat chips) when you were eight years old. Now you are twenty-five, you realise that you no longer have such strong willingness to eat chips like you did before. The question is whether such reduction in your willingness to eat chips is because you know/acknowledge so many bad issues that chips bring to our health, which you did not know before (change in perception on health risk of chips) and/or you just purely do not like chips as much as before (change in attitude towards chips). If *perception* on the health riskiness of chips is the main cause, it means that you still like chips a lot now, at least as much as when you were eight. However, your willingness to eat chips reduces because you know that it is unhealthy. With the understanding of the underlying reason for individual's willingness to eat chips, you can alter someone's consumption of chips by **altering** his perception, perhaps by providing them more knowledge and information about chips.

few sections of this chapter will provide readers with a *brief and simple* introduction to those three empirical studies.

1.3.1 Empirical study 1. Financial Risk Tolerance Across Age: An Examination of the Mediating roles of Risk Perception and Risk Attitude

The influence of age on FRT has captured an extensive attention from researchers and practitioners and is found to be one of the most prominent demographic determinants of FRT (Hallahan et al., 2003). Extending the age-FRT topic, the first empirical study of this thesis attempts to examine whether RP and RAtt mediate the influence of age on FRT. Given that previous literature has extensively tested the age effect on FRT, yet no research has been conducted to examine the underlying mechanisms of that age influence, despite that many studies has examined the mediating roles of RP and RAtt on other determinants of FRT. These include gender (Olsen and Cox, 2001); culture (Bontempo et al., 1997; Luce and Weber, 1986; see also[3]); career (Cooper et al., 1988); situational domains (Nosic and Weber, 2010; Weber et al., 2002; see also[4]); outcome domains (Weber and Milliman, 1997; Mellers et al., 1997); and time (Weber et al., 2012; Hoffmann et al., 2013). Consequently, the study contributes additional knowledge to the literature regarding the mechanisms through which the age effect on FRT takes place.

Particularly, the examination of the relationship between age and FRT in previous studies provide answer to the following question:

"Does a 60-year-old individual take more or less risk than a 30-year-old individual?"

Despite the importance of age within the academic and in practice, a research gap regarding the underlying process of difference in FRT across age remains unresolved. By identifying two mechanisms (RP and RAtt) of the variation in one's FRT with age, this study discovers the answer to the following question:

"Is a 60-year-old person willing to take more (less) risk than a 30-year-old person, because the older one sees the same investment as less (more) risky and/or because she simply enjoys to take on higher (lower) risks?"

[3] Weber and Hsee, 1998; Cheung et al., 2012
[4] Blais and Weber, 2006; Johnson et al., 2004; Arrow, 1974

1.3.2 Empirical study 2. Does Age Influence Cross-cultural Difference in Financial Risk Tolerance? Reduction of Cushion Buffer in Older Individuals

The examination of age influence on FRT is enhanced to a global level using cross-cultural investigation. Numerous research (Bontempo et al., 1997; Weber and Hsee, 1998, see also[5]) have explored that culture is an important factor attributing to the difference in FRT and risk-related behaviours across individuals. The most common cultural value used in the topic is the individualism-collectivism continuum defined by Hofstede (2001).

The cultural effect on FRT has been obtained by extant research with consistent findings indicating that collectivism is associated with increased financial risk tolerance relative to individualism. To explain these findings, Weber and Hsee (1998) developed the cushion hypothesis, which is based on differences in the natures of collectivism and individualism cultural continuums. The hypothesis asserts that, in financial hardship, members of collectivistic society can approach their internal groups (family and social network) for help and support. Weber and Hsee (1998) claim that such readily available financial support acts as a cushion protecting individuals from getting hurt by financial failure and thus, collectivistic individuals perceive the same financial option as less risky. Therefore, they are more risk tolerant comparing to their individualistic counterparts. Based on this finding, culture is a proxy of FRT. However, its predictive power is strong if culture influences FRT *independently*. Nevertheless, a study conducted by Fan and Xiao (2006) shows that the reduction in reported FRT across age is faster with Chinese individuals than with Americans. This statistical result hints that the cultural difference in FRT between China (collectivism) and America (individualism) may reduce across age. Hence, age may influence the cross-cultural difference in FRT. The idea is solidified based on previous anthropological and psychological literatures that report changes in one's personal traits, patterns of thinking, judging, and acting, across age. Particularly, as collectivistic members grow older, the development of their self-conscious emotions (embarrassment, shame, guilt, and self-esteem)[6] may reduce their willingness to ask for financial help[7]. According to the cushion hypothesis, collectivistic individuals perceive lower financial risk because of their ready access to financial support. However, as they grow older, even the support remains, their willingness to ask for such support may reduce. Therefore,

[5] See also: Cheung et al. (2013), Hsee and Weber (1999), Weber et al. (1998), Breuer et al. (2012), Fan and Xiao (2006)

[6] Hofstede (2001), Mandel (2003), Lewis et al. (1989 and 1991), Benedict (1974), Bedford and Hwang (2003), Hwang (2001), Izard (1997), Bedford (1990), Demo (1992), Bengtson et al. (1985), Shaw et al. (2010), Giarrusso et al. (2001), Orth et al. (2010), Robins et al. (2002), Rosow (1985), Mirowsky and Ross (1992)

[7] Harel et al. (1990), Veroff (1981)

the so-called cushion that protects individuals from getting financial pain may get thinner across age. Consequently, the RP of older collectivistic may increase and thus their FRT may reduce. Consequently, it is predicted that as age increases, the FRT gap between the two cultures reduces.

As a result, the primary contribution of this study is to enhance the culture-FRT relationship by investigating if age influences their relationship, along with identifying reasons for such influence if found to be present. In other words, this study examines whether age is a factor that influences one's personal cushion and provide an answer to the following question:

"Does the cushion buffer reduce across age?"

1.3.3 Empirical study 3. From Language to Financial Risk Tolerance through the Channels of Risk Perception and Risk Attitude

Despite many factors has been found to influence FRT, the current study is the first to propose language as an additional factor that may account for differences in FRT. Psycholinguistic discipline has argued that language, 'the vehicle of thought' (by Wittgenstein in Widhiarso, 2009), has effects on human thoughts and cognitions (Whorf, 1956; Scholz et al., 2015), perceptions and beliefs. The linguistic-FRT hypothesis is built on the conjecture developed by Chen (2013) for his linguistic-saving hypothesis.

More precisely, different languages encode the temporal phases of an event differently in such a way that whether time is required a grammatical distinction between the present and the future (Dahl, 2000; Thieroff, 2000; Gell, 1992). According to Chen (2013), languages that require precise separation between the future and the present using grammatical words or tense markers, are referred to as strong future time reference (strong-future) languages. An example of strong-future languages is English. The construction of a sentence in English describing a future event requires a future marker such as "will", "is going to", or "is about to". In contrast, weak future time reference (weak-future) or futureless languages do not require grammatical words or tenses to mark future events, thus future events are often described as present ones (Gell, 1992). German and Chinese are two examples of weak-future languages.

Differences in future description between languages is the key element used in this study. According to Chen (2013), such differences in the way languages encode the temporal relations in a future event drive speakers of strong-future languages to feel the same future event as more distant from the present than speakers of weak-future languages. Combining this difference in time perception with the pricing model as explained in Chen's (2013) study, linguistic-FRT association is hypothesised. With the same motivation as the first empirical study of this thesis,

after the empirically tests for the linguistic-FRT hypothesis, its underlying mechanism (RP and RAtt) will be examined. Overall, this empirical attempts to provide answer to the following questions:

> *"Is a weak-future language speaking individual willing to take more (less) risk than a strong-future language speaking individual? If yes, is it because the weak-future language speaking person sees the same investment as less (more) risky and/or because she simply enjoys to take on higher (lower) risks?"*

1.3.4 Countries under investigation

Given the cross-cultural and cross-linguistic focuses of this thesis, the investigation is conducted in two collectivistic countries in Asia, **China and Vietnam**, and two individualistic countries, **the United States and Great Britain** (based on Hofstede's (2001) cultural classification). Besides the significant differences in political systems and cultural values between these two groups, they are also influential nations in the today's global economy, world trade and international affairs. Particularly, the total GDP of the US, China, and the UK accounts for more than 37% of the World GDP (19.31% for the US, 15.4% for China, and 2.75% for the UK) (Quandl.com, 2015). They are also three dominant merchandised traders in the world in 2013 with the total trading amount accounts for roughly a quarter of the world's merchandise trading value (Anon, 2015).

Recently, Anon (2015b) reported that developing economies has recently played an increasing large role in the global economy. Vietnam is a South East Asian developing economy, whose GDP takes up only small share of the World GDP (0.41%) in 2013. However, over the past 5-year from 1998-2013, the GDP share of Vietnam has been increased by 0.03%, comparing to a fall of 1.1% and 0.28% of the US and the UK respectively over the same period (Quandl.com, 2015). Furthermore, the share in merchandise trade of Vietnam from 2012-2013 has significantly increased by 16%, which surpassed the increase of the US, China, and the UK (Anon, 2015).

Another country of investigation is **Singapore**, which is chosen for the controlling purpose as the country has been well-perceived and proven as a multicultural and multilinguistic land. Especially for the cross-linguistic study, the employment of Singapore can control for the overlapping country effect. Specifically, the majority of samples from other countries are either weak- or strong- future language, whilst Singapore is the only sample with a well-mixed of both language types. Without this sample, the objectives of linguistic study would not be achievable.

1.4 Research questions

Following the overview of the research and consistent with the research objectives, three research questions (RQ) are developed to direct this study:

RQ1: Does difference in financial risk tolerance across age occur through risk perception and/or risk attitude?

RQ2: Does age moderate the cultural difference in financial risk tolerance? If yes, does the moderating effect arise through risk perception and/or risk attitude?

RQ3: Is there observable difference in financial risk tolerance across individuals that speak different languages? If yes, is the difference associated with their differences in risk perception and/or risk attitude?

Chapter Two:
Definition, Measure and Theoretical Background

2.1 Introduction

This chapter introduces readers to three main constructs of the study, along with their underlying theoretical framework, survey design, and measurements. Initially, definitions of the three constructs, namely, financial risk tolerance (FRT), risk perception (RP), and risk attitude (RAtt) are provided. Subsequently, theoretical backgrounds of these concepts are reviewed, which provide the basis for the development of the survey design and the measures used.

To avoid repetition, the subsequent two general chapters (Chapter 2 and Chapter 3) apply to, and provide background for, the three research studies presented in three empirical chapters (Chapter 4 to Chapter 6) of this thesis.

2.2 Main terminologies

2.2.1 Financial risk tolerance (FRT)

Financial risk tolerance (FRT) is one of the most heavily researched concepts within the financial and economic areas. Perhaps the most common definition of FRT is the maximum amount of uncertainty that an investor is willing and able to accept when making financial decisions (Harlow and Brown, 1990; Grable, 2000; Grable and Lytton, 1999). Another conceptualisation of FRT refers to an individual's willingness to undertake a financial behaviour where the attainment of desirable outcomes associated with such behaviour is uncertain with the possibility of loss (Irwin, 1993).

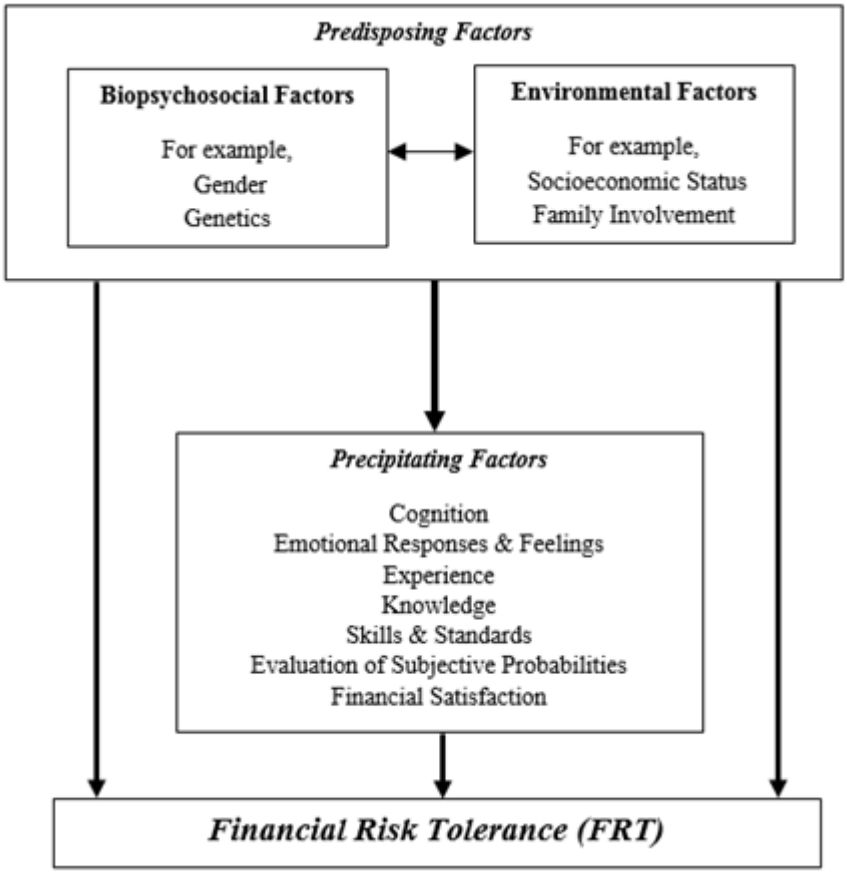
Literature in this field is replete with many terms such as 'risk attitude', 'risk propensity', 'risk preference', and 'risk acceptance', which basically carry the same notion with FRT (Roszkowski and Davey, 2010). In most economic studies, FRT is often understood as, and used interchangeably with, risk attitude (Hallahan et al., 2004; Wang and Hanna, 1997). However, for the purpose of this study, which proposes risk attitude (RAtt) as a determinant of FRT, their concepts are clearly distinct from one another. FRT, as used in this study, carries the same meaning as 'risk preference' defined by Weber and Hsee (1998). For simplicity, it is consistently defined as a person's willingness to engage in a risky financial investment and is measured as one's willingness to pay for a risky option. For example, if two individuals are considering the same risky investment option X, the individual that is willing to pay more for X is more risk tolerant than the other.

2.2.2 Risk perception (RP) and Risk attitude (RAtt) as determinants of FRT

Risk perception (RP) and risk attitude (RAtt) have been increasingly suggested as two determinants of FRT in a number of empirical studies (see Section 4.2.2). These studies examined whether differences in FRT across individuals (with different genders and cultures, etc.) are associated with differences in RP and/or RAtt. Furthermore, according to Irwin's (1993) model (Figure 2.1), the effects of predisposing factors, comprising of biopsychosocial and environmental factors, on FRT operate through a number of precipitating factors, such as experience, cognition and emotional responses. Drawing on Irwin's (1993) model, this research proposes to examine three predisposing factors: age (biopsychosocial factor), culture and language (environmental factors) that influence FRT through two precipitating factors: risk perception (cognition) and risk attitude (emotional responses and feeling).

Risk perception is classified as cognition because it is "conceived as primarily as cognitive activity, involving the accurate appraisal of external and internal states" (Roszkowski and Davey, 2010, p.43). On the other hand, the classification of risk attitude as an emotional response and feeling is based mainly on its definition. Attitude is a broad term that comprises four interrelated components: affective responses, cognitions, behaviours and behavioural intentions (Zimbardo and Leippe, 1991). For the purpose of this research, the main interest is paid on the affective component of an attitude. It refers to one's interpretation, evaluation, liking of, disliking of, or emotional responses to a situation, object or person. This affective component reflects one's attitude with sentiments of happiness, pleasure, or anxiety.

Figure 2.1: Principal factors affecting financial risk tolerance adapted from Irwin's (1993)



2.2.2.1 Risk perception (RP)

Generally, risk perception (RP) is simply defined as the amount of risk that a person perceives to be embedded in a financial option. In this study, we consider two main measures of RP, namely, objective RP and subjective RP. Basically, objective RP is the amount of financial risk that investment theories (such as the Modern Portfolio Theory) assume individuals *should* perceive, such as variance of investment outcomes. With subjective RP, on the other hand, individuals can perceive and measure risk in whatever way they deem to be appropriate.

Objective RP relates closely with the measure of risk in the conventional finance. It assumes that the financial risk one perceives is objective, rational, analytic, and wise (Slovic, 1999). Given many techniques of measuring objective financial risk have been developed, such as variance, mean excess loss, probability of loss, and Weber's coefficient of variance, there remains an unresolved debate over the most robust risk measurement (Bernstein, 1995). Following the approach of Weber and Hsee (1998), which is based on the tradition mean-variance model of Markowitz (1952), the objective RP is measured by the variance of an investment option's outcomes. It assumes that everyone defines and understands risk in the same way, as well as measuring the riskiness of an investment using the same technique and

calculation of variance. Consequently, their risk perceptions are objectively the same. In brief, objective RP is constant across individuals and can be measured as the variance of outcomes.

Subjective RP, on the other hand, is a broader concept. It can be conceptualised as:

> *"Beliefs about the riskiness of the choice situation"*
> *(Weber, Blais, and Betz, 2002, p.267)*

Subjective RP is referred to as an individual's personal assessment on the riskiness of a financial choice. It implies that financial risk can be defined and measured in any way and, therefore varies between individuals. Stone and Winter (1987) and Slovic (1999) argued that financial risk does not readily exist and hence, needs to be measured at the individual level, as individuals tend to "rely on perceptions of risk that are subjective, often hypothetical, emotional, foolish, and irrational" (Slovic, 1999, p.690). Basically, "risk means different things to different people" (Slovic et al., 1982, p.85). Some may see financial risk as variance, some may perceive it as probability of loss, and some tend to measure risk intuitively and unsystematically.

2.2.2.2 Risk attitude (RAtt)

As emphasised in Section 2.2.1, FRT and RAtt are two distinct constructs and cannot be used interchangeably. Importantly, RAtt is a determinant of FRT. Within different contexts and research areas, RAtt can be understood in different ways. Theories underpinning different conceptualisations of RAtt will be discussed in Section 2.3. In this study, RAtt can be understood as an emotional response and feeling, which refers to the extent to which a person likes or dislikes financial risk. The same notion of RAtt was defined by Weber and Milliman (1997, p.142) as "the tendency to be attracted or repelled by alternatives that are perceived as risky". For the purpose of this research, the qualitative aspect of RAtt will be quantified using the risk-return framework, as in Weber and Hsee (1998) (see Section 2.4.2.3).

In a similar way to the perception of the riskiness of a financial option being either objective (objective RP) or subjective (subjective RP), RAtt can also be objective or subjective RAtt. Objective RAtt is the attitude towards financial risk given an individual's RP is objective, whilst subjective RAtt is the attitude towards financial risk given an individual's RP is subjective. A risk-seeking person, who chooses a higher-variance investment instead of a lower-variance one (with equal expected value), is said to exhibit a positive attitude towards risk. In other words, they truly prefer an investment perceived to be riskier. However, others may make the same choice, that is, choose the higher-variance investment, but base it on a different subjective perception of the riskiness of the higher-variance investment. Indeed, they see it as the less risky investment. In that case, these individuals possess a subjective RP that is different from the

objective RP (i.e., variance), and they are choosing what they perceive as the less risky investment. As a result, these individuals are risk averse and exhibit negative attitudes toward subjective risk.

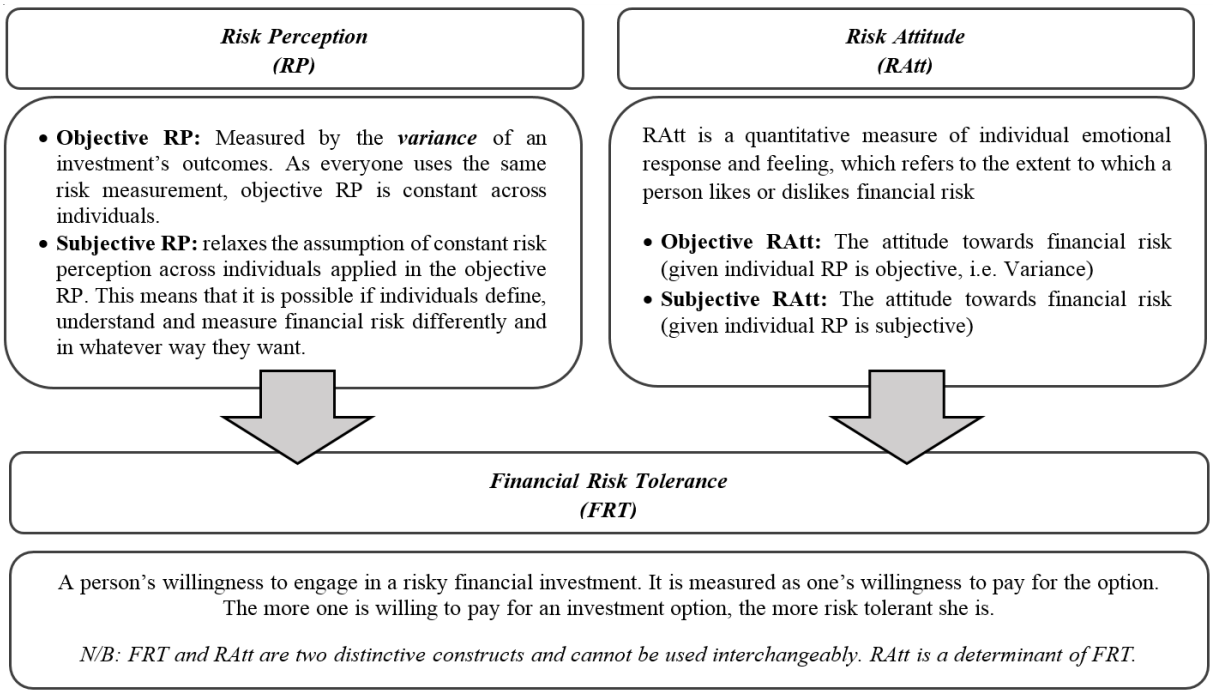
According to Van de Venter et al. (2012), RAtt can be conceptualised either as a stable trait or a psychological state that changes overtime and is influenced by both internal and external factors. They conducted a longitudinal study using the *FinaMetrica* risk-profiling system and the 2002-2006 Smart Investor survey dataset, to examine the variability of RAtt. The results indicated that FRT[8] is a stable personality trait rather than a variable construct that varies over an individual's life-cycle, or is influenced by demographic and situational factors. Supporting such view, Roszkowski and Davey (2010) and Gerrans et al. (2013) provide evidence to confirm the stability of RAtt after the 2008 global economic crisis. Furthermore, studies of Weber and Hsee (1998), Cheung et al. (2012) and Weber et al. (2002) found that subjective RAtt is relatively stable and does not predict risk tolerance as effectively as risk perception.

On the other hand, there is support for a changeable RAtt. Sherman (1974) and Rubin and Paul II (1979) argue that RAtt varies over the life cycle due to the evolutionary or biological process. Malmendier and Nagel (2011) analysed data from the Survey of Consumer Finances 1960-2007 and found that RAtt is significantly lower when individuals have experienced low stock market returns throughout their life. In other words, an individual's RAtt changes as their experiences of macro-economic shocks change. Likewise, an extensive body of research found a significant change in RAtt across one's life span, such as Dohmen et al. (2009), Riley and Chow (1992), and Hallahan et al., (2003) to mention just a few. Due to the inconclusive nature of these findings, the dispute of the stability of RAtt remains an ongoing issue.

In brief, the whole thesis centres on the two underlying mechanisms, namely, RP and RAtt, through which the differences in FRT across individuals take place. As mentioned earlier in this section, the thesis focuses on three main explanatory factors, namely, age (study 1), culture (study 2), and language (study 3). Figure 2.2 depicts definitions and acronyms of the three main terminologies. These terms will be used and remain unchanged across the whole study.

[8] As mentioned in Section 2.2.1, studies that do not distinguish RP and RAtt as determinants of FRT, consider FRT as RAtt. In other words, these studies treat the two concepts as the same thing to be used interchangeably.

Figure 2.2: Understanding main definitions and acronyms



In this research, the core definitions, conceptual framework, survey design, and measures of FRT, RP and RAtt are mainly adapted from Weber and Hsee's (1998) study to answer the three research questions and to achieve its novelties. Note that the contributions of this study are completely different from that of Weber and Hsee (1998). However, the general findings of this research can relate back to their study, and other preceding studies in this topic area (more explanation in Section 2.2.3). Therefore, this study replicates the Weber and Hsee's (1998) methods as the baseline to contrast the general findings of this research with their own. This allows for a comparison of this study's data to their data. Additionally, the study also applies some adjustments and employs alternative methods, where appropriate, to improve the Weber and Hsee's (1998) approaches and hence, to yield better and more robust results. To assist readers in distinguishing the novelties of the current research from the research of Weber and Hsee's (1998) study, the following section discusses in detailed the study of Weber and Hsee (1998) comprising of their research's objectives, methodology and findings, as well as how their study is relates to the current research.

2.2.3 Weber and Hsee's (1998) study

The main contribution of Weber and Hsee's study is the examination of the cross-cultural difference in financial risk tolerance (FRT). Besides, they also examined whether the obtained cross-cultural difference in FRT is associated with the cross-cultural difference in risk perception (RP) and/or risk attitude (RAtt). They found a difference in FRT across cultures, which mainly goes through the cross-cultural differences in RP, whilst RAtt remains constant across cultures. Another fundamental contribution of their study is that they developed the cushion hypothesis (discuss briefly in this Section and in more detailed in Section 5.2.1.2) as a potential explanation for cross-cultural difference in RP, which subsequently leads to cross-cultural difference in FRT.

Weber and Hsee (1998) investigated their cross-cultural study using a convenience sample of students from China (N=86), the US (N=85), Germany (N=31) and Poland (N=81) by means of questionnaires related to judgments and decisions under risk (refer to as FRT experimental task in this thesis). Throughout the survey, respondents reported their willingness to pay for given investment options (their FRT), and their risk perception on those options (subjective RP). By employing individuals' reported FRT and subjective RP, together with the expected value and variance (objective RP) of the investment options' outcomes, individual RAtt (both objective RAtt and subjective RAtt) is mathematically computed using the risk-return framework. Further to the computations of these main constructs, Weber and Hsee employed the mosaic bivariate approach (ANOVA and Bonferonni adjusted t-test) as the main statistical analysis. The whole analysis comprises three main mosaics, which examines whether there is a significant difference in FRT, RP and RAtt, respectively, as a function of nationality. In Weber and Hsee's paper, nationality is the proxy for culture, which is based on Hofstede's (2001) culture classification for the collectivism-individualism dimension. In other words, culture is measured at the national level. For example, respondents from China are automatically classified as collectivism, whilst American respondents are individualism.

According to their bivariate analysis results, risk perception (subjective RP) of respondents from China are significantly lower than that of respondents from America. Furthermore, Chinese respondents on average offered higher prices for investment options than American respondents did. In other words, Chinese are more risk tolerant (higher FRT) than Americans. Lastly, they found that there are no significant differences in perceived-risk attitude (subjective RAtt) across the four countries. Combining the three mosaics together, Weber and Hsee concluded that collectivistic individuals are more risk tolerant than their individualistic counterparts. However, the cross-cultural difference in FRT was "associated primarily with

cultural differences in the *perception of the risk* of the financial options rather than with cultural differences in *attitude towards perceived risk*" (Weber and Hsee, 1998, pp. 1205, emphasis added).

After these intriguing findings were obtained, Weber and Hsee (1998) developed a conjecture, namely, the cushion hypothesis[9] as the underlying reasons for the lower RP of collectivism which leads to their higher FRT, when compared to individualism. The cushion hypothesis generally asserts that collectivistic individuals have greater access to financial help from their social network (excluding their spouses). These help act as a cushion buffering them from getting hurt due to 'financial' falls. Therefore, collectivistic individuals perceive lower risk and hence, are more risk tolerant (not because they like risk more than individualistic individuals). In this paper, the cushion hypothesis remains a conjecture, which is later tested empirically by Hsee and Weber (1999) using a bivariate one-way ANOVA test. They obtain a cushion variable that measures the number of social contacts (excluding their spouses) that an individual can access for financial support. The obtained result supported the cushion hypothesis such that collectivistic respondents report more access to financial support comparing to their individualistic counterparts. Such larger cushion made them see the financial risk as smaller and hence, they are more willing to take on financial risk.

Thus far, the objectives, methodology and results of Weber and Hsee's (1998) paper have been discussed. The remainder of this section explains how their research is applied in the current study. Although the three research questions have their own academic contributions, the study relies on the Weber and Hsee's (1998) study for two main reasons. *Firstly,* the study of Weber and Hsee is the first to exclusively define and clearly distinguish the three core constructs: FRT, RP and RAtt. They also advanced the experimental survey task and mathematical framework to quantify these constructs. As this research also aims to examine individuals' FRT formation processes through RP and RAtt, reliance on Weber and Hsee's (1998) study is a tool to answer the three proposed research questions and to achieve the study's objectives.

Secondly, it can be said that all studies working on the topic of FRT tend to target one single general objective. That is, to determine factors that influence individual FRT, or in other words, to understand the differences in FRT across individuals. However, each study aims at either one, or a few determinants, of FRT. For example, Weber and Hsee (1998) targets culture whilst this thesis targets age, culture (an extending perspective) and language. Furthermore, recent research focussing on the FRT topic has been extended. Many studies have increasingly paid

[9] The cushion hypothesis will be discussed more in Section 5.2.1.1

more attention on RP and RAtt as the two underlying mechanisms of an individual's FRT formation process. The majority of the literature (Section 4.2.2) confirmed that differences in FRT across individuals (such as culture, gender, situational domains, outcome domains, and time period) are because individuals exhibit different risk perceptions, but not because of differences in their attitudes toward financial risk. In other words, individual RAtt is constant and stable across individuals. Overall, the general findings of studies working in this topic are 'constant RAtt across individuals', and 'differences in FRT are associated with differences in RP'. The current research employs the Weber and Hsee's (1998) experimental survey task and mathematical derivations to measure FRT, RP and RAtt, as well as employing their statistical method (mosaic bivariate analysis) as the baseline. Therefore, our general findings are comparable with those of Weber and Hsee's (1998), which can be used to infer the comparability of the data of this research with the data of Weber and Hsee (1998). In general, the employment of this baseline method is useful in placing this thesis in a stronger position in terms of its sample's quality, which is at least as good as that of Weber and Hsee (1998). After employing Weber and Hsee's (1998) statistical methods as the baseline, the study employs alternative approaches[10] (e.g., the model-based mosaic analysis, structural equation modelling and so on) with the aims of tackling the drawbacks of their approaches to obtain more robust results. Table 2.1 provides a summary of the disparities between Weber and Hsee (1998) and the current thesis.

[10] More details provide in Section 3.4

<table>
<tr><th colspan="2">Table 2.1: The comparison between this thesis and study of Weber and Hsee (1998)</th></tr>
<tr><th>Weber and Hsee (1998)</th><th>The current thesis</th></tr>
<tr><td><u>Research contributions:</u>
1) Cross-cultural differences in FRT.
2) RP and/or RAtt as the underlying mechanisms of (1).
3) Conjecture the cushion hypothesis as a potential explanation for (1) & (2).</td><td><u>Research contributions:</u>
Study 1 (Chapter 4):
1) RP and/or RAtt as the underlying mechanisms of differences in FRT across age.
Study 2 (Chapter 5):
2) Moderating effect of age on the cross-cultural differences in FRT.
3) Underlying mechanisms (RP and/or RAtt) of (2).
4) Reduction in cushion buffer across age as an explanation for (2) & (3).
Study 3 (Chapter 6):
5) Differences in FRT across individuals speaking different languages.
6) RP and/or RAtt as the underlying mechanisms of (5).</td></tr>
<tr><td colspan="2"><u>Definitions of main construct</u>
The same notions of FRT, objective RP, subjective RP, objective RAtt, and subjective RAtt.</td></tr>
<tr><td colspan="2"><u>Experimental task for main constructs (FRT task)</u>
(Section 2.4)
The same experimental task is employed to capture individual FRT, RP, and RAtt.
*Note that FRT and subjective RP are the responses provided by respondents. RAtt needs to be computed separately from these responses.</td></tr>
<tr><td>- The FRT task comprises of 12 investment products.</td><td>- The FRT task comprises of 6 investment products (taken from the 12 products of Weber and Hsee)[11].</td></tr>
</table>

[11] The baseline method (exactly the same with Weber and Hsee (1998), i.e. national measure of culture and bivariate analysis) is employed to compare the findings obtained in the second study (Chapter 5) and those of Weber and Hsee. If the same findings are found, the data of this thesis is comparable to that of Weber and Hsee. Therefore, the reduction of investment products does not influence the quality of the data obtained.

<table>
<tr><td colspan="2"><u>Theoretical framework and Computation of RAtt</u>
(Section 2.3 and Section 2.4.2)
The same risk-return frameworks are employed to compute objective and subjective RAtt: the traditional risk-attitude model (TRAM) and the perceived risk-attitude model (PRAM).</td></tr>
<tr><td><u>Methodology</u>
Culture measure:
1) Culture is measured at the national level using Hofstede (2001) cultural dimensions. Specifically, an individual's country is used as the proxy of her culture.

Statistical method:
2) Mosaic bivariate analysis (ANOVA and Bonferroni t-test).</td><td><u>Methodology</u>
Culture measure (Study 2, Chapter 5):
1) Main culture measure is at the individual level using 30 likert-scale cultural items of Singelis (1994).
However, the same national measure of culture is employed as the baseline.

Statistical method (all studies):
2) Main statistical approach is the mosaic model-based multivariate analysis.
However, the same bivariate analysis is employed as the baseline.</td></tr>
</table>

Moving away from pure definitions of the three main concepts, the remaining sections of this chapter will discuss their constructions and quantitative measurements. Firstly, theoretical frameworks underpinning the concepts are introduced, from which a bespoke survey is designed to derive individual FRT, RP, and RAtt.

2.3 Theoretical framework

Various theories were developed to explain FRT. These include the traditional expected utility theory (EUT), higher-order EUT (prudence and temperance), non-EUT (prospect theory), and modern portfolio theory, MPT (mean-variance model), to mention just a few. For a better understanding of FRT, this section will first introduce a fundamental theory of FRT - the EUT, followed by the MPT, which is the main theoretical framework of this study.

Despite of its irrelevance in this research, the reason for discussing EUT is that traditional finance considering decision-making under risk relies heavily on this theory. Nevertheless, this study primarily employs the MPT risk-return framework because it is the only framework that allows for the simultaneous measures of FRT, RP and RAtt, as well as providing a clear differentiation between FRT and RAtt. Without such properties, the objectives of the study could not be achieved.

2.3.1 Financial risk tolerance within the expected utility theory (EUT)

The expected utility theory (EUT) of Von Neumann and Morgenstern (1947) remains a prevalent model that theoretically describes the link between risk tolerance and risk-taking behaviour. Based on the EUT framework, individual FRT can be derived from one's actual behaviour. Notably, within the EUT, FRT carries the same meaning with RAtt. The two terms are apparently identical and can be used interchangeably. Within EUT, risk attitude is a descriptive label for the concavity of the investor's utility function for money. The utility function is a mathematical equation used to compute investor's actual level of satisfaction from the income associated with investor's choices (Harlow and Brown, 1990; Weber et al., 2002; Weber and Milliman, 1997). The Bernoulli measure of risk attitude based on the notion of certainty equivalent c(F,u), which can be derived when:

$$u\big(c(F,u)\big) = \int u(x)dF(x)$$

Whenever the utility function (u) is concave, the certainty equivalent c(F,u) of lottery F is less than its expected value (E_F). As individuals accept a certain amount that is lower than the expected value of the lottery, a concave function indicates risk aversion. In contrast, a convex function indicates risk seeking, as individuals will only forgo the lottery when they are offered a sure payment, which is higher than the expected value of the lottery.

In addition to the Bernoulli certainty equivalent, another metric of risk attitude was developed by Arrow (1974) and Pratt (1964), so-called the Arrow-Pratt coefficient of absolute risk aversion. The coefficient is defined as A(x,u)= –u"(x)/u'(x), where u' and u" are the first and second derivatives of the utility function u, respectively. When A(x,u)>A(x,v), the utility function u is more concave than the utility function v. In other words, u is more risk-averse than v. Consequently, a risk-averse individual exhibits a concave utility function; a risk-seeking individual exhibits a convex utility function; and an individual is risk neutral if her utility function is linear. According to the EUT, a risk averter prefers a sure outcome to a gamble with the same expected value, i.e. U[E(W)] > E[U(W)]. Generally, the less risk-averse an individual is, the higher expected utility of uncertain outcomes she has.

Although the EUT is the building block and one of the most recognised theories of FRT, the risk-return model is the main theoretical framework of the current research as it exhibits a property that allows FRT and RAtt to be treated as two different concepts. Consequently, the measures of financial risk tolerance (FRT), risk perception (RP) and risk attitude (RAtt) are constructed based on this framework.

2.3.2 Financial risk tolerance within Modern Portfolio Theory (MPT)

The modern portfolio theory (MPT) of Markowitz (1952) postulates that risk-averters aim at holding a diversified portfolio that maximises the portfolio returns for a given level of risk. The risk-return framework is a normative theory of risk in which an investor's willingness to pay (WTP) for option X is the function of its value and riskiness. The conventional risk-value framework can be formulized as:

$$WTP(X) = f(Value(X), Risk(X)) = aValue(X)) + bRisk(X) \qquad (eq.2.1)$$

According to the traditional risk-attitude model (TRAM) (Fraser-Mackenzie et al., 2014 and Sarin and Weber, 1993), the value of X is its expected returns (EV), and the riskiness of X can be measured by its variance (VAR). Hence, equation 2.1 can be written as:

$$WTP(X) = aEV(X) + b_{VAR}VAR(X) \qquad (eq.2.2)$$

The ***TRAM*** (eq.2.2) is applied when individuals exhibit objective RP, which is the variance of investment X. As the magnitudes of VAR(X) and EV(X) of a risky option are the same between individuals, differences in risk tolerance, WTP(X), can only be explained by differences in attitude towards objective RP (objective RAtt, the risk trade-off coefficient b_{VAR}), assuming everyone's attitude towards money award (coefficient a) is the same.

However, the TRAM is exposed to limitations with regards to the nature of the investment's riskiness, VAR(X), and the interpretation of the risk-preference term, $b_{VAR}VAR(X)$. Particularly, individuals do not truly perceive financial risk using variance, and it has been shown that variance is only applicable for quadratic utility functions (Fraser-Mackenzie et al., 2014). In the study of Duxbury and Summers (2004), although variance of an option does affect one's risk perception, their finding remains contradictory to traditional finance. Particularly, individuals perceive high variance options as being less risky than options with low variance. This indicates that individuals are not variance averse in general, or perhaps not aware of variance as a measure of risk. As a result, Nosic and Weber (2010) and Johnson et al. (2004) argue that subjective RP is better in predicting risk-taking behaviour.

Accordingly, Weber and Milliman (1997) and Weber and Hsee (1998) proposed the perceived risk-attitude model (PRAM), in which risk of X is measured based on individual subjective judgments (subjective RP). The PRAM can be written as follow:

$$WTP(X) = aEV(X) + b_R R(X) \qquad (eq.2.3)$$

where R(X) is the subjective RP, and the risk trade-off coefficient b_R is the subjective RAtt, attitude towards subjective risk.

The ***PRAM*** provides an alternative interpretation of one's decision making under risk, which is affected by outcome domains or situational factors. According to equation 2.3, differences in choices across different domains, or situations, may be the result of differences in individual subjective RAtt (b_R), subjective RP (R(X)), or both. The first interpretation is consistent with that of the TRAM (eq.2.2) such that differences in choices across different domains/situations may occur because individuals perceive similar level of riskiness, but their attitudes toward risk are different. In other words, people may like risks in one domain/situation, but dislike risks in other domains/situations. The second interpretation is exclusive to the PRAM (eq.2.3). It refers to different perceptions on financial risk (subjective RP), whilst the attitudes toward perceived risk stay constant at all times. Basically, while the extent to which one likes/dislikes risk are similar, individuals may exhibit different FRT because they perceive different levels of investment's riskiness. Alternatively, discrepancies in individual FRT may be the result of differences in both subjective RP and subjective RAtt across individuals. For example, two investors are considering an investment option X, one is more risk tolerant than the other because she likes risk more, as well as perceiving the riskiness of X to be smaller than does the other investor.

After acknowledging the underlying theoretical framework of the three main constructs, the subsequent sections explain the survey design for the main experimental task and the mathematical computations of individual FRT, RP, and RAtt.

2.4 Survey design and measure

2.4.1 Question design for FRT, RP, and RAtt (See Appendix 1, Part II)

Following Weber and Hsee (1998), the same experimental task is employed to capture individual FRT, RP and RAtt. Respondents are instructed to examine 6 different investment products separately[12], each of which carries three potential outcomes, with at least one possible gain and one possible loss. The 6 investment products are shown to respondents both numerically and graphically, depicting the probabilities of obtaining each outcome. The outcomes of the six investment products along with their expected values and standard deviations are represented in Table 2.2. Respondents are asked to assume that they have a maximum of $30,000 to invest in each investment product.

[12] The decision of employing six investment options instead of twelve investment options included in Weber and Hsee's (1998) paper is mainly driven by the respondents' feedback in the pilot study. The employment of six investment options is claimed to improve the quality of respondent's responses whilst still allows the research questions to be answered sufficiently. More explanation will be discussed in Section 2.2.3 and empirical results will be provided in later chapters.

Table 2.2: Description of 6 Risky Investment Products

Investment Product	Outcome 1	P1	Outcome 2	P2	Outcome 3	P3	EV	SD
1	$600	0.56	-$200	0.38	-$1,100	0.06	$194	$502
2	$5,200	0.79	-$7,900	0.20	-$24,000	0.01	$2,288	$5,862
3	$13,900	0.11	$5,100	0.44	-$3,600	0.45	$2,153	$5,822
4	$6,900	0.56	-$2,500	0.38	-$12,100	0.06	$2,188	$5,748
5	$1,300	0.11	$500	0.44	-$300	0.45	$228	$533
6	$25,800	0.01	$12,400	0.20	-$700	0.79	$2,185	$5,746

Subsequent to the consideration of the possible gains and possible losses that each investment product may bring, respondents are asked to answer the following two questions:

1) What is the maximum price you would be willing to pay for this investment product, rather than forgoing it? [If you wouldn't buy it at any price, write $0.]

This question captures individual risk tolerance level in facing financial risks (FRT) through one's willingness to pay (WTP) for risky investments. The higher the WTP, the higher risks they are willing to endure.

2) On a scale of 0 to 100, how risky do you think this investment product is?

This question captures individual subjective perception in the riskiness of investment products (subjective RP). The value of subjective RP is expressed on a numerical rating scale that ranged from 0 (not at all risky) to 100 (extremely risky).

2.4.2 Derivation of main dependent variables: FRT, RP and RAtt

After the respondents state their WTP and subjective RP for the six investment options, measures of an individual's FRT, RP and RAtt are mathematically derived based on their responses. The theory-based measures and the mathematical computations of these constructs are summarised in Table 2.3.

2.4.2.1 Financial risk tolerance (FRT)

FRT of an individual is calculated as the mean of six WTP values stated by each respondent. The FRT calculation can be written as follows:

$$\text{WTP} = \overline{WTP} = \frac{\sum_{i=1}^{6} WTP_i}{6} \qquad \textit{(eq.2.4)}$$

2.4.2.2 Financial risk perception (RP)

I) Objective RP

The objective RP for each investment option is its variance. Consequently, the objective RP of an individual is the mean variance of the six investment options, which can be written as shown in Equation 2.5. As all respondents are given the same investment options, their objective RP are the same.

$$VAR = Objective\ RP = \frac{\sum_{i=1}^{6} VAR_i}{6}$$

$$= \frac{\sum_{i=1}^{6}\{[(O_1{}^2 * P_1)+(O_2{}^2 * P_2)+(O_2{}^2 * P_3)]-[(O_1 * P_1)+(O_2 * P_2)+(O_3 * P_3)]^2\}_i}{6} \qquad \textit{(eq.2.5)}$$

where O denotes the outcomes of an investment option and their corresponding probability P.

II) Subjective RP

Subjective RP on six investment options is reported by respondents in the survey. Individual subjective RP is calculated as the mean subjective RP of the six investment options. Its calculation is shown in equation 2.6:

$$\text{Subjective RP} = \overline{RP} = \frac{\sum_{i=1}^{6} RP_i}{6} \qquad \textit{(eq.2.6)}$$

2.4.2.3 Financial risk attitude (RAtt)

With regards to the measure of financial risk attitude (RAtt), the study employs the Weber and Hsee's (1998) approach. As discussed in the theoretical framework Section 2.3, there are two measures of individual RAtt. These are the objective RAtt (b_{VAR}) and the subjective RAtt (b_R). These RAtt measures, which are based on the risk-return framework (the TRAM and the PRAM), identify whether an individual is risk averse (negative b_{VAR}/b_R) or risk seeking (positive b_{VAR}/b_R). Accordingly, the mathematical computations of RAtt are constructed as follows:

I) Objective RAtt (b_{VAR})

In accordance with the TRAM (equation 2.2), the objective RAtt (b_{VAR}) of an individual is derived by regressing the WTP on expected value and objective RP (variance) of the six investment options. The intercept term *a* reflects individual differences in FRT, and the coefficient b_{VAR} reflects individual objective RAtt.

II) Subjective RAtt (b_R)

The derivation of subjective RAtt is based on the PRAM (equation 2.3), which relaxes the assumption of constant RP across individuals. Similarly, individual subjective RAtt is obtained by regressing the WTP on expected value and subjective RP of the six investment options. The risk trade-off coefficient b_R is the individual subjective RAtt.

Table 2.3: Theory-based measures of FRT, RP and RAtt

Main variable *(Variable Code)*	Theory	Measure	Formula
❖ **Financial risk tolerance (FRT)**			
FRT (WTP)	**The TRAM** $WTP(X) = aEV(X) + b_{VAR}VAR(X)$ **The PRAM** $WTP(X) = aEV(X) + b_RR(X)$	Willingness to pay; WTP(X)	$WTP = \overline{WTP} = \frac{\sum_{i=1}^{6} WTP_i}{6}$
❖ **Risk perception (RP)**			
Objective RP ***(VAR)***	**The TRAM** $WTP(X) = aEV(X) + b_{VAR}VAR(X)$	Variance of X; VAR(X)	$VAR = \frac{\sum_{i=1}^{6} VAR_i}{6}$
Subjective RP ***(RP)***	**The PRAM** $WTP(X) = aEV(X) + b_RR(X)$	Subjective risk; R(X)	$RP = \overline{RP} = \frac{\sum_{i=1}^{6} RP_i}{6}$
❖ **Risk attitude (RAtt)**			
Objective RAtt ***(b_{VAR})***	**The TRAM** $WTP(X) = aEV(X) + b_{VAR}VAR(X)$	Risk trade-off coefficient; b_{VAR}	Regression analysis
Subjective RAtt ***(b_R)***	**The PRAM** $WTP(X) = aEV(X) + b_RR(X)$	Risk trade-off coefficient; b_R	Regression analysis

2.4.2.4 Objective RAtt (b_{VAR}) vs. Subjective RAtt (b_R)

Whilst the objective measure of RAtt is calculated based on the variance of investment option's outcomes, the subjective measure of RAtt is based on the risk that one personally and intuitively perceives. For the objective RAtt, it assumes that everyone sees risk as variance, and thus the amount of risk individuals perceive are the same. However, in the real world, people can understand financial risk in different ways, see financial risk from different perspectives, and hence employ different methods to measure it. Although financial specialists may have remarkable insight on variance, its computation can be problematic owing to resource and time

constraints. Therefore, the assumption of a constant RP across individuals is often violated. As a result, subjective measure of RAtt are alternatively employed allowing individuals to independently and subjectively perceive and evaluate financial risk.

In this study, statistical tests are implemented to initially examine whether the assumption of constant RP across individuals holds. If RP reported by individuals are the same, both measures of RAtt will be taken into consideration and their results will be evaluated and ultimately compared. On the other hand, if the reported RP is found to be significantly different across individuals, it can be concluded that the assumption of constant RP across individuals is violated. Consequently, the objective RAtt (b_{VAR}) will not be pursued further, and only subjective RAtt (b_R) will be employed.

Chapter Three:

Survey Design, Data Collection, and Research Method

3.1 Introduction

Chapter 2 has explained the building framework of the whole study that assists the readers in understanding the definitions, as well as the quantitative measures of the three main constructs: financial risk tolerance (FRT), risk perception (RP) and risk attitude (RAtt). These understandings should be carried to this empiric chapter (Chapter 3) to understand how the study's data was obtained and analysed. This chapter will first introduce readers to the administration of the survey, which aims to get the survey ready for the data collection process. Subsequently, the methods of statistical analysis will be discussed. As previously mentioned, this chapter provides information that can be generally used by all empirical studies in this thesis. It is created separately to avoid repetition at the later stage.

3.2 Administration of the survey

3.2.1 Translation of questionnaire survey

The primary quantitative data was collected via a bespoke questionnaire, which was originally written in English. The same questionnaire surveys were employed in the US, the UK, China, Vietnam, and Singapore using their local languages. Specifically, the English survey was distributed in the US, UK, and Singapore, and Vietnamese and Chinese surveys were distributed in Vietnam and China, respectively. The original English survey was translated into Vietnamese and Chinese using back translating method (Brislin, 1986).

For the translations of Vietnamese and Chinese, two independent professional translation companies were employed in each country (Vietnam[13] and China[14], respectively). One company was responsible for translating the original English survey into the target language; and the translated version is subsequently translated back to English by the other company. The

[13] Translation companies:
English to Vietnamese: Dịch Thuật Việt Uy Tín, Ho Chi Minh City, Việt Nam
Email: sales@dichthuatuytin.com
Vietnamese to English: Hội Nghiên Cứu Dịch Thuật, Ho Chi Minh City, Việt Nam
Email: hncdt1@gmail.com

[14] Translation companies:
English to Chinese: PTSGI, Taipei, Taiwan
Email: Market@PTSGI.COM
Chinese to English: Ectranslator Translation Services, Shanghai, China
Email: sales@ectranslator.com

two English versions were then compared and modified by two native-speaking academic colleagues[15] by means of in-depth discussions.

3.2.2 Currency exchange

The US Dollar is chosen as the base currency in the original English survey because the FRT experimental question were originally quoted in US Dollars in the study of Weber and Hsee (1998). It is unclear whether the $20,000 initial endowment set by Weber and Hsee (1998) is random or critically derived. It is possible that the level of the endowment was critically originated by the authors, perhaps because it is the most appropriate amount for the study's objectives and for participants from all countries to understand and work with the task effectively. In such case, if we chose other currencies as the base currency (£20,000 or S$20,000), the initial endowment would be different from the plausible $20,000 decided by Weber and Hsee (1998) in the first place. Due to the ambiguity about the decision made by Weber and Hsee (1998) on the initial investment amount, it was prudent to use the same amount denominated in the same currency ($20,000) with Weber and Hsee's study. However, to account for the relative time value of the amount set by Weber and Hsee (1998) 20 years ago, the $20,000 endowment is multiplied by an inflation multiplier of 1.499 (see Section 3.2.3).

Surveys distributed in the five countries are presented using their national currencies. The amounts denominated in the US Dollar (USD) are required to be converted into Pound Sterling (GBP), Vietnamese Dong (VND), Chinese Yuan (CNY), and Singaporean Dollar (SGD) for the surveys distributed in the UK, Vietnam, China, and Singapore, respectively. The US Dollar is converted into four targeted currencies using the market exchange rates of each currency against the US Dollar on the 5th of February 2016. The final exchange rates were adjusted for the Local Purchasing Power of each country relative to the United States. There were three methods considered to account for the Purchasing Power Parity (PPP): the LPPI method, the CPI+R method, and the PPP conversion factor method.

After thoroughly considering advantages and drawbacks of each approach (details provided in Appendix 2), the study uses the CPI+R method that gives an approximation of national purchasing power based on the costs of living of residents from each country compared to that of American residents. The method employs the Consumer Price Plus Rent Index (CPI+R). The index estimates the relative price level for consumer goods, including groceries, restaurants, transportations and utilities, plus other accommodation expenses (mortgage and rent), of each individual country comparing to the US. Table 3.1 provides summary for the market exchange

[15] Chinese version: Yuanyu Yang (Y.Yang41@newcastle.ac.uk), Liu Jia (Jia.Liu@newcastle.ac.uk)
Vietnamese version: Ngân Đường Cao (the researcher), Vũ Quang Trịnh (Q.V.Trinh2@newcastle.ac.uk)

rate and the Local Purchasing Power Index in 2016. For example, the CPI+R of Singapore is 138.71, which estimates the cost of living in Singapore is 38.71% more expensive than the United States in 2016.

The calculation for currency exchange rates accounting for purchasing power using CPI+R method can be written as:

$$S_{\$/i\_adj} = S_{\$/i} * \frac{CPI+R(i)}{CPI+R(The\ US)} \quad \text{(eq.3.1)}$$

where $S_{\$/i\_adj}$ and $S_{\$/i}$ are the exchange rates of target currency per US Dollar after and before adjusting for PPP, respectively.

Table 3.1: Exchange Rate and Consumer Price Plus Rent Index (CPI+R) in 2016[16]

Currency	Exchange rate	Countries	CPI+R (2016)
USD	**1**	**The US**	**100**
USD/GBP	0.6858	The UK	104.57
USD/SGD	1.3969	Singapore	138.71
USD/CNY	6.5548	China	62.70
USD/VND	21,920	Vietnam	47.81

After all the data had been collected, monetary values, such as WTP, income and wealth, that are denominated in currencies other than the US Dollar are converted back to the US Dollar using the same CPI+R method. The conversion is calculated as presented in the equation 3.2.

$$V_{\$} = V_i * \frac{CPI+R_{the\ US}}{S_{\$/i} * CPI+R_i} = V_i * \frac{100}{S_{\$/i} * CPI+R_i} \quad \text{(eq.3.2)}$$

where V_i is the converted value in the US Dollar; $S_{\$/i}$ is the exchange rates of target currency per US Dollar; and $CPI+R_i$ is the CPI+R index of the target country.

Although the FRT survey task was mainly taken from the study of Weber and Hsee (1998), a number of adjustments from the original version were made. The remaining section will explain the reasons of those adjustments.

[16] Sources:
Currency Conversion (Yahoo Finance, 2016)
Cost of Living Index for Countries in 2016 (Numbeo, 2016)

3.2.3 Adjustments from Weber and Hsee's (1998) FRT Task

Adjustment 1: As the study of Weber and Hsee (1998) was conducted about 20 years ago, there may be problems regarding the relative time values of the monetary amounts that they set for the FRT task. Consequently, the study adjusted all those amounts using the following formula:

$$V_{adjusted} = V_{original} * 1.499 \qquad (eq.3.3)$$

The inflation multiplier of 1.499 is calculated using the annual inflation rates in the United States from 1995 to 2015 collected from the World Bank (2016).

Adjustment 2: During the process of pilot study[17], the FRT questions appeared to be a difficult and complicated task for respondents to understand. To assist respondents in interpreting the question accurately and consistently, they were initially provided with an example investment product along with a guideline answer as presented in Table 3.2. The answer is explained in ordinary language so that participants from different educational and professional backgrounds could understand. Nevertheless, being aware of the possible anchoring bias (Ackert and Deaves, 2010), the guideline answer does not give a specific numerical answer to the example question. Alternatively, an alphabetical letter "X" is used to denote the amount of money respondents are willing to spend.

Table 3.2: Example question and guideline answer for the FRT task

Assume that you have a maximum of $30,000 to invest in **each** investment product.

The investment product S has three potential outcomes. P1, P2, and P3 indicate the probabilities of obtaining outcome 1, outcome 2, and outcome 3, respectively.

Investment Product	Outcome 1	P1	Outcome 2	P2	Outcome 3	P3
S	$1000	59 %	-$500	30 %	-$2000	11%

Question: What is the **maximum** price you would be willing to pay for this investment product, rather than forgoing it? **[If you wouldn't buy it at any price, write 0]**

Answer: $X ⇒ You are happy to pay up to $X to buy this product S, which gives you 59% chance to win $1000; 30% chance of losing $500, and 11% chance of losing $2000. And remember that you **will not** get back the **$X** you paid. Therefore, with Outcome 1, you would **RECEIVE** $1000, and with Outcome 2 or Outcome 3, you would **PAY EXTRA** either $500 or $2000, respectively.

Note: $X is the highest price you would be willing to pay, not the lowest price.

[17] Details for the pilot process provided section 3.3.1

Adjustment 3: Although the FRT question was sourced from Weber and Hsee's (1998) study, the logic and understanding of the question that the authors intended to convey is subject to ambiguities[18]. These include two main points:

- Ambiguity 1: The paper stated that "Respondents were told to assume that they were investing their own money and that they currently had $20,000 available to make investments" (Weber and Hsee, 1998, pp. 1209). However, the instruction does not clearly explain whether the $20,000 endowment is used to invest in each investment option or to distribute among the 12 investment options.

Decision: After thorough consideration, the current study assumes that the investment options should be independent from one another and the initial endowment of $20,000 is to invest in each investment option. There are two rationales for this decision. Firstly, if $20,000 is spread among the six investment options, the decision made on each of them will be dependent on the riskiness and values of other investment options. Furthermore, the respondents are required to constantly keep in mind the amount they have spent on previous investment options with their related risks and returns, the available funds, together with assessing the amounts of losses and gains, and their respective possibilities of the current option. Consequently, the question would have been remarkably complicated and challenging for respondents to answer.

Secondly, the study aims at investigating the differences in individual RP when facing risky financial investments. According to the risk-return framework (Markowitz, 1952), the decision made on any investment should only depend on its risks, returns, and investor's risk attitude, but not on other external factors. Indeed, Weber and Hsee instructed their respondents "to examine each investment option separately" (Weber and Hsee, 1998, pp. 1210); yet extra emphasis on the word 'separately' is essential to avoid misinterpretation and confusion of respondents.

- Ambiguity 2: It is vague whether the costs of investment options are reimbursed.

Decision: In their instructions, Weber and Hsee (1998) used the word "investment options" and asked respondents to "invest" in them. Investment is defined in Oxford dictionaries (2016) as "the action or process of investing money for profit". On the other hand, Investopedia (2003) refers investment as "a monetary asset purchased with the idea that the asset will provide income in the future or appreciate and be sold at a higher price". Corresponding to these two definitions, investors/respondents should be able to get the initial investment back.

[18] The researchers contacted the authors via email to clarify these points. However, no response was received.

Nevertheless, the objective of the study, that is, to capture one's FRT and RP, cannot be achieved if the investment principal is reimbursed. First of all, the options' outcomes are specific amounts; not percentages of the invested amount. Consequently, if the investor can get back the investment cost, the willingness to pay would merely be based on if she thinks the investment worth investing. If she wants to invest in a particular investment, there is no difference whether the investment costs $20,000 or $1, because that amount will eventually be repaid. In that case, although the risk of each investment is still perceived differently across individuals, this risk is independent of the willingness to pay. This study is predominantly based on the risk-return model which states that FRT is a function of RP. As a result, it is more reasonable for the cost of investment to be a one-off payment that cannot be reimbursed.

Additionally, Weber and Hsee (1998) asked their respondents to state the maximum amount they would be willing to "pay" for the investment options, and if the respondents do not want to "buy" the option at any price, say $0. The two words 'pay' and 'buy' may have indicated that the initial investment cost is a one-off cost.

The ambiguity 2 is used as one criteria to exclude non-qualified answers. Specifically, if the respondents understand that they cannot get back the cost of investment, the highest amount they would like to pay for any investment option cannot exceed the highest amount of gain provided by that investment. Basically, it is not logical to pay a price that you never can recover. It is important to notice that for all investment options, the maximum amount[19] that respondents end up losing in the worst outcome, does not exceed the initial endowment of $20,000. Therefore, Weber and Hsee (1998) have given the respondents enough budget to pay for that.

As the investment cost cannot be reimbursed, it is more appropriate to refer to these options as gambles rather than investments. Nevertheless, to ensure that the objectives of the question remain unchanged, the study retains the use of the word 'investment', but more explanation is provided in the instructions to attract the attention of respondents to this point.

Adjustment 4: An adjustment on the design of the task was made to ensure the quality of the data, whilst the purpose of Weber and Hsee's study remains unmodified. In this study, respondents are presented with 6 investment options, instead of the 12 used in Weber and Hsee's study. The main reason for this modification is strongly related to the quality of the obtained data. During the pilot study, the majority of respondents provided negative feedback on the length of the FRT question when all 12 investment options were included. They showed

[19] Net loss = cost of investment* + loss outcome
* Cost of investment ≤ the highest possible outcome.

significant loss in their focus after the first half of the task. According to Baumeister (2003), the self becomes depleted and tired after a series of decisions, which causes the subsequent decisions to be costly and foolish. Consequently, such decision fatigue leads respondents to provide deteriorating quality of decisions and biased answers for latter part of the task (Baumeister, 2003). Note that the FRT task is presented in the beginning of the survey after roughly one minute of answering demographic questions (Appendix 1).

Although the number of investment products have been reduced, the purpose of the study is maintained and remains comparable to the study of Weber and Hsee (1998). As individual FRT is measured as the mean WTP of all investment options, if the results of Weber and Hsee (1998) are robust, findings should not change if another random sample is taken to do the task again with six investment options. As discussed in Section 2.2.3, the study replicates Weber and Hsee's (1998) study in many aspects and uses their mosaic bivariate analysis as the baseline statistical method. With this approach, if the same findings are obtained, it can be concluded that this study's data is comparable to theirs. Consequently, the reduction in the number of investment products may not influence the results' quality.

This study has made a thorough consideration of the six options to be included in the survey, accounting for certain heuristics that individuals may use when facing with uncertain choices. Specifically, previous literature has reported that individuals can either place relatively more weight on the probability of loss (Bontempo et al., 1997; Alderfer and Bierman, 1970), or on the magnitude of possible gains (Bontempo et al., 1997; Lopes, 1987), or the magnitude of possible losses (Weber and Hsee, 1998; Lopes, 1987; Alderfer and Bierman, 1970), and size of payoffs (Holt and Laury, 2002).

The first two selected investment options are ones with the most desirable, and the most undesirable outcomes among the original 12 investment options in Weber and Hsee's (1998) study, in terms of their possible gains and losses. According to Table 2.1, these two options exhibit similar expected values (EV) and standard deviations (SD) but different distributions of losses and gains. The investment product 2 gives respondents an extremely high amount of loss (-$24,000) but only 1% chance that the outcome would occur, whilst the investment product 6 gives respondents a very high amount of gain ($25,800) but similarly, with only 1% chance of occurrence.

The other four options take into account the size effects of the payoffs. Two pairs of options are selected, in each of which the probability of possible gains and losses are the same, whilst the magnitudes of gains and losses are adjusted and scaled up by a factor of 10 (approximately).

Specifically, the outcomes of investment products 3 and 4 are approximately 10 times higher than investment products 1 and 5, respectively.

Adjustment 5: The order of six investment options are the same when being presented to all respondents. The main aim of this study is to compare individual FRT. Hence, fixing the order of the six investment options can assist the comparability of the task. As recommended by Kelley et al. (2003), questions should be standardized and presented to respondents in the same order. Similarly, as stated by Fink (2013, pg.65), "it is important to ask everyone the same questions in the same way or results will not be comparable".

It is noteworthy that the carry-over effects (COE) are not relevant in this FRT task. COE is defined by Harrison et al. (2011, pp.5) as "events and processes occurring in one season that result in individuals making the transition between seasons in different states (levels of condition) consequently affecting individual performance in a subsequent period". COE would be a concern as it causes challenges in distinguishing COEs from other investigated effects. For example, the examination of the influence of music on one's essay quality is likely to be subjected to COEs. If respondents are instructed to write an essay without music following by writing another essay with music, the higher quality of essay that was written with music may be argued to be influenced by COEs rather than the music effect. To be specific, the participants might be warmed up after the first essay which causes the higher quality of the second essay (a COE of individual's writing quality). Within the current research, the focus is not on comparing the performance (WTP/subjective RP) of the same individual across the six investment options. Instead, the examination is mainly conducted to compare the average performance (mean WTP/subjective RP) across individuals. Consequently, COEs are not a concern.

3.3 Data collection

3.3.1 The pilot study

Before the translation process took place, the original English survey had been piloted on a small-scale sample to examine its quality in terms of its readability, intelligibility, and coherence. The pilot study aims at identifying questions that do not make sense, or are interpreted incorrectly and inconsistently by respondents, together with other issues that may trigger biased answers, such as the design and wording of the questions.

Pre-pilot and pilot study: For both pre-pilot and pilot studies, native English-speaking staffs and students were recruited from the Newcastle University Business School. Before the official pilot study, the survey was pre-piloted on five PhD students to skim through the survey to identify mistakes, such as typing errors, spelling errors, grammatical errors, and duplicated

questions. During the pilot sessions, respondents were provided with a research information sheet and a hard copy of the survey (as presented in Appendix 1), which was completed by the participants. The whole pilot process was timed and observed by the researcher. Once completed, respondents were provided a feedback sheet (Appendix 3, P.I) based on which they gave verbal feedback with regards to the length, understandability, sensitivity, layout, and presentation of the questions.

The feedback sheet contains general questions which apply to all participants. Besides, more questions were particularly tailored for each respondent to capture their own understanding and attitude towards the questionnaire, based on their reactions and emotional responses during the survey. For example, if a respondent was hesitant while answering a question, such as taking too long to think, changing the answers many times, leaving the question blank, smiling, sighing loudly, or shaking their heads, the researcher would take note and discuss with the respondent in the feedback time.

The official pilot study contained two rounds. The first round was conducted on twenty-eight participants, and the survey was adjusted once every five respondents. The second round was required due to some unresolved issues regarding inconsistent understandings and interpretations of the FRT experimental-designed task (Appendix I, Part II). This task was exclusively piloted on roughly eighty students additionally. The researchers asked the respondents questions which focussed on respondents' understanding of the task, such as "why are you willing to pay £X for this investment but you will only get back £Y (<X) in the best scenario?" or "Do you understand whether you can get back the cost of investment?" or "Do you understand whether £20,000 is the endowment for each investment option or is allocated among six investment options?" (See more in Appendix 3, P.II). Based on the feedback received, adjustments were made until a consistent and comprehensive understanding of the task was achieved.

After the pilot study, the final English survey was translated into Vietnamese and Chinese using the back-translating method as stated in Section 3.2.1. Subsequently, the translated surveys were piloted on about 10-15 Chinese and Vietnamese native respondents for each survey until the final qualified questionnaires (as required in the English survey) are attained.

3.3.2 Official data collection process

The study targets a broad sample of the population in each country with minimum age of 18 up to the age of retirement as the research is solely interested in studying the risk-profile of individuals prior to their retirement stage. Furthermore, as the focus is on the age difference in

individual FRT, stratified random sampling method is employed. Basically, the whole sample is equally divided into 4 age groups. Each age group represents approximately 25% of the whole sample. With roughly equal age strata, the age difference can be better examined comparing to the using a student sample with limited range of age.

Participants were recruited through an external data-collecting service[20] with the aim of collecting at least 300 well completed responses from each country. As the survey needs to be distributed across 5 different countries, approaching respondents online through a market research company was considered to be the most economically effective method for this research.

To control for the quality of the respondents' answers, a quality control process was put in place throughout the pilot stage until the final data cleaning process. In the market research industry, it is a common practice such that low-quality answers will not be charged. One essential criteria for a well completed response is that all questions are answered. Additionally, the company employs a number of techniques to detect underqualified responses. The first technique is the "straight-liner", which detects participants that tend to select the same exact response over a series of questions. The second technique is the "speeder". It detects respondents that finished the survey in less than half of the average length of time. Besides, deficient answers were also excluded under the judgements of the researcher as well as using some logical follow-up questions to detect if the respondents take the survey seriously (details in Appendix 3, P.III). The field work keeps on running until at least 300 completed survey are collected in each respective market.

Notably, for the FRT experimental task, respondents who stated the WTP as '$0' for all investment options are not excluded as the answers of '$0' do make economic sense such that the respondents do not want to invest at all regardless what the investments offer. However, respondents who provided a constant but non-zero WTP for all investment options are included and would be considered as noise in the data sample (N=43). All multivariate tests (Section 3.4.3) for all three empirical studies have been implemented which revealed that findings remain unchanged when those 43 observations are excluded from the sample.

With the online sample, the internet literacy penetration may lead to potential selection bias in the sample of countries with low internet literacy and coverage as the access to respondents

[20] Data collection company:
iPanel Online Market Research, Rotterdam, the Netherlands
Email: sales-europe@ipanelonline.com

online in those countries may be challenging. Particularly, China and Vietnam have the lowest internet coverage of roughly 50% comparing to the other three countries with more than 80% internet coverage (IWS, 2017). Such under-coverage issue in these two countries may cause the samples to be problematic such that the final participating respondents may not be a good representative of the population. Technically, the representativeness of a sample can be tested by comparing the population parameters (the distribution of the population) with the statistics of the obtained sample. In an ideal world, this procedure can be simply completed. However, in practice, there are two restrictions associated with it. *Firstly*, this study uses the stratified sample with respect to age (discussed earlier in this section). Hence, the age distribution of the sample is not comparable with that of the population. The *second* problem is related to the inaccessibility of the population data. However, basic population demographic information of Vietnam and China can be found on IndexMundi (2017a,b) database, which reveals that the gender ratios (male to female) within the age range of 25 to 65 in China and Vietnam are 1.03 and 0.98, respectively. Comparing these population figures to those of the samples (1.11 and 1.01, respectively), the differences are less than 10% (8% in China and 3% in Vietnam). The divergence in gender ratios in these two countries can be considered as relatively small. Therefore, the representativeness of Chinese and Vietnamese samples may not be an issue. However, as further comparisons are restricted due to the unattainability of the population data, such conclusion cannot be assured.

Furthermore, the internet literacy penetration may create another issue with approaching older respondents in Vietnam and Singapore. According to Statista (2017a,b), less than 20% of the internet users in Vietnam and Singapore age 45 or above. This creates some restrictions regarding the age of respondents from Vietnam and Singapore as it is generally difficult in reaching audiences with an age above 45 through online channels in these two countries. The research market company did inform us of such a restriction initially and we decided to remain our focus on collecting a random sample, but with the risk of not getting any respondents from Vietnam and Singapore with an age above 45. Fortunately, after the data was obtained, the final sample comprised of a sufficient number of Vietnamese and Singaporean participants of this age range[21].

It is argued that data collection using fieldwork (such as, postal or interview survey) is not exposed to the sampling limitation of under-coverage as with the online data collection method. However, this study requires the survey to be distributed in five different countries (the US, the UK, China, Vietnam, and Singapore). With a tight timeframe of 3 years and limited financial

[21] See Section 4.4.2 for data descriptive statistic of respondents' age across the five countries

funding provided for PhD research, the use of fieldwork for data collection was infeasible. Furthermore, no single data collection is perfect; each method tends to be subject to its own limitations. Taking into account all the constraints, the online survey is the most sufficient and economically feasible method to be employed.

3.3.3 Final data sample

The final sample for the study contains 1,889 observations with 413 respondents from the US, 387 respondents from the UK, 328 respondents from Vietnam, 361 respondents from China, and 382 respondents from Singapore. More detailed descriptive statistics of the whole sample will be provided in the empirical chapters.

After the data was obtained, it was carefully cleaned for the statistical analysis. The subsequent sections will provide information about the statistical analysis methods being employed in this study.

3.4 Main statistical analysis

3.4.1 The model-based mosaic multivariate approach

As previously mentioned in Section 2.2.3, the current study relies on the study of Weber and Hsee (1998) in three aspects. *Firstly,* the definitions of FRT, RP and RAtt (see Section 2.2). *Secondly,* this study also employs the risk-return modern portfolio theory as the main theoretical framework (see Section 2.3). *Lastly,* the same experimental FRT task (subject to a number of adjustments for improvement, Section 3.2.3), and how the quantitative measures of the three constructs are computed (see Section 2.4). With regards to statistical analysis, this study will also employ their main statistical approach, namely, the mosaic bivariate approach (ANOVA and Bonferonni adjusted t-test). However, the method is only used as the baseline, not as the main test. By conducting the same analytical tests, the general finding, such that RAtt is similar across individuals and hence differences in individual FRT are mainly caused by differences in RP, can be compared with that of Weber and Hsee (1998). If the same general finding is obtained, it can be inferred that the data obtained for this study is comparable to Weber and Hsee's data. Note that this baseline test will be conducted in the first two empirical studies (Chapters 4 and 5). After the quality of this study's data is verified in these two empirical studies, the baseline method will be dropped in the third empirical studies (Chapter 6).Nevertheless, there are a numbers of limitations with the use of bivariate analysis.

Firstly, as bivariate analysis can only identify linear relationship between two variables, whilst their non-linear and causal relationship are ignored, the complexity of reality cannot be captured.

Secondly, subjective judgements are involved when deciding the number of groups that an independent variable should be divided into, and how the division should be conducted. Owing to such subjective judgement, the results can be easily manipulated by sub-grouping an independent variable in different ways. As an illustration, for the age variable, the whole sample can be divided into either four age groups with a range of 10 years old per group, or nine age groups with a range of 5 years old per group. Different number of age groups might provide different pictures on the relationship between age and FRT.

Lastly, the analysis fails to take into account other potential factors. This can lead to misleading conclusions owing to overlapping characteristics of two variables (Maylor and Blackmon, 2005). Basically, the obtained significant relationship between an explanatory factor and a dependent variable can be spurious when the genuine factor, which has one or more overlapping characteristics (highly correlated) with the explanatory factor, has been omitted or failed to be controlled for in the bivariate analysis. For example, researchers may think that they have found a relationship between culture and individual FRT when the relationship is actually caused by other variables, such as, the country variable. Possibly, China and the US have different cultural values as well as their macroeconomic conditions, languages, political system and geographical locations, which are all captured in the country variable (Weber and Hsee, 1999). Hence, if only the culture variable is tested exclusively, the conclusions may be deceptive.

Due to these limitations, although the mosaic bivariate analysis is still conducted as the baseline, the study employs the model-based mosaic multivariate analysis as the main analytical method. Weber and Hsee (1999) critically reviewed the methods of conducting a multistudy project that aimed at examining the cross-national differences in FRT between the collectivism and individualism. They developed two main recommendations for future cross-cultural research, namely, model-based approach and mosaics. In their study, they did employ the *mosaic* approach but not the *model-based* approach. The *model-based approach* recommendation suggests that all cross-cultural studies should be model-based to determine the causal effects, as well as moderating and mediating effects, of hypothesised variables on attitudes, beliefs, and behaviour. As a result, the contribution is not simply an investigation of cross-cultural differences in target behaviour, but also a prediction of the behaviour. Accordingly, the study employs the model-based mosaic analysis for all three empirical research questions. Such model-guided mosaic building follows the recommendation of Weber and Hsee (1999) such that the method "provides for cumulative results from multiple studies designed to investigate different aspects and determinants of the behaviour of interest" (pp.617).

3.4.2 Statistical problems and remedies

With regards to the model-based approach, OLS models are conducted using the mean-centering robust standard error method to tackle the issues of nonessential multicollinearity, heteroscedasticity and non-normality of error terms.

3.4.2.1 Nonessential ill-conditioning multicollinearity

For all employed OLS estimating models of this study, that are based on the general model (eq.3.1, Section 3.4.3), the presence of interactive and polynomial variables is likely to create concern for the presence of multicollinearity which will be detected by the variance of inflation factors (VIFs) for each model. According to Gujarati (2003), multicollinearity would be a concern if the VIF is greater than 10. Nevertheless, if the issue arises merely due to high correlations between the product terms and their component variables (main effects) rather than high correlations between independent variables, the collinearity problem is referred to as non-essential multicollinearity (Dalal and Zickar, 2012). Many researchers alleviate this nonessential ill-conditioning result by mean-centering both the predictor and moderator variables (Aiken and West, 1991; Jaccard, Turrisi, and Wan, 1990). According to Dalal and Zickar (2012), Afshartous and Preston (2011), and Paccagnella (2006), further to effectively removing multicollinearity, mean-centering improves the precision of estimates and the interpretability of results, stabilises regression models, all without affecting the regression model fit and the reliability of multiplicative terms. Furthermore, following recommendation provided by Aguinis et al. (2017), the mean-centering method is essential as the current analysis also focuses on the main effects of predictors, rather than just on the non-linear or moderation effects.

3.4.2.2 Heteroskedasticity and non-normality of error terms

A robust standard error is used as most models are subject to concerns of heteroscedasticity as diagnosed by White Test and Breusch-Pagan Test, and/or the issue of normality of error terms. A Shapiro-Wilk normality test in error terms states that the hypothesis of normality of error terms is rejected at 99% confidence level for all models used in this study.

3.4.2.3 Endogeneity

Endogeneity was investigated using the two-stage least square (2SLS) estimator for three variables which are suspected to be endogenous independent variables due to simultaneity. These are wealth, income, and self-reported risk aversion (SRA). Specifically, it is possible that the respondent's wealth, income, and SRA are jointly determined with their FRT, RP, and RAtt. To perform the two-stage least square test for each suspected variable, five instrumental

variables are employed which are exogenous and correlated with the tested variables. Table 3.3 provides the coding of the four instrumental variables. In general, no endogeneity is captured for any of the three variables. As a result, OLS remains an appropriate method for this study.

Table 3.3: Instrumental variables for 2SLS test for endogeneity

MEASURE	DESCRIPTION	TYPE/SCALE
SavHorizon P.IX (Q1)	A measure of respondent's planning horizon for saving, in years.	Ratio (19-65)
Fsupport P.IX (Q2)	A measure of whether respondents fully or partially or not at all support their family financially.	Ordinal (1-3)
Retsupport P.IX (Q3)	A measure of the extent to which respondents expect their children to support them financially in retirement.	Ordinal (1-10)
Investhorizon P.IX (Q4)	A measure of how long respondents have invested in stocks, in months.	Ratio (0-480)
Inheritimp P.IX (Q5)	How important to leave an inheritance.	Ordinal (1-10)

3.4.3 General estimated models

Adopt the approach from Weber and Hsee's (1998) for the mosaic building, this study treats the effects of the three main predisposing factors (age, culture and language), which will be consistently referred to as 'explanatory' factors, on individual FRT, RP and RAtt as three mosaics. The whole picture is drawn by combining these three mosaics together. A general regression model, which is used across these mosaics, can be written as follows:

$$FRT/RP/RAtt_i = \alpha_i + \beta_{G1}*Group1 + \beta_{G2}*Group2 + \beta_{G3}*Group3 + \beta_{G4}*Group4 + \beta_{G5}*Group5 + \beta_{G6}*Group6 + \varepsilon_i, \quad (eq.3.4)$$

All the estimating models (equation 3.4) are conducted using the mean-centering robust standard error method to tackle statistical problems of nonessential multicollinearity, heteroscedasticity and non-normality of error terms (details in Section 3.4.2).

For the three empirical studies that make up this thesis, there are 23 independent factors being employed. These factors are classified into six groups: explanatory factors (age, culture and language), demographic factors (group 2), socioeconomic factors (group 3), attitudinal factors

(group 4), geographic factors (group 5) and cushion hypothesis factors (group 6[22]). Explanations for all these variables are presented in Appendix 4 that briefly describes their measures and coding. The specific models for each empirical study, which are slightly modified from the general model in terms of their contents of independent factors, will be stated and explained in the methodology section of its empirical chapter.

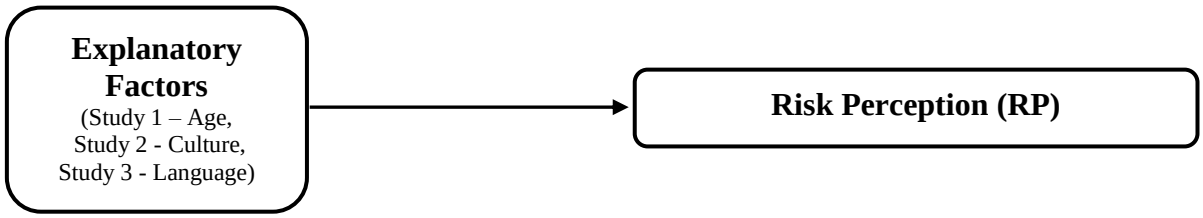
The choice of all controlling variables being included in this study is mainly built on the extant literature. Particularly, demographics as well as socioeconomic and attitudinal factors have long been important heuristics in predicting investor's FRT (Roszkowski et al., 1993; Grable, 2000; Hallahan et al., 2003). Consequently, in addition to the explanatory factors, this study controls for a number of demographic, socio-economic and attitudinal factors (Variables group 2 to group 4) that are suggested by researchers and practitioners to play significant roles in identifying FRT of an individual. The Appendix 5 provides a list of studies that have examined for those variables as the determinants of FRT.

Furthermore, to effectively distinguish the cultural effect (at individual level[23]) from the nationality/country effects, geographical variables will be controlled for. No questionnaire is required to capture the respondent's country as the surveys are distributed separately in each country. The last controlling variable group is named "the cushion hypothesis factors". These factors are included based on the cushion hypothesis advanced by Weber and Hsee (1998), which is suggested to mediate the cultural effects on FRT through RP. More explanation on the cushion hypothesis is presented in the second empirical study (Chapter 5).

The subsequent three sub-sections will provide more details regarding the interpretation of each mosaic. Notes that based on the contribution of each empirical study, the orders of these mosaics can be modified accordingly.

3.4.3.1 Mosaic 1: Determinants of individual risk perception (RP)

This mosaic determines whether the explanatory factors influence individuals' RP.



[22] More explanation in empirical Chapter 5

[23] The cultural effect in this study is measured at individual level instead of at national level (country is used as a proxy of culture), i.e. individuals from the same country can exhibit different cultural values. More explanation and discussion will be presented in empirical Chapter 5.

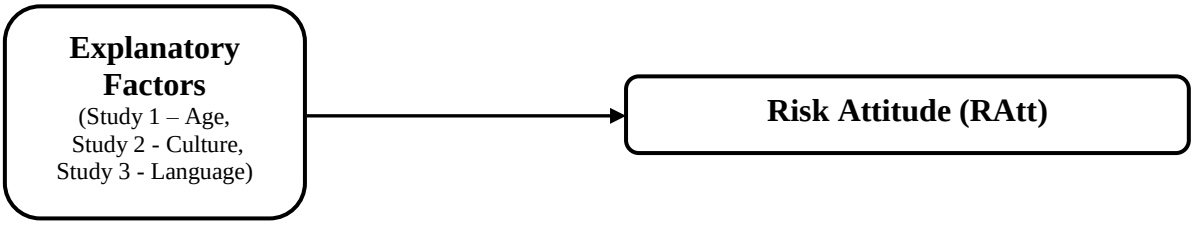
The general estimating regression model for this mosaic can be written as follows:

$$RP_i = \alpha_i + \beta_{G1}*Group1 + \beta_{G2}*Group2 + \beta_{G3}*Group3 + \beta_{G4}*Group4 + \beta_{G5}*Group5 + \beta_{G6}*Group6 + \varepsilon_i,$$

The result obtains for this mosaic identifies whether the assumption of constant RP across individuals in the TRAM is violated. If differences in individual RP are found, the use of objective RP (Variance) is deemed to be inappropriate, and thus, the objective RAtt (b_{VAR}) will not be pursued further. Therefore, only subjective RAtt (b_R) is considered for the next mosaic.

3.4.3.2 Mosaic 2: Determinants of individual risk attitude (RAtt)

This mosaic of the picture determines whether the explanatory factors influence individual's RAtt.



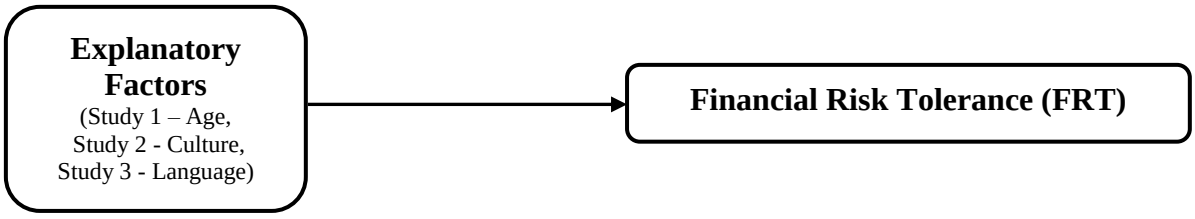
As there are two measures of individual RAtt, two estimated models are put in place.

The general model for this mosaic can be written as follows:

$$(b_{VAR}/b_R)_i = \alpha_i + \beta_{G1}*Group1 + \beta_{G2}*Group2 + \beta_{G3}*Group3 + \beta_{G4}*Group4 + \beta_{G5}*Group5 + \beta_{G6}*Group6 + \varepsilon_i,$$

3.4.3.3 Mosaic 3: Determinants of individual financial risk tolerance (FRT)

This mosaic is the key part of the picture and the main target of the study. It investigates whether the explanatory factors influence individual FRT.



The general model for this mosaic can be written as follows:

$$Ln(WTP)_i = \alpha_i + \beta_{G1}*Group1 + \beta_{G2}*Group2 + \beta_{G3}*Group3 + \beta_{G4}*Group4 + \beta_{G5}*Group5 + \beta_{G6}*Group6 + \varepsilon_i,$$

To account for the highly skewed distribution of WTP (Section 4.4.1), the natural log of WTP is used as the dependent variable.

With regards to the general interpretation of the results, if the results are statistically significant for all three mosaics, the whole picture depicts that the effects of the explanatory factors (age, culture, and language) influence individuals' FRT through RP and RAtt. On the other hand, significance of mosaic 3 (effects of explanatory factors on FRT) and insignificance of the first two mosaics (effects of explanatory factors on RP and RAtt, respectively) indicates that there are influences of the explanatory factors on FRT, but this influence does not go through the channels of RP and RAtt. Alternatively, if the results are statistically significant for either, or both, of the first two mosaics but not for the last one, it can be concluded that the explanatory factors influence individual RP and/or RAtt, but the effect is not sufficiently strong to change one's FRT.

Before moving onto the three empirical chapters, it is worthwhile noting that the bivariate and multivariate tests are employed in all three empirical studies. Therefore, they are explained in this general chapter to avoid repetition later on. However, for the second empirical study, the cross-cultural research, two additional statistical tests will be implemented. These are the Baron and Kenny four-step mediation model and the structural equation modelling (SEM). The reasons of their uses as well as the specific testing models will be explained in detailed in the relevant chapter (Chapter 5).

Chapter Four: Empirical Study 1

Financial Risk Tolerance Across Age: An Examination of the Mediating role of Risk Perception and Risk Attitude

4.1 Introduction

This chapter aims at presenting the first empirical study. Its principal objective is to investigate the underlying mechanisms (specifically, risk perception and risk attitude), through which age influences financial risk tolerance (FRT). During the current global aging and increasing longevity era, understanding of age-related responses to risky financial investment is valuable. Since FRT is an important determinant of a wide range of financial decisions (Snelbecker et al., 1990), the influence of age on FRT has captured an extensive attention from researchers and practitioners. However, the finding of age-FRT relationship can be used solely for prediction, whilst leaving no room for alteration, of an individual's risk appetite. Therefore, recently, academy does not focus *exclusively* on factors that influence one's FRT, but extends their interests to also the underlying mechanism of FRT formation. The two most researched mechanisms are perhaps the risk perception (RP) and risk attitude (RAtt). In addition to an implication of predictability, understanding of the underlying process possesses an intervention property that allows adjustments of one's FRT level through altering RP and/or RAtt. Thus far, extant studies examined the mediating effects of RP and RAtt on influences of different factors (such as culture, gender, career, situational domains, outcome domains and time period) on FRT. Nevertheless, to the best of my knowledge, no research has examined whether these two channels mediate the differences in FRT across age, despite the important of age influence on FRT within the academy and practice. Consequently, the current study aims at addressing this literature gap. By identifying the underlying channels of difference in FRT across age, the findings are not only used for predictive purposes, but also for interventions in individual's RP and/or RAtt to alter one's contemporary risk tolerance level based on their age.

The chapter starts with reviewing the literature on which the study is developed. Subsequently, detailed methodology, followed by the data description, empirical results, and robustness test, will be presented and discussed.

4.2 Literature review

As the main objective of this study is to examine whether RP and RAtt mediate the effect of age on FRT, it is essential to *firstly* investigate the existence of such age influence. Therefore, the literature review section will start with the discussion of preceding research on the relationship between age and FRT.

4.2.1 Effect of age on FRT

Age has been found to be one of the most prominent demographic determinants of FRT (Hallahan et al., 2003). The age-risk relationship has been examined by a myriad of published research. However, the findings remain inconclusive as demonstrated by the discussion of the literature to follow.

Dohmen et al. (2009) employed the German Socio-Economic Panel (GSOEP) dataset with more than 20,000 respondents, and a real-stake lottery field experiment conducted on 450 German participants. In both approaches, the key findings of the study are strongly aligned with a significant decrease in FRT throughout one's life-cycle in general as well as in all five tested domains: car driving, finance, sports and leisure, health, and career.

The negative age-risk relationship found by Dohmen et al. (2009) is consistent with findings obtained in many other studies. Weber (2014) employed the same dataset used in Dohmen et al.'s (2009) paper but used different statistical analysis, that is, the generalized ordered logit model. Regarding the age effect, she found that "elderly individuals are more likely to be very risk averse and less likely to be more risk tolerant", thus "risk propensity decreases with age" (Weber, 2014, pg. 146).

The research of Jianakoplos and Bernasek (2006) used three consecutive panels of the Federal Reserve-sponsored Survey of Consumer Finances (SCF) to obtain 2 measures of risk taking: the self-assessment in willingness to take risk and the observed portfolio allocation of wealth. Similarly, they captured a downward sloping age-FRT relationship for both measures after controlling for cohort effect. Using the same source of data (the SCF), Morin and Suarez (1983), Schooley and Worden (1996), and Chaulk et al. (2003) reported a strong increasing level of relative risk aversion with respect to age. Especially, in a cross-sectional study using the 1998-2007 SCF datasets conducted by Yao et al. (2011), after decomposing the effect of chronological age from the period and generation effects, they reported a statistically significant negative age effect on individual FRT.

Palsson (1996) derived both the pre-tax and post-tax risk aversion coefficients (RRA) from the actual investment portfolios of more than 7,000 households in Sweden. He revealed that both

RRA coefficients are systematically independent of all investigated variables, such as, gender, wealth, and income, but except age. Specifically, risk aversion is found to increase with age or in other words, FRT decreases with age. Furthermore, in the study of Bellante and Green (2004), the elderly group (70 years old or above) was studied using the Asset and Health Dynamics Among the Oldest Old (AHEAD) dataset. It is found that relative risk aversion in portfolio allocation was found to increase with age.

The negative age-FRT relationship was also obtained by more recent studies. Tanaka et al. (2010) and Albert and Duffy (2012) employed the Holt-Laury paired lottery choice experiment (2002) to elicit financial risk aversion. They confirmed that the older participants was more risk averse than their younger counterparts.

Notably, the age-FRT topic not only attracts scholars from Financial and Economics, but also scholars from other disciplines. Harlow and Brown (1990) studied FRT from biological and psychological perspectives. They employed a psychometric measure of "sensation-seeking" personality traits with measures of enzyme monoamine oxidase. Based on these psychological personality traits and neurochemical activity, their findings support the conventional wisdom of the reduction in FRT with age due to a higher level of the enzyme monoamine oxidase and a lower degree of sensation-seeking.

Despite the accumulation of evidence for the uniformly linear decrease in individual FRT with respect to age, inconsistent results were obtained by other researchers. Two studies conducted by Hallahan et al. (2003 and 2004) revealed a non-linear pattern with respect to changes in individual FRT across the life course though the relationship remains significantly negative. Basically, as people age, their willingness to take financial risk decreases at a decreasing rate.

The nonlinearity of age-FRT relationship was confirmed by other studies, such as, Riley and Chow (1992), Yoo (1994), Bajtelsmit and Vanderhei (1997), and Halek and Eisenhauer (2001). However, these three studies reported contradictory results with those obtained by Hallahan et al. (2003 and 2004) in terms of the sign of the relationship. A common feature of these studies is that the FRT is derived from one's actual asset allocation decisions, rather than being psychometrically derived as in the studies of Hallahan et al. (2003 and 2004). Based on the analysis of data from the longitudinal Survey of Income and Program Participation, Riley and Chow (1992) found that relative risk tolerance rose with age, and subsequently decreased after the retirement age of 65. The same quadratic movement in FRT across the life-cycle were found by Yoo (1994) using the 1962 Survey of the Financial Characteristics of Consumers, and the 1983 and 1986 SCF. The obtained association between age and portfolio allocation indicated a

decreasing risk aversion throughout individuals' working life, following by an increase in risk aversion after retirement age. Similarly, Bajelsmit and Vanderhei (1997) suggested that the level of FRT, which is derived from investor's fixed-income holding, initially increased with age and subsequently dropped at later stage. Additionally, Halek and Eisenhauer (2001) found that as one gets one-year older, her risk aversion falls by 4.72-5.1%. Nevertheless, when individuals reach the age of 65 or above, their risk aversion significantly surged by about 95-114%.

In a work conducted by Faff et al. (2008), FRT was computed by two approaches: a psychometrical survey and an online lottery choice experiment. Across both measures, the study explored a non-linear convex linkage between age and FRT. Particularly, FRT initially reduces following by an increase at the latter stage.

In contrast to these above findings, a decline in risk aversion or increase in risk tolerance across age were also obtained. For example, based on data obtained from the SCFs 1983-1989, Wang and Hanna (1997) conclude that "relative risk aversion decreases as people age (i.e., the proportion of net wealth invested in risk assets increases as people age) when other variables are held constant" (Wang and Hanna, 1997, pg. 30).

Similar age-FRT pattern was uncovered in studies of Grable (2000) and Sulaiman (2012) such that older participants were more financial risk tolerant than their younger counterparts. In addition, based on the actual investment allocation of almost 1000 active financial investors obtained by means of a questionnaire survey, Cohn et al. (1975) reported that there is a plunge in relative risk aversion throughout investors' life span.

Summers et al. (2006) employed data from the International Institute of Banking and Financial Services' (IIBFS) Financial Well-being Survey (FWS) to conduct two studies. The first study examines how individuals think they should allocate their portfolio investment. The second study investigate their actual investment behaviour. The results interestingly revealed that individuals' intuition is different from their actual behaviour. Particularly, people felt that they would be less risk tolerant as they age, by invest more in a deposit account and less in equities. However, their investment allocation shown the opposite such that as age increases, people tend to invest more aggressively in equity, indicating an increase in FRT.

Thus far, the literature has shown that although the age-FRT association has been heavily researched, their relationship has yet been conclusively established. Particularly, a linear negative age-FRT relationship were assured by many studies, such as Dohmen et al. (2009),

Weber (2014), and see also[24]. Especially, Hallahan et al. (2003 and 2004) and Faff et al. (2008) also obtained a negative effect of age on FRT yet the effect is non-linear. The former found that FRT reduced with at an increasingly rate, whilst the latter revealed a convex relationship such that FRT reduced across age but subsequently increased at the later stage. Inconsistently, findings of other studies indicate a positive linear relationship between age and FRT. These include Wang and Hanna (1997), Grable (2000), Sulaiman (2012), and Cohn et al. (1975). Other studies, on the other hand, reported a concave age-FRT relationship, such as Riley and Chow (1992), Yoo (1994), Bajelsmit and Vanderhei (1997), and Halek and Eisenhauer (2001). Regarding these inconsistent findings of age effect on FRT, prior to the examination of whether age influences FRT through RP and/or RAtt, it is important to clarify the existence of the age effect on FRT. For this reason, the following hypothesis will be tested:

H_1: There is a statistically significant difference in individual FRT across age

Subsequent to the examination of difference in FRT across age, the interest moves toward the main concern of this study. That is, whether age influences FRT through RP and RAtt. As mentioned, a handful of preceding research has investigated the mediating roles of RP and RAtt in the influences of different determinants of FRT. These include culture, gender, situation domain, outcome domain, and time period. They consistently found that differences in FRT across these factors are mainly associated with differences in RP, rather than with differences in RAtt. The subsequent section will discuss the literature in more detailed.

4.2.2 Mediating roles of risk perception (RP) and risk attitude (RAtt)

Many scholars reported the variation of RP as the primary cause of the variation in FRT. Due to such obtained differences in RP, these studies supports the subjective RP rather than objective RP. Nosíc and Weber (2010) observed investors' stock investment decisions in hypothetical scenarios to identify whether objective RP (variance or standard deviation), or subjective RP is a better determinant of risk-taking behaviours. The study concluded that investor's risk-taking behaviour in the stock investment domain could be better explained by subjective RP rather than objective RP. However, only subjective RP varies causing FRT to change, whilst "subjective financial risk attitude is a stable predictor of risk-taking behavior" (pp.295).

The same pattern of findings pertained to differences in domain-specific risk taking behaviours. Weber et al. (2002) conducted studies assessing individual's risk taking (FRT), risk perception

[24] See also: Jianakoplos and Bernasek (2006), Morin and Suarez (1983), Schooley and Worden (1996), Chaulk et al. (2003), Yao et al. (2011), Palsson (1996), Bellante and Green (2004), Tanaka et al. (2010), Albert and Duffy (2012), Harlow and Brown (1990).

(subjective RP), and perceived-risk attitude (subjective RAtt) in six content domains using questionnaires on undergraduate students at The Ohio State University. They reported that the content-specificity of individuals' degree of risk taking are primarily associated with differences in the risk perception, rather than with differences in perceived-risk attitude (subjective RAtt).

Blais and Weber (2006) revised the Domain-Specific Risk-Taking (DOSPERT) Scale advanced by Weber et al. (2002) on a broader range of adult populations in terms of ages, cultures, and educational levels, along with more sophisticated statistical analysis. Based on data obtained from 172 English-speaking and 187 French-speaking respondents, the study revealed a significant negative association between FRT and RP across the five domains of investigation, and inferred the attitude towards (perceived) risk as a relatively constant variable.

Johnson et al. (2004) also employed the English version of DOSPERT Scale on more than 500 Germany students in the Free University of Berlin with the aim of obtaining a valid German DOSPERT scale. Based on the scale, they obtained analogous findings such that differences in RP across domains could "almost completely" (pp.161) explain differences in risk-taking. However, subjective RAtt rather shown a stable nature across those domains thus hardly could explain for the differences in FRT.

Regarding outcome domains, Weber and Milliman (1997) found that differences in risky choice behaviour are associated with differences in RP, but not in RAtt. Specifically, using experiments in commuting train and in stock investment choices, they found that choices of participants is significantly different between the gain and loss domains. However, such differences are found to be systematically associated with differences in risk perception, whilst participants' risk preferences toward perceived risk (i.e. subjective RAtt) are considerably consistent across both domains.

Similar findings were reported by Mellers et al. (1997). The study instructed participants to make choices between pairs of risky gambles, they found the 'risk-averse' behaviour in the gain domain, and the 'risk-seeking' behaviour in the loss domain. By noticeably distinguishing the economic risk attitude (objective RAtt) from the perceived-risk attitude (subjective RAtt), a stable pattern of perceived-risk aversion[25] was reported in both gain and loss domains. Consequently, differences in willingness to take risk (FRT) between the gain and loss domains

[25] Perceived-risk aversion = Negative subjective RAtt. Specifically, if individuals choose a higher-variance option (objective RAtt is positive) because they perceive that option as less risky, it indicates that their subjective RAtt is negative. In other words, individuals are actually risk-averse after their lower subjective RP is taken into account.

are mainly due to different levels of riskiness being perceived (subjective RP) for gain and loss situations.

Individual's RP in financial activities was also found to vary substantially across cultures. Bontembo et al. (1997) observed choices in a set of monetary lotteries of students from two Western countries (Netherland and America) and two Chinese cultural countries (Taiwan and Hong Kong), together with a group of fifty Taiwanese security analysts. The results indicated cross-cultural differences, but not occupational differences, in the individual perception of financial risks, which caused cross-cultural differences in risky choice behaviour. Furthermore, using the conjoint expected risk (CER) model developed by Luce and Weber (1986), the findings suggested that the magnitude of potential losses was more influential to the risk perception of respondents from Hong Kong and Taiwan, whilst the probability of losses had larger effects on the risk evaluation of the two Western samples.

Using the DOSPERT Scale advanced by Weber et al. (2002), Cheung et al. (2012) compared the RP and RAtt of respondents from Hong Kong and mainland China. Supporting the view that RP is a better predictor of risk-taking behaviour, they reported that respondents from Hong Kong were more risk tolerant, as they perceived the "riskiness" associated with the choice options as relatively less than did their mainland China counterparts in the social, recreational, health/safety, and financial context domains.

In a cross-cultural study, Weber and Hsee (1998) reported the cross-cultural difference in FRT which is associated mainly with cross-cultural difference in RP rather than with cross-cultural difference in RAtt. In the study, individual FRT was measured using the willingness to pay for risky financial options of participants from the United States, Poland, Germany, and China. The elicited cross-cultural variations in FRT was found to be the result of the subjective beliefs in the riskiness (subjective RP) of the investment options, whilst the perceived-risk attitudes (subjective RAtt) revealed a far greater consistency. More information about their study was discussed in Section 2.2.3.

Weber et al. (2012) observed a fluctuation in investors' risk taking from time to time based on the survey of Barclays online brokerage personal investors for the period from September 2008 to June 2009. Their study focused on determining whether the change was the result of change in risk expectation and/or risk attitude. They specified the reason to lie mainly in variations in the investors' subjective return and risk expectations over survey period, rather than in their risk attitudes.

Consistently, Klos et al. (2005) investigated the effect of time horizon on investment behaviour by employing a gambling experiment on business graduate students. They found that as the number of repeated plays increased, the participants tend to perceive the lotteries as less risky. As a result, such lower RP leads them to provide higher certainty equivalents for the gambles. In other words, RP significantly predicts and negatively influences one's FRT.

Another evidence from Hoffmann et al. (2013) wherein investors' investment behaviours in stock market were recorded during the financial crisis 2008-2009, together with their FRT, RP, and stock return perception. Using the monthly survey data from 1,510 investors in the Netherlands between April 2008 and March 2009, the findings indicated that during the crisis, investors' FRT reduced which was driven by an increase in their RP. The substantial variations in stock trading over the investigated period was accounted for by variations in investors' risk perception. Interestingly, in contrast to the conventional views about investors' behaviour, although the magnitude of risks they perceive increased during the crisis, along with a decrease in their reported FRT, the investors did not cease their trading activities or de-risk the investment portfolios. Instead, they tend to take advantage of the depressed stock prices during the period.

In another piece of research implemented by Olsen and Cox (2001), they conducted a questionnaire survey on roughly 500 professional men and women investment managers, including Chartered Financial Analysts (CFA) and Certified Financial Planners (CFP). A gender difference in risk-taking behaviour was found to be the result of gender difference in the perceptions of investments' riskiness (subjective RP). In particular, professional women investors take on less financial risk as they tend to weight the potential downside of the activities more heavily than do their male counterparts.

Cooper et al. (1988) conducted an analysis on 2,994 entrepreneurs to measure their perceptions in probability of success. They found that entrepreneurs exhibit greater willingness to take risk than other managers and the reason for that lies mainly in an excessively optimistic perception of the risks contained in decisions they make.

Arrow (1974) argued that gamblers tend to have *subjective* judgement on the risk of a bet, which is lower than the *objective* judgement on the risk of the same bet. The expected utility theory has not been able to fully explain the simultaneous behaviours gambling (implied a convex utility function) and insurance (implied a concave utility function). Hence, this finding of Arrow (1974) could provide a potential solution to the puzzle such that gamblers do exhibit risk-averse

utility functions, they engage in gambling activities owing to their underestimation of the risk embedded in the bet.

All the above-mentioned studies have shown a substantial interest in this topic. They consistently found evidences supporting the variability in FRT across different factors. These include gender (Olsen and Cox, 2001); culture (Bontempo et al., 1997; Luce and Weber, 1986; see also[26]); career (Cooper et al., 1988); situational domains (Nosic and Weber, 2010; Weber et al., 2002; see also[27]); outcome domains (Weber and Milliman, 1997; Mellers et al., 1997); and time (Weber et al., 2012; Hoffmann et al., 2013). Primarily, they confirmed that the differences in FRT across these factors are associated with differences in RP, whilst RAtt is a relatively stable construct. According to these findings, it is expected that if age is found to influence FRT, the influence is mediated by RP but not RAtt. As a result, the following hypotheses will be tested:

H_2: There is a statistically significant difference in individual RP across age

H_3: There is a statistically significant difference in individual RAtt across age

4.3 Methodology

4.3.1 Mosaic Bivariate analysis: ANOVA and Bonferroni t-test

As defined by Iversen and Norpoth (2002), an analysis of variance (ANOVA) is used to compares the average values of two or more independent groups for one dependent variables. Applied on this study, ANOVA is used to compares the means of FRT (WTP), RP and RAtt of different age groups. Therefore, the age variable is divided into four age groups forming 4 binary variables as follows:

Age_1: Respondent's age ranges from 18 to 29 years old.

Age_2: Respondent's age ranges from 30 to 39 years old.

Age_3: Respondent's age ranges from 40 to 49 years old.

Age_4: Respondent's age ranges from 50 to 65 years old.

[26] Weber and Hsee, 1998; Cheung et al., 2012
[27] Blais and Weber, 2006; Johnson et al., 2004; Arrow, 1974

The three hypotheses of this empirical study (H_1 – H_3) will be tested using ANOVA and Bonferroni t-test[28].

H_1 [Financial risk tolerance]: $\overline{WTP}_{\text{Age1}} = \overline{WTP}_{\text{Age2}} = \overline{WTP}_{\text{Age3}} = \overline{WTP}_{\text{Age4}}$;

H_2 [Risk perception]: $\overline{RP}_{\text{Age1}} = \overline{RP}_{\text{Age2}} = \overline{RP}_{\text{Age3}} = \overline{RP}_{\text{Age4}}$;

H_3 [Risk attitude]:

(1) [Objective RAtt]: $\overline{b_{VAR}}_{\text{Age1}} = \overline{b_{VAR}}_{\text{Age2}} = \overline{b_{VAR}}_{\text{Age3}} = \overline{b_{VAR}}_{\text{Age4}}$;

(2) [Subjective RAtt]: $\overline{b_R}_{\text{Age1}} = \overline{b_R}_{\text{Age2}} = \overline{b_R}_{\text{Age3}} = \overline{b_R}_{\text{Age4}}$;

Despite the limitations of bivariate analysis (Section 3.4.1), the analysis is the first test to be conducted as the baseline. The main purpose is to compare the *general findings*[29] obtained with that of Weber and Hsee's (1998) study. Particularly, since the study of Weber and Hsee (1998) is the key *cross-cultural* study that examined the mediating roles of RP and RAtt, the current study replicates their study in many aspects. One of them is the mosaic bivariate analysis. As explained in the literature review (Section 4.2.2), all studies that examined the mediating roles of RP and RAtt in the influences of different factors on FRT, including the study of Weber and Hsee (1998), obtained the same general findings such that RP is a variable construct that explains the variability in FRT, whilst RAtt is found to be relatively stable. As a result, by employing the same statistical analysis, if the same general finding is obtained, it can be inferred that the data of this study is comparable with that of Weber and Hsee (1998).

Following the baseline analysis, the study investigates its main interest using the model-based mosaic multivariate analysis as the main statistical approach. Specific empirical models will be discussed in the subsequent section.

[28] Subsequent statistical tests are stated in null hypothesis
[29] General findings: Constant RAtt and Variable RP across individuals (Section 2.2.3)

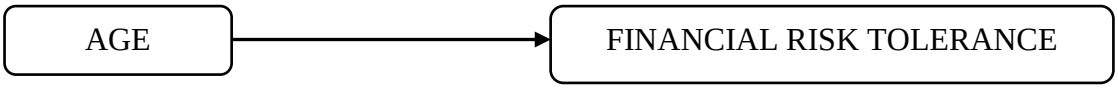
4.3.2 Multivariate analysis: Model-based mosaic analysis

The analysis composes three mosaic. Firstly, the study will re-examines the age effect on FRT (mosaic 1). If found to be present, the mediating roles of RP (mosaic 2) and RAtt (mosaic 3) will be tested.

Mosaic 1: Age influences FRT

To test the hypothesis *"H_1: There is a statistically significant difference in individual FRT across age"*, the regression specification is as follows:

$$Ln(WTP)_i = \alpha_i + \beta_{G1}*Group1 + \beta_{G2}*Group2 + \beta_{G3}*Group3 + \beta_{G4}*Group4 + \beta_{G5}*Group5 + \varepsilon_i,$$



Where the content for each independent variable group is listed in Table 4.1 (See Appendix 4 for more explanation of each variable component).

Table 4.1: Content of each independent variable group

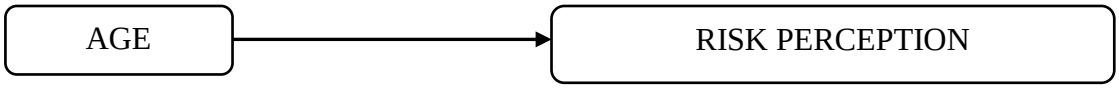
Independent variable	Classification content ***Explanation see Appendix 4***
Group 1: Main variables	Age; Age^2
Group 2: Demographic variables	Age*LnW; Single; Gender; Child; Highschl; Hhsize; LnW; LnInc
Group 3: Socioeconomic variables	Unemp; Selfemp; Homeown
Group 4: Attitudinal variables	Rbelief; IncStab; Health; SRA; Ecoexp; Interestexp
Group 5: Geographical	US; UK; VN; SG

Mosaic 2: Age influences RP

To test the hypothesis *"H_2: There is a statistically significant difference in individual RP across age"*, the regression specification is as follows:

$$RP_i = \alpha_i + \beta_{G1}*Group1 + \beta_{G2}*Group2 + \beta_{G3}*Group3 + \beta_{G4}*Group4 + \beta_{G5}*Group5 + \varepsilon_i,$$

If significant age effect on RP is found, it can be concluded that individuals with different age exhibit different level of risk perception. In other words, older individuals perceive the same investment option to have ***different*** riskiness comparing to their younger counterparts. As a result, it indicates that RP contributes to the effect of age on FRT.

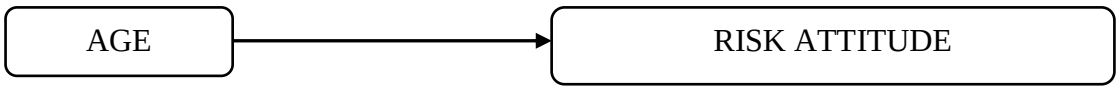


Mosaic 3: Age influences RAtt

To test the hypothesis *"H_3: There is a statistically significant difference in individual RAtt across age"*, the regression specification is as follows:

$$(b_{VAR}/b_R)_i = \alpha_i + \beta_{G1}*Group1 + \beta_{G2}*Group2 + \beta_{G3}*Group3 + \beta_{G4}*Group4 + \beta_{G5}*Group5 + \varepsilon_i,$$

If significant age effect on RAtt is found, it can be concluded that individuals with different age exhibit different attitudes toward financial risk. Therefore, age difference in their RAtt contributes to the age difference in FRT.



Furthermore, the selection of the most appropriate measure of RAtt will be evaluated based on the result of mosaic 2. Particularly, as discussed in Section 3.4.3.1, if RP is found to vary across individuals, objective RAtt (b_{VAR}) will not be pursued further.

4.4 Data description

The current section describes the data sample by presenting the descriptive statistics of all variables included in the study. These are the three main dependent variables and the five independent variable groups as discussed in Section 3.4.3 and Appendix 4. Based on a total sample size of 1,889 respondents, their central tendencies, dispersions and frequencies are calculated and graphically depicted where appropriate.

4.4.1 Main dependent variables: FRT, RP and RAtt

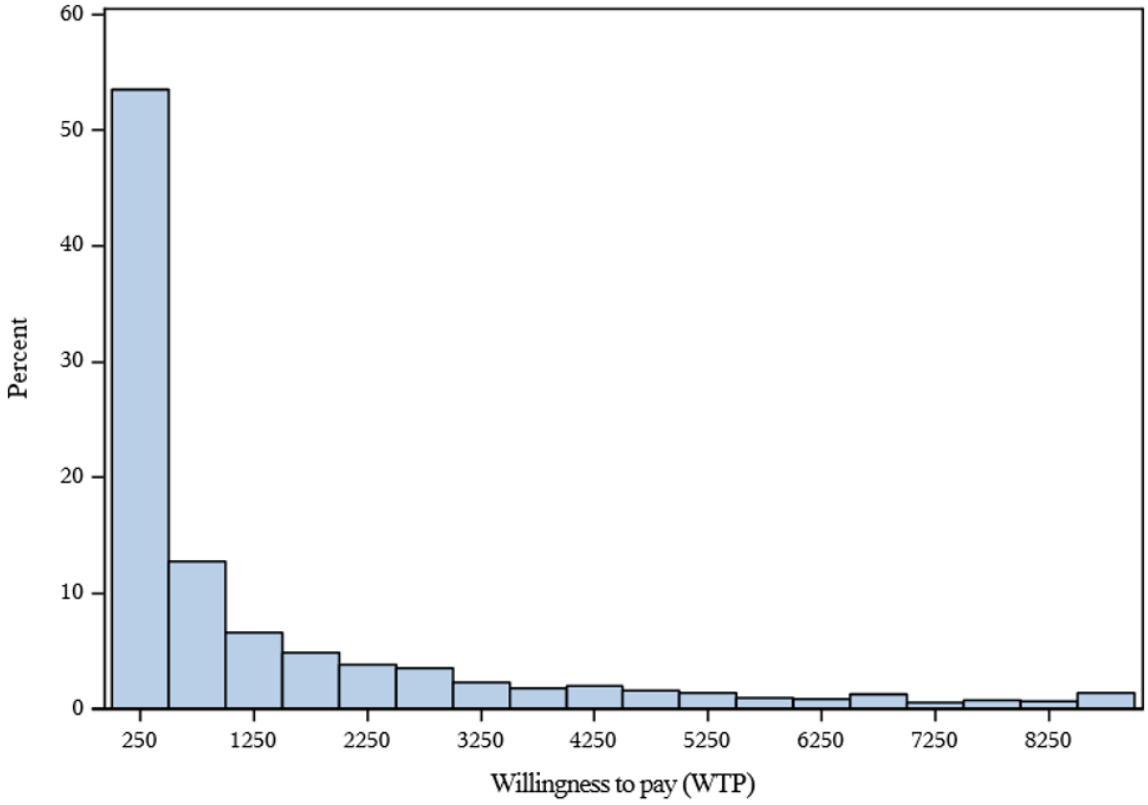
Table 4.2 presents the descriptive statistic of the main dependent variables of this study which measures individual FRT, RP and RAtt.

Table 4.2: Descriptive Statistics of Dependent Variables

Variable	Measure	Mean	Median	Std Dev	Min	Max	N
FRT	WTP	$1,308	$425.3	$1,991	$0	$8,954	1,889
Subjective RP	RP	54.182	53.333	19.583	0	100	
RAtt	b_{VAR}	0.00040	0	0.0015	-0.00482	0.00794	
	b_R	-16.793	-0.837	151.287	-2644.59	2492.08	

The average amount that the respondents are willing to pay for the investment options is around $1,308 whilst the median WTP is only $425.3. The much higher mean comparing to median implies a large proportion of respondents reported low WTP, which indicates a likely positive skew distribution of the variable. Figure 4.1 plotted the distribution of individual FRT, which evidently reveals the highly positive skewness of WTP. Specifically, more than 50% of respondents reported a mean WTP of around $0-$500 for the six investments, which significantly pulled down the value of median to roughly $425.

Figure 4.1: Distribution of individual FRT (mean WTP)



The distribution of individual subjective RP (RP) is potentially close to the normal distribution than the other dependent variables, both mean and median RP are around 50, which is the approximate mid-point of the RP range (1-100). For the measures of RAtt, the objective RAtt (b_{VAR}) implies the general risk-neutral characteristic of respondents as both its mean and median are close to zero. On the other hand, the subjective RAtt (b_R) is rather negatively skewed (Median > Mean) and on average individuals tend to be risk-averse. This is inherently possible and anticipated according to the notion of 'risk repugnant' mentioned by Yates and Stone (1992) such that risk is repellent to people, and for people to take on any risk, a premium should be offered.

4.4.2 Variable group 1: Explanatory variable (Age)

Table 4.3 presents the descriptive of age factor that determine individual FRT.

**Note: Explanation of the variable can be found in Appendix 4*

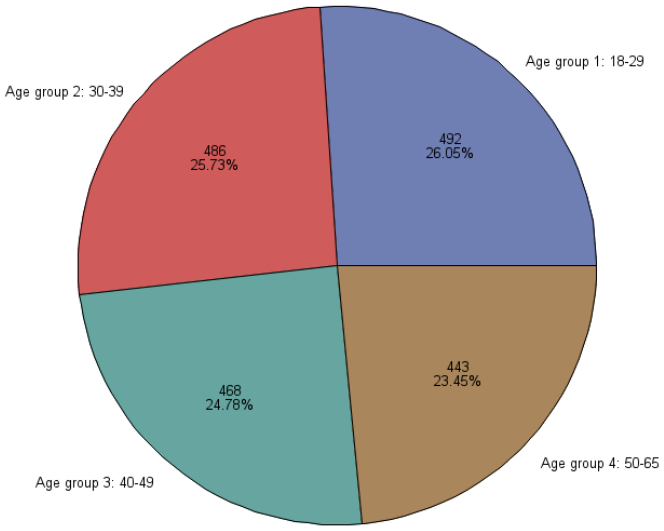
Table 4.3: Descriptive Statistics of Age (Group 1)

Variable	Measure	Mean	Median	Std Dev	Min	Max	N
Age	Age	39.596	38	11.883	19	65	1,889

Age across Countries	Sum of the UK	Sum of The US	Sum of Singapore	Sum of Vietnam	Sum of China
18-29	112	107	95	81	97
30-39	99	112	102	82	91
40-49	88	106	97	84	93
50-65	88	88	88	81	98
Grand Total	**387**	**413**	**382**	**328**	**379**

Age: The mean age of the sample is around 40 years old with the median age of 38 and standard deviation of 11.9. As discussed in Section 3.3.2, the study employs the stratified random sampling method based on age. Therefore, the whole sample is divided roughly equally among four age groups in the whole sample as well as in each country. The pie chart of the frequency distribution of respondent age is presented in Figure 4.2. Furthermore, due to the low internet literacy in Singapore and Vietnam for individuals that are 45 years old or above, the study exposed to the risk of missing data for this age group in these countries as the attempt to maintain a random sample was given a priority (Section 3.3.2). Despite such risk, according to Table 4.3, the sample has sufficiently included respondents who fall in this group.

Figure 4.2: Frequency Distribution of Age



4.4.3 Variable group 2: Demographic variables (Wealth, Income, Household size, Children, Gender, Marital Status, Education)

The descriptive statistic of demographic variables is presented in Table 4.4.

Table 4.4: Descriptive Statistics of Demographic Variables (Group 2)

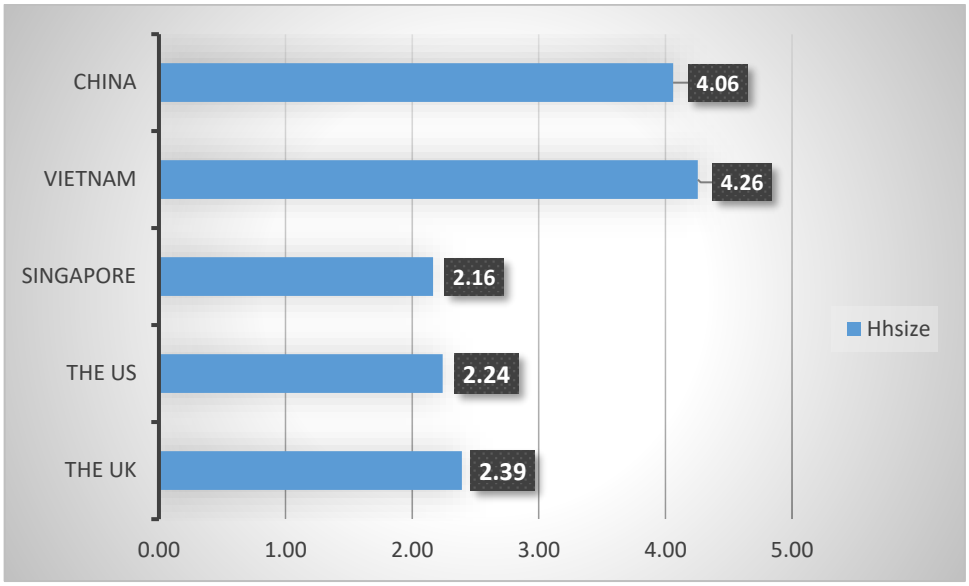
Variable	Measure	Mean	Median	Std Dev	Min	Max
Wealth	Wealth	$210,807	$69,723	$373,778	$0	$5,000,000
Income	Income	$32,972	$22,488	$38,847	0	$864,000
Household size	Hhsize	3.765	4	1.559	1	16
Dummy Variable					**Count**	**Percent**
Children	Child				1206	63.84
Marital Status	Single				597	31.60
Gender	Male				965	51.09
Education	Highschl				1528	80.89

Note: Explanation of the variables can be found in Appendix 4

Wealth and Income: The mean wealth and income of the whole sample is $210,463 and $32,972 with the median of $69,723 and $22,488, respectively. The smaller means comparing to medians indicate their positively skewed distributions. As these two variables are controlled for in the multivariate estimating models (Section 4.3.2), a natural logarithmic transformation is applied to tackle such skewness of the two variables. Furthermore, with this transformation, the model can assume a constant change in each dependent variables to be associated with a relative difference in one's level of wealth and income. Moreover, it also reduces the weight given to individuals with extreme levels of wealth and income.

Household size: The variable's distribution are skewed toward smaller amount of people living in a household. On average, individuals are living with 4 people besides themselves, whilst the range of the variable is from one to sixteen people. Figure 4.3 presents the mean household size of the respondents across the five countries. It can be seen that the respondents from China and Vietnam tend to live with more people than do respondents of the other countries. This pattern is anticipated as China and Vietnam are classified by Hofstede (2001) as collectivistic cultural countries, within which the formation of large group is common. Singapore, on the other hand, exhibits similar average household size with the US and UK. Based on the data obtained in this study, Singapore is found to be an individualistic country as so do the US and the UK (see Section 6.2.3).

Figure 4.3: Household Size across Countries



Gender, education, marital status and children: The gender variable contains roughly 51% of male and 49% of female. Such distribution is quite a representative pattern of gender, which should be obtained if the data is random. The sample comprises a large proportion (81%) of well-educated individuals who have attained their high school certificates. Furthermore, roughly 32% of respondents are single (not a widow, not separated or divorced) and 63.84% of the sample (1,206 respondents) haves at least one child. The descriptive of these two variables are reasonable as their sum is less than 100%.

4.4.4 Variable group 3: Socioeconomic variables (Self-employment, Unemployment, and Homeowner)

To capture the influence of the respondent's employment status on their FRT, two variables are used, which state whether the respondents are self-employed (self_emp) or unemployed (unemp). The simultaneous use of these two variables follows previous studies, such as, Yao et al. (2011), Halek and Eisenhauer (2001), and Palsson (1996). According to Table 4.5, the frequency distributions of these two socio-economic variables as well as the homeowner variable seem sensible. The proportion of respondents that fall in either the self-employed or unemployed categories is less than a fifth of the whole sample. With regards to homeowner variable, it has been revealed that 1,534 out of 1,889 respondents own at least one house either with or without mortgage. Such amount represents more than 80% of the sample.

Table 4.5: Descriptive Statistics of Socioeconomic Variables (Group 3)

Variable	Measure	Count	Percent	N
Self-employment	Self-emp	119	6.30	
Unemployment	Unemp	169	8.95	1,889
Homeowner	Homeown	1534	81.21	

Note: Explanation of the variables can be found in Appendix 4

4.4.5 Variable group 4: Attitudinal variables (Income Stability, Health, Self-reported risk aversion, Economics Expectation, Interest Expectation, and Religious Belief)

Table 4.6 provides the descriptive statistic of six attitudinal variables. The variable measuring the respondent's judgement on their income stability (IncStab) seems to be symmetric with a normal shape as its mean and median are approximately the same (4.998 versus 5) with a range from 1 to 10. With regards to the health status, the respondents show an optimistic view as they rated their health 7 on the scale of 10 on average. For the self-reported risk aversion (SRA) variable, its mean value is approximately 3 out of 5. This indicates that on average, individuals are risk neutral where they are willing to "take average financial risk expecting to earn average returns" (Appendix 1, P.VI_Q3). Lastly, the descriptive statistic of the respondent's expectations on the future economy and interest rate (Ecoexp and Interestexp) reveal that respondents on average are pessimistic about the future economic prospect. Particularly, they expect the economy to perform worse in the next 5 years ($mean_{ecoexp}$ = 2.6 out of 5) with an increase in interest rates over the coming year ($mean_{interestexp}$ = 2.5 out of 5).

Table 4.6: Descriptive Statistics of Attitudinal Variables (Group 4)

Variable	Measure	Mean	Median	Std Dev	Min	Max	N
Income Stability	IncStab	4.998	5	2.482	1	10	1,889
Health	Health	7.306	8	1.777	1	10	1,889
Self-reported risk aversion	SRA	3.011	3	1.255	1	5	1,889
Economic expectation	Ecoexp	2.632	2	1.063	1	5	1,889
Interest expectation	Interestexp	2.536	2	0.924	1	5	1,889
Dummy Variable					**Count**	**Percent**	**N**
Religious belief	Rbelief				797	42.19	1,889

Note: Explanation of the variables can be found in Appendix 4.

4.4.6 Variable group 5: Geographical variables

As there are five countries being investigated, respondents recruited in each country take up roughly 1/5 or 20% of the sample as presented in Table 4.7. The study has successfully achieved the target set prior to the data collection stage, that is, to obtain at least 300 respondents from each country (Section 3.3.2). To capture the country effect, the study employs four dummy variables (US, UK, VN, SG) which are denote 1 if respondents are recruited from the US, the UK, Vietnam and Singapore, respectively.

Table 4.7: Descriptive Statistics of Geographical Variables (Group 5)

Variable	Count	Percent	N
US	413	21.86	
UK	387	20.49	
VN	328	17.36	1,889
SG	382	20.22	
CN	379	20.06	

Note: Explanation of the variables can be found in Appendix 4

4.4.7 Correlation matrix of all independent variables

The Pearson correlation coefficients between each independent variable and the others are reported in Table 4.8, in which pairs of variable with significant correlation coefficient are marked bold. According to the guidelines of Nunnally and Bernstein (1994), most of significantly correlated variables are in the weak range ($|r| < 0.3$) except from four pairs of variable with absolute correlation coefficients are greater than 30%. These are correlations between age and single ($r_{age\_single} = -0.449$); age and child ($r_{age\_child} = 0.359$); single and child ($r_{single\_child} = -0.69$); and between wealth and income ($r_{wealth\_income} = 0.449$). The respondents' age is negatively related to their marital status, and positively related to whether they had a child. The two associations are plausible and anticipated. Specifically, as one gets older, one is more likely to have found a partner and to be in a family building stage; or filed a divorce; or gone through the loss of their partner. Therefore, they are less likely to be single and more likely to have at least one child. There is a strong negative relationship between the variables single and child. It is not a surprise to find a single person who have yet been in an official relationship to be less likely to have a child. Note that, a person reported herself as single which means she is not a widow, or has divorced or separated from her husband/partner. Lastly, a positive correlation between wealth and income is also predicted. Ones would expect that high earners are more likely to accumulate higher net wealth. Overall, although the four pairs of variables are moderately correlated, their absolute correlation coefficients fall below the acceptable limit of 80% for multicollinearity to be a concern (Kennedy, 2008). Notes that the multicollinearity issue will be further tested for each regression using the Variance of Inflation Factor (VIF), which will be presented in the multivariate analysis result section (Section 4.5.1).

Table 4.8: Pearson Pair-wise Correlation Matrix (N = 1889)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Age (1)	1	**-0.449**	0.020	**0.359**	**-0.165**	**-0.102**	**0.176**	0.037	**0.058**	**0.048**	0.007	**0.051**	**-0.085**	**-0.127**	**0.148**	**0.088**	**0.065**	0.008	-0.015	-0.006	-0.012	**-0.101**	**-0.087**
Single (2)		1	0.005	**-0.690**	-0.040	**-0.161**	**-0.161**	**-0.129**	**0.066**	-0.022	**-0.125**	**-0.069**	**0.090**	0.003	0.026	**0.059**	-0.017	**0.045**	**0.084**	**-0.104**	**0.091**	-0.040	0.022
Gender (3)			1	-0.013	**0.063**	-0.028	**0.096**	**0.173**	**-0.142**	0.027	0.036	0.002	-0.034	**0.077**	**-0.171**	**-0.056**	**-0.045**	0.033	-0.012	-0.010	-0.006	**-0.079**	0.036
Child (4)				1	0.010	**0.270**	**0.157**	**0.136**	**-0.058**	0.009	**0.095**	**0.099**	-0.036	-0.004	**-0.065**	**-0.088**	-0.012	**-0.050**	-0.044	**0.141**	**-0.120**	**0.064**	-0.024
Highschl (5)					1	0.015	**0.143**	**0.161**	**-0.206**	**-0.057**	**0.107**	-0.024	**-0.081**	**0.129**	**-0.191**	-0.044	-0.021	**-0.075**	-0.040	0.006	0.003	**0.065**	0.010
Hhsize (6)						1	-0.013	0.013	**-0.060**	0.032	**0.198**	**0.132**	**0.047**	**0.061**	**-0.105**	**-0.110**	**-0.098**	**-0.136**	**-0.210**	**0.307**	**0.178**	**0.084**	**0.048**
WealthN (7)							1	**0.449**	**-0.108**	-0.028	**0.180**	0.021	**-0.147**	**0.112**	**-0.137**	-0.043	0.012	0.011	0.013	**-0.085**	**-0.083**	**0.056**	-0.003
AnnualInc (8)								1	**-0.139**	**-0.052**	**0.130**	**0.142**	**-0.052**	**0.135**	**-0.230**	**-0.100**	**-0.120**	**0.250**	**0.056**	**-0.172**	**-0.066**	-0.025	0.032
Unemployment (9)									1	**-0.081**	**-0.191**	**0.066**	**0.109**	**-0.192**	**0.187**	**0.144**	0.009	**0.193**	0.039	**-0.095**	-0.010	**-0.075**	-0.044
Self_employed (10)										1	-0.037	-0.010	**0.073**	-0.014	0.031	0.028	0.022	-0.037	0.014	**0.123**	-0.044	-0.013	-0.026
HomeOwner (11)											1	**0.073**	**-0.052**	**0.139**	**-0.183**	**-0.129**	-0.004	**-0.152**	**-0.189**	**0.181**	**0.084**	**0.108**	0.026
Rbelief (12)												1	**0.099**	**0.071**	**-0.136**	**-0.068**	**-0.200**	**0.251**	**-0.139**	-0.004	**0.160**	**-0.072**	0.031
IncStability (13)													1	**-0.102**	-0.033	**0.083**	**-0.071**	0.039	0.019	-0.015	**0.107**	**-0.065**	**-0.062**
Health (14)														1	**-0.202**	**-0.253**	**-0.096**	-0.020	**-0.093**	**0.077**	-0.033	**0.127**	**0.057**
SRA (15)															1	**0.232**	**0.147**	**-0.056**	**0.091**	-0.001	-0.025	**-0.064**	-0.038
EcoExp (16)																1	**0.268**	**-0.052**	**0.081**	**-0.215**	**0.209**	**-0.111**	**-0.080**
InterestExp (17)																	1	**-0.125**	-0.016	**-0.169**	-0.043	0.023	0.009
US (18)																		1	**-0.269**	**-0.242**	**-0.266**	**-0.128**	-0.022
UK (19)																			1	**-0.233**	**-0.256**	**-0.097**	0.020
VN (20)																				1	**-0.231**	**0.194**	**0.053**
SG (21)																					1	**-0.134**	-0.030

Note: Bold figures denote the result is statistically significant at the 5% level or below.

4.5 Empirical results

4.5.1 Bivariate mosaic analysis (Weber and Hsee, 1998)

The study employs the bivariate mosaic analysis of Weber and Hsee (1998) as the baseline method despite a number of limitations exposed to the method per se. By contrasting this study's results using this method with those found by Weber and Hsee (1998) which support the notion of variable RP and constant RAtt, the comparability of the data of this study to that of Weber and Hsee (1998) can be inferred.

Table 4.9 provides a brief summary of mean judgments of individual FRT (WTP), RP, and RAtt for the four age groups. The ANOVA results stated in column (1) reveal a non-significant difference in the magnitude of WTP as a function of age (F-value = 1.01; n.s). It indicates that individuals from different age groups exhibit relatively similar level of FRT. In other words, the willingness to engage in risky financial option of individuals with different age is not significantly different from each other.

Comparing the average WTP of each age group with the average expected value of the six investment options ($\overline{EV}$ = \$1,539), individuals from all age groups are classified as risk-averse under the traditional expected-utility view as they are willing to pay less than the expected returns of the investments. According to the ANOVA results along with the box plot diagram for WTP displayed in Figure 4.4, no apparent trend in WTP across the four age groups is identified. As revealed in the diagram, median values for all age groups are smaller than their mean values, which implies a highly positive skewed distribution of WTP. Particularly, 75% of respondents from each age group reported a WTP of lower than \$2000, whilst the upper 25% of respondents reported a WTP ranging from \$2000 to \$5000.

With regard to age difference in RP, the ANOVA analysis ascertains a statistically significant difference in the magnitudes of perceived riskiness judgement between the four age groups. According to column (2) of Table 4.9, an F-value statistic of 2.63 is statistically significant at 5% critical level. Subsequently, the Bonferroni t-test indicates that RP differs significantly between age group 1 and age group 3 at 5% level, with individuals from age group 3 perceiving the riskiness of the investment options higher than do their counterparts from age group 1 ($\overline{RP_3}$ = 56.12 > $\overline{RP_1}$ = 52.79).

Moving on to the last construct (individual RAtt), it is worthy to mention about the definitions of the two measures of RAtt as discussed in Section 2.2.2. The objective RAtt (b_{VAR}) is the attitude towards financial risk given that individuals perceive risk in the same way using the variance computation. On the other hand, the measure of subjective RAtt (b_R) relaxes the

assumption of constant risk perception across individuals. According to the last two columns of Table 4.9, the ANOVA results for the objective RAtt (b_{VAR}) and the subjective RAtt (b_R) reveal two different findings. Based on their definitions, as the study found that there is a significant difference in RP across age (Table 4.9, column 2), the assumption that everyone perceives the same level of risk is evidently violated. Therefore, objective RAtt (b_{VAR}) is proved irrelevant. Hence, only the subjective RAtt (b_R) should be taken into consideration. Its statistical result reveals that subjective RAtt (b_R) is insignificantly different as a function of age ($Fvalue_{b_R}$ = 0.57). In other words, individual RAtt is constant across age.

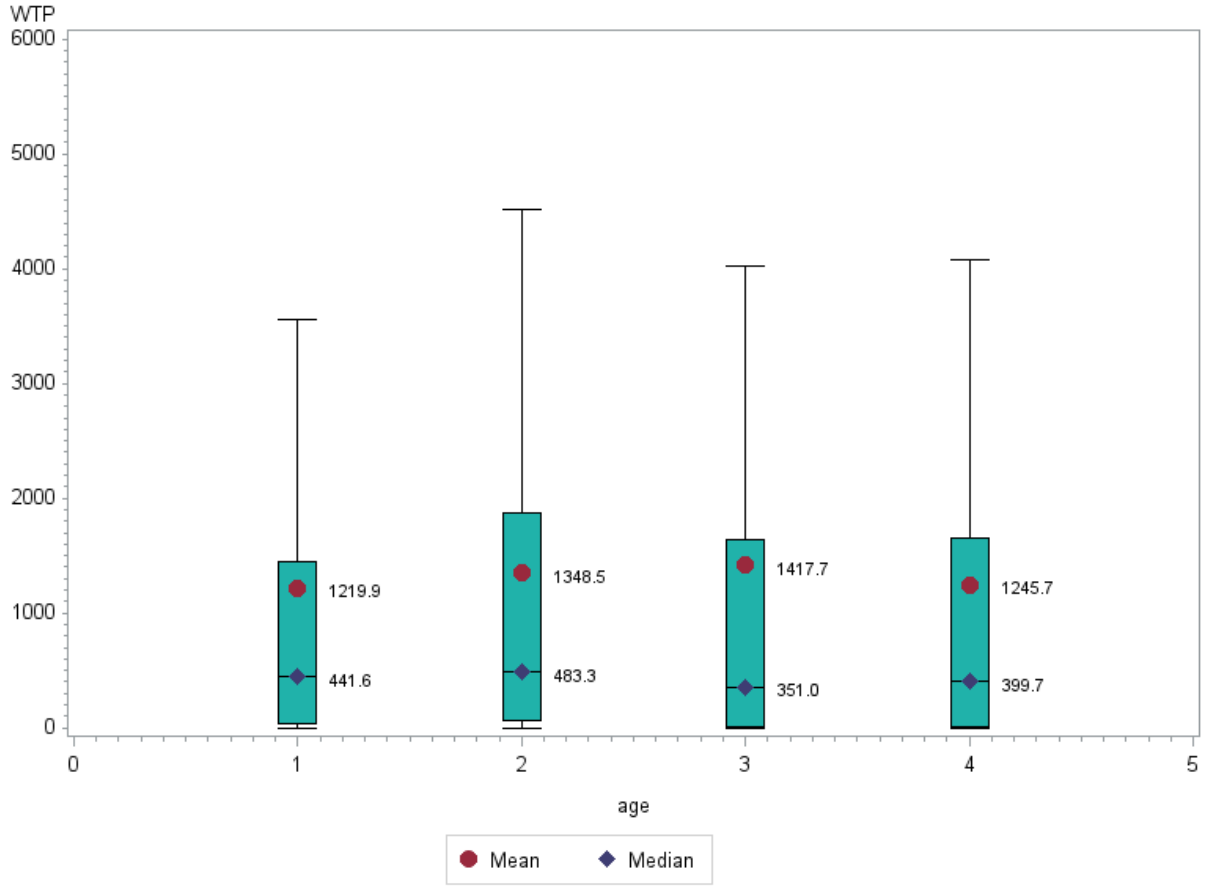
Table 4.9: Mean Judgements of WTP and RP as A Function of Respondents' Age

Age Group	*Respondents' Age*	*Sample Size (N)*	*WTP (1)*	*Risk Perception (2)*	*Objective RAtt - b_{VAR} (3)*	*Subjective RAtt - b_R (4)*
1	18-29	492	1220	52.79[a]	0.000240[a]	-11.697
2	30-39	486	1349	53.50	0.000325	-23.259
3	40-49	468	1418	56.12[a]	0.000489	-13.709
4	50-65	443	1246	54.44	0.000542[a]	-18.617
F-Value[30] (DF = 3)			0.95	2.63**	4.10***	0.57

Note: Two age groups with the same superscripts down each column (comparing only with the first country group assigned with the superscript) indicate that their means are significantly different at the 0.05 level using Bonferroni T-test.
, **, and * denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

[30] Firstly, Levene's test for equal age group variances is implemented. If the assumption of homogeneity of variances is violated, the ANOVA result is based on the Welch's test.

Figure 4.4: Box plot for Willingness to Pay across four age groups



In general, findings obtained from bivariate analysis suggest that individuals' FRT do not differ across age groups. Therefore, even difference in RP as a function of age is found, it does not cause age difference in FRT. As discussed in Section 3.4.1, there are few limitations exposing to bivariate analysis, which challenge the reliability of these findings. For example, one main issue of ANOVA for identifying the difference in FRT across age is that the findings can be easily manipulated with categorical age variable (division of age group). As tested, if the study divides the sample into nine age groups with a range of 5 years old per group instead of the current four age groups, a significant difference in FRT will be obtained. Despite of these limitations, ANOVA is conducted as the baseline method to compare the findings with those of Weber and Hsee (1998). At the bottom line, with the same statistical method, the general finding of this study (variable RP and constant RAtt) is the same with Weber and Hsee's and other preceding studies (Section 4.2.2). Consequently, it can be concluded that the data employed is comparable to Weber and Hsee's data. This comparability implies that the reduction of the 12 investment options to six investment options in the FRT experimental task (Section 2.4.1) may still allow the research to be conducted sufficiently. As discussed, after the baseline analysis (mosaic bivariate analysis), the multivariate regression analysis is used as the main approach whose results are presented in the subsequent section.

4.5.2 Multivariate analysis: Model-based mosaic approach

In this section, summary result tables reveal the estimated coefficients and significance levels of main variables for five model variations. The first variation contains only variable group 1 (main variables) which capture the pure age effects. As the study sample is pooled data from five countries, the second variation attempts to examine pure age effects after controlling for specific country effect by adding 4 country dummy variables (group 5). The third variation, on the other hand, controls for demographic and socioeconomic factors (group 2 and group 3). The fourth variation additionally controls for the attitudinal variable group 4. Lastly, the fifth variation is the full model that contains all variables indicated in Table 4.1.

The full results for the fifth variation of the estimating regression models are presented in the appendix section (Appendix 6-8). These appendix tables contain results for both uncentered and centered regressions, along with the corresponding variance inflation factors (VIFs) of all variables to test for multicollinearity. Furthermore, the results for heteroscedasticity, normality of error terms, and endogeneity can be found in Appendix 9 (Part 1) and Appendix 10 (Part 1), respectively. Overall, the results indicate that the estimating OLS models of this study do not have endogeneity problem but are subjected to heteroscedasticity and non-normality issues. However, as discussed in Section 3.4.2, these issues are tackled using the mean-centering robust standard error approach.

4.5.2.1 Mosaic 1: Does individual FRT vary across age?

H_1: There is a statistically significant difference in individual FRT across age

Table 4.10 reveals that all five variations of mosaic 1 report consistent results such that age significantly negatively influences individual FRT at 1% critical level (β_A = -0.0165, β_B = -0.0174, β_C = -0.0335, β_D = -0.0279, β_E = -0.0271). The results indicate that as age increases, people are less willing to take on financial risks. Although many previous studies captured non-linear effects of age[31], non-significant results are found on the coefficients of Age^2 (β_A = -0.00031, β_B = -0.00025, β_C = -0.00059, β_D = -0.00055, β_E = -0.00052; n.s). This indicates that there is no presence of non-linear relationship between age and FRT.

Furthermore, adjusted R-square increases when more factors are controlled for. The fifth model variation has the highest adjusted R-square of 6.17%, which means that all proposed controlling factors significantly improve the explanation power of the estimating model and thus should be included.

[31] Section 4.2.1: Yoo (1994); Hallahan et al. (2003); Riley and Chow (1992); Bajelsmit and VanDerhei (1997).

Table 4.10: Determinants of Financial Risk Tolerance. Dependent Variable: LnWTP

Mosaic 1	**Centered-score Regression (Robust Standard Errors)**				
Independent Variables	(A)	(B)	(C)	(D)	(E)
Intercept	5.2803***	5.7874***	4.3615***	5.0621***	5.4209***
Age	-0.0165***	-0.0174***	-0.0335***	-0.0279***	-0.0271***
Age²	-0.00031	-0.000250	0.000589	0.000550	0.000527
Group 2	NO	NO	YES	YES	YES
Group 3	NO	NO	YES	YES	YES
Group 4	NO	NO	NO	YES	YES
Group 5	NO	YES	NO	NO	YES
Sample size	1889	1889	1889	1889	1889
Adj. R-Square	0.0049	0.0147	0.0477	0.0594	0.0617

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

For more information, the full result of the fifth model variation is presented in Appendix 6. As revealing in the appendix table, when uncentered method is employed, VIFs are high for variables Age, Age^2, LnW and Age*LnW (VIFs = 70.5, 61.6, 13.7, and 33.2, respectively). These statistically high VIF values indicate the concern of nonessential multicollinearity (Section 3.4.2.1). By employing mean-centering method, VIFs of these variables reduce significantly to around 2, where multicollinearity is no longer a concern.

The insignificant estimate of the interaction term between age and wealth (Appendix 6, $\beta_{Age*LnW}$ = 0.00224; n.s) rejects the moderating effect of wealth on the relationship between age and FRT. In other words, the extent to which FRT reduces across age is independent of one's wealth level.

Besides age, one's wealth and level of self-reported risk aversion (SRA) are significant predictors of FRT. Their effects are statistically significant at 1% critical level. Wealth is found to positively influence FRT (Appendix 6, β_{LnW} = 0.1237; t-stat = 4.21). This implies that, the richer individuals are, the more risk tolerant they are in the financial context. On the other hand, SRA is negatively associated with FRT (Appendix 6, β_{SRA} = -0.2763; t-stat = -4.73) implying that the general subjective risk judgements they have on themselves are accurately predicted their FRT. Specifically, when individuals think of themselves as being less willing to take on risk in general, they report smaller WTP figures.

For mosaic 1 (Appendix 6), three foremost independent variables that are significantly associated with FRT at critical value of 5% or below, and account for the highest proportion of variance in FRT, are wealth, SRA, and age, in descending order. Their $\eta^2_{partial}$ values[32] are 0.0240, 0.0132 and 0.006, respectively. Consequently, it can be said that individuals' wealth, their subjective general risk judgement, and their age are the three most important determinants of their willingness to take financial risk.

4.5.2.2 Mosaic 2: Is RP accounted for changes in FRT across age?

H_2: There is a statistically significant difference in individual RP across age

The result for mosaic 2 is presented in Table 4.11. It is found that as individuals get older, they perceive higher risks embedded in a financial option. This finding is drawn from the significant positive coefficients of Age variable at 5% critical level or below for all five model variations ($\beta_A = 0.089$, $\beta_B = 0.091$, $\beta_C = 0.156$, $\beta_D = 0.105$, $\beta_E = 0.097$; p-value < 0.05). Besides, non-linear effect of age on RP is failed to be captured due to the nonsignificant estimates of Age^2 ($\beta_A = -0.0037$, $\beta_B = -0.0036$, $\beta_C = -0.0057$, $\beta_D = -0.0047$, $\beta_E = -0.0042$; n.s). Based on this result, it can be concluded that the increased RP contributes to the reduced FRT across age.

Among the four model variations, the fifth variation exhibits the highest value of adjusted R-square of 0.0496. It is the strongest model in explaining the variability of individual RP. Hence, the results obtained from this model variation should be interpreted and taken as the main finding of the mosaic.

[32] The partial eta-square ($\eta^2_{partial}$) measures the proportion of variance in a dependent variable that is accounted for by each independent variables.

Table 4.11: Determinants of Financial Risk Perception. Dependent Variable: RP

Mosaic 2	**Centered-score Regression (Robust Standard Errors)**				
Independent Variables	(A)	(B)	(C)	(D)	(E)
Intercept	54.698***	53.4985***	55.0981***	41.2299***	41.0400***
Age	0.0889**	0.0910**	0.1564***	0.1047**	0.0973**
Age^2	-0.0037	-0.0036	-0.0057	-0.0047	-0.0042
Group 2	NO	NO	YES	YES	YES
Group 3	NO	NO	YES	YES	YES
Group 4	NO	NO	NO	YES	YES
Group 5	NO	YES	NO	NO	YES
Sample size	1889	1889	1889	1889	1889
Adj. R-Square	0.0018	0.0105	0.0279	0.0472	0.0496

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Appendix 7 provides the full result of the fifth model variation of mosaic 2. The qualitative findings are consistent regardless of whether uncentered regression or centered regression is employed. However, to efficiently abolish the problem of nonessential multicollinearity, the results are mainly drawn from the mean-centering method. As expected, VIF values of multiplicative terms and their component variables reduce tremendously after the centered-score regression is used.

Wealth is also found to significantly influence one's RP at 5% level, but negatively in this mosaic (Appendix 7, β_{LnW} = -0.4385). The richer individual is, the smaller risk she perceives. Due to such smaller level of risk perceived by richer individuals, they exhibit higher levels of FRT as found in mosaic 1.

The interaction term between age and wealth is significantly negative at 5% level (Appendix 7, $\beta_{Age*LnW}$ = -0.0319, t-stat = -2.26). It indicates the moderating effect of wealth on the relationship between age and RP. Consequently, coefficient of age is no longer interpreted as a main effect but a conditional effect, which is dependent on individual's wealth level. Basically, older people tend to perceive higher financial risk. Nevertheless, if they are wealthier, such increased RP becomes smaller. In other words, higher wealth level reduces the effect of age on one's RP.

As age effect on RP is significantly conditional on wealth level, partial eta-square ($\eta^2_{partial}$) of age effect should be the sum of $\eta^2_{partial\_age}$ and $\eta^2_{partial\_Age*LnW}$. According to the $\eta^2_{partial}$ values of all variables reported in Appendix 7, five main determinants of RP that are statistically significant at 5% critical level or below, and are at source of the highest proportion of variance

in RP, are SRA, wealth, economic expectation, unemployment, and age, in descending order ($\eta^2_{partial}$ = 0.0113, 0.0099, 0.0078, 0.0064, and 0.0056, respectively). Despite the ranking of age among these five main factors, it still holds an important influence in one's RP comparing to many other factors.

Noticeably, the obtained results support the repellent nature of risk such that higher RP leads to lower FRT. Specifically, younger and richer individuals who think themselves as a risk-taker in general tend to see lower financial risks, and thus, they are more risk tolerant than others.

4.5.2.3 Mosaic 3: Is RAtt at source of changes in FRT across age?

H_3: There is a statistical significant difference in individual RAtt across age

As explained in Section 3.4.3, when mosaic 2 is incorporated into the picture with mosaic 1, it plays an important role in determining the best suited piece of mosaic 3, that is, the best measure of RAtt. Mosaic 2 depicts that RP is not constant across individuals of different ages. Apparently, the assumption of constant RP (objective RP) is proved to be invalid. This implies that objective measure of RAtt (b_{VAR}) is not applicable and should be excluded from the entire picture.

Table 4.12 reveals the result for mosaic 3 with the subjective RAtt (b_R) as the dependent variable. According to the results obtained, nonsignificant estimates of Age and Age^2 across all five model variations indicates a constant RAtt across age. Notably, the almost zero adjusted R-square values of all model variations and their substantial and statistically significant intercepts at 1% critical level, inherently support the notion of RAtt as a personality trait which is stable and not influenced by other factors. Once again, this finding is consistent with the literature and especially with Weber and Hsee (1998) when the same computation method of RAtt (PRAM model) is employed.

Matching together the three obtained mosaics, the picture draws a story such that older people are less risk tolerant in financial context as they see higher risk, whilst their attitudes toward financial risk do not change.

Table 4.12: Determinants of Subjective RAtt. Dependent Variable: b_R

Mosaic 3	Centered-score Regression (Robust Standard Errors)				
Independent Variables	(A)	(B)	(C)	(D)	(E)
Intercept	-18.8400***	-24.758***	-58.682***	-28.852***	-42.664***
Age	-0.0161	-0.0152	-0.1221	0.0323	0.1058
Age²	0.0145	0.0126	0.0267	0.0242	0.0214
Group 2	NO	NO	YES	YES	YES
Group 3	NO	NO	YES	YES	YES
Group 4	NO	NO	NO	YES	YES
Group 5	NO	YES	NO	NO	YES
Sample size	1889	1889	1889	1889	1889
Adj. R-Square	0	0.0023	0	0	0.0019

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

The result of the full model (model variation E) with b_R the dependent variable are provided in Appendix 8. As previously discussed, the subjective RAtt (b_R) reveals its nature as a stable characteristic of individuals. Hence, none of the controlled factors shows significant effect on the construct, except for gender where male individuals tend to like financial risk more than female, but the effect is only significant at marginal level ($\beta_{Gender} = 13.16$).

4.6 Robustness test: GMM and Aggregating Bootstrap Estimators

The aim of the robustness tests is twofold. *Firstly*, it examines if the findings obtained by the main statistical approach (the model-based mosaic multivariate method) remains if different statistical method is employed. This study employs the generalized method of moment (GMM) as a robustness test. The reason is that in addition to the robust standard error, GMM is an alternative remedy for the heteroscedasticity issue exposed to the OLS models. *Secondly*, the test clarifies the robustness of the Weber and Hsee's (1998) measure of RAtt (b_{VAR} and b_R) using the bagging resampling method (bootstrap aggregating) advanced by Breiman (1996). This robustness test is conducted on mosaic 3 exclusively, in which RAtt is the dependent variable. As discussed in Section 2.4.2.3, the study employs Weber and Hsee's (1998) method to compute individual RAtt (both objective RAtt and subjective RAtt). Specifically, the derivation of RAtt is based on the risk-return framework. It is obtained by regressing the WTP on expected return and objective RP (variance) or subjective RP of the *six* investment options. The risk trade-off coefficient b_{VAR} and b_R are the individual objective and subjective RAtt, respectively. The concern of this method is that as each respondent was provided with six

investment options, only six observations are fitted to each regression. This may provide a wide range of estimates (vibration of effect) or instability of estimates, which largely vary with a minor change in the sample (Button et al., 2013). Accordingly, to tackle this issue of 'unstable' estimates, bagging resampling method (bootstrap aggregating) is employed, which can effectively reduce variability in the estimates of RAtt and improve their accuracy (Breiman, 1996; Dudoit and Fridlyand, 2003; and Buhlmann and Yu, 2002).

The bagging procedure to compute individual objective RAtt (b_{VAR_b}) and subjective RAtt (b_{R_b}) starts by forming randomly non-parametric bootstrap replicates with replacement for each individual sample. Subsequently, aggregating bootstrap estimates of b_{VAR_b} (TRAM regression) and b_{R_b} (PRAM regression) are built for each replicate. Eventually, the average of these bootstrap b_{VAR_b} and b_{R_b} are calculated and used as individual objective RAtt and subjective RAtt, respectively.

Whilst employing GMM provides an assurance for the findings, the use of the bootstrap aggregating method offer an alternative check on the data obtained of this study. The current study employed Weber and Hsee's (1998) FRT experiment task to derive FRT, RP and RAtt. However, to ensure the quality of participant's responses for the task, the study has reduced the number of investment options from the original 12 to six. Consequently, to check for the comparability of this study's data sample with that of Weber and Hsee, the same statistical analysis, the mosaic bivariate approach, is employed as the baseline. As stated in Section 4.5.1, the same general finding (variable RP and constant RAtt) was obtained. As a result, it can be concluded that despite the reduction of investment options presented, the data of this study can be comparable to that of Weber and Hsee, and thus sufficiently achieves the research objective. Alternatively, the bagging procedure provides a different computation of RAtt. If the constant RAtt remains, it implies that the data of this study may be comparable to Weber and Hsee's even with less investment options.

The results for the robustness tests (GMM and bagging bootstrap method) mentioned above in this section are presented in Table 4.15. It can be seen that the final story remains unchanged such that older individuals are less risk tolerant because they perceive higher level of riskiness. Specially, when individual RAtt is derived using aggregating bootstrapping method, the adjusted R-square of 0.0043 also indicates risk attitude as a personality trait which is constant and stable across individuals. This notion of constant RAtt is consistent with that obtained by the Weber and Hsee's RAtt used in the main analysis, as well as with previous literature. Notes that the quadratic term of age (age^2) is statistical significant, but only at marginal level. However, as the independent effect of age on RAtt (b_{R_b}) is not significant in the first place, the

significant of age^2 is ambiguous and not economically meaningful. Particularly, the non-significant coefficient of age (b_{Age} = 4.416) becomes even more significant as the significant coefficient of age^2 is negative (b_{Age^2}= -0.4219). Overall, age does not significantly influence one's RAtt.

Table 4.13: Robustness Tests (GMM) and Aggregating Bootstrapping RAtt (b_{R_b})

	GMM Regression			**Bagging Bootstrap**
IVs	Coefficients (Mosaic 1: LnWTP)	Coefficients (Mosaic 2: RP)	Coefficients (Mosaic 3: b_R)	Coefficients (Mosaic 3: b_{R_b})
Intercept	5.421***	41.0400***	-42.66*	-384.466
Age	-0.0271***	0.0973**	0.1057	4.416
Age^2	0.00053	-0.0042	0.0214	-0.4219*
Group 2	YES	YES	YES	YES
Group 3	YES	YES	YES	YES
Group 4	YES	YES	YES	YES
Group 5	YES	YES	YES	YES
Sample size	1889	1889	1889	1889
Adj. R-Square	0.0617	0.0612	0.0019	0.0043

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

4.7 Summary and conclusion

The study has presented tests for the three hypotheses developed to provide findings for the first empirical research. Table 4.14 presents a summary of the hypothesis testing results and the obtained story, respectively.

Table 4.14: Empirical Study 1 – Summary of the Hypothesis Testing Results

Hypothesis	Expected Effect	Result	Obtained Sign
H_1	There is a statistically significant difference in individual FRT across age	Supported	Negative
H_2	There is a statistically significant difference in individual RP across age	Supported	Positive
H_3	There is a statistically significant difference in individual RAtt across age	Not Supported	-

The literature has shown a strong interest in the age-FRT relationship, yet a conclusive finding has yet emerged. Nevertheless, the majority of extant studies reported a decreased financial risk tolerance (FRT) across age. This association supports the life-cycle risk aversion hypothesis of Bakshi and Chen (1994). The hypothesis asserts that as individuals get older, their remaining paychecks decline and future income becomes more uncertain. Consequently, people become more repellent to financial risk as they cannot afford to lose when there are fewer opportunities for potential losses to be covered by labour income. As stated by Yao et al. (2011), "individuals approaching or in retirement may shift focus from asset accumulation to asset preservation" (p.885). This negative age-FRT finding can be used for predicting one's appetite in investment based on his age. Nevertheless, beyond the predictability implication, many researches recently have attempted to acquire also the ability to alter one's risk appetite by investigating the underlying mechanisms of FRT formation. Virtually all extant studies working in this area obtained the same *general finding* such that differences in FRT across difference factors (gender, culture, career, outcome domain, situational domain and time) is mainly caused by differences in RP across these factors, whilst RAtt is a relatively stable and constant construct. As can be seen, no study has been conducted to examine the mediating roles of RP and RAtt in the effect of age on FRT.

Consequently, the current study extended the age-FRT topic by investigating the underlying mechanisms of their association. Particularly, the study is interested in whether the effect of age on FRT is mediated by risk perception (RP) and/or risk attitude (RAtt). Firstly, consistent with the majority of studies, the result drawing from the first hypothesis H_1 assured that age

negatively influences one's FRT. Most importantly, it is found that, as clarified in the last two hypotheses (H_2 and H_3), the decreased FRT is caused by an increase in RP, whilst RAtt remains constant across age. Notably, this general finding obtained in this study such that differences in FRT is associated with differences in RP rather RAtt is consistent with that of literature.

In brief, the study concluded that older individuals are less willing to take on financial risk because they perceive the same financial investment as riskier, whilst their attitudes toward financial risk are generally the same with their younger counterparts. In this case, it is the age difference in risk perception causes the age difference in risk tolerance. Therefore, if the risk perceptions of older individuals are reduced, their risk tolerance level may increase. As Weber and Hsee (1998) suggested, to alter individuals' RP, their cognition should be targeted by providing more information about investment, risk-return relationship, measures of financial risks, and so on. Wider practical implications of this study will be discussed further in Chapter 7.

Chapter Five: Empirical Study 2

Does Age Influence Cross-cultural Difference in Financial Risk Tolerance? Reduction of Cushion Buffer in Older Individuals

5.1 Introduction

Acknowledging the importance of assessing FRT, many studies attempt to generalise the assessment process in practice by identifying its determinants. Due to the subjective nature of FRT, these significant factors are used as proxies to estimate one's risk tolerance level. Thus far, numerous factors have been documented as having an impact on FRT, such as, demographic (age and gender), socioeconomic (employment, wealth and income), and attitudinal (economic and interest expectations) factors. Notably, over the last decade, the FRT research has changed its direction from the focus on a single culture to a cross-cultural perspective. Weber and Hsee (1998) is the first to explore the fundamental influence of culture on FRT. This shift made by Weber and Hsee (1998) has fostered many other studies to the investigation of cross-cultural and cross-national differences in FRT using samples of different countries. A review of these extant studies reveals a consistent finding that collectivism is found to be associated with increased FRT relative to individualism. As the founder of the culture-FRT topic, Weber and Hsee (1998) introduced the cushion hypothesis as a potential explanation for their findings. Specifically, in financial hardship, members in collectivistic society can approach their internal groups (family and social network, excluding spouses) for help. Weber and Hsee (1998) claim that such readily available financial support covers the riskiness of financial options. Consequently, collectivistic individuals perceive the same financial option as less risky (lower RP), and hence they are more risk tolerant comparing to their individualistic counterparts. This finding implies that individuals coming from a collectivistic society may be more willing to take on financial risk compared to those from an individualistic society. However, making predictions of an individual's risk appetite based on their cultural background can be susceptible to error if culture does not independently influence FRT.

Before progressing into the current study, it is important to consider the study conducted by Fan and Xiao (2006). Their empirical results show that the reduction in reported FRT across age is faster with Chinese individuals than with Americans. This finding suggests that the cultural differences in FRT between China (collectivism) and America (individualism) may reduce across age. Hence, age may influence the cross-cultural difference in FRT. According to the previous empirical study of this thesis and numerous preceding research, age has been

well documented as an important determinant of FRT. Therefore, it is possible that its effect may be influential enough to moderate other determinants of FRT, including culture.

Progressing the idea with further exploration into the literature, previous anthropological and psychological research reported changes in one's personal traits, patterns of thinking, judging, and acting, across the life span. Particularly, as collectivistic individuals grow older, the development of their self-conscious emotions (embarrassment, shame, guilt, and self-esteem)[33] may reduce their willingness to seek financial help[34], especially in societies with high level of power distance (strong social hierarchy) assuming that the availability of support stays unchanged. In this event, perhaps older collectivistic individuals have the same level of financial support as do younger collectivistic individuals, but avoid asking for support. The question is whether the availability of financial support can still be perceived as *'cushion'* when individuals do not consider using the available support in their financial distress. Consequently, the effect of the cushion hypothesis, which asserts that collectivism perceives lower financial risk due to their larger pool of financial support, may be dampened across age. Building on these conjectures, the current study extends the culture-FRT literature by investigating the potential moderating effect of age on the cross-cultural difference in FRT.

Consequently, this chapter aims at presenting the second empirical study of this thesis, a cross-cultural research, whose principal objectives are twofold. *Firstly*, the study examines whether age moderates the effect of culture on FRT. *Secondly*, the study investigates if reductions in one's cushion across age are the underlying reasons for the moderating effect of age if found to be present. The study is conducted by surveying the responses of 1,889 individuals from five different countries: the US and the UK (individualism); China and Vietnam (collectivism); and Singapore (a multicultural nation, allowing within-country cultural heterogeneity). The chapter starts with reviewing the literature on which the study is developed. Subsequently, detailed methodology, followed by the data description, empirical results, and robustness test, will be discussed.

[33] Hofstede (2001), Mandel (2003), Lewis et al. (1989 and 1991), Benedict (1974), Bedford and Hwang (2003), Hwang (2001), Izard (1997), Bedford (1990), Demo (1992), Bengtson et al. (1985), Shaw et al. (2010), Giarrusso et al. (2001), Orth et al. (2010), Robins et al. (2002), Rosow (1985), Mirowsky and Ross (1992)
[34] Harel et al. (1990), Veroff (1981)

5.2 Literature review

The literature review section is divided into three main parts. The first part aims at explaining the cultural value of an individual as suggested in the literature. The remaining two parts are closely related to the main contributions of the study. This is developed by two arguments: the increased FRT of collectivism through their lower RP compared to individualism, and the cushion hypothesis. Therefore, the second part reviews how the literature links culture with financial risk tolerance (FRT). Lastly, the third part will discuss the conjecture of the moderating effect of age on the cross-cultural difference in FRT.

5.2.1 Cultural values

Culture is a widely used notion with many interpretations and connotations. In broad terms, anything that is associated with the creativity of man (material and spiritual products) in the course of employment is considered to be the product of culture, including language, ethics, law, science, religion, literature, art, and tools for living, food, clothing, and many more.

In social science, Breuer et al. (2012) defines culture as unchanged customary beliefs and values that are transmitted from one generation to another. On the other hand, Hofstede (2001, pp.12) metaphors culture as "the crystallization of history in the minds, hearts, and hands of the present generation"; and as the collective programming of the mind of members of a group that is distinctive from any other social groups. Weber and Hsee once reported that "culture has been shown to influence a wide range of basic psychological processes" (1999, pp.611). Through culture, one's values and attitude are developed, which orient the behaviour of individuals and groups.

The culture of a nation, ethnicity, or community is an incredibly abstract subject. But at its core, culture is an overbearing determinant of the thoughts, perceptions, and actions of individuals, organisations, and societies. Consequently, anthropologists consistently focus on learning about culture with the aim of constructing a common measure to analyse and assess a particular culture, and to compare it with others. Apparently, it is no easy task to achieve.

A cultural measure is a tool to quantify, to the most possible extent, the abstract aspect of culture. One of the most well-known cultural measures has been used in numerous studies is the five cultural dimensions developed by Geert Hofstede (2001). These dimensions include power distance, individualism-collectivism, masculinity-femininity, uncertainty avoidance and Confucianism dynamism (Long-term orientation). Among these five, perhaps the most common measure that has been used in the literature to examine the cross-cultural difference in FRT through RP and/or RAtt is the individualism-collectivism cultural dimension.

Furthermore, the development of this study's contribution is built on the Weber and Hsee's (1998) cushion hypothesis, which explains the difference in FRT between individualism and collectivism. Consequently, the current study will employ this individualism-collectivism continuum as the main cultural measure. The subsequent section will discuss in detailed the nature of this cultural continuum prior to the explanation of the cushion hypothesis.

5.2.1.1 Hofstede's cultural classification: Individualism-Collectivism

According to Hofstede (2001), different cultures have different family structures. Compared to collectivistic societies, within individualistic societies the majority of children are born in families consisting of only parents and children, whilst other relatives tend to live elsewhere with less frequent contact with each other. Growing up in such family-style society, children learn to think of themselves as "I", their personal identity, which is distinct from other personal identities or group identities. The purpose of education in individualism is to help children stand on their own feet in any circumstances of life. Hence, no single healthy members in the individualistic society must bear any responsibility or dependence on the group.

In contrast, there are societies where group interests are of higher importance than individual rights. Hofstede (2001) refers these societies as Collectivism. In collectivistic societies, while growing up, children learn to think of themselves as part of the "we", the so-called internal group. The internal group is the main source of human identity, and is also a secure safeguard when one is facing hardships of life. As a result, the reliance of collectivistic individuals on their family and other social group members is perceived as the key to stability and security. In turbulent times, one's family and social group acts as a reliable 'lifejacket' for an individual. However, in return, collectivistic members are obligated to a lifelong loyalty to their internal group and any act that violates this loyalty is considered to be the worst misconduct. The dependent relationship between members and their internal group is developed both practically and psychologically. Over time, embedding in collectivistic members is the priority of the internal group's goals over their own personal goals.

Based on these differences between the independent self in the individualism and the symbiotic relationship in the collectivism, Weber and Hsee (1998) developed the cushion hypothesis to explain the higher levels of FRT exhibited by collectivism. In essence, in financial hardship members in collectivistic societies can approach their internal groups (family - excluding spouses and social network) for help. Such readily available financial support is claimed by Weber and Hsee to be the source of the concealment of the risk embedded in financial options. It acts as a 'cushion' that protects people from getting hurt when they 'fall' financially. Consequently, with the provided cushion, collectivistic individuals perceive the same financial

option as less risky (lower RP), and hence they are more risk tolerant (higher FRT) comparing to their individualistic counterparts.

It is worthwhile emphasizing that the notion of the cushion developed by Weber and Hsee (1998) refers entirely to one's personal private network. The size of the network is measured by the number of people that individuals can access for financial help (excluding their spouses). Therefore, public cushion (state benefits and supports) and personal access to overdraft, credit or loan, are not considered. The main reason is that a public cushion and personal financial access do not differ across cultures, hence, it cannot be used to explain the cross-cultural difference in FRT. Particularly, the former is the right that everyone is eligible for within a nation and there are binding restrictions to certain types of support available. The latter indicates that individuals engage in other financial commitments rather than a financial support. Primarily, both public cushion and personal financial access tends to differ across countries and socioeconomic characteristics, rather than cultures.

Moving away from the concept of culture and the cushion hypothesis, the main concern of this research topic is to have a measure of culture. Up until now, all research (Section 5.2.2) studying the culture-FRT relationship employs the Hofstede's cultural classification. In these studies, country is used as a proxy for culture. In other words, cultural value is measured at the national level. For example, based on Hofstede's (2001) individualism index, the US and the UK have high individualism index. Therefore, respondents from these countries will be automatically classified as individualistic. However, this culture's proxy is subject to a number of limitations and has increasingly been challenged and critiqued by the literature (Section 5.2.1.2). Consequently, as a way for improvement, the current study does not proxy culture but measures it at the individual level. Basically, the cultural value is measured specifically for each respondent participating in the survey by employing the Singelis's (1994) self-construal scale. The rationales for the measure of culture at an individual level and the use of the Singelis's SCS scale will be discussed in the subsequent Section 5.2.1.2.

5.2.1.2 Singelis's independent & interdependent self-construal measurement (SCS)

To start with, this section discusses the drawbacks of Hofstede's cultural dimension. The Hofstede's individualism index has been applied in numerous empirical studies in different fields over the last three decades due to its convenience and straightforward practice (Kirkman et al., 2006). However, its application has increasingly received lots of challenges and critiques from academic scholars (Schwartz, 1994; Smith and Bond, 1999; McSweeney, 2002; Smith, 2002, cited in Kirkman et al., 2006, p.285). The main argument is in regards to its *simplistic* and *obsolete* conceptualization. The 'simplicity' critique raises two concerns. Firstly, as the

measure uses the country individualism index to assign cultural values to all of its members, this causes overlap between country effect and culture effect such that obtained cross-cultural differences can be indeed cross-country differences (differences in macroeconomic conditions, geographic or politics). Technically, it is questionable to assign the cultural value of an employee of a company to the entire country. Even Hofstede (2001) himself argues that individuals possess *their own* "mental programme" and these programmes only contain parts of the national culture. Furthermore, the index usage does not provide room for within-country cultural heterogeneity among individuals and does not allow for variation of culture overtime. According to Matsumoto (1996, pp.81), "culture is not a static entity" which changes across time and is different among individuals. Other researchers also found significant within-country differences in cultural values (Au, 1999, cited in Kirkman et al., 2006, p.288). This heterogeneity and alterability of culture becomes increasingly observable in face of many multicultural nations. This gives rise to concerns that the symbiotic relationship in collectivism will face challenges as a shift toward individualism as the habit of independent thinking gradually takes place. As a result, these arguments have supported McSweeney (2002) that one's nation is not a robust unit to measure culture.

The latter argument questions the reliability of the index as the data was collected in the 1960s and early 1970s (Kirkman et al., 2006). Such outdated measure may no longer be applicable at the current point of time. As a result, an individual level of cultural analysis can tackle all these limitations of the Hofstede's framework. It ensures the data is up-to-date, and allows for the possibility that culture is dynamic, and is different across individuals of the same country.

One potential argument against of Hofstede's Individualism-Collectivism dimension (2001) is whether individualism and collectivism are two independent aspects of culture, or two extreme ends of the same cultural facet (Rhee et al., 1996). According to Hofstede (2001), he conceptualised individualism and collectivism as a single bipolar construct, which are on the two opposite sides of a coin, thus an individual can exhibits his/her sense of either individualistic or collectivistic. The two aspects of a culture under Hofstede view are inversely related. In comparing cultures of two societies, the average score of individuals' personal values in each society represents its general cultural characteristics. If a society highly scores in Individualism, all members will be classified as individualistic; and vice versa. Nevertheless, individuals within a society tend to pursue various personal values; a person may simultaneously have high scores on Individualism in one aspect and high scores on Collectivism in other aspects. For example, a person can possess a high sense of responsibilities in his family (collectivism). However, he may be a self-responsible person such that he has his own

judgements on his education/career plan, instead of strongly considering his family's advice (individualism). As a result, by comparing individuals' cultural values, Individualism and Collectivism are two independent aspects.

Overall, in this study, the individualism-collectivism cultural dimension will be primarily measured at individual level using Singelis's measurement of independent and interdependent self-construal (1994). Singelis (1994) accepts the existence of individualism and collectivism as two distinct constructs. Consequently, an individual can exhibit both constructs, but one may dominate the other. Details about the mathematical computation of an individual's cultural value will be explained in Section 5.3.1. According to the reviews by Cozma (2011) and Hardin et al. (2004), the SCS of Singelis (1994) is a particularly popular measure which shows "strong evidence for reliability and validity" (Cozma, 2011, pp.14). It has been cited more than 180 times, and either one, or both, of the independent and interdependent subscales have been employed in more than 50 studies across different disciplines in different languages and countries. Hardin et al. (2004) also validated the reliability of Singelis's SCS on 786 European American and Asian/Asian American college students. Consequently, its use has been recommended for future cross-cultural research.

In brief, this first part of the literature review discussed the main cultural dimension used in this study, the individualism-collectivism dimension. Based on the differences between these two continuums, the cushion hypothesis was developed to explain the cross-cultural difference in FRT. The key concern for this cross-cultural research is the measure of culture. As explained, due to a number of limitations of using country as the proxy for culture based on Hofstede's cultural classification, this study assesses the cultural value of each individual in the sample. This individual level of cultural analysis is conducted using the Singelis's (1994) SCS scale. Moving away from the concepts of culture and its measure, the next section will discuss the literature investigating the differences in FRT across cultures.

5.2.2 Cross-cultural differences in FRT

According to Weber (2014), cultural background does influence one's FRT and risk taking behaviour. The study of cross-cultural differences in FRT is initiated by an intriguing finding of Weber and Hsee (1998). Their findings indicate that Chinese respondents are systematically more risk tolerant in the financial domain than their American counterparts. Weber and Hsee (1998) recruited university students for their surveys from four countries: People's Republic of China, America, Germany, and Poland. They inferred the respondents' FRT from their reported willingness to pay for risky financial investment options. The results suggested that among four countries of investigation, Chinese participants are the most financial risk tolerant whereas

Americans and Germans exhibit the lowest levels of FRT. The authors attribute the cross-cultural differences in FRT to cross-cultural differences in RP, rather than cross-cultural differences in perceived-risk attitude (subjective RAtt). In other words, individuals' attitudes toward financial risk, the extent to which they like or dislike risk, are relatively the same across cultures, and the difference in willingness to pay between members of different cultures is because of the differences in their perceptions in the option's riskiness. Based on these findings, the cushion hypothesis (Section 5.2.1.1) was first developed to explain the decreased RP, which leads to the increased FRT, of collectivism compared to individualism. However, at that stage, the cushion hypothesis remains a conjecture, which has yet been empirically tested.

In their later study, Hsee and Weber (1999) re-confirmed the results by asking American and Chinese students to participate in a different experimental questionnaire. The results again revealed that American respondents are less risk tolerant than Chinese respondents. According to the cushion hypothesis as conjecturing in their previous study, it is expected that Chinese respondents are members of a collectivistic society wherein they have more access to financial help from other members than do Americans. As a result, they perceive risk of the same risky option as smaller than Americans do, and thus are more risk tolerant.

To justify for the cushion hypothesis, Hsee and Weber (1999) empirically conducted tests on individual FRT in financial, medical and academic contexts. The results confirmed the prediction of the cushion hypothesis by showing that Chinese participants exhibited a higher level of FRT than American participants only in the investment domain, but not in the other two domains. The study also found that the size of one's social network significantly mediates the effect of culture on FRT. In essence, the larger and readily supporting social network of the Chinese causes their RP to be lower and hence, their FRT to be higher than those of the American.

Another study of Weber and her colleagues (Weber et al., 1998) investigated the FRT of American, German and Chinese samples. In this study, they employed the German sample as the control group, which exhibited similar standard of living, political and socio-economic conditions with the United States, whilst exhibited a closer score of collectivism and similar governmental social safety-net to China. As expected, the study found that with the higher level of social relatedness and interdependence, Chinese and German participants revealed greater risk taking than their American counterparts. Once again, these findings advocate the prediction of the cushion hypothesis such that systematic cross-cultural differences in FRT are the results of the longstanding cultural norms and values of the collectivism rather than the national situational circumstances.

Bontempo et al. (1997) employed a model-based approach in their cross-cultural investigation on financial RP, so-called, the Conjoint Expected Risk (CER) model, and obtained consistent results with Weber and Hsee (1998, 1999). They found that respondents from two individualistic countries (America and Netherland) exhibited significantly higher RP than respondents from two collectivistic countries (Taiwan and Hong Kong). Furthermore, to exclude the national situational effects, they compared RP of Taiwanese students with RP of Taiwanese security analysts, who are from the same cultural environment. The results revealed that they had similar risk judgements, which were significantly different from other cultures. The study suggested that the longstanding cultural values play greater roles in shaping one's RP than situational circumstances, incentives, or loss functions.

Fan and Xiao (2006) examined the self-reported FRT and stock participation of non-student samples from China (N=470) and America (N=2,671). After controlling for a number of demographic factors, they found that Chinese were more risk-tolerant in making financial decisions, and were more likely to participate in equity markets than Americans. Nevertheless, as the variable capturing the respondent's participation in the stock market was self-reported and dichotomous, the observed behaviour might be different from the actual and the quantitative differences in amounts invested in stock cannot be captured. To account for the obtained differences in FRT and investment behaviour across culture, the authors proposed a rationale in addition to the cushion hypothesis with regards to insufficiency in financial knowledge. They stated that owing to the lack of financial education and knowledge of the Chinese about the financial risk-return relationship, they erroneously calibrate the magnitude of risk embedded in the equity investment.

Another study conducted by Statman (2010) in which students from 23 countries were approached to complete a survey about their FRT through hypothetical scenarios in the domains of job and investment portfolio. The study provided evidence that levels of FRT for both job and portfolio domains are higher in societies that are more collectivistic, low uncertainty avoidance, and relatively hierarchical (high power distance). Out of the 23 countries of investigation, there were four countries that the current research targets, namely, Vietnam, China, the United Kingdom, and the United State. Consistently, Vietnam and China, countries with the same score in individualism continuum, revealed higher FRT in investment portfolios than the other two individualistic countries (16.34 and 17.06 versus 11.64 and 12.61, respectively). The same results were obtained in a previous study of Statman (2008), which found that Vietnam and China possess higher propensities to take on portfolio risk than the UK and the US. Statman (2010) also investigated whether public cushion, which was determined

by levels of social spending in the investigated nations, would impose the same impact with the private cushion on individual's FRT. However, the results did not support this prediction.

Similarly, Schneider et al. (2017) investigated the 'social' cushion hypothesis and the 'state' cushion hypothesis in three countries: Austria, Italy, and the USA. Repeatedly, their results did not give support for the 'state' cushion, whilst partly support the 'social' cushion hypothesis. More specifically, American habitants exhibited higher levels of FRT than their European counterparts, despite the weaker state support network. The underlying reason for the increased FRT of the Americans lay in part due to their larger social networks. In other words, one's social cushion partially mediates the differences in FRT between countries, as the nationality variable remained statistically significant after social network information was controlled for in the regression model.

Wang and Fischbeck (2008) conducted a multi-outcome lottery experiment on thirty-five US students and thirty-seven Chinese students to infer their FRT through willingness to pay and their RP. They found that Chinese participants on average were more risk tolerant in both the gain and loss domains. Their results were consistent with those obtained by Hsee and Weber (1999), as the study found that the higher degree of FRT found in the lottery tasks are not inherent in health, safety, and other everyday non-financial contexts.

Despite the extensive evidence of cross-cultural differences in FRT supporting the cushion hypothesis, there were several exceptions. Rieger et al. (2014) ran the largest-scale international survey on FRT in 53 nations. The respondents were instructed to provide their willingness to pay for hypothetical lotteries with different gain and loss compositions. As suggested by the prospect theory, the study found that respondents across all countries of investigation were risk-averse in the gain domain and risk-seeking in the loss domain. However, findings on cross-cultural differences in FRT were inconsistent with the cushion hypothesis addressed in the aforementioned literature. Particularly, members of cultures with higher individualism scores were found to have higher FRT. Nevertheless, subsequent to the input of Uncertainty Avoidance Index (UAI) as a controlling variable, the effect of individualism-collectivism continuum became statistically insignificant. The results further revealed that respondents from countries with higher UAI exhibit higher degrees of irrational preferences, as they were more risk-averse in gains and more risk-seeking in losses.

In a study conducted by Breuer et al. (2012) on a sample comprising of 449 economic students, they concluded that individuals' FRT and their financial risk-taking behaviour were significantly positively associated with individualism. Hence, the study implied a prediction

that equity holdings should be high in countries with high individualism, and low in countries with low individualism. They also tested and confirmed this prediction using data from EIU WorldData on stock portfolio allocation such that stock market participation was positively related to individualism score of the countries. A behavioural rationale was put in place to account for this relationship, which asserts that members of individualistic societies tend to be overconfident and overoptimistic, thus leading to their higher willingness to take risk in financial market.

To sum up, the entire literature working in this topic assures there is a cross-cultural difference in FRT. Except from two studies of Rieger et al. (2014) and Breuer et al. (2012), all other studies (Weber and Hsee, 1998; Hsee and Weber, 1999; see also[35]) found that collectivistic individuals are more willing to take financial risk comparing to individualistic individuals. The reason for such higher FRT levels exhibited by collectivism lies mainly on their lower risk perception (RP), whilst their attitudes toward financial risk are similar to individualism. To explain for these findings, the cushion hypothesis is supported empirically (Hsee and Weber, 1999; and Schneider et al., 2017). Note that the main contribution of this study is to investigate whether culture independently influences FRT. Therefore, the effect of culture on FRT as well as the cushion hypothesis are required to be clarified initially. Following these key studies, the following hypotheses will be tested:

Cross-cultural difference in FRT through RP and/or RAtt (**H_4 to H_6**):

H_4: More collectivistic individuals exhibit significantly lower RP than less collectivistic and individualistic individuals.

H_5: More collectivistic individuals exhibit significantly higher RAtt than less collectivistic and individualistic individuals.

H_6: More collectivistic individuals exhibit significantly higher level of FRT than less collectivistic and individualistic individuals.

The cushion hypothesis (**H_7**):

H_7: More collectivistic individuals have significantly more access to financial support than less collectivistic and individualistic individuals.

[35] Weber et al., 1998; Bontempo et al., 1997; Fan and Xiao, 2006; Statman, 2010; and Wang and Fischbeck, 2015.

Extending the culture-FRT relationship, this study conjectures that older collectivistic individuals may experience different self-conscious emotions comparing to younger collectivistic individuals. Specifically, they experience higher levels of embarrassment, guilt, shame and self-esteem. The development of these emotions may reduce the willingness of older collectivistic members to seek financial help. The financial support of these older collectivistic individuals may remain the same as their younger counterparts, but because they are less willing to ask for help the buffer of the cushion they perceive is less than that of younger collectivistic individuals. Overall, the reduction in cushion's buffer of the older collectivistic individuals may cause the cultural differences in FRT to decline across age. Nevertheless, as this lies beyond the scope of this thesis, the development of shame, guilt, embarrassment, and self-esteem remains a conjecture to explain why age may influence the cultural effect on FRT. This study cannot explicitly measure and test it. Nonetheless, the implication of a reduction of a collectivistic individual's cushion buffer across age is drawn from consensus findings of many studies. The next section will discuss those studies in more detailed.

5.2.3 Age effect on one's self-conscious emotions and help-seeking attitudes

The novel idea of the mitigating age effect on the cushion hypothesis was originated from the statistical findings of studies conducted by Fan and Xiao (2006). According to the statistical testing result Table 2 of Fan and Xiao's study (2006, pp.65), it is noticeable that individuals tend to be less risk tolerant as they age, but the marginal decrease in FRT was larger for the Chinese than for the American. With the obtained differences in FRT between the two cultures, the larger reduction in FRT across age of the Chinese implies that the cross-cultural difference in FRT may be narrowed as age increases. In other words, age may moderate the cultural influence on FRT.

The proposed idea is formulated based on anthropological and psychological literature. Hofstede (2001) found that age influences values of individuals in the same way as national culture. Value refers to feelings and "a broad tendency to prefer certain states of affairs over others" (Hofstede, 2001, pp.5). In essence, values are the basic concepts for humans to make assessments on what is right, wrong, good, bad, just, fair, important, and unimportant. This research suggests that an individual's values differ across age because the development of self-conscious emotions, including embarrassment, shame, guilt, and self-esteem, may occur, reducing the willingness of older collectivistic members to seek financial help.

According to Cohen (1999, pp.67), when facing the need to ask for support, people need to "overcome a wide range of social and psychological obstacles that may, in the end, preclude the articulation of the request and the subsequent receipt of assistance". Although no research

has directly studied the relationship between age and financial help-seeking attitudes, Harel et al. (1990) and Veroff (1981) found that older adults resist help seeking more than younger adults in the medical context. Brown (1978) conducted a longitudinal study of 1106 adults aged from 20 to 70 years in Chicago and obtained the same result that there was an evident decline in the seeking of help in different events across age for both genders with a dramatic drop among the elderly.

Notably, the current study conjectures not only the reduction in willingness to ask for help across age, but also that such a reduction tends to occur in collectivistic societies. Therefore, the remainder of this section provides evidences supporting for the increased guilt, shame, self-esteem and embarrassment of *older collectivistic* individuals. In essence, asking for financial support increases the likelihood that one is put into a state of embarrassment, guilt, shame and loss of self-esteem. Therefore, older collectivistic members may be less willing to ask for financial help to avoid such circumstances.

First of all, it is important to understand another cultural continuum classified by Hofstede (2001), namely, power distance. Although this cultural continuum is an independent cultural dimension, it closely relates to the individualism-collectivism continuum. A power distance culture relates to the degree of inequality between individuals within a society. A society with high power distance will generally accept and perpetuate the inequalities in power between humans, and members of such society distinctly perceive their position and status within the community, and are unconditionally submissive to ones with higher power. Geert Hofstede (2001) suggested that societies with high score of power distance tend to be high scoring in Collectivism and vice versa. The development of self-conscious emotions (shame, loss of self-esteem, embarrassment and guilt) over the lifecycle emerges from one's social status in societies with high power distance (highly collectivistic).

Benedict (1974) refers to collectivism as the shame culture. A person is put into a state of shame when the wrongdoing is known by others (Hofstede, 2001). Shame occurs when a person fail to live up to one's role or status expectations, and is the feeling of loss of standing in the eyes of the other people within their society (Bedford and Hwang, 2003). In higher power distance societies, maintaining one's status is the duty of higher ranked members (Hwang, 2001). Basically, the role and status of older collectivistic members is usually greater than when they were young. As a result, it becomes more essential for them to act appropriately according to the standards, rules and goals of the group so that they may earn and maintain respect from lower status members, and maintain their status or identity. Importantly, Hofstede (2001) mentioned the concept of 'face' in collectivist families, members of collectivistic societies care

more about avoiding losing face, which occurs when one's own actions, or one's closely related members, fail to meet the expectations and requirements placed upon him by one's social position and status.

A handful of psychological studies report changes in one's self-esteem over a person life course. Majority of studies conclude either a stable (Demo, 1992; Bengtson et al., 1985) or an increasing level (Shaw et al., 2010; Giarrusso et al., 2001) of self-esteem as age advances. Nevertheless, Orth et al. (2010) and Robins et al. (2002) found that the level of self-esteem increases over the life of adulthood until the age of 60 and then sharply declines. The rationale for this is that self-esteem is structured by the acquisition and loss of social roles (Rosow, 1985; Mirowsky and Ross, 1992). The acquisition occurs throughout adulthood, but when people get older in later life, their roles are gradually eroded and replaced. Therefore, in a strong hierarchical society (or higher collectivism), once in adulthood individuals tends to pay intensive care to their social status, and thus exhibit high and increasing sense of self-worth.

Furthermore, Amsterdam and Levitt (1980) and Lewis et al. (1989) concluded that the state of embarrassment is not established without the emergence of self-awareness. In other words, individuals without self-recognition, which evidently presents itself with self-esteem, will not show or exhibit the feeling of embarrassment. Therefore, the development of self-esteem across age may cause the development of embarrassment. Furthermore, Mandel (2003) stated that members of collectivistic societies care about avoiding embarrassment more than members of individualist society. Additionally, Lewis et al. (1991) observed that the level of embarrassment increases with age.

Lastly, Hofstede (2001) states that within individualism, children are taught to be on their own feet since they are born, and live away from their parents when they turn into adolescents. Parents are supposed to live on their own without being dependent on their children. In contrast, in collectivistic societies, parents have the responsibility to raise and take care of their children, and later on, they are taken care of by their grown-up children. Consequently, as growing older, the financial responsibility and obligation to one's family increases in the collectivism. According to Bedford and Hwang (2003), Izard (1997), and Bedford (1990), when individuals accept and bear some feelings of responsibility, the state of guilt will be established. Hence, the higher responsibility tolerated by older collectivistic individuals will cause them to bear the feeling of guilt for wrong doings with, or without, the wrong doing being known by others.

In brief, this evidence suggests that *older collectivistic* individuals care more about avoiding any conduct or behaviour that may increase the likelihood they are put into a state of

embarrassment, guilt, shame and loss of self-esteem. Seeking financial support when facing financial problems or failures is an example of this behaviour. As a result, these older members of the collectivism are less willing to ask for financial help even though their access to support remains intact. Therefore, it is conjectured that older collectivistic individuals may subconsciously perceive their cushion as thinner compared to younger collectivistic individuals.

As the cushion of older collectivistic individuals is thinner, their risk perception is higher, and hence they have lower FRT, compared to younger collectivistic individuals. Eventually, the cross-cultural differences in FRT become smaller with age. Accordingly, the moderating effects of age on the cross-cultural difference in FRT through RP and/or RAtt, following from the shrinkage of the collectivism's social cushion will be tested as stated in the following hypotheses:

The moderating effect of age on cross-cultural difference in FRT through RP and/or RAtt (**H_8 to H_{10}**):

H_8: Age significantly positively affects the cross-cultural difference in RP
H_9: Age significantly negatively affects the cross-cultural difference in RAtt
H_{10}: Age significantly negatively affects the cross-cultural difference in FRT

The shrinkage of individual's cushion (**H_{11} and H_{12}**):

H_{11}: Older collectivistic individuals have significantly less access to financial support than younger collectivistic individuals
H_{12}: Older collectivistic individuals are significantly less willing to ask for financial help than younger collectivistic individuals

Before the discussion of statistical methods employed to conduct this cross-cultural study, it is fundamental to present the quantitative measure of an individual's culture. As mentioned in Section 5.2.1, instead of employing Hofstede's (2001) cultural classification to proxy culture, the study employs the Singelis's (1994) SCS to measure the culture at an individual level. Therefore, each respondent will be assigned with a cultural value and respondents from the same country can exhibit different cultural views.

5.3.1 Cultural value of an individual

The construct is a two-dimensional scale for measuring individualism and collectivism. It contains thirty 7-point likert-scale items out of which fifteen items measure the individualistic aspect and the other fifteen items measure the collectivistic aspect.

Measure of culture variable (COL_IDV): Each cultural continuum contains 15 questions[36], which will be averaged to obtain the mean scores of collectivism ($\overline{COL}$) and individualism ($\overline{IDV}$). The culture variable (COL_IDV) is the difference in their mean scores calculated by subtracting the mean score of individualistic construct from that of collectivistic construct. The formula of culture variable can be written as follows:

$$\text{COL\_IDV} = \overline{COL} - \overline{IDV}$$

Individuals with collectivistic value dominates individualistic value, that is, COL_IDV is greater than zero, are classified as collectivism dominance. In contrast, individuals with negative COL_IDV are dominated by individualistic construal, and thus are classified as individualism dominance. In the case the culture variable is equal to zero (COL_IDV = 0), individuals are culturally neutral. Consequently, the culture variable (COL_IDV) forms an ordinal variable ranged from -6 (most individualistic) to 6 (most collectivistic).

Moving away from the measure of culture, the subsequent section will provide the statistical approaches for the main empirical parts. The whole empiric section is divided in to three main parts. The first part is the examination of the cross-cultural differences in FRT through RP and/or RAtt, together with the main contribution of this study, which is, the moderating effect of age on the cross-cultural differences *(Age-culture-FRT analysis).* Subsequently, the second part provides the approach that the study uses to clarify the Weber and Hsee's (1998) cushion hypothesis *(Effect of cushion)*. Lastly, the investigation of the shrinkage of an individual's cushion, which is conjectured to be the rationale for the age moderating effect on the culture-FRT relationship, will be discussed *(Shrinkage of cushion)*.

[36] Appendix I, P.IV:
Independent Subscale (Individualism) Item1, Item2, Item5, Item7, Item9, Item10, Item13, Item15, Item18, Item20, Item22, Item24, Item25, Item27, Item29
Interdependent Subscale (Collectivism) Item3, Item4, Item6, Item8, Item11, Item12, Item14, Item16, Item17, Item19, Item21, Item23, Item26, Item28, Item30

5.3.2 Age-culture-FRT analysis

5.3.2.1 National analysis - Weber and Hsee's (1998) approach: Using country as culture's proxy and mosaic bivariate analysis

The statistical analysis in this section is an important test, which uses the exact same approach as Weber and Hsee's (1998). Firstly, the culture is measured at a national level using Hofstede's (2001) cultural dimensions. Specifically, country is used as the proxy for respondent's culture. Therefore, the cross-cultural differences in FRT can be inferred based on the cross-country differences in FRT. Secondly, the same statistical analysis, the mosaic bivariate analysis (ANOVA and Bonferroni t-test) is employed. Consequently, the findings regarding the cross-cultural differences in FRT through RP and/or RAtt, can be directly compared with those of Weber and Hsee (1998).

The three proposed hypotheses regarding cross-cultural differences in FRT, RP, and RAtt (H_4 – H_6; Section 5.2.2) will be tested[37].

H_4 [Risk perception]: $\overline{RP}_{US} = \overline{RP}_{UK} = \overline{RP}_{SG} = \overline{RP}_{VN} = \overline{RP}_{CN}$;

H_5 [Risk attitude]:

(1) [Objective RAtt]: $\overline{b_{VAR}}_{US} = \overline{b_{VAR}}_{UK} = \overline{b_{VAR}}_{SG} = \overline{b_{VAR}}_{VN} = \overline{b_{VAR}}_{CN}$;

(2) [Subjective RAtt]: $\overline{b_R}_{US} = \overline{b_R}_{UK} = \overline{b_R}_{SG} = \overline{b_R}_{VN} = \overline{b_R}_{CN}$;

H_6 [Financial risk tolerance]: $\overline{WTP}_{US} = \overline{WTP}_{UK} = \overline{WTP}_{SG} = \overline{WTP}_{VN} = \overline{WTP}_{CN}$;

5.3.2.2 Mosaic bivariate analysis: Individual level of culture analysis (Singelis's SCS)

In this section, the study continues using the mosaic bivariate analysis approach. However, culture is measured at an individual level using the Singelis's SCS (1994) instead of country-level measure. As explained in Section 5.3.1, each individual's cultural value is denoted COL_IDV ($\overline{COL}$ - $\overline{IDV}$). The whole sample is divided into three main cultural groups: individualism dominance (IND, COL_IDV<0), collectivism dominance (COL, COL_IDV>0), and cultural neutrality (N, COL_IDV=0).

[37] Subsequent statistical tests are stated in null hypothesis

The ANOVA and Bonferroni t-test are conducted to test whether there are significant differences in FRT, RP, and RAtt between individuals as a function of culture (H_4 – H_6; Section 5.2.2).

H_4 [Risk perception]: $\overline{RP}_{IND} = \overline{RP}_{COL} = \overline{RP}_{N}$;

H_5 [Risk attitude]:

(1)[Objective RAtt]: $\overline{b_{VAR}}_{IND} = \overline{b_{VAR}}_{COL} = \overline{b_{VAR}}_{N}$;

(2)[Subjective RAtt]: $\overline{b_R}_{IND} = \overline{b_R}_{COL} = \overline{b_R}_{N}$;

H_6 [Financial risk tolerance]: $\overline{WTP}_{IND} = \overline{WTP}_{COL} = \overline{WTP}_{N}$;

The two bivariate tests with the country-level measure and the individual-level measure of culture (Section 5.3.2.1 and 5.3.2.2, respectively) are the baseline methods of the study. The findings obtained in these tests will be compared directly with those of Weber and Hsee (1998). Consequently, the comparability of this study's data can be inferred. The next section presents the main statistical analysis (model-based mosaic approach).

5.3.2.3 Model-based mosaic multivariate analysis - Individual level of culture analysis

For each mosaic, the presence of cultural influences on the main constructs (FRT, RP and RAtt) will be initially examined, followed by the investigation of age as a moderator of the cultural effects on those main constructs.

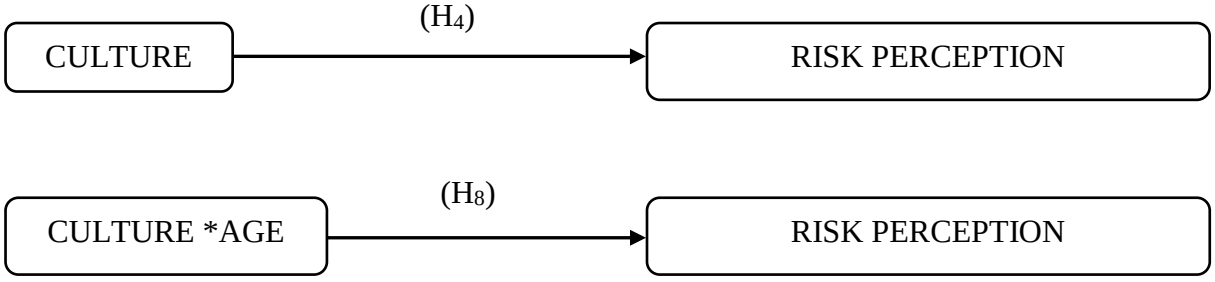
Mosaic 1: Age influences the cross-cultural difference in RP

To respectively test the two proposed hypotheses:

"H_4: More collectivistic individuals exhibit significantly lower RP than less collectivistic and individualistic individuals" **&** *"H_8: Age significantly positively affects the cross-cultural difference in RP"*

The estimating regression model can be specified as follows:

$$RP_i = \alpha_i + \beta_{G1}Group1 + \beta_{G2}Group2 + \beta_{G3}Group3 + \beta_{G4}Group4 + \beta_{G5}Group5 + \beta_{G6}Group6 + \varepsilon_i,$$



Where the content for each independent variable group is listed in Table 5.1 (See Appendix 4 for more explanation of each variable component).

Table 5.1: Classification content for each independent variable group

Independent variable	Classification content ***Explanation see Appendix 4***
Group 1: Main variables	COL_IDV, COL_IDV*Age; Age; Age^2
Group 2: Demographic variables	Age*LnW; Single; Gender; Child; Highschl; Hhsize; LnW; LnInc
Group 3: Socioeconomic variables	Unemp; Selfemp; Homeown
Group 4: Attitudinal variables	Rbelief; IncStab; Health; SRA; Ecoexp; Interestexp
Group 5: Geographical	US; UK; VN; SG
Group 6: Cushion hypothesis variables	Finhelp; Helpatt; Age*Finhelp; COL_IDV*Finhelp; Age*Helpatt; COL_IDV*Helpatt; COL_IDV*Helpatt; Finhelp*Helpatt; COL_IDV*Age*Finhelp; COL_IDV*Age*Helpatt

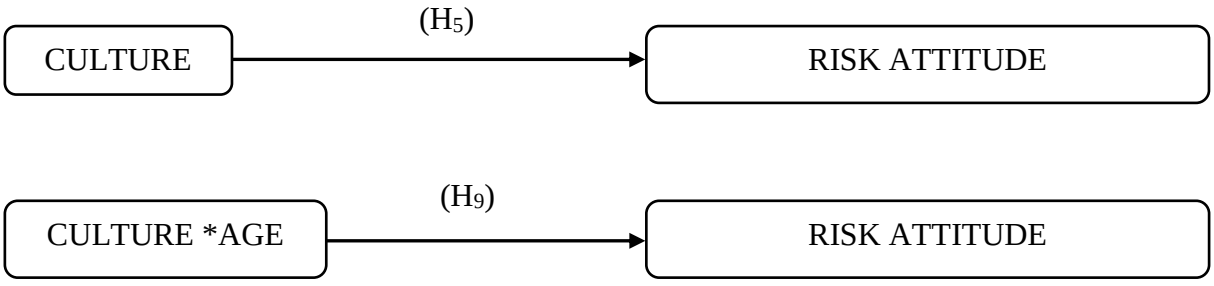
Mosaic 2: Age influences the cross-cultural difference in RAtt

To respectively test the two proposed hypotheses:

"H_5: More collectivistic individuals exhibit significantly higher RAtt than less collectivistic and individualistic individuals" **&** *"H_9: Age significantly negatively affects the cross-cultural difference in RAtt"*

The estimating regression specification as follows:

$$(b_{VAR}/b_R)_i = \alpha_i + \beta_{G1}Group1 + \beta_{G2}Group2 + \beta_{G3}Group3 + \beta_{G4}Group4 + \beta_{G5}Group5 + \beta_{G6}Group6 + \varepsilon_i,$$



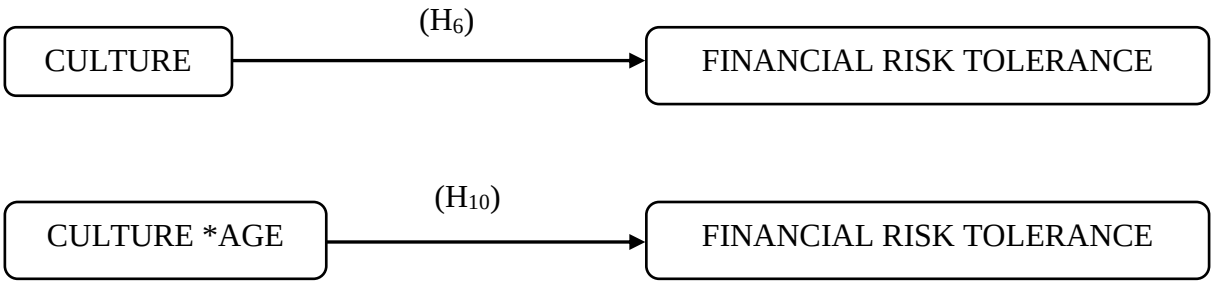
Mosaic 3: Age influences the cross-cultural differences in FRT

To respectively test the two proposed hypotheses:

"H_6: More collectivistic individuals exhibit significantly higher level of FRT than less collectivistic and individualistic individuals" **&** *"H_{10}: Age significantly negatively affects the cross-cultural difference in FRT"*

The estimating regression specification as follows:

$$Ln(WTP)_i = \alpha_i + \beta_{G1}Group1 + \beta_{G2}Group2 + \beta_{G3}Group3 + \beta_{G4}Group4 + \beta_{G5}Group5 + \beta_{G6}Group6 + \varepsilon_i,$$



The study then moves away from the main findings of whether culture influences FRT through RP and/or RAtt, and whether its influence is moderated by age, to the reasons behind these effects. Initially, to explain the cross-cultural difference in FRT through RP (as found by literature, Section 5.2.2), the study clarifies the cushion hypothesis of Weber and Hsee (1998) using exactly the methods employed by Hsee and Weber (1999) and two alternative statistical methods as explained in the following section.

5.3.3 Effect of cushion (The cushion hypothesis)

The main variable that Hsee and Weber (1999) used to validate their cushion hypothesis measures the number of people that individuals can access for financial help, excluding their spouses. The study employs the same questionnaire with Hsee and Weber (1999) to measure the same variable, termed 'Finhelp', as presented in Appendix 1 (Part VII, 3rd question). The question asks the respondents to state the number of people from their social network (stated in questions one and two) that they can ask for financial support. Individuals with better access to financial support tend to have more buffering cushion in case of financial failure or difficulty.

There are three statistical methods employed to clarify the cushion hypothesis. Firstly, exactly the same bivariate analysis (ANOVA) of Hsee and Weber (1999) is employed as the baseline. Alternatively, two additional tests are implemented to verify this cushion hypothesis. These are the four-step mediation model of Baron and Kenny (1986) and the structural equation modelling (SEM). The use of these two methods aims to improve the bivariate method of Hsee and Weber

(1999). Particularly, the results of the ANOVA analysis only determine whether collectivistic individuals have significantly more access to financial help compared to individualistic individuals. If that statement is supported, the cushion hypothesis is confirmed. Nevertheless, it is possible that the greater access to financial support may have nothing to do with lower RP and higher FRT. Therefore, the story that is made from different separate mosaics rather than a completely connected picture does not allow for the examination of the mediating effect of one's social cushion (Finhelp) on the cross-cultural difference in RP and FRT. For this reason, the Baron and Kenny's (1986) mediation model and the SEM are employed to overcome the issue.

5.3.3.1 Bivariate analysis: Cross-cultural difference in social cushion

Completely replicating Hsee and Weber's (1999) approach, the ANOVA analysis and Bonferroni t-test are conducted to examine the differences in individual's financial support availability ($\overline{Finhelp}$) across cultures. Hence, *"H_7: More collectivistic individuals have significantly more access to financial support than less collectivistic and individualistic individuals"* is examined as follows:

H_7: $\overline{Finhelp}_{IND} = \overline{Finhelp}_{COL} = \overline{Finhelp}_{N}$;

To verify the cushion hypothesis in a more comprehensive manner, the study conducts an examination of the mediating effect of financial support availability (Finhelp) on cultural differences in FRT, RP, and/or RAtt. Two statistical models: the four-step mediation model of Baron and Kenny (1986) and the Structural Equation Modelling (SEM) are employed and presented in the following Section 5.3.3.2 and Section 5.3.3.3, respectively.

5.3.3.2 Mediation model 1: The four-step mediation model (Baron and Kenny, 1986)

In the first empirical part (Section 5.3.2), the influence of culture on FRT through RP and/or RAtt was examined. The whole study includes three mosaics: cultural influences on RP, RAtt and FRT (mosaics 1 to 3, respectively). In this empirical part, the main objective is to clarify the cushion hypothesis of Weber and Hsee (1998). Specifically, the study tests whether the cultural effects on RP, RAtt, and FRT operate through the individual's access to financial support (Finhelp). With the use of the Baron and Kenny's (1986) mediation model, these three mosaics are further tested with financial support availability (Finhelp) is the mediating variable in each mosaic.

The four-step mediation model of Baron and Kenny (1986) is depicted in the following diagram (Figure 5.1):

Figure 5.1: The mediation paths in examining the cushion hypothesis (Four-step model)

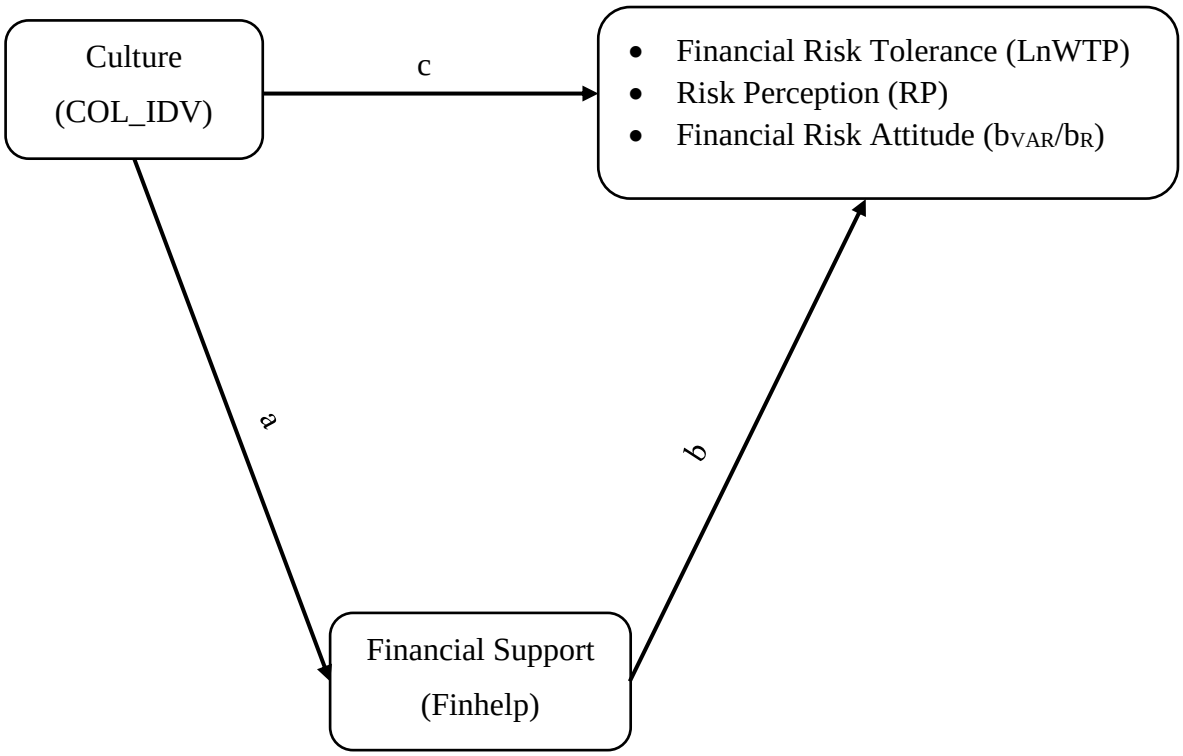
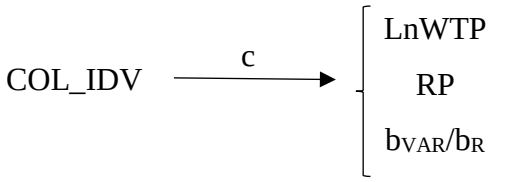
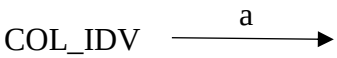
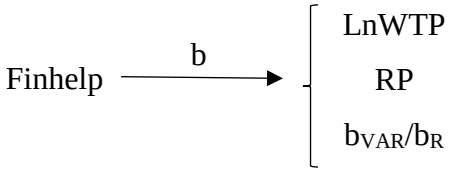
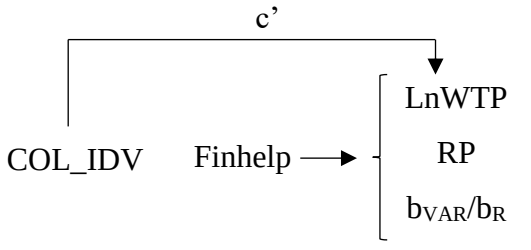


Table 5.2 briefly describes the mediation model diagram depicted in Figure 5.1. The first three steps of the mediation model for each mosaic (path a, b, and c) aim to examine the existence of zero-order relationships among the variables. Particularly, three regressions for each mosaic are run: ***(Step 1 – path c)*** COL_IDV → RP (mosaic 1) – b_{VAR}/b_R (mosaic 2) – LnWTP (mosaic 3), ***(Step 2 – path a)*** COL_IDV → Finhelp, and ***(Step 3 – path c)*** Finhelp → RP (mosaic 1) – b_{VAR}/b_R (mosaic 2) – LnWTP (mosaic 3). According to Baron and Kenny (1986), if any of these tested relationships in the first three steps of each mosaic are insignificant, the result indicates no mediation. Otherwise, test proceeds with the final step. In the last regression model, both culture (COL_IDV) and financial support availability (Finhelp) are controlled for as independent variables which influence RP (mosaic 1), b_{VAR}/b_R (mosaic 2), and LnWTP (mosaic 3). If the effects of Finhelp on RP, RAtt, and FRT (path b) remain significant after controlling for COL_IDV the conclusion of either full mediation, or partial meditation is reached. This depends on the direct effect of culture on RP, RAtt, and FRT (path a). If the direct effect c' becomes insignificant, full mediation is acknowledged. On the other hand, if the direct effect c' remains statistically significant, researchers often conclude that partial mediation is supported.

Table 5.2: The four-step Baron and Kenny (1986) mediation model

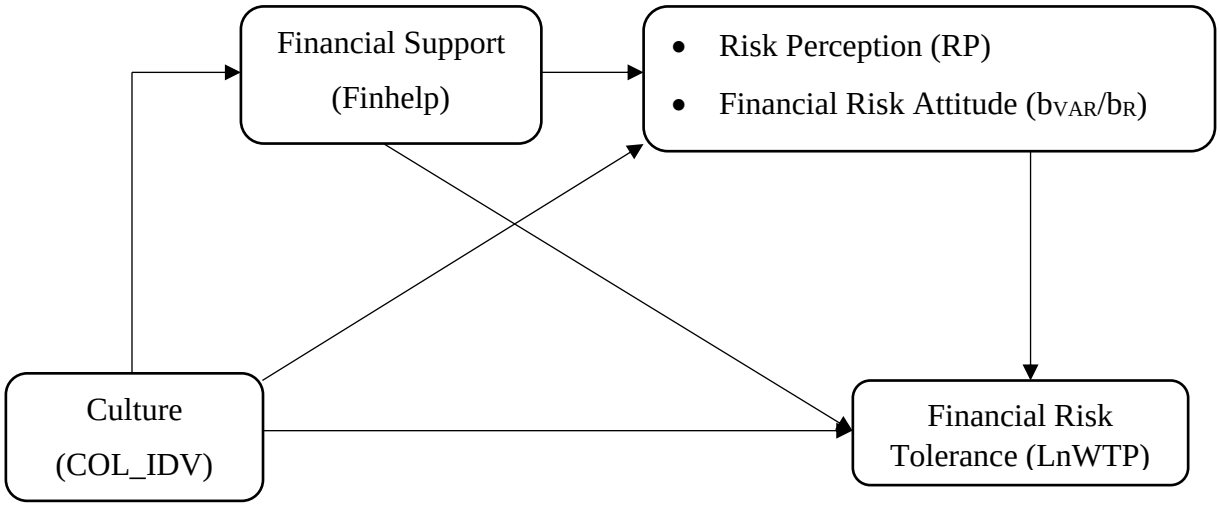
	Visual Depiction	*Mediating effect of Finhelp*
Step 1		Direct effects of culture on financial risk tolerance, risk perception, and risk attitudes to test for path c, $\begin{Bmatrix} \text{LnWTP} \\ \text{RP} \\ b_{VAR}/b_R \end{Bmatrix} = \beta_0 + \beta_1 \text{COL\_IDV} + e$
Step 2		A regression with culture predicting financial support availability (Finhelp) to test for path a, $\text{Finhelp} = \beta_0 + \beta_1 \text{COL\_IDV} + e$
Step 3		A regression analysis with financial support predicting financial risk tolerance, risk perception, and risk attitude, to test for path b, $\begin{Bmatrix} \text{LnWTP} \\ \text{RP} \\ b_{VAR}/b_R \end{Bmatrix} = \beta_0 + \beta_1 \text{Finhelp} + e$
Step 4		A multivariate regression with both culture and financial support availability predicting financial risk tolerance, risk perception, and risk attitudes $\begin{Bmatrix} \text{LnWTP} \\ \text{RP} \\ b_{VAR}/b_R \end{Bmatrix} = \beta_0 + \beta_1 \text{COL\_IDV} + \beta_2 \text{Finhelp} + e$

Controlling variables (Appendix 4): Age, Age^2, Age*LnW, Helpatt, Age*Helpatt, Single, Gender, Child, Highschl, Rbelief, Hhsize, LnW, Lninc, Incstab, Unemp, Selfemp, Homeown, Health, SRA, Ecoexp, Interestexp, US, UK, VN, SG.

5.3.3.3 Mediation model 2: The Structural Equation Modelling (SEM)

Although the Baron and Kenny (1986) mediation model allows for the examination of moderating roles of financial support availability (Finhelp) on the three mosaics (RP, RAtt, and FRT, respectively), the three mosaics are tested separately. In other words, the four-step model is implemented three times for the three main constructs. However, the story is glued together better by comparing this to the use of Hsee and Weber's (1999) approach (bivariate analysis). For further improvement, the study employs the SEM with maximum likelihood estimation, which visually presents all mosaics to one complete picture as depicted in Figure 5.2.

Figure 5.2: The mediation paths in examining the cushion hypothesis (SEM)



SEM is a confirmatory technique that examines complex (direct and indirect) relationships between more than one independent variables and more than one dependent variables. Its goal to validate the proposed model as specified a priori in Figure 5.2. The figure shows the complete culture-FRT picture. Specifically, collectivism exhibits greater access to financial support (COL_IDV → Finhelp). The greater support acts as a cushion for those collectivistic individuals. Hence, they perceive the same investment option as less risky (Finhelp → RP) *and/or* they like risk more (Finhelp → RAtt) compared to their individualistic counterparts. Because of the lower RP and/or higher RAtt, individuals of collectivism are more tolerant than those of individualism.

5.3.4 Shrinkage of cushion effect

As the cushion hypothesis causes cultural differences in FRT through RP and/or RAtt, changes in such cultural difference may be explained by differences in individual's social cushion across ages. Firstly, it is possible that older collectivistic individuals have less access to financial support (finhelp) compared to the younger individuals. Alternatively, as projected, older collectivistic individuals are less willing to ask for help as they try to avoid being put into the stage of shame, guilt, embarrassment and loss of self-esteem (Section 5.2.3). Therefore, if older collectivistic individuals have less access to financial support and/or are less willing to ask for financial help from others, it can be said that the cushion buffer of collectivistic individuals reduces across ages. Because of that decreasing cushion buffer, older collectivistic individuals perceive higher risk, and hence, their FRT increases comparing to younger collectivistic individuals.

Consequently, to test this conjecture, the study is the first to propose a factor, namely, attitude towards financial help (helpatt), which potentially adds to the explanation of the variation in cultural difference in FRT across age. To obtain an individual's help attitude four 7-point likert-scale items, developed by Cohen (1999), were asked (Appendix 1, P.VIII). The Helpatt variable is constructed by calculating the mean score of the answers to those four questions. Therefore, the variable ranges from 1 (least willing to ask for help at all) to 7 (most willing to ask for help). Note that question 1 and question 2 are inverse scales and need to be converted to the common scale by subtracting the respondent's answer from 8.

5.3.4.1 Bivariate analysis: Individual's social cushion across age

Initially, the ANOVA and Bonferroni t-test are employed on the full sample to examine if cushion hypothesis variables change as a function of age.

(1) $\overline{Finhelp}_{\text{Age1}} = \overline{Finhelp}_{\text{Age2}} = \overline{Finhelp}_{\text{Age3}} = \overline{Finhelp}_{\text{Age4}}$;

(2) $\overline{Helpatt}_{\text{Age1}} = \overline{Helpatt}_{\text{Age2}} = \overline{Helpatt}_{\text{Age3}} = \overline{Helpatt}_{\text{Age4}}$;

5.3.4.2 Multivariate analysis: Individual's social cushion across age

To test these conjectures as stated in hypothesis H_{11} and H_{12} (Section 5.2.3), the full sample is divided into collectivism and individualism. Subsequently, two multivariate estimating models are specified as follows:

$$\left.\begin{array}{l}(1)\ Finhelp_i \\ (2)\ Helpatt_i\end{array}\right\} = \alpha_i + \beta_1 * Age + \beta_{G2} Group2 + \beta_{G3} Group3 + \beta_{G4} Group4 + \beta_{G5} Group5 + \beta_{G6} Group6 + \varepsilon_i,$$

Where the content for each independent variable group is listed in Table 5.3 (See Appendix 4 for more explanation of each variable component).

Table 5.3: Classification content for each independent variable group

Independent variable	Classification content ***Explanation see Appendix 4**
Group 1: Main variables	Age, Age^2
Group 2: Demographic variables	COL_IDV; COL_IDV*Age; Age*LnW; Single; Gender; Child; Highschl; HhSize; LnW; LnInc
Group 3: Socioeconomic variables	Unemp; Selfemp; Homeown
Group 4: Attitudinal variables	Rbelief; IncStab; Health; SRA; Ecoexp; Interestexp
Group 5: Geographical	US; UK; VN; SG
Group 6: Cushion hypothesis	❖ **Model 1 - Dependent variable: Finhelp** Helpatt; Age*Helpatt; COL_IDV*Helpatt; COL_IDV*Age*Helpatt ❖ **Model 2 - Dependent variable: Helpatt** Finhelp; Age*Finhelp; COL_IDV*Finhelp; COL_IDV*Age*Finhelp

5.4 Data Description

This section describes the data sample by presenting the descriptive statistics of the variables included in this study. These are the three main dependent variables and the five independent variable groups as discussed in Section 3.4.3 and explained in Appendix 4. However, to prevent repetition, only the main independent variable group 1 (cultural value, COL_IDV), and cushion hypothesis variables group 6 (Finhelp and Helpatt) are discussed here. All other variables have been explained in the first empirical study (Chapter 4, Section 4.4).

5.4.1 Variable group 1: Main independent variables

Table 5.4 presents the description of the individual cultural value (COL_IDV), which is the main proposed determinant of individual FRT. The sample contains individuals ranging from very individualistic (min_{COL_IDV} = -5.73) to very collectivistic (max_{COL_IDV} = 5.2). On average, individuals are slightly individualistically dominant ($mean_{COL\_IDV} \approx$ -0.14) with a standard deviation of 0.926.

Table 5.4: Descriptive Statistics of Culture (Group 1)

Variable	Mean	Median	Std Dev	Min	Max	N
COL_IDV	-0.1365	0	0.926	-5.73	5.2	1,889

5.4.2 Variable group 6: Cushion hypothesis variables

The description of the last variable group is presented in Table 5.5. The financial help availability (Finhelp) reported by the study sample has mean of 2.971 and median of 2. The variable exhibits a positive skewness of distribution as depicted in Figure 5.3. The number of people who could be approached for financial help most respondents reported are ranged from zero to six. Figure 5.4 provides a comparison of financial help available across the five countries. As expected, China and Vietnam reveal the highest mean values (4.06 and 4.26) compared to a mean value of around 2 for the other three countries. The variable Helpatt which measures one's attitude towards financial help is rather skewed to the high willingness to ask for financial help. Its mean and median values are both around 4.

Table 5.5: Descriptive Statistics of Cushion Hypothesis Variables (Group 6)

Variable	Mean	Median	Std Dev	Min	Max	N
Finhelp	2.971	2	3.031	0	40	1,889
Helpatt	4.0527	4	0.938	1	7	1,889

Figure 5.3: The distribution of Finhelp variable

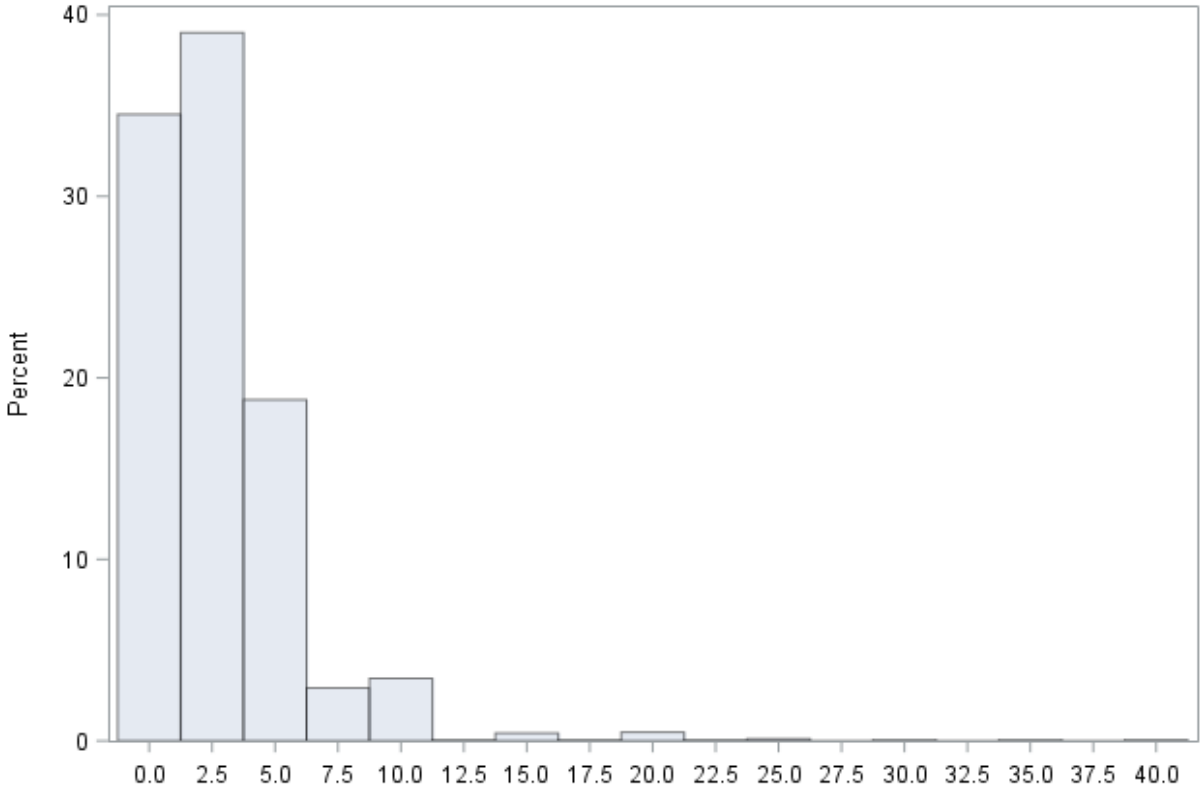
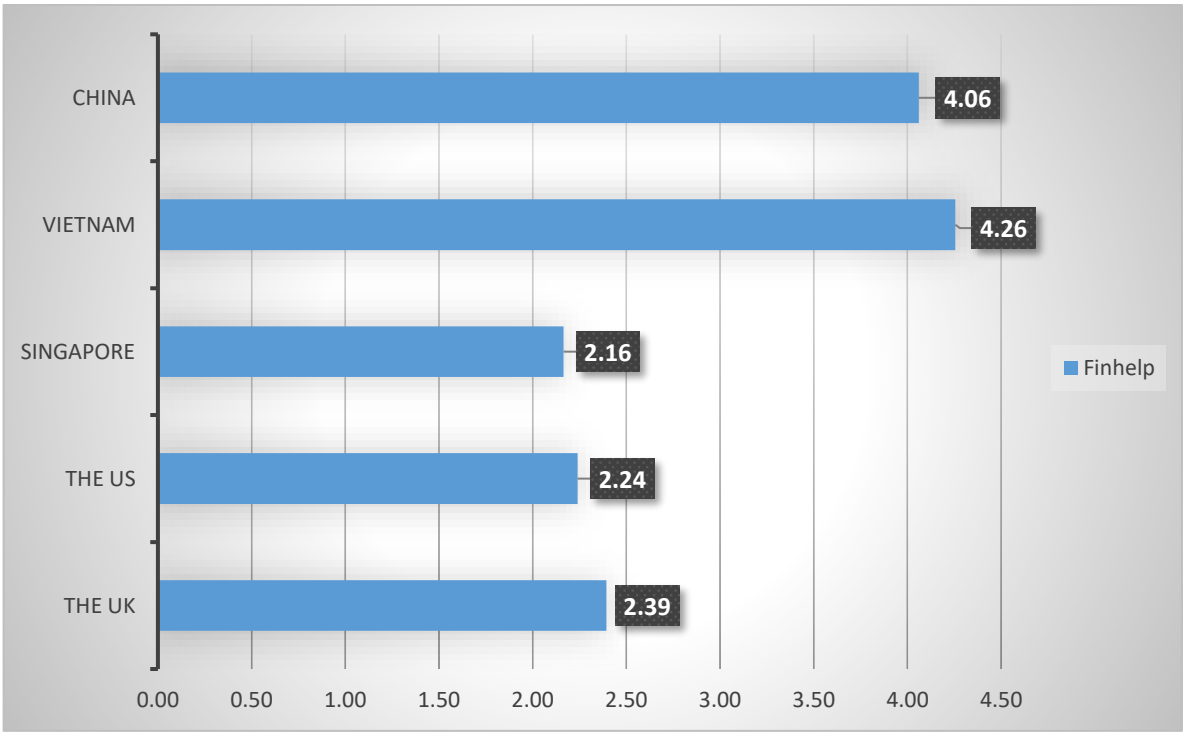


Figure 5.4: Financial Support across Countries



5.5 Empirical results

Before discussing the findings for the main tests as explained in the methodology section 5.3, the overall cultural value of each five investigated countries will be revealed using both Singelis's SCS and Hofstede's cultural classification. As noticed in Section 5.2.1, the Hofstede's cultural conceptualization is critiqued as simplistic and obsolete, so that it may no longer a robust proxy for individual culture. Consequently, the current study measures culture at individual level using the Singelis's (1994) SCS to tackle these limitations. Basically, the study initially tests for the aggregating cultural values of the five countries using the Singelis's SCS and subsequently, the cultural classification based on the results is compared with that of Hofstede (2001).

5.5.1 Cultural values of investigated countries (Hofstede versus Singelis)

This section measures the general cultural values of the five tested countries using the Singelis's (1994) SCS, and accordingly classifies their cultures based on the obtained results. Subsequently, this Singelis's cultural classification will be compared to the cultural classification of Hofstede (2001). Table 5.6 reports the cultural value of each country using both measures.

According to Hofstede, the US and the UK are categorised as individualistic countries with the highest individualism indexes in the world. On the other hand, the remaining countries, Singapore, Vietnam, and China, are collectivistic countries that exhibit the lowest individualism indexes in the world. The Hofstede's cultural indexes for the five countries are presented in the upper panel of Table 5.6.

Alternatively, the cultural classification of these countries is classified using the individual level using Singelis's SCS. As explained in the previous Section 5.3.1, each individual's cultural value is denoted COL_IDV ($\overline{COL}$ - $\overline{IDV}$). To derive the culture of a country, the mean cultural value of all individuals from each country ($\overline{COL\_IDV}_{country}$) is tested to determine whether it is statistically different from zero using an independent sample t-test. If the $\overline{COL\_IDV}_{country}$ is not statistically different from zero, the country is classified as 'culturally neutral'. In contrast, if the $\overline{COL\_IDV}_{country}$ is statistically positive, the country is classified as collectivism dominance, and otherwise, individualism dominance.

According to the statistical result (the lower panel of Table 5.6), $\overline{COL\_IDV}_{country}$ is found to be statistically significant at the 1% critical level, which is negative in the UK, the US, and Singapore ($\overline{COL\_IDV}_{country}$ = -0.3537, -0.3758 and -0.1353, respectively), and positive in Vietnam ($\overline{COL\_IDV}_{country}$ = 0.2482). China, on the other hand, its mean cultural value is not

significantly different from zero ($\overline{COL\_IDV}_{China}$ = 0.0116, n.s). Similar to Hofstede (2001), Singelis's SCS also classifies the US and the UK as favouring individualism, and Vietnam as favouring collectivism. However, different from what Hofstede found, Singapore is dominantly individualistic, and China exhibits a cultural neutrality.

Table 5.6: Cultural Value of Each Investigated Country

HOFSTEDE SCALE

Country	Individualism Index	Cultural classification
The UK	90	Individualism
The US	91	Individualism
Singapore	25	Collectivism
Vietnam	20	Collectivism
China	20	Collectivism

SINGELIS SCALE (COL_IDV)

Country	N	Mean	t-statistic	Cultural classification
The UK	387	-0.3537[a]	-6.31***	Individualism Dominance
The US	413	-0.3758[b]	-7.06***	Individualism Dominance
Singapore	382	-0.1353[a,b,c]	-3.63***	Individualism Dominance
Vietnam	328	0.2482[a,b,c,d]	5.33***	Collectivism Dominance
China	379	0.0116[a,b,d]	0.38	Culture Neutrality
F-value (DF = 4)			30.57***	

Note: Two country groups with the same superscripts down each column (comparing only with the first country group assigned with the superscript) indicate that their means are significantly different at the 0.05 level using Bonferroni T-test.
, **, and * denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Although the cultures of China and Singapore are different from that stated by Hofstede, the results are not surprising as they were well documented in literature. Many studies have mentioned about the cultural transformation of China from collectivism to individualism, which is referred to as the individualisation of China (Beck and Beck-Gernsheim, 2010). Yan (2010), Beck and Beck-Gernsheim (2010), Cao (2009), Steele and Lynch (2013), and Zeng and Greenfield (2015) indicated the ongoing transition of Chinese culture from collectivism to individualism as a result of its drastic economic growth that has averaged 10 percent annually since the early 1990s, and its prominent economic reforms in 1978. According to Hofstede (2001), the higher the wealth and economic growth, the more likely the country is to be an individualism as poverty makes individuals become independent of their group both financially and mentally. Besides economic development, other reasons have been suggested by these

studies for the rapid pace of China's cultural shift, namely, urbanisation, ecological change, globalisation, education, mass media, and change in social pattern.

In the case of Singapore, due to a wide spectrum of its cultures, Singapore is epitomised as a multicultural country (Chan, 2013). The country comprises the Chinese (74.3%), Malays (13.3%), Indian (9.1%) and others (3.3%) (Ortiga, 2015). Over the last 50 years, Singapore has been one of the world's fastest growing countries economically. It has been grown incredibly from a GDP per capita of US$320 to US$60,000, making it now the sixth richest country in the world (Thoughtco, 2017). For similar reason with the transition of China's culture, as well as its dominant Chinese population, it is plausible for Singapore to be dominated by individualism.

The statistical results are presented in the following sections and are structured through *three* main parts as stated in the Methodology section 5.3. Firstly, the 'age-culture-FRT' association in section 5.5.2 reveals the findings for the examination of cross-cultural difference in FRT through RP and/or RAtt; and whether age influences such cross-cultural differences if found to be present. The main statistical method employed for this part is the model-based mosaic analysis. However, the results of the mosaic bivariate analysis will be presented first as the baseline.

5.5.2 Age-culture-FRT

5.5.2.1 National analysis - Weber and Hsee's (1998) approach: Using country as culture's proxy and mosaic bivariate analysis

The analysis starts with an *exact* replication of the approach Weber and Hsee (1998) used to examine the cross-cultural difference in FRT through RP and/or RAtt (Section 5.3.2.1). Basically, they employed the mosaic bivariate analysis (ANOVA and Bonferonni t-test) to compare FRT, RP, and RAtt of individuals from different countries. In other words, they use country as a proxy for culture (based on Hofstede's cultural dimensions). Therefore, the interpretations of the obtained results are based on the cultural classification of each country defined by Hofstede (2001)[38]. Specifically, this section compares the FRT, RP and RAtt of collectivistic countries (China, Vietnam, and Singapore) with those of individualistic countries (the US and the UK).

Table 5.7 provides summary of the mean judgements for willingness to pay (WTP), perceived riskiness (subjective RP), and risk attitude (RAtt) of individuals as a function of their country of nationality. The results from ANOVA imply that individual FRT and RP are significantly different across the five countries of investigation at the critical level of 1% ($F\text{-value}_{(1)} = 20.36$,

[38] Singelis's (1994) cultural measure is taken out of the picture at this stage.

F-value$_{(2)}$ = 5.09). Accordingly, it ascertains that country lies at source of differences in individual FRT and RP. These findings prove the importance of the multivariate analysis, in which country variables can be controlled for, to better distinguish the cultural effect from the country effect at the later stage.

Based on the superscripts which mark the results of the Bonferroni t-tests, the mean WTP of Vietnam, the most collectivistic country, ($WTP_{Vietnam}$ = \$1,887) is the highest among the five countries, which is statistically significantly higher than that of the UK, the US and Singapore, three individualistic countries. Concurrently, its mean value of RP ($RP_{Vietnam}$ = 50.95) is the lowest and significantly lower than the UK and Singapore. These results imply that Vietnamese individuals exhibit the highest level of FRT, which may be attributed by their lowest level of RP.

Following Vietnam, China clinches the second place in terms of its second highest mean WTP (WTP_{China} = \$1775) and second lowest mean RP (RP_{China} = 53.053), both of which are significantly different from those of the UK, the US, and Singapore. On the other hand, the remaining three countries exhibit significantly lower FRT with significantly higher levels of RP when compared to China and Vietnam. However, their FRT and RP are not significantly different from each other.

Overall, the results indicate that the collectivistic country group comprising of Vietnam, China, and Singapore, exhibit higher levels of FRT due to their lower levels of RP (WTP = \$1887, \$1775, and \$1105; RP = 50, 53, and 57; respectively) when compared to their individualistic counterparts, namely, the US and the UK (WTP = \$1011 and \$886; RP = 54 and 55; respectively). These findings are consistent with those of Weber and Hsee (1998).

Besides the significant cross-national differences in FRT and RP, individual RAtt is also found to vary as an effect of country (Table 5.7, Columns 3 and 4). The results are statistically significant at 5% critical level or below, which are consistent across both measures of RAtt (F-value$_{(3)}$ = 7.29 and F-value$_{(4)}$ = 2.51). Nevertheless, the Bonferroni t-test results imply different stories, which are not consistent across different RAtt measures.

With regards to cross-cultural differences in RAtt, the results are displayed in Table 5.7, Columns 3 and 4. Assuming that RP is constant across individuals and thus, objective measures of RAtt (b_{VAR}) are employed, Vietnamese and Chinese respondents exhibit significantly higher positive attitudes toward financial risk when compared to the others. Using comparative words, it can be said that Vietnamese and Chinese individuals do not hate financial risk as much as respondents from the other three countries. Indeed, according to the mean objective RAtt

(b_{VAR}), all respondents of the five tested countries are risk-seeking as their mean RAs are positive. Therefore, the finding indicates that with the same level of risk perceived (variance), Vietnamese and Chinese individuals like financial risk more than other respondents from Singapore, Britain and America. Hence, they are willing to pay more for the financial options (higher FRT).

However, as the main underlying assumption of constant RP across individuals has been verified to be violated (Table 5.7, Column 2), the objective RAtt (b_{VAR}) is not incorporated in the picture. Consequently, the subjective RA (b_{VAR}) are taken into account (Column 4), which depicts a different picture. Firstly, the negative mean b_R of the five countries (all except the US) indicates that the majority of respondents are risk-averse instead of being risk-seeking as objective RAtt suggests. Secondly, although ANOVA analysis provides a significant F-value at 5% level, no significant pair-wise difference is found when the cut-off significant level of the Bonferroni t-test is applied. This inherently indicates that country may not be a factor that influences individuals' risk attitudes (RAtt).

Table 5.7: Mean Judgements of Willingness-to-Pay, Subjective Risk Perception, and Risk Attitude as A Function Of Respondents' Country

Country	*Sample Size (N)*	*WTP (1)*	*Risk Perception (2)*	*Objective RAtt - b_{VAR} (3)*	*Subjective RAtt - b_R (4)*
The UK	387	885.764[a]	55.373[a]	0.000323[a]	-15.487
The US	413	1011.062[b]	53.968	0.000315[b]	1.244
Singapore	382	1105.004[c]	57.104[b]	0.000192[c]	-31.234
Vietnam	328	1887.159[a,b,c]	50.950[a,b]	0.000760[a,b,c]	-17.020
China	379	1775.072[a,b,c]	53.053[b]	0.000444	-23.031
F-Value (DF = 4)		20.36***	5.09***	7.29***	2.51**

Note: Two country groups with the same superscripts (comparing only with the first country group assigned with the superscript) down each column indicate that their means are significantly different at the 0.05 level using Bonferroni T-test.
, **, and * denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

To sum up, with the Weber and Hsee's (1998) approach, the whole cultural picture is the same as theirs and other studies[39] such that cross-cultural difference in FRT are associated by cross-cultural difference in RP but not RAtt. Furthermore, according to Hofstede individualism index,

[39] Bontempo et al. (1997); Hsee and Weber (1999); and Weber et al. (1998); Fan and Xiao (2006) and Statman (2010)

it is found that collectivistic societies (Singapore, China, and Vietnam) are more risk tolerant owing to their lower RP when compared to their individualistic counterparts (the UK and the US), whilst individual RAtt across these countries is relatively the same. Consequently, as the current study employs the same FRT experimental task, the same measures of FRT, RP and RAtt, and the same statistical approach, the same findings are obtained. It implies that the data obtained in this study is comparable to that of Weber and Hsee (1998). Referring back to the reduction of 12 investment options to six investment options in the FRT experimental task (Section 2.4.1), this data's comparability implies that the research can be conducted sufficiently with the adjustment.

5.5.2.2 Mosaic bivariate analysis: Individual level of culture analysis (Singelis's SCS)

In this section, results of another bivariate test is revealed. With this method, the mosaic bivariate analysis is still employed. However, instead of measuring culture at the national level (Weber and Hsee's approach), the Singelis's SCS is used to measure culture at the individual level. As discussed in Section 5.2.1.2 regarding the drawbacks of the national analysis using Hofstede's cultural classification, this study mainly focuses on the individual analysis using the Singelis's SCS, which can tackle those limitations. Therefore, the results obtained from the national analysis in the previous section (Section 5.5.2.1) is used as the baseline to compare the results with those of Weber and Hsee (1998), who employs the national analysis as the main statistical methodology.

Table 5.8 reveals mean values of individual FRT (column 1), RP (column 2), and RAtt (columns 3 and 4) across cultures. According to the ANOVA results, the mean values of WTP and RP are significantly different as a function of culture ($F\text{-value}_{WTP} = 3.21$, p-value = 0.05; $F\text{-value}_{RP} = 4.80$, p-value = 0.01). In other words, members of different cultures tend to exhibit different levels of FRT and RP.

According to the Bonferroni t-test, individuals, who are dominated by the collectivism continuum, are significantly more risk tolerant in the financial context than those who are dominated by individualistic continuum (WTP_{COL} = \$1430 versus WTP_{IND} = \$1191). On the other hand, individuals who are neither dominated by collectivism nor individualism on average are less risk tolerant than those that are dominated by collectivism, but are more risk tolerant than individualistic dominance individuals (WTP_N = \$1376). However, the pair-wise differences between them are not statistically significant. Specifically, the FRT of culturally neutral individuals are statistically similar to those of individualistic and collectivistic individuals.

Cross-cultural differences in one's RP are also found to be statistically significant at 1% critical level (F-value = 4.80). This indicates that the cross-cultural difference in FRT are associated with cross-cultural differences in RP. The Bonferroni t-test further reveals a significantly lower risk perceived by collectivistic members relatively to those perceived by individualistic members (RP_{COL} = 52.74 versus RP_{IND} = 55.6, p-value < 0.05). Culturally neutral individuals perceive lower risk than individualistic members, but higher risk than do collectivistic members (RP_N = 53.2). Similar to FRT results, the differences in RP between culturally neutral individuals and those of individualism/collectivism are not statistically significant.

The story thus far depicts that since collectivistic individuals perceive smaller financial risk than individualistic individuals, they are more willing to engage in risky financial options (higher FRT). Hence, cross-cultural differences in RP are the reason for cross-cultural difference in FRT. However, with regards to the mean RAtt of individuals with different cultural values, the ANOVA results for both measures of RAtt show that there are no significant cross-cultural difference in individual RAtt due to the nonsignificant F-value ($F\text{-value}_{(3)}$ = 0.59; $F\text{-value}_{(4)}$ = 1.23). This implies that attitudes towards the financial risk of individuals with different collectivism-individualism values are relatively similar. Therefore, the obtained cross-cultural differences in FRT may be better explained by cross-cultural differences in RP, but not by the cross-cultural differences in RAtt.

Table 5.8: Mean Judgements of Willingness-to-Pay, Subjective Risk Perception, and Risk Attitudes as A Function Of Respondents' Cultural Value

Culture	*Sample Size (N)*	*WTP (1)*	*Risk Perception (2)*	*Objective RAtt - b_{VAR} (3)*	*Subjective RAtt - b_R (4)*
Collectivism D.	802	1430.468[a]	52.735[a]	0.000438	-23.015
Individualism D.	934	1191.6971[a]	55.585[a]	0.000364	-12.808
Culture N.	153	1376.8045	53.207	0.000355	-8.505
ANOVA F-test		3.21**	4.80***	0.59	1.23

Note: Two country groups with the same superscripts (comparing only with the first country group assigned with the superscript) down each column indicate that their means are significantly different at the 0.05 level using Bonferroni T-test.
, **, and * denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

To conclude, because of a number of limitations of the national-level of culture analysis using Hofstede's cultural dimension (Weber and Hsee's approach), this study mainly employs the individual-level of culture analysis using the Singelis's SCS. With the use of mosaic bivariate analysis and the measure of culture at individual level, this study updated the cultural values of

respondents at the time of research. With this improvement in the measure of culture, the findings remain in line with those obtained by Weber and Hsee (1998). However, due to a number of drawbacks of the bivariate analysis as discussed in Section 3.4.1, the main findings of this study are mainly drawn on the results produced by multivariate analysis.

5.5.2.3 Model-based mosaic multivariate analysis - Individual level of culture analysis

This section presents the regression results of five hierarchical model variations for each mosaic. The first model variation contains only variable group 1 (main variables) to capture the main cultural effect and the moderating effect of age. The second model variation inserts variable group 5 to control for the specific country effect. The third model variation, on the other hand, does not control for country effect but instead taking into account the demographic, socioeconomic, and attitudinal factors measured by variable groups 2, 3, and 4. The fourth variation only controls for variable group 6 that are related to cushion hypothesis of Weber and Hsee (1998, 1999). Lastly, the fifth model variation is the full model that contains all variables from the classified five groups listed in Table 5.1 (Section 5.3.2.3).

The full results for the fifth variation of the estimating regression models are presented in the appendix section (Appendix 11-13). These appendix tables contain results for both uncentered and centered regressions, along with the corresponding variance inflation factors (VIFs) of all variables to test for multicollinearity. Furthermore, the results for heteroscedasticity, normality of error terms, and endogeneity can be found in Appendix 9 (Part 2) and Appendix 10 (Part 2), respectively. Overall, the results indicate that the estimating OLS models of this study do not have endogeneity problem but are subject to heteroscedasticity and non-normality issues. To tackle these issues, as discussed in Section 3.4.2, the mean-centering robust standard error approach is employed.

Mosaic 1: Age influences the cross-cultural difference in RP

H_4: More collectivistic individuals exhibit significantly lower RP than less collectivistic and individualistic individuals.
H_8: Age significantly positively affects the cross-cultural difference in RP

Table 5.9 displays the results for mosaic 1, which identify whether members of different cultures perceive financial risk differently. The significantly negative coefficients of culture variable (COL_IDV) are consistently obtained for all five model variations at 1% level (β_A = -1.88, β_B = -1.61, β_C = -1.59, β_D = -1.57, β_E = -1.36). It indicates that *more collectivistic* individuals perceive the riskiness of the same investment option as lower. Furthermore, this cross-cultural difference in RP is not influenced by one's age as the coefficients of the

interaction terms between culture and age (COL_IDV*Age) are not statistically significant (β_A = 0.010, β_B = 0.017, β_C = 0.015, β_D = 0.013, β_E = 0.016; n.s). The results obtained for both H_4 and H_8 conclude that the more collectivistic an individual is, the lower the risk they perceive; and this lower level of perceived risk does not change with age. In other words, the difference in RP between collectivism and individualism stays constant across age. The increased adjusted R-square values signify the enhancing explanatory power of the model as more independent variables are incorporated. The full model variation (E) has the strongest explanatory power as its adjusted R-square is the highest among the five (Adj. R-square$_{(E)}$ = 0.0608).

Table 5.9: Determinants of Financial Risk Perception. Dependent Variable: RP

Mosaic 1	**Centered-score Regression (Robust Standard Errors)**				
Independent Variables	(A)	(B)	(C)	(D)	(E)
Intercept	54.63787***	53.66915***	41.23775***	54.69340***	42.11438***
COL_IDV	-1.88150***	-1.60992***	-1.59486***	-1.56595***	-1.35612***
*COL_IDV*Age*	0.00992	0.01742	0.01509	0.01267	0.01589
Age	0.09222***	0.09565***	0.10744**	0.07610**	0.08882*
Age^2	-0.00503	-0.00472	-0.00548	-0.00551	-0.00573
Group 2	NO	NO	YES	NO	YES
Group 3	NO	NO	YES	NO	YES
Group 4	NO	NO	YES	NO	YES
Group 5	NO	YES	NO	NO	YES
Group 6	NO	NO	NO	YES	YES
Sample size	1889	1889	1889	1889	1889
Adj. R-Square	0.0088	0.0153	0.0520	0.0235	0.0608

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Appendix 11 provides the full results for the fifth model variation (E) of mosaic 1. When the uncentered method is employed, culture is found to have no effect on RP (Appendix 11, β = -4.908, t-value = -0.95, n.s). However, the variable's VIF value raises a serious concern of nonessential multicollinearity[40] (Appendix 11, VIF_{COL_IDV} = 111.58). To tackle the issue, mean-centering method is used, which has effectively reduced the VIF value to 1.2, and cultural effect becomes statistically significant at 1% critical level (β_{COL_IDV} = -1.356, t-value = -2.71). According to partial-eta square results, culture is one of the foremost factors (after the SRA, economic expectation, and unemployment variables) that accounts for a large proportion of variance in individual RP (Appendix 11, $\eta^2_{partial}$ = 0.0082).

[40] More explanation on the issue, see Section 3.4.2.1

There are a number of other statistically significant determinants of RP (Appendix 11). These are the respondents' age (β_{Age} = 0.089), wealth as a moderator of age effect on RP ($\beta_{Age*LnW}$ = -0.031), unemployment (β_{Unemp} = 4.989), reported general risk attitude (β_{RRA} = 1.575), and the respondents' expectation on the economy (β_{Ecoexp} = 1.042). These determinants of RP are consistent with those that were attained in the first empirical study (Section 4.5.2.2). Additionally, it is found that if one has access to greater social financial support and are more willing to ask for help, their RP significant reduce at 5% level or below (Appendix 11, $\beta_{Finhelp}$ = -0.444 and $\beta_{Helpatt}$ = -1.105).

Mosaic 2: Age influences the cross-cultural differences in RAtt

H_5: More collectivistic individuals exhibit significantly higher RAtt than less collectivistic and individualistic individuals.

H_9: Age significantly negatively affects the cross-cultural difference in RAtt

Mosaic 1 indicates that individuals with different cultural values exhibit different RP. According to the explanation provided in Section 3.4.3 concerning the most appropriate measure of RAtt, mosaic 1 has proven the absence of the constant RP across individuals. Consequently, the objective measure of RAtt (b_{VAR}) is excluded from the picture.

Table 5.10 displays the results for mosaic 2. When the subjective RAtt (b_R) is employed as the main measure of RAtt, the coefficient of the culture variable (COL_IDV) across all model variations are statistically nonsignificant (β_A = -3.148, β_B = -1.784, β_C = -4.009, β_D = -2.324, β_E = -2.263, n.s). Hence, it can be concluded that culture does not influence individual RAtt. In other words, individual's attitude towards financial risk is constant across different cultural milieus.

Whilst culture shows no impact on individual RAtt, the estimates of the interaction terms between culture and age across the five variations are positively significant at the marginal level (β_A = 0.3920, β_B = 0.4106, β_C = 0.3945, β_D = 0.4273, β_E = 0.4294). This indicates the significant moderating effect of age on the cross-cultural differences in RAtt. Nevertheless, there are no cross-cultural differences in RAtt being observed in the first place. The interpretation of age as a moderator is ambiguous. Specifically, as the significant positive moderating effect of age (β_E = 0.4294) would make the nonsignificant negative cultural effect of RAtt (β_E = -2.263) become even more nonsignificant, hence, the moderating effect of age is rejected.

Appendix 12 presents the full results for the fifth model variation (E) of mosaic 2 in which all variables are included. The almost zero adjusted R-square values of all model variations imply

that virtually none of the explanatory factors significantly influence individual RAtt. This finding supports the stable nature of individual RAtt that is consistent with those obtained using the mosaic bivariate analysis and with the extant studies[41].

Table 5.10: Determinants of Subjective RAtt. Dependent Variable: b_R

Mosaic 2	**Centered-score Regression (Robust Standard Errors)**				
	Subjective RAtt (b_R)				
Independent Variables	(A)	(B)	(C)	(D)	(E)
Intercept	-18.9788***	-24.6834***	-27.8708	-18.3524***	-38.8625
COL_IDV	-3.1476	-1.7838	-4.0090	-2.3236	-2.2631
*COL_IDV*Age*	0.3920***	0.4106*	0.3945*	0.4273*	0.4294*
Age	0.0761	0.0806	0.1214	0.0946	0.2029
Age^2	0.0131	0.0123	0.0235	0.0119	0.0195
Group 2	NO	NO	YES	NO	YES
Group 3	NO	NO	YES	NO	YES
Group 4	NO	NO	YES	NO	YES
Group 5	NO	YES	NO	NO	YES
Group 6	NO	NO	NO	YES	YES
Sample size	1889	1889	1889	1889	1889
Adj. R-Square	0	0.0026	0.0003	0	0

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Mosaic 3: Age influences the cross-cultural difference in FRT

H_6: More collectivistic individuals exhibit significantly higher level of FRT than less collectivistic and individualistic individuals.

H_{10}: Age significantly negatively affects the cross-cultural difference in FRT

The first two mosaics indicate that individuals with different cultural values exhibit similar attitudes toward financial risk. In other words, there are no differences in the degree to which collectivistic and individualistic individuals like/dislike financial risk. However, more collectivistic individuals see the riskiness of the same investment option as smaller than their individualistic counterparts. Together with these two mosaics, the third mosaic determines whether the cross-cultural differences in RP cause the cross-cultural difference in FRT.

[41] Weber and Hsee, 1998 and 1999; Hsee and Weber, 1999; Weber et al., 1998; Bontempo et al., 1997.

Furthermore, in spite of the cross-cultural difference in risk perception, such cross-cultural differences are not influenced by age. In other words, the differences in RP between the two cultures remain constant as individuals age. Nevertheless, it is still possible that age moderates the cross-cultural difference in FRT, but the moderating age effect does not operate through the channels of RP or RAtt.

According to Table 5.11, all model variations for mosaic 3 support the same finding with the bivariate tests (Section 5.5.2.1 and 5.5.2.2). Specifically, individuals with higher values of collectivism are willing to pay more to engage with the investment options than the less collectivistic or individualistic individuals. In other words, collectivistic individuals are more risk tolerant than individualistic individuals. All positive coefficients of the culture variable (COL_IDV) are statistically significant at 1% critical level ($\beta_A = 0.330$, $\beta_B = 0.303$, $\beta_C = 0.292$, $\beta_D = 0.308$, $\beta_E = 0.293$). This finding is consistent with the majority of previous cultural studies[42]. Combining all three mosaics obtained for the three hypotheses ($H_4 – H_6$), the study found the same stories as Weber and Hsee (1998). Particularly, collectivistic individuals are more risk tolerant than individualistic individuals as they perceive the same investment as less risky, though the attitudes toward financial risk are constant across cultures.

Intriguingly, despite the significant cross-cultural differences in FRT, such differences are found to be influenced by one's age. Evidently, the interaction term between culture and age (COL_IDV*Age) is significantly negative at 1% level across five variations (Table 5.11). This indicates that as age decreases the increased FRT is exhibited by more collectivistic individuals. Consequently, as an illustration, the finding implies that a 20-year-old collectivistic individual is more risk tolerant when compared to a 20-year-old individualistic individual. Nevertheless, the difference in FRT of those two 20-years-old individuals decreases across age (FRT_{COL}^{20yrs} - $FRT_{IND}^{20yrs} > FRT_{COL}^{50yrs}$ - FRT_{IND}^{50yrs}). The results also reveal that the model's explanation power sustainably improves as more factors are controlled for. Particularly, the adjusted R^2 increases from 2.51% (variation A) to 10.61% (variation E) after all controlling variables are included.

[42] See Section 5.2.2 for details of these studies: Weber and Hsee, 1998, 1999; Hsee and Weber, 1999; Weber et al., 1998; Bontempo et al., 1997; Fan and Xiao, 2006; Statman, 2010; and Wang and Fischbeck, 2010.

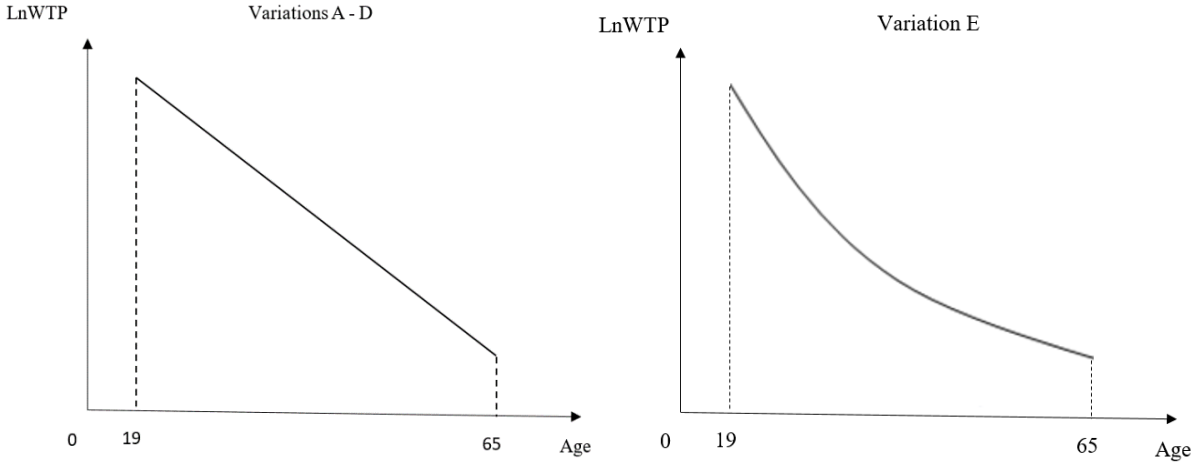
Table 5.11: Determinants of Financial Risk Tolerance. Dependent Variable: LnWTP

Mosaic 3	**Centered-score Regression (Robust Standard Errors)**				
Independent Variables	(A)	(B)	(C)	(D)	(E)
Intercept	5.292***	5.759***	5.024***	5.287***	5.224***
COL_IDV	0.330***	0.303***	0.292***	0.308***	0.293***
*COL_IDV*Age*	-0.017***	-0.018***	-0.016***	-0.015***	-0.015***
Age	-0.021***	-0.022***	-0.032***	-0.017***	-0.027***
Age^2	-0.0001	-0.0001	0.0006	0.00006	0.0008*
Group 2	NO	NO	YES	NO	YES
Group 3	NO	NO	YES	NO	YES
Group 4	NO	NO	YES	NO	YES
Group 5	NO	YES	NO	NO	YES
Group 6	NO	NO	NO	YES	YES
Sample size	1889	1889	1889	1889	1889
Adj. R-Square	0.0251	0.0330	0.0758	0.0646	0.1061

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Appendix 13 reveals the full results for the fifth variation (E) of mosaic 3. Firstly, it is important to take a note of the pure-effect of age on FRT. All model variations indicate significant negative age effect at 1% critical level (β_A = -0.021, β_B = -0.022, β_C = -0.032, β_D = -0.017, β_E = -0.027). However, variation model E, which is claimed to possess the strongest explanatory power, provides a marginally significant positive estimate of the polynomial term Age^2 (β = 0.0008, p-value = 0.1). This implies a non-linear influence of age on FRT such that FRT decreases initially and subsequently increases at one point. Based on the center-score regression panel of Appendix 13, all statistically significant factors are incorporate into a function of FRT. The study indicates the minimum stationary point of age is 101 years old, after which the level of FRT will increase (Detailed calculation is presented in Appendix 14). As the sample's age ranges from 19 to 65 years old, the general negative age effect is still valid, yet at a decreasing rate, as depicted in Figure 5.5.

Figure 5.5: Pure age effects on Financial Risk Tolerance



Additionally, when the uncentered method is employed, the VIFs of the multiplicative terms and their components are very high (Appendix 13, VIFs > 10) indicating serious multicollinearity. The problem has been effectively alleviated using mean-centering method. Furthermore, the partial eta-square ($\eta^2_{partial}$) indicates that the four most important determinants of one's FRT that are significant at 5%, or below, and account for the highest proportion of variance in FRT, are wealth, culture, self-reported risk aversion (SRA), and availability of financial help, in descending order with $\eta^2_{partial}$ values of 0.0239, 0.0182, 0.0136, and 0.0126, respectively (Appendix 13).

5.5.2.4 Summary of the Age-Culture-FRT findings

Combining all three mosaics together, the full picture depicts that individuals exhibit similar attitudes toward financial risk across different cultures. However, with the same investment option, more collectivistic individuals perceive the option as less risky. As a result, because of their lower risk perception, they are more willing to get a chance to engage in that investment by offering a higher price. In other words, more collectivistic individuals are more risk tolerant than less collectivistic or individualistic individuals. Nevertheless, the increased FRT exhibited by collectivism reduces over the life stages. In fact, collectivism is still more willing to engage in the investment than individualism, but such stronger willingness is not as much as the younger individuals are. Hence, the FRT gap between collectivism and individualism is narrowed down across age.

Moving away from the culture-FRT-age findings, the study investigates the underlying rationale for these findings. As the story progresses, the subsequent 'Effect of cushion' section presents the findings for the clarification of the cushion hypothesis advanced by Weber and Hsee (1998). using three different statistical approach: bivariate analysis (Weber and Hsee's

approach), the four-step mediation model of Baron and Kenny (1986), and the structural equation modelling (SEM).

5.5.3 Effect of the cushion (The cushion hypothesis)

This section provides the results for the investigation of the cushion hypothesis as an explanation for the cross-cultural differences in FRT through cross-cultural difference in RP. Note that as cross-cultural similarity in RAtt was obtained (Mosaic 2, Section 5.5.2.3), the second mosaic is taken out of the picture. Particularly, the cross-cultural differences in FRT are not associated with cross-cultural differences in RAtt, no mediating effect of cushion (Finhelp) is expected. The effect of cushion is examined using three different statistical approaches: bivariate analysis (Weber and Hsee's approach), the four-step mediation model of Baron and Kenny (1986), and the structural equation modelling (SEM). Details of these methods are presented in the Methodology section 5.3.3.

5.5.3.1 Bivariate analysis

Weber and Hsee (1998) conjectured the cushion hypothesis and subsequently, Hsee and Weber (1999) empirically proved that members of collectivistic culture have greater access to financial support than do their individualistic counterparts. When their method is employed, the same findings are obtained in this study. The results of ANOVA analysis presented in Table 5.12 reveal significant differences in social contact (contact) and financial support availability (Finhelp) across culture at 1% critical level ($\text{F-value}_{\text{Contact}} = 6.30$ and $\text{F-value}_{\text{Finhelp}} = 8.67$). Subsequently, Bonferonni adjusted t-test reveals that the mean values of social contact and financial support of individuals from a collectivistic dominant culture are significantly higher than those of individuals froms a individualistic dominant culture ($\overline{Contact}_{\text{COL}} = 8.55$ versus $\overline{Contact}_{\text{IDV}} = 7.48$ and $\overline{Finhelp}_{\text{COL}} = 3.30$ versus $\overline{Finhelp}_{\text{IDV}} = 2.69$). In brief, supporting the cushion hypothesis, the findings imply that collectivistic individuals not only keep more social contacts but also have more financial support available in case of financial failure and difficulty than individualistic ones.

Table 5.12: Mean Judgements of Social Network and Attitudes Toward Help As A Function Of Respondents' Culture

SINGELIS	*Contact*	*Finhelp*
Collectivism Dominance	8.5461[a]	3.2968[a]
Individualism Dominance	7.4786[a]	2.6916[a]
Culture Neutrality	7.7255	2.9739
ANOVA F-test	6.30***	8.67***

Note: Two age groups with the same superscripts (comparing only with the first country group assigned with the superscript) down each column indicate that their means are significantly different at the 0.05 level using Bonferroni T-test.
, **, and * denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

The following sections will provide results of the two additional models. Notably, as the cross-cultural difference in FRT is associated mainly with the cross-cultural difference in RP but not with the cross-cultural difference in RAtt, individual risk attitude (RAtt) is excluded from the model sketched in Figure 5.1 (Mediation model 1) and Figure 5.2 (Mediation model 2).

5.5.3.2 Mediation model 1: The four-step mediation model (Baron and Kenny, 1986)

Firstly, the study investigates the mediating effect of financial support (Finhelp) on cross-cultural differences in RP. Table 5.13 presents the results of the four-step mediation approach. In the first three steps, statistically significant effects of culture on RP (path c, β_{COL_IDV} = -1.5354, p-value = 0.01), financial support on RP (path b, $\beta_{Finhelp}$ = -0.3305, p-value = 0.01), and culture on financial support (path a, β_{COL_IDV} = 0.1412, p-value = 0.05), are obtained. This validates the existence of the mediation effect. In the last regression, when both culture and financial support variables are included, the cultural effect reduces from β_c = -1.5354 to $\beta_{c'}$ = -1.4917 yet remains statistically significant at the 1% level. Consequently, the partial mediating effect of financial support on RP is supported. In other words, more collectivistic individuals perceive lower financial risk partly because they have access to more financial support from their social network.

Table 5.13: Mediation effects of financial support decomposed total effect of culture on financial risk perception (RP)

Mosaic 1	**Robust Centered-score Regression**			
	Step 1	Step 2	Step 3 COL_IDV → Finhelp	Step 4
Independent Variables	Coefficient	Coefficient	Coefficient	Coefficient
Intercept	41.4032***	42.0155***	2.8727***	42.2935***
COL_IDV	-1.5354***	NO	0.14116**	-1.4917***
FinHelp	NO	-0.3305***	Dependent variable	-0.3099***
Controlling variables	YES	YES	YES	YES
R-square	0.0572	0.0547	0.1205	0.0588

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Thus far, it has been found that individuals with stronger collectivistic values tend to perceive smaller risk because they have greater access to financial support. The cushion hypothesis will be fully validated if the mediation effect of financial support on cultural difference in FRT is also obtained. According to Table 5.14, the first three steps capture statistically significant effects of culture (COL_IDV) and financial support (Finhelp) on FRT at 1% critical level (path c, $\beta = 0.3328$ and path b, $\beta = 0.1041$, respectively), and a positive effect of culture on Finhelp at 5% level (path a, $\beta = 0.1412$). These results support the existence of a significant mediating effect of financial support on the cultural differences in FRT. The final step reveals whether the mediating effect is full or partial. When both culture and financial support variables are included in the regression, the coefficient of culture reduces to 0.3187, but remains statistically significant at 1% level (path c'). Therefore, partial mediation is supported. It implies that the cultural effect on FRT is partly explained by the greater financial support available to collectivistic individuals.

Table 5.14: Mediation effects of financial support decomposed total effect of culture on financial risk tolerance (LnWTP)

Mosaic 3	Robust Centered-score Regression			
	Step 1	Step 2	Step 3 COL_IDV → Finhelp	Step 4
Independent Variables	Coefficient	Coefficient	Coefficient	Coefficient
Intercept	5.3282***	5.1012***	2.8727***	5.0418***
COL_IDV	0.33275***	NO	0.14116**	0.31868***
FinHelp	NO	0.10407***	Dependent variable	0.09968***
Controlling variables	YES	YES	YES	YES
R-square	0.0850	0.0850	0.1205	0.0950

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

In conclusion, remaining consistent with the bivariate analysis, the four-step mediation model of Baron and Kenny (1986) partly supports the cushion hypothesis such that more collectivistic individuals tend to have greater access to financial help, which acts as a cushion when they fall 'financially'. Consequently, because of the social buffer, they perceive the same investment as less risky, and thus are more risk tolerant when compared to less collectivistic and individualistic individuals.

Thus far, both the Hsee and Weber's (1999) approach (the bivariate analysis) and the Baron and Kenny's mediation model support the cushion hypothesis conjectured by Weber and Hsee (1998). The subsequent section will present the results for another statistical test, the SEM, to confirm the hypothesis.

5.5.3.3 The structural equation modelling (SEM)

The four-step mediation models tested in Section 5.5.3.2 are combined into one single proposed model displayed in Figure 5.2 using SEM (Section 5.3.3.3). The results obtained from these two mediation approaches are consistent with each other such that the cushion hypothesis is partly supported. Particularly, an individual's personal cushion is found to play a role in mediating the influence of culture on one's RP, through which the FRT is affected.

The SEM result is shown in Table 5.15 and graphically depicted in Figure 5.5. Individuals' access to financial support is the proxy for their personal cushion. The significant positive relationship between COL_IDV and Finhelp ($\beta = .11$, $p < .01$), and negative relationship between Finhelp and RP ($\beta = -.08$, $p < .01$) demonstrate that more collectivistic individuals tend to have more access to financial support. Hence, they exhibit lower RP. As a result, the more

collectivism oriented individuals are more risk tolerant ($\beta_{RP \rightarrow LnWTP}$ = .11, p < .01). However, culture per se has its own effects on one's RP either directly or through other channels (β = -.08, p < .01).

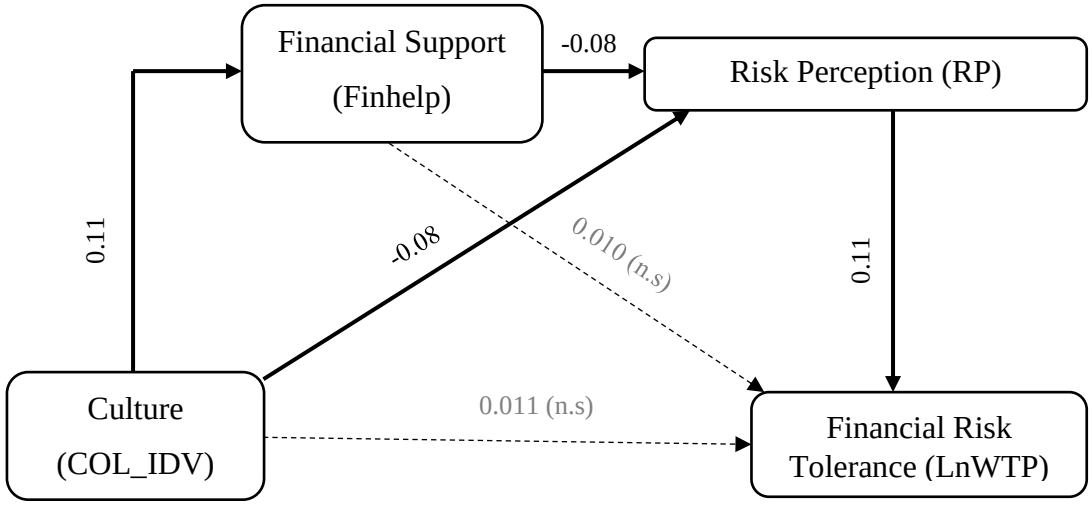
The SEM results reveal that the cultural effect on one's financial risk tolerance is fully mediated through one's private cushion and their RP, respectively, as is demonstrated by the insignificant beta between COL_IDV and LnWTP. Furthermore, the cushion effect does not directly impact one's risk tolerance ($\beta_{Finhelp \rightarrow LnWTP}$ = 0.01, n.s). These results indicate that an individual's RP are an important determinant of their FRT as they have fully mediated the effects of both culture and cushion on the FRT. As is shown in Table 5.15, the proposed model shows a good fit with the data overall: χ^2 = 162.5 p < .01, CFI = .95, GFI = 0.97, NFI = 0.95, and RMSEA= 0.292, 90% confidence interval for RMSEA = (0.25, 0.33).

Table 5.15: Results of SEM mediation tests

	β (t-value)
Path	
COL_IDV → Finhelp	0.111 (4.987)***
COL_IDV → RP	-0.078 (-3.410)***
COL_IDV → LnWTP	0.011 (1.075)
Finhelp → RP	-0.083 (-3.640)***
Finhelp → LnWTP	0.010 (1.005)
RP → LnWTP	0.114 (10.825)***
Overall fit	
χ^2	162.491***
RMSEA	0.292
CFI	0.951
GFI	0.97
NFI	0.95

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Figure 5.6: The SEM results with significant paths



5.5.3.4 Summary of the cushion hypothesis analysis

To sum up, the cross-cultural differences in financial risk tolerance can be explained by the cushion hypothesis advanced by Weber and Hsee (1998, 1999) such that collectivism provides greater access to readily available financial support, which cushions individual when they fall. The subconscious perception of such support causes ones to see risk as smaller. Consequently, collectivistic individuals are more risk tolerant in financial context when compared to individualistic individuals.

This 'Effect of the cushion' result chapter mainly explains the cushion hypothesis of Weber and Hsee (1998) using the same approach of Hsee and Weber (1999), and two additional statistical methods to confirm the result. The next section will explain the results for the 'shrinkage of cushion effect' as explained in Section 5.3.4. Particularly, in Section 5.5.2 ('Age-culture-FRT' section), besides confirming the cross-cultural differences in FRT through RP, this study also finds that the obtained cross-cultural differences in FRT are narrowed by age, but not through either the channel of RP or RAtt. The underlying reason for these findings will be presented in the subsequent section.

5.5.4 Shrinkage of cushion effect

To recap, this study found that although the higher level of FRT exhibited by more collectivistic individuals is reduced across age, the change in cross-cultural differences in FRT do not operate through RP or RAtt, but other channels. This section will provide statistical results that justify the findings. Particularly, the study finds a significant decrease in the private cushion of individuals across age. However, the reduction of individual cushions occurs for *both* collectivism and individualism, yet through different channels. Therefore, the moderating effect of age does not significantly influence the cross-cultural differences in RP. The reduction of cushion buffer across age will be first examined by the bivariate analysis as discussed in the next section.

5.5.4.1 Bivariate analysis: ANOVA, Bonferroni t-test, and Pearson Correlation Test

The ANOVA results shown in Table 5.16 indicate significant differences in both financial support availability (Finhelp) and financial help attitude (Helpatt) as a function of age at the 1% critical level ($\text{F-value}_{\text{Finhelp}}$ = 6.07 and $\text{F-value}_{\text{Helpatt}}$ = 4.78). The mean values of Finhelp and Helpatt reveal consistent reductions across the four age groups ($\overline{Finhelp}$ = 3.44, 2.93, 2.83, and 2.65 respectively; $\overline{Helpatt}$ = 4.16, 4.09, 3.99, and 3.95 respectively). Further to this, the Bonferonni adjusted t-test justifies that individuals aged from 40-65 years old (age groups 3 and 4) have significantly less access to financial support and also have lower attitudes toward financial help when compared to younger individuals aged from 18-29 years old. This implies

that as age increases, individuals have less access to financial support as well as being less willing to ask for financial help from others.

Table 5.16: Mean Judgements of Social Network and Attitudes toward Help As a Function of Respondents' Age

Age Group	*Respondents' Age*	*Sample Size (N)*	*FinHelp (1)*	*HelpAtt (2)*
1	18-29	492	3.4411[a]	4.1646[a]
2	30-39	486	2.9321	4.0859
3	40-49	468	2.8269[a]	3.9915[a]
4	50-65	443	2.6456[a]	3.9565[a]
	ANOVA F-test		6.07***	4.78***

Note: Two age groups with the same superscripts (comparing only with the first country group assigned with the superscript) down each column indicate that their means are significantly different at the 0.05 level using Bonferroni T-test.
, **, and * denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

5.5.4.2 Multivariate analysis

Nonetheless, with the bivariate results, this implies that as the financial support availability and help attitude decreases as one ages, the FRT of both collectivistic and individualistic individuals is reduced. Moreover, as the analysis is applied on the full sample, it cannot be determined whether the reduction of cushion occurs in both cultures, or in just one of them. Therefore, as discussed in Section 5.3.4.2, multivariate analysis is tested on two sub-samples: individualism and collectivism samples.

Table 5.17 reveals the results for age effects on financial support availability and financial help attitude across collectivistic and individualistic dominant cultures. All models fully control for variables listed in Table 5.3 (Section 5.3.4.2). Consistent with the conjecture the study developed (Section 5.2.3), it is found that financial support, which is readily available for collectivism does not change as one ages ($\beta_{(1)}$ = -0.0227, n.s.), but their attitudes toward help significantly decrease ($\beta_{(1)}$ = -0.0144, p-value = 0.01). In other words, collectivistic individuals have a constant access to their financial support across age, but as age increases, they are less willing to ask for those help. Such reductions in the willingness to seek for financial help of collectivistic individuals damages their perceived cushion. Accordingly, their RP may increase with age, and thus their FRT may decrease.

Nevertheless, age does not moderate the cross-cultural differences in RP as predicted because the cushion of individualism also reduces across age. However, this reduction is not associated with a reduction in willingness to ask for help, but with the reduction in access to financial help

over time. Particularly, the financial support availability for individualism significantly reduces across age ($\beta_{(3)}$ = -0.028, p-value = 0.01) but their attitudes toward financial help stay the same as the younger individuals ($\beta_{(4)}$ = -0.00038, n.s). This change is coherent in individualistic society as when the members were young, they stay with their parents as well as maintaining close contacts with their relatives (such as uncles, aunts and cousins) and friends. However, as they get older, they will live their own life and pay much more focus to their immediate family or close relatives (parents and siblings). Therefore, their social circles become smaller reducing their access to financial support. On the other hand, their attitudes toward help remain unchanged because of the nature of individualism is based on 'independence', and thus they are not keen on being dependent on others.

Table 5.17: Cushion hypothesis for Collectivism and Individualism

	Centered-score Regression (Robust Standard Errors)			
	Collectivism		**Individualism**	
Independent Variables	Finhelp (1)	Helpatt (2)	Finhelp (3)	Helpatt (4)
Intercept	3.181***	3.920***	3.2285***	4.1866***
Age	-0.0227	-0.0144***	-0.028***	0.00038
Age²	0.00013	-0.000085	0.00080	0.0004
Group 2	YES	YES	YES	YES
Group 3	YES	YES	YES	YES
Group 4	YES	YES	YES	YES
Group 5	YES	YES	YES	YES
Group 6	YES	YES	YES	YES
Sample size	802	802	934	934
Adj. R-Square	0.1170	0.0669	0.1439	0.0318

, **, and * denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Overall, all the main empirical findings (from the main statistical approach) as explained in this section are combined together. It can be concluded that *older collectivistic* individuals' access to financial supports is the same as the access of the young, but they are less willing to ask for help, causing their perceived cushion to be thinner compared to that of the young. As conjectured, it may be because of their development in self-conscious emotions (guilt, shame, embarrassment and self-esteem) across age. However, simultaneously, the cushion of older individualism is also thinner because their access to financial support declines overtime, whilst their attitudes toward help is the same with younger individualistic individuals. Consequently, although there is a decline in cushion effect (reduction in help attitude) of *collectivistic* individuals across age, the declined cushion also occurs for individualism. Consequently, age

does not influence the cross-cultural difference in RP, and the moderating effect of age on the cross-cultural differences in FRT may go through different channels rather than RP.

5.6 Robustness test: GMM and Aggregating Bootstrap Estimators

This section displays the results for the robustness tests of this study as stated in Section 4.6. According to the results of GMM and bagging bootstrap method presented in Table 5.18, the final story remains unchanged such that individuals with higher collectivistic culture are more risk tolerant as they perceive risk lower than those with lower collectivistic score and individualistic-dominant score. However, as age increases, the higher levels of FRT reduce but the effect does not operate through changes in cross-cultural differences in RP across age. Evidence shows that when using a different derivations of RAtt (bagging estimators) and different analytical methods: Weber and Hsee's (1998) bivariate method, multivariate or GMM approach, individual risk attitude remains constant across individuals with different ages, cultures, genders, and so on as found by previous studies.

Table 5.18: Robustness Tests (GMM) and Aggregating Bootstrapping RAtt (b_{R_b})

	GMM Regression			**Bagging Bootstrap**
IVs	Coefficients (Mosaic 1: RP)	Coefficients (Mosaic 2: b_R)	Coefficients (Mosaic 3: LnWTP)	Coefficients (Mosaic 3: b_{R_b})
Intercept	42.114***	-38.86	5.225***	-359.87
COL_IDV	-1.356***	-2.26	0.293***	39.863
*COL_IDV*Age*	0.0159	0.429*	-0.015***	3.645
Age	0.089*	0.203	-0.027***	5.736
Age^2	-0.0057	0.0195	0.0008*	-0.380
Group 2	YES	YES	YES	YES
Group 3	YES	YES	YES	YES
Group 4	YES	YES	YES	YES
Group 5	YES	YES	YES	YES
Group 6	YES	YES	YES	YES
Sample size	1889	1889	1889	1889
Adj. R-Square	0.0608	0	0.1061	0.0012

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

5.7 Summary and conclusion

To have a concise view of the whole study, Table 5.19 provides a summary of all hypothesis testing results.

Table 5.19: Empirical Study 2 – Summary of the Hypothesis Testing Results

Hypothesis	Expected Effect	Result
H_4	More collectivistic individuals exhibit significantly lower RP than less collectivistic and individualistic individuals	Supported
H_5	More collectivistic individuals exhibit significantly higher RAtt than less collectivistic and individualistic individuals	Supported
H_6	More collectivistic individuals exhibit significantly higher level of FRT than less collectivistic and individualistic individuals	Supported
H_7	More collectivistic individuals have significantly more access to financial support than less collectivistic and individualistic individuals	Supported
H_8	Age significantly positively affects the cross-cultural difference in RP	Not Supported
H_9	Age significantly negatively affects the cross-cultural difference in RAtt	Not Supported
H_{10}	Age significantly negatively affects the cross-cultural difference in FRT	Supported
H_{11}	Older collectivistic individuals have significantly less access to financial support than younger collectivistic individuals	Not Supported
H_{12}	Older collectivistic individuals are significantly less willing to ask for financial help than younger collectivistic individuals	Supported

The cross-cultural differences in financial risk tolerance (FRT) operating through the channel of risk perception (RP) have been examined and assured by a number of extant studies. A consistent story has been obtained such that collectivistic individuals have similar risk attitudes, but perceive the same investments as less risky when compared to individualistic individuals. Although the attitudes toward financial risk are similar across culture, because of the lower risk perception exhibited by collectivism, they are more risk tolerant than individualism. Subsequently, Weber and Hsee (1998) developed the cushion hypothesis as a conjecture for these findings and Hsee and Weber (1999) was the first to empirically test the conjecture. The cushion hypothesis asserts that collectivistic individuals have more access to financial support from their social networks than individualistic individuals. Larger access to financial support

acts as a cushion preventing individuals from falling financially. Therefore, collectivistic individuals perceive financial risk to be lower and thus is more tolerant to risk when compared to individualistic individuals.

Enhancing this cross-cultural study in the financial risk tolerance topic, the current study aims at examining whether culture *independently* influences FRT, RP and RAtt. The idea was initially formed by the empirical results of Fan and Xiao (2006). According to their statistical results, it revealed that the reduction in reported FRT across age is faster with Chinese individuals than with Americans. This finding hinted that the cultural effect on FRT, RP and RAtt, may be moderated by age. Progressing the idea, drawing on the anthropological and psychological literatures, the study conjectures that developments in one's self-conscious emotions as the underlying reason for the reduction in attitude towards financial help of *collectivism* across age. In essence, *older collectivistic* individuals care more about avoiding being put into the states of guilt, shame, embarrassment, and loss of self-esteem than younger collectivistic and individualistic individuals. Asking for help from others and letting others acknowledge about one's financial difficulties and failures are likely to expose them to those risks. Therefore, the access to financial help of older collectivism may remain unchanged, but they are less willing to ask for help. In other words, the cushion of older collectivistic individuals is thinner than that of younger collectivistic individuals. As the result, their risk perception increases and hence, their risk tolerance becomes smaller. To sum up, the study hypothesizes that the reduction of cushion buffer across age of collectivism is the underlying reason for the moderating effect of age on cross-cultural difference in FRT through RP and/or RAtt. Note that as no study has developed a quantitative measure for these emotions, the examination of the conjecture is beyond the scope of this study.

Before examining the main contribution, the current study re-examined the cross-cultural difference in FRT through RP and/or RAtt and the cushion hypothesis. By employing exactly the same methodologies, these being the use of country as the proxy for culture based on the Hofstede's classification and the mosaic bivariate analysis, the same findings were obtained. Subsequently, the study employed the same statistical method with Hsee and Weber (1999) and confirmed the cushion hypothesis. As noticed, this study replicated the study of Weber and Hsee (1998) in many aspects: definitions and measure of FRT, RP and RAtt, theoretical frameworks, FRT experimental task. By re-examining their contributions and replicating their statistical approach, the same findings were obtained indicating that the data of this study is comparable to that of Weber and Hsee (1998). This comparability assures the sufficiency of the FRT experimental task with the reduction in the number of investment options (twelve to six)

presented to the respondents. After the data's comparability is tested, the study confirmed the above results again using the individual-level of culture analysis (Singelis's SCS) and the main statistical test (mosaic multivariate analysis). Especially, the examination of the cushion hypothesis was clarified using two additional tests: the Baron and Kenny's (1986) mediation model and the structural equation modelling (SEM). In general, the current study assured that individuals, who hold stronger collectivistic views have more access to financial support from their society, than less collectivistic or individualistic individuals. The greater financial support acts as a cushion preventing individuals from getting hurt by financial failure. As a result, with the same financial investment, those more collectivistic individuals perceive the investment as less risky when compared to less collectivistic and individualistic individuals. With lower risk perceptions, more collectivistic individuals are more willing to engage in the investment, showing their higher level of risk tolerance.

Proceeding to the main academic contributions of this study, these are the moderating role of age in cross-cultural differences in FRT, RP and RAtt, together with the reduction of individual cushion buffer across age. According to the statistical results, the study's conjecture for reduction in social cushion of collectivistic individuals is empirically confirmed. Specifically, it is found that older collectivistic individuals are less willing to ask for financial help whilst their access to help remains unchanged across age. However, such reduction in cushion of collectivism does not cause the gap in RP between collectivism and individualism to reduce as expected. The reason is that the cushion of individualism also declines with age. Nevertheless, the reduction is not associated with reduction in willingness to ask for support but with the reduction in access to financial help across age due to the nature of individualism. Consequently, as age increases, both social cushions of collectivism and individualism decrease, their RP may simultaneously increase. Consequently, age does not influence the cross-cultural differences in RP.

Despite the insignificant influence of age on the cross-cultural difference in RP, age is found to reduce the cross-cultural difference in FRT, that is, the FRT gap between individualism and collectivism reduces as age increases. The result implies that age does play a significant role in determining the financial risk tolerance of individuals from different cultures. However, such moderating effect of age may operate directly or through different channels rather than RP. Therefore, future research can attempt to address this question.

Chapter Six: Empirical Study 3
From Language to Financial Risk Tolerance through the Channels of Risk Perception and Risk Attitude

6.1 Introduction

This chapter aims at presenting the final empirical study of this thesis, whose principal interest is placed on the relationship between language and financial risk tolerance (FRT). Adopting the 'cross-cultural' term used by Weber and Hsee (1998) to explain the difference in FRT across cultures, this study refers the difference in FRT across languages as the *cross-linguistic* difference in FRT.

An extensive effort has been paid on different factors that influences individual FRT. Following this research route, the current study aims at investigating one predisposing environmental determinant of FRT as suggested in Irwin's (1993) model (Figure 2.1, Section 2.2.2). This proposed factor is the language one speaks. Language may be categorised as an environmental predisposing factor because it is not an innate unique trait of an individual, but is affected by their social environment (Grable, 2016). A review of literature working on the FRT topic reveals that no research has investigated the influence of language on FRT. Therefore, this research is the first to hypothesize the association between language and FRT. The inspiration of this prediction arises from the study of Chen (2013). He investigated and assured that speakers of languages that grammatically associate the future and the present, tend to engage in more future-oriented behaviours when compared to speakers of languages that grammatically divide the future and the present. They save more, smoke less, practice safer sex and are less obese. The current study is built on Chen's explanation for his linguistic-saving hypothesis. The explanation combines the effects of language structure on one's bias in time perception and a simple model of intertemporal choice[43].

As the link between language and FRT is projected, the underlying mechanisms (RP and RAtt) are subsequently examined. The motivation of this investigation is the same as that of the first empirical study (Chapter 4). Basically, RP and RAtt were theoretically suggested in Irwin's (1993) model as two mediating (precipitating) factors of FRT formation, and were researched in numerous empirical studies due to its intervention property. Therefore, it is important to examine whether the cross-linguistic difference in FRT (if found to be present) is associated with cross-linguistic difference in RP and/or cross-linguistic difference in RAtt.

[43] Exponential discounted cash flow (Section 6.2.4)

The chapter starts with discussing the differences in the way in which languages encodes time, and how these differences influence one's time perception. Subsequently, the study presents Chen's explanation for his linguistic-saving hypothesis, which is appropriately adjusted and applied in this study's linguistic-FRT hypothesis. The development of the main hypotheses is discussed is followed by sections presenting the methodology, empirical results and robustness test. After the main empirical hypotheses are tested and concluded, if the cross-linguistic difference in FRT is found to operate through RP and/or RAtt, an additional section is constructed providing suggestions of a few possible reasons for these findings. Note that the current study makes the first step into this research agenda to study the link between language and FRT and its underlying mechanisms. Academic researchers can observe and consider further extensions of the topic in the future.

6.2 Literature review

As mentioned, this study is the first to investigate language as a factor that influences individual financial risk tolerance (FRT). Consequently, the subsequent literature review section provides evidence from different fields that supports the conjecture for the link between language and FRT. Basically, language cannot itself affect FRT if it does not influence some forms of human internal cognitive processes, such as, attention, perception, memory, learning and reasoning. Consequently, the first section of this literature review discusses whether language influences human cognition.

6.2.1 Language and human cognition (Perception, mind, and thought)

Language is a special signal system which plays an important role in human life. It is a distinctive characteristic of human species, a unique gift for our human kind. Language is used as a means of social communication and can be understood as the method of human expressions through words. Indeed, the ways we talk describe so much about ourselves. Our dialects and accents could point out where we are originally from. The way we use vocabulary suggests our education levels. However, whether the languages that we use can determine our thoughts and our idea formation, remains a challenging discussion amongst anthropologists, cognitive psychologists, philosophers and linguists.

Karl Marx once said in the German Ideology (1976): "Language is the immediate actuality of thought" (cited in Smith, 2004, p.451). Without language, humans cannot think. In other words, all human thinking operations are conducted on the substance of language. In the 1950s, linguists Edward Sapir (Sapir and Mandelbaum, 1949) and his student Benjamin Lee Whorf (Whorf, 1956) described two tenets of the relationship between language and thought:

"I. Structural differences between language systems will, in general, be paralleled by nonlinguistic cognitive differences, of an unspecified sort, in the native speakers of the two languages.

II. The structure of anyone's native language strongly influences or fully determines the world-view he will acquire as he learns the language." (Quoted from Brown, 1976, p. 128)

In general, the Sapir-Whorf hypothesis states that human mind, thought, perception and cognition are affected through differences in the habituation and operation of the formal aspects of language.

Edward Sapir (Sapir, 1958 [1929], p.69) stated that:

"The fact of the matter is that the 'real world' is to a large extent unconsciously built upon the language habits of the group. No two languages are ever sufficiently similar to be considered as representing the same social reality."

According to this hypothesis, individuals speaking different languages think differently and thus view the world differently in an unconscious way. Therefore, for example, it can be said that the mental world of Chinese people is different from the mental world of English people.

This debatable psycholinguistic topic, specifically the Sapir-Whorf hypothesis, has received extensive attention from academic researchers. Many cognitive psychologists conducted empirical research to examine the Whorfian view and obtained some remarkable results that supported the hypothesis. The most consistent findings are related to colour such that different languages cause differences in colour perception and/or cognition (Kay and Regier, 2006; Regier and Kay, 2009; Roberson et al., 1999; Roberson, 2005; Roberson and Hanley, 2007; Winawer et al., 2007; and Franklin et al., 2008; Athanasopoulos, 2011). Others obtained results for linguistic effects on conceptual presentation (Potter et al., 1984; Papafragou et al,. 2007), spatial thinking (Bowerman, 1996; and Levison, 1996; Li and Gleitman, 2002), and time perception[44] (Chen, 2013; Boroditsky, 2001; Miles et al., 2011; Boroditsky et al., 2011; Chen and Su, 2011), to mention just a few.

Overall, the study follows the view of the Sapir-Whorf hypothesis such that language influences our cognition in numerous ways: colour perception, time perception, spatial thinking, and so on. However, through which of those linguistic influences, one's willingness to pay (measure

[44] Among these studies, only the studies of Chen (2013), and Chen and Su (2011) are central to the purpose of this research. Therefore, these will be reviewed in detailed in later sections.

of FRT) is affected? Adopting Chen's (2013) explanation, the main focus will be paid on the linguistic effect on *time perception (perception in time)*. The subsequent section will first explain differences in language structure, specifically the way they encode time, before discussing how such time encoding affects time perception.

6.2.2 Language and Future time reference (Future)

Many linguistic relativists have been focusing on the effects of grammar and lexicon of a language on human time perception. The relationship between language and future time reference refers to the way language encodes the temporal relation in an event. Languages that grammatically mark the future to clearly distinguish it from the present and the past are referred to as strong future time reference languages (strong-future languages). In other words, speakers of strong-future languages are required to signal that they are talking about a future event by precisely structuring their sentences in accordance to the grammatical rules of the languages. Before discussing the future time reference of a language in more detailed, it is worthy to note that Chen (2013) use FTR as the abbreviation for future time reference, whilst this study uses 'future'. The reason is that this study uses FRT to denote financial risk tolerance, the use of FTR for future time reference may cause readers confusion between these terms. Therefore, Chen's strong-FTR and weak-FTR languages are termed the strong-future and weak-future languages in this study, respectively.

English and Vietnamese are two examples of strong-future languages, which distinctly mark the future. Grammatically, English uses the modal auxiliary 'will' or forms of 'be going to' to mark future time:

The train *will* leave at 5 in the afternoon

The train *is going to* leave at 5 in the afternoon

Similarly, Vietnamese uses 'sẽ' to mark future events:

Xe lửa	*sẽ*	rời ga	lúc	5 giờ	chiều
Train	will	leave the station	at	5 o'clock	afternoon

'The train will leave at 5 in the afternoon'

On the other hand, speakers of weak-future languages (futureless languages) are not obligated to use markers of modality to distinguish the future from the present. With the same description, if I want to tell my English-speaking friends about the train time tomorrow, according to English grammar, I must use the modal verbs (will, be going to) to signal that the event is in the future.

However, with Mandarin speakers, it is natural for them to omit those modal markers without misunderstanding and say *Huǒ chē zài xià wǔ wǔ diǎn fā chē* (Train leaves at 5 afternoon):

Huǒ chē zài xià wǔ wǔ diǎn fā chē

Train in afternoon 5 o'clock leave

'The train will leave at 5 in the afternoon'

English and Vietnamese enforce their speakers to specify and signal the timing of the future events. In contrast, Chinese do not enforce their speakers to specify the duration of actions, the same verbs can be used to indicate actions that take place in the past, present or future. However, this does not mean that the Chinese cannot understand the concept of time. Instead, they are just not required to think about the time when describing a certain action. In general, speakers of strong-future languages are enforced to habitually make clear distinction between the present and future whilst speakers of weak-future languages are not.

In brief, Chinese is a weak-future language that associates the future and the present. Speakers of this language are not required to grammatically mark the future tense to distinguish future events from the present ones. On the other hand, English and Vietnamese are strong-future languages that divide the future and the present. Speakers of these languages are obligated to distinguish future events by grammatically specifying their timing. Following this, the next chapter will discuss the question: when a person (while speaking) is forced to care and focus on the timing of events more than others, is his perception of time different?

6.2.3 Language and time perception

As noted by a renowned linguist Roman Jakobson: "Languages differ essentially in what they *must* convey and not in what they *may* convey." (Jakobson, 1959, p.237). This aphorism helps us understand the real force of the native language such that "if different languages influence our minds in different ways, this is not because of what our language *allows* us to think but rather because of what it habitually *obliges* us to think *about*" (Deutscher, 2012, pp.51). Therefore, when the language one speaks requires them to specify certain information, they are forced to pay attention to some details and some aspects that speakers of other languages do not necessarily notice. As that happens regularly from the first year of life, it will subconsciously influence an individual's idea formation, experience, perception, awareness, emotion, and cognition.

The ways one talks about the present, the future, and the past, influences their perception on temporal distance. Since the first century, many writers told their stories in the past using the present tense to make those historical stories more vivid and spirited. Longinus once wrote:

> *"If you introduce things which are past as present and now taking place, you will make your story no longer a narration, but an actuality." (Cited in Chen, 2013, p.5)*

Chen (2013) conjectured that "if speaking about current events in a distant tense makes them seem distant, languages which oblige speakers to use a future (distant) tense may make future events seem more distant" (pp.696). In other words, as speakers of different languages talk about time in different ways, they subconsciously perceive the temporal distance differently. Specifically, speakers of strong-future languages who habitually use future tenses may feel the same future events as more distant from the present when compared to speakers of weak-future languages (Chen, 2013). This statement naturally implies that an English-speaking or Vietnamese-speaking individuals perceive the same future event in five years' time to be further away from the present than a Chinese-speaking individual.

In case of multilingual individuals, according to Chen and Su (2011), Chinese speakers' perceptions on the future phases of an event change as their experiences in English enhance. More precisely, the study concluded that Chinese-English bilinguals with high proficiency in English (CE-high) perceive the temporal phase of an event more readily than Chinese monolinguals or Chinese-English bilinguals with low proficiency in English (CE-low). As a result, whilst a Chinese monolingual or a CE-low bilingual "tends to describe the past and *the future* phase of an action as present" (Chen and Su, 2011, pg.355), a CE-high bilingual can precisely distinguish the boundaries between the present and the future phases of an event. The findings are coherent in a way such that when a Chinese learns English as a foreign language, they are required to pay lots of attention in English tenses, sometimes even more than an English-native speaker. Accordingly, they are forced to clearly distinguish the future, and the past, from the present. Taking these findings of Chen and Su (2011) and applying them in the linguistic-time perception link, it can be conjectured that a weak-future language speaker with high proficiency in at least one strong-future language (weak-strong multilingual) perceives future events as more distant than a monolingual of a futureless language.

Up to now, the study has explained that because different languages enforce their speakers to focus on the timing of events differently, individuals tend to have different perceptions on the temporal distance between the present and the future. Specifically, because individuals speaking strong-future languages are required to clearly specify whether the events they are

talking about are in the future or the present, they perceive the future further away from the present when compared to individuals speaking weak-future languages (futureless languages). This link between language and perception in time conjectured by Chen (2013) has not yet been empirically tested as there is no literature developing a quantitative measure for time perception of an individual. Therefore, no direct measure of this construct is available.

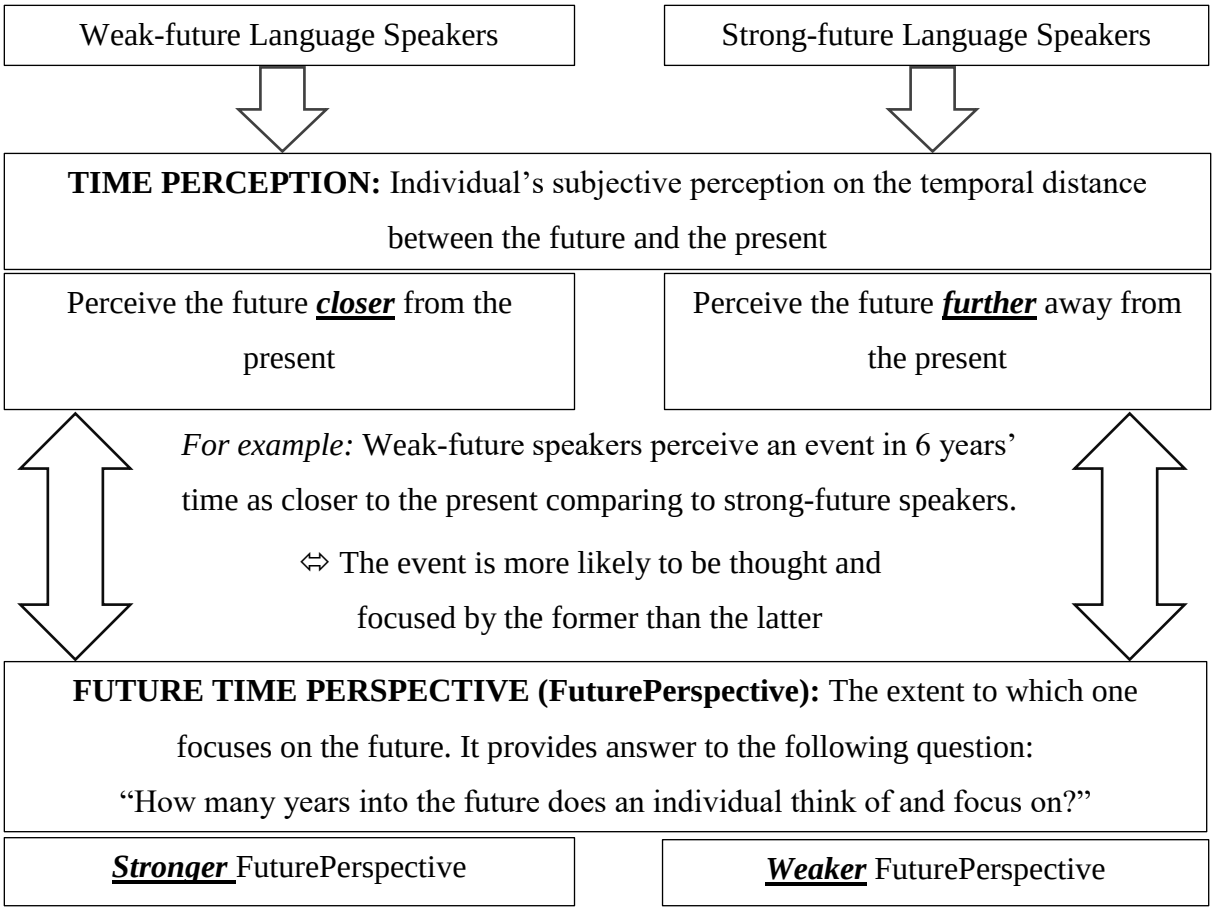
Nonetheless, based on a number of psychological research papers, this study considers a time-related construct to proxy the notion of time perception. The construct is so-called future time perspective (FuturePerspective). Figure 6.1 provides a summary for the hypothesised links between language, time perception and FuturePerspective. As a quick recap, time perception is the time distance (time interval) between the timing of a future event and the present, which is *subjectively* perceived by an individual. Similar to time perception, FuturePerspective is an important dimension of one's **psychological** time (Zimbardo and Boyd, 1999). It refers to the extent to which one focuses on the future (Hershey et al. 2007 and Jacobs-Lawson and Hershey, 2005). A person is said to exhibit a *strong* FuturePerspective if he focuses strongly on the future rather than on the present. Alternatively, FuturePerspective can be defined in a more quantitative manner as "the length of the future time span which is conceptualized" (Wallace, 1956, pp.240). According to this definition, FuturePerspective answers the question: "How many years into the future could I think of and focus on?" For example, Wallace's (1956) study found that individuals with normal health condition can focus up to 30 years, approximately, whilst individuals being diagnosed with schizophrenia can only focus on around 12 years into the future. Evidently, the former exhibited longer FuturePerspective than the latter.

Bringing the understanding of time perception and FuturePerspective onward, lets consider an example with a weak-future speaking individual A and a strong-future speaking individual B. As they speak different languages, their time perceptions are different. Specifically, A sees the future closer when compared to B. Therefore, it naturally implies that the same advanced-planned event in 6 years' time (for example, their kids start their undergraduate study), is more likely to be thought about and focused on by A than B, as A perceives that 6-year interval (objective time) closer to the present than B. As a result, it is expected that because of this difference in time perception, A is more likely to exhibit longer/stronger FuturePerspective. In other words, *weak-future language* speaking individual A focus more into the future (stronger FuturePerspective) than *strong-future language* speaking individual B.

Furthermore, Chen (2013) found that differences in time perception across individuals speaking different languages caused differences in their future-oriented behaviours. Specifically, as weak-future speaking individuals perceive the future to be closer, they engage in more future-

oriented behaviour, such as saving more, smoking less and remaining less obese. In other words, they focus more on the future. Stemming from these findings it can be hypothesised that speakers of weak-future languages have stronger FuturePerspective when compared to strong-future language speaking individuals.

Figure 6.1: Links between language, time perception and future time perspective



Building on the baseline of reasoning, this study employs FuturePerspective developed by Hershey et al. (2007) as a proxy for time perception. This allows the study of indirectly test for the linguistic-time perception association through the linguistic-FuturePerspective link. Consequently, the following hypothesis is examined:

H_{13}: Individuals speaking weak-future languages exhibit significantly stronger focus on the future (stronger FuturePerspective) than individuals speaking strong-future languages

As FuturePerspective is used as proxy for time perception, hypothesis H_{13} indicates a linguistic effect on time perception. Subsequently by applying this cross-linguistic difference in time perception in the financial context, individuals investing their money today expect a profitable return in the future. With different time perceptions due to language, individuals have different

perceptions on "*how far* is that future?*"* In other words, they possess different perceptions of the investment horizon. For example, a Chinese-speaking investor A and an English-speaking investor B invest in a stock for 5 years. Investor A perceives the same 5-year length to be shorter when compared to investor B because of his weak-future language. Due to this difference in their time perception, the study expects their willingness to pay (FRT) to be different. Consequently, the following section explains how this influence may take place.

6.2.4 Language influence one's financial risk tolerance (FRT)

The link between language and FRT is built on the same conjecture developed by Chen (2013). Similar to the linguistic-saving hypothesis (Chen, 2013), the linguistic-FRT hypothesis also naturally springs from two different mechanisms: bias in time perception and the precision of beliefs about time. Considering the same simple subjective pricing discounted model, suppose a decision maker is deciding on how much to pay for an investment X (WTP) now, which expects to yield an expected return R at some time in the future. The variable WTP(X) is the price of X that is subjectively perceived by the decision maker. Suppose the decision maker is uncertain about when the return will materialize, she holds beliefs with distribution F(t). If her individual discounted rate is δ, then her willingness to pay (WTP) should be evaluated as follows:

$$WTP(X) = \int e^{-\delta t} RdF(t) \qquad \text{(eq.6.1)}$$

There are two mechanisms as explained by Chen (2013) that project the linguistic-FRT association. *Firstly*, as weak-future language speakers perceive the future to be closer to the present, $F_s(t)$ would first-order stochastically dominate (FOSD) $F_W(t)$. Therefore, $WTP_w(X)$ is greater or equal to $WTP_s(X)$.

Specifically, the distribution of $F_s(t)$ FOSD $F_w(t)$ if and only if:

$P_w(T \geq t) \leq P_s(T \geq t) \Leftrightarrow F_w(t) \geq F_s(t)\ \forall t$, then $\int e^{-\delta t} RdF_w(t) \geq \int e^{-\delta t} RdF_s(t)$ $\leftrightarrow WTP_w(x) > WTP_s(x)$. Note that for any discount rate $\delta > 0$, $e^{-\delta t}$ is strictly continuous non-increasing function.

Secondly, as strong-future language speakers are obligated to habitually specify the timing of events, they may hold more accurate timing of the expected return R when compared to weak-future language speakers (Chen, 2013). Consequently, $F_w(t)$ is a mean-preserving spread of $F_s(t)$, and hence, $WTP_w(X)$ is greater than $WTP_s(t)$.

Specifically, the more precise timing of strong-future language speakers implies that $Var[F_s(t)] \leq Var[F_w(t)]$, thus $F_w(t)$ is a m.p.s of $F_s(t) \leftrightarrow F_s(t)$ second-order stochastically

dominate $F_w(t)$, then $\int e^{-\delta t} RdF_w(t) \geq \int e^{-\delta t} RdF_s(t) \leftrightarrow WTP_w(x) > WTP_s(x)$. Note that for any discount rate $\delta > 0$, $e^{-\delta t}$ is strictly continuous non-increasing function.

As willingness to pay for an investment option measures one's financial risk tolerance (FRT), these two mechanisms lead to the expectation that speakers of weak-future languages are more risk tolerant than speakers of strong-future languages. It is important to note that neither study of Chen (2013), nor the current study, empirically test for the linguistic effects on bias in time perception, or on precision in timing. These two conjectures are stemmed from linguistic and psycholinguistic literatures such that if the habit of specifying the timing of events leads to perceptions of further future and more precise beliefs about the timing, weak-future speakers will be more risk tolerant than strong-future speakers. Therefore, the following hypothesis will be tested:

H_{14}: Individuals speaking weak-future languages exhibit significantly higher FRT than individuals speaking strong-future languages

Subsequent to the examination of cross-linguistic difference in FRT, its underlying mechanisms will be examined. To investigate whether cross-linguistic difference in FRT is associated with cross-linguistic difference in RP and/or cross-linguistic difference in RAtt, the following hypothesis will be tested:

H_{15}: Individuals speaking weak-future languages exhibit significantly lower RP than individuals speaking strong-future languages

H_{16}: Individuals speaking weak-future languages exhibit significantly higher RAtt than individuals speaking strong-future languages

6.3 Methodology

6.3.1 Measure of Language Variable

Following the majority of linguistic studies (Chen and Su, 2011; Boroditsky et al., 2011; Kay and Kempton, 1984; Boroditsky, 2001; Au, 1983), the current study uses respondents' native language as the main proxy of the language that structures their thoughts. Most importantly, this study is based on the relativistic view of the Sapir-Whorf hypothesis, which suggests that ones' native language has an influence on their mind and thought (Section 6.2.1). Furthermore, in Borokitsky study (2001, p.1), he concluded that "one's native language plays an important role in shaping habitual thought (e.g. how one tend to think about time) ..." As this study is

based on the linguistic effect on one's *perception* in time, the native language of respondents is employed.

To obtain linguistic variables, a question was constructed in the survey to capture the respondents' native language as well as all other languages that they speak with corresponding proficiency in each language. The questionnaire is presented in Appendix 1, Part V. Based on the participants' responses, each language will be classified as either strong-future language or weak-future language using Chen's online-text based coding in which the future values of 39 coded languages are included (Chen, 2013).

There are two main categorical, dummy coded, linguistic variables. The *first* variable (Native_Weak) was coded to match the native language of each respondent. Native_weak equals to 1 if the native language one speaks is the weak-FRT language (futureless language) and zero otherwise. The *second* variable (Prof_Strong) captures any other languages the respondents speak with a high proficiency level in addition to their native language. According to the questionnaire for language (Appendix I, Part V), a respondent is classified as speaking a *second* language *proficiently* if the reported language is *not* "1: native speaker" *and* is either "2: Near native/Fluent" or "3: Excellent command/Highly proficient in spoken and written". Subsequently, to consider multilingual aspect, an interaction variable Native_weak*Prof_strong (Nweak_Pstrong) is formed and coded 1 if the respondents are native speakers in a weak-future language *and* can speak proficiently in at least one strong-future language (Weak-Strong multilinguals).

As discussed in Section 6.2.3, the language-FRT association is conjectured through the linguistic-induced bias in time perception. Specifically, individuals speaking weak-future languages perceive the future to be closer to the present when compared to individuals speaking strong-future languages. To test this conjecture, the subsequent section provides a preliminary examination for the linguistic effect on time perception (H_{13}). However, there is no literature developing a direct quantitative measure for time perception of an individual. Therefore, based on the literature, the current study employs future time perspective (FuturePerspective) measure as a proxy for individual time perception.

6.3.2 Language influences future time perspective (FuturePerspective)

To obtain an individual's future time perspective (FuturePerspective), four 7-point likert-scale items are presented to the respondents (Appendix 1, P.X). The future_perspective variable is constructed by calculating the mean value of the answers to those four questions. Consequently, the variable ranges from 1 (lowest future time perspective) to 7 (strongest future time

perspective). Note that question 3 and question 4 take an inverse scale, which require to be converted back to the common scale by subtracting the respondent's answer from 8. The study employs the bivariate analysis comprising ANOVA and Bonferroni t-test to examine differences in FuturePerspective as a function of language.

H_{13}: $FuturePerspective_{N\_weak} = FuturePerspective_{Nweak\_Pstrong} = FuturePerspective_{N\_strong}$;

After testing for the conjecture of language-FRT relationship, the empirical analysis for the main research question (H_{14}-H_{16}) will be discussed in the following sections.

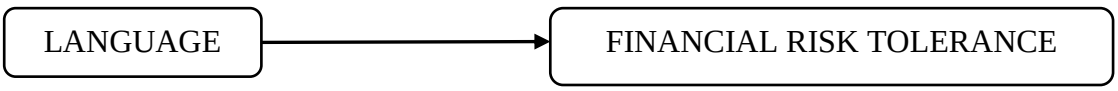
6.3.3 Multivariate analysis: Model-based mosaic analysis

As discussed in Section 3.4, the main statistical analysis is the model-based mosaic multivariate analysis. The picture is comprised of three mosaics. Firstly, as projected, mosaic 1 examines the effect of language on individual FRT. Subsequently, the other two mosaics test for the underlying mechanism of the linguistic influence, if found to be present.

6.3.3.1 Mosaic 1: Language influences FRT

To test the hypothesis *"H_{14}: Individuals speaking weak-future languages exhibit significantly higher FRT than individuals speaking strong-future languages"*, the regression specification as follows:

$$Ln(WTP)_i = \alpha_i + \beta_{G1}Group1 + \beta_{G2}Group2 + \beta_{G3}Group3 + \beta_{G4}Group4 + \beta_{G5}Group5 + \beta_{G6}Group6 + \varepsilon_i,$$



Where the content for each independent variable group is listed in Table 6.1 (See Appendix 4 for more explanation of each variable component).

Table 6.1: Classification content for each independent variable group

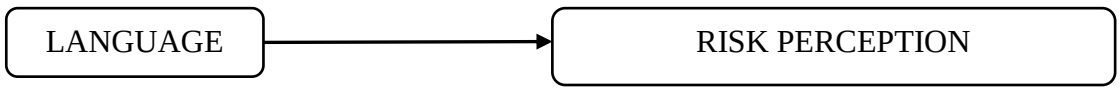
Independent variable	Classification content ***Explanation see Appendix 4***
Group 1: Main variables	Native_weak; Prof_Strong; Nweak_Pstrong
Group 2: Demographic variables	Nweak_Age; Nweak_COL_IDV; COL_IDV; COL_IDV*Age; Age; $Age^{2;}$ Age*LnW; Single; Gender; Child; Highschl; Hhsize; LnW; LnInc
Group 3: Socioeconomic variables	Unemp; Selfemp; Homeown
Group 4: Attitudinal variables	Rbelief; IncStab; Health; SRA; Ecoexp; Interestexp
Group 5: Geographical	US; UK; VN; SG
Group 6: Cushion hypothesis variables	Finhelp; Helpatt; Age*Finhelp; COL_IDV*Finhelp; Age*Helpatt; COL_IDV*Helpatt; COL_IDV*Helpatt; Finhelp*Helpatt; COL_IDV*Age*Finhelp; COL_IDV*Age*Helpatt

6.3.3.2 Mosaic 2: Language influences RP

To test the hypothesis *"H_{15}: Individuals speaking weak-future languages exhibit significantly lower RP than individuals speaking strong-future languages"*, the regression specification as follows:

$$RP_i = \alpha_i + \beta_{G1}Group1 + \beta_{G2}Group2 + \beta_{G3}Group3 + \beta_{G4}Group4 + \beta_{G5}Group5 + \beta_{G6}Group6 + \varepsilon_i,$$

If significant linguistic effect is found, individuals' perception on financial risk are influenced by the languages they speak.

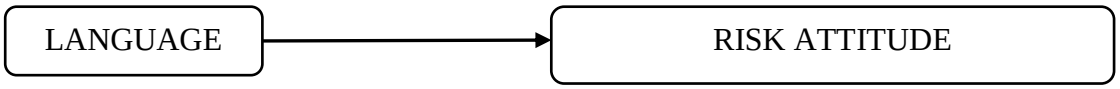


6.3.3.3 Mosaic 3: Language influences RAtt

To test the hypothesis *"H_{16}: Individuals speaking weak-future languages exhibit significantly higher RAtt than individuals speaking strong-future languages"*, the regression specification as follows:

$$(b_{VAR}/b_R)_i = \alpha_i + \beta_{G1}Group1 + \beta_{G2}Group2 + \beta_{G3}Group3 + \beta_{G4}Group4 + \beta_{G5}Group5 + \beta_{G6}Group6 + \varepsilon_i,$$

This final mosaic examines whether language affects individual attitude towards financial risk. If significant positive results are obtained, H_{15} is supported. Furthermore, depending upon the results found in mosaic 2, either the objective RAtt (b_{VAR}) or subjective RAtt (b_R) is chosen as the main dependent variable for this mosaic. As discussed in Section 3.4.3.1, if RP is found to vary across individuals, objective RAtt will not be pursued further.



6.4 Data description

This section describes the data sample by presenting the descriptive statistics of all variables included in the current study. These are the three main dependent variables (FRT, RP and RAtt) and the five independent variable groups as discussed in Section 3.4.3 and explained in Appendix 4. However, to prevent repetition of the descriptive statistics of some variable, only the main independent variable group 1 (linguistic variables as discussed in Section 6.3.1) are discussed here. All other variables were discussed in the first and second empirical studies (Chapter 4, Section 4.4; and Chapter 5, Section 5.4).

According to Table 6.2, there are 458 respondents, which represents 24.25% of the whole sample, speaking weak future time reference (future) languages as their mother tongue. The majority of them are from China (74.67% of the whole sample). This is logical as the main language spoken in China is Chinese Mandarin, which is classified as weak-future language. Whilst Chinese is a weak-future language, English and Vietnamese are two strong-future languages. These are the main languages in the US and the UK, and Vietnam, respectively. Therefore, the majority of respondents from the US, the UK and Vietnam (99.03%, 98.45%, and 98.48%, respectively) are coded to speak strong-future language. Singapore is a special sample as it is a multilingual country. Specifically, around 30% of Singaporean sample reported Chinese (weak-future language) as their mother tongue. This is also anticipated as according to a statistic, in Singapore, 35% of its population speak Mandarin and 23% speak English (World Languages, 2017). By including Singapore in the sample, the country effect is controlled for. Without the Singaporean sample, it could be a serious challenge to isolate the linguistic and country effect and thus to robustly conduct this research. Consequently, future studies need to include at least one controlling multilingual country as the controlling sample to prevent confounding research findings.

According to the descriptive of the Prof_Strong variable, 390 respondents are multilinguals who speak at least one strong-future language proficiently in addition to their native weak-

future languages. In China and Vietnam, only a small proportion of respondents are coded at unity for this variable (12.4% and 9.76%, respectively). It is not because people are not multilinguals but because it is challenging to be proficient in using foreign languages in countries with a rare chance for practice. In the case of Singapore, 111 respondents out of 382 are claimed Chinese to be their native language; and 160 respondents (41.88%) reported that they can speak English proficiently. This high proportion comparing to that of Chinese and Vietnamese samples are plausible and anticipated because both Mandarin and English are popularly used in Singapore.

Table 6.2: Descriptive Statistics of Language

Linguistic Binary Variables	Countries	Count	Percent	N
Native_weak	The US	4	0.97	413
	The UK	6	1.55	387
	China	342	90.24	379
	Vietnam	5	1.52	328
	Singapore	111	29.06	382
	Whole Sample	**458**	**24.25**	**1,889**
Prof_strong	The US	94	22.76	413
	The UK	57	14.73	387
	China	47	12.4	379
	Vietnam	32	9.76	328
	Singapore	160	41.88	382
	Whole Sample	**390**	**20.65**	**1,889**

6.5 Empirical results

6.5.1 Language influences future time perspective (FuturePerspective)

H_{13}: Individuals speaking weak-future languages exhibit significantly stronger focus on the future (stronger FuturePerspective) than individuals speaking strong-future languages

This section provides the results for the bivariate test that examines whether individuals' future time perspectives (FuturePerspective) differ across languages. Since FuturePerspective is employed as a proxy for time perception, the results support the conjecture of the underlying

channels through which language influences financial risk tolerance (FRT). The statistical results presented in Table 6.3 indicate a significant difference in FuturePerspective as a function of language at the 1% level (F-value = 10.36). Based on the Bonferroni t-test results, weak-future native speakers tend to focus more on the future than strong-future native speakers ($FuturePerspective_{Native\_Weak} > FuturePerspective_{Native\_Strong} = 4.49 > 4.2042$, p-value = 5%). Furthermore, it is also found that the future time perspective of Weak-Strong multilinguals is significantly lower than that of weak-future monolinguals ($FuturePerspective_{Native\_Weak} > FuturePerspective_{Nweak\_Pstrong} = 4.49 > 4.1848$, p-value = 5%). However, although the FuturePerspective of the Weak-Strong multilingual is lower than the strong-future monolinguals, the difference is insignificant.

Table 6.3: Mean Future Time Perspective (FuturePerspective) As a Function Of Respondents' Languages

Language	*Sample Size (N)*	*Future Time Perspective (FuturePerspective)*
Native_Weak	366	4.4931[a]
Nweak_Pstrong	92	4.1848[a]
Native_Strong	1431	4.2042[a]
F-value (DF= 2)		10.36***

Note: Two country groups with the same superscripts (comparing only with the first country group assigned with the superscript) down each column indicate that their means are significantly different at the 0.05 level using Bonferroni T-test.
, **, and * denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Overall, the ANOVA findings revealed in this section imply that weak-future native speakers see the future as closer to the present when compared to strong-future native speakers and to other weak-native speakers who can speak fluently in at least one strong-future language. As discussed in Section 6.2.4, this linguistic difference may lead to higher level of FRT. The later part of this Empirical Results section reports the results of a multivariate analysis for the cross-linguistic difference in FRT through RP and/or RAtt to test for this hypothesis.

6.5.2 Multivariate analysis

In this section, regression results for five model variations of each mosaic are presented. The first model variation contains only variable group 1 (main variables) to capture the effect of language. The second variation controls for specific country effect by adding country variables in group 5. The third variation only controls for demographic, socioeconomic, and attitudinal factors measured by variable groups 2, 3, and 4. The fourth model variation controls for all

variables, but not variable group 6. Lastly, the fifth variation is the full model that contains all variables indicated in Table 6.1.

The full results for the fifth variation of the estimating regression models are presented in the appendix section (Appendix 15-17). These appendix tables contain results for both the uncentered and centered regressions, along with the corresponding variance inflation factors (VIFs) of all variables to test for multicollinearity. Furthermore, the results for heteroscedasticity, normality of error terms, and endogeneity can be found in Appendix 9 (Part 3) and Appendix 10 (Part 3), respectively. Overall, the results indicate that the estimating OLS models of this study do not have an endogeneity problem, but are subjected to heteroscedasticity and non-normality issues. To tackle these issues, as discussed in Section 3.4.2, the mean-centering robust standard error approach is employed.

6.5.2.1 Mosaic 1: Does language influence individual FRT?

H_{14}: Individuals speaking weak-future languages exhibit significantly higher FRT than individuals speaking strong-future languages

Table 6.4 reveals the results for the first mosaic, the main part of the whole picture, which examines if there is a cross-linguistic difference in FRT. According to the results, multivariate analysis produces a significant effect of language on FRT. Particularly, the main linguistic variable (Native_weak) is significantly positive at the 5% level or below across all five model variations ($\beta_A = 0.781$, $\beta_B = 0.653$, $\beta_C = 0.597$, $\beta_D = 0.657$, $\beta_E = 0.716$). It implies that individuals speaking weak-future languages exhibit higher levels of FRT when compared to strong-future language speakers.

The results also indicate that the multilingual aspect should be taken into consideration. Basically, the effect of weak-future language on FRT depends on whether those weak-future language native speakers can speak fluently in any strong-future language as the interaction term Nweak_Pstrong is significantly negative at 1% level for all model variations ($\beta_A = -1.334$, $\beta_B = -1.282$, $\beta_C = -1.135$, $\beta_D = -1.142$, $\beta_E = -1.265$). This indicates that FRT levels of weak-future language speakers, who can speak at least one strong-future language with high proficiency (Weak-Strong multilingual) are significantly lower than those who only speak weak-future languages. As explained, those weak-future language monolinguals perceive the future to be closer to the present comparing to other Weak-Strong multilinguals. The reason is that the strong-future second language that they can speak proficiently requires them to distinguish clearly the future events from the present ones (just as other strong-future native speakers). As a result, subconsciously those multilinguals perceive the future to be further away

from the present compared to the former monolingual group. This linguistic difference pulls down the FRT of Weak-Strong multilinguals. The full model variation E provides the highest value of adjusted R-square (Adj. R-square = 0.12), thus it has the strongest explanation power.

Table 6.4: Determinants of Financial Risk Tolerance. Dependent Variable: LnWTP

Mosaic 1	**Centered-score Regression (Robust Standard Errors)**				
Independent Variables	(A)	(B)	(C)	(D)	(E)
Intercept	5.1415***	5.3253***	4.9399***	4.8314***	4.6969***
Native_Weak	0.7813***	0.6535**	0.5973***	0.6569**	0.7156***
Prof_Strong	-0.1403	-0.1061	-0.3282*	-0.3165*	-0.27495
Nweak_Pstrong	-1.3339***	-1.2818***	-1.1351***	-1.1417***	-1.2649***
Group 2	NO	NO	YES	YES	YES
Group 3	NO	NO	YES	YES	YES
Group 4	NO	NO	YES	YES	YES
Group 5	NO	YES	NO	YES	YES
Group 6	NO	NO	NO	NO	YES
Sample size	1889	1889	1889	1889	1889
Adj. R-Square	0.0163	0.0178	0.0915	0.0907	0.1200

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively. Native_weak equals to 1 if the native language one speaks is the weak-FRT language (futureless language) and zero otherwise. Prof_Strong is coded 1 if respondents speak any other foreign languages with a high proficiency level in addition to their native language. Nweak_Pstrong is the interaction variable which equals to 1 if the respondents are weak-future language native speakers and can speak proficiently in at least one strong-future language.*

Appendix 15 provides the results for the full model variation E of mosaic 1, in which all variables are accounted for. The main analysis method is the centered-score regression, which has effectively eliminated the issue of non-essential multicollinearity demonstrated through the decreased VIF values of multiplicative variables and their components.

Noticeably, the interaction term between language and culture (Nweak_COL_IDV) is statistically insignificant (Appendix 15, $\beta_{Nweak\_COL\_IDV} = 0.0992$, n.s). This indicates that culture does not have any impact on the effect of language on FRT. In other words, language and culture influence one's minds and thoughts distinctively, and thus independently impact FRT. Intriguingly, the study obtains a significant moderating effect of age on the cross-linguistic difference in FRT (Appendix 15, $\beta_{Nweak\_age} = 0.032$, p-value = 0.01). It implies that the increased FRT exhibited by the weak-future language native speakers increases with age, causing the cross-linguistic difference in FRT between the two linguistic groups to be larger. The reason for this may be that older individuals tend to see their future approach closer comparing to

younger individuals (for both linguistic speaking groups). Nonetheless, weak-future native speakers possess relatively less precise timing and tend to see future as closer compared to strong-future native speakers. As a consequence, such age increase may impact on the weak-future native speaking individuals more strongly such that the reduction in their perception on temporal distance across age is larger comparing to strong-future language speaking group.

According to the partial-eta square ($\eta^2_{partial}$) values (Appendix 15, Centered-score regression panel), six main determinants of FRT are determined. These are language, culture, age, wealth, SRA (self-reported risk aversion), and financial help availability. Consistent with the previous two empirical studies, the same determinants of FRT, in addition to language, with the same signs of influence are obtained. These include the respondents' culture ($\beta_{COL\_IDV} = 0.306$), moderating effect of age on cultural effect ($\beta_{COL\_IDV*Age} = -0.014$), age ($\beta_{Age} = -0.034$), wealth ($\beta_{LnW} = 0.108$), income ($\beta_{LnInc} = 0.058$), reported risk-averse ($\beta_{RRA} = -0.258$), financial support availability ($\beta_{Finhelp} = 0.116$), and help attitude ($\beta_{Helpatt} = 0.228$). Putting these effects in different words, individuals who hold stronger collectivistic view, at younger age, wealthier, with higher income, perceive themselves as risk-seeking in general, with more financial supports from others and are more willing to ask for those help, tend to be more tolerant to financial risk than otherwise.

6.5.2.2 Mosaic 2: Does language influence individual RP?

H_{15}: Individuals speaking weak-future languages exhibit significantly lower RP than individuals speaking strong-future languages

The result for mosaic 2 is displayed in Table 6.5. It indicates that considering the same investment option, weak-future language native speakers perceive the investment as less risky than do strong-future language speakers. The finding is drawn from the significant negative coefficients of the Native_Weak variable at the 1% critical level across the four model variations ($\beta_A = -2.897$, $\beta_B = -4.918$, $\beta_C = -2.688$, $\beta_D = -5.065$, $\beta_E = -5.360$). The conjecture for this finding will be discussed in Section 6.7. Because of this lower level of risk perception, these weak-future monolinguals are more risk tolerant as was found in the first mosaic (Section 6.5.2.1).

Nonetheless, if weak-future language native speakers proficiently speak at least one strong-future language (Weak-Strong multilinguals) their RP significantly increases. The finding is inferred by the significantly positive coefficients of the interactive term between weak-future native language and strong-future foreign languages (Nweak_Pstrong) at the 1% level ($\beta_A = 11.323$, $\beta_B = 12.233$, $\beta_C = 11.341$, $\beta_D = 12.250$, $\beta_E = 12.619$). Therefore, Weak-Strong

multilinguals exhibit higher levels of RP when compared to individuals speaking weak-future language solely. Among the five model variations, the full model variation E has the highest value of adjusted R-square (Adj. R-Square$_E$ = 0.0734). Therefore, it has the strongest explanatory power and should be relied on for finding interpretation.

Table 6.5: Determinants of Financial Risk Perception. Dependent Variable: RP

Mosaic 2	**Centered-score Regression (Robust Standard Errors)**				
Independent Variables	(A)	(B)	(C)	(D)	(E)
Intercept	54.4832***	56.2236***	41.6910***	44.9030***	45.8320***
Native_Weak	-2.8967***	-4.9182***	-2.6881**	-5.0646***	-5.3598***
Prof_Strong	-0.7265	-2.0107	-0.5308	-1.2918	-1.4519
Nweak_Pstrong	11.3230***	12.2334***	11.3406***	12.2500***	12.6193***
Group 2	NO	NO	YES	YES	YES
Group 3	NO	NO	YES	YES	YES
Group 4	NO	NO	YES	YES	YES
Group 5	NO	YES	NO	YES	YES
Group 6	NO	NO	NO	NO	YES
Sample size	1889	1889	1889	1889	1889
Adj. R-Square	0.0102	0.0186	0.0635	0.0655	0.0734

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively. Native_weak equals to 1 if the native language one speaks is the weak-FRT language (futureless language) and zero otherwise. Prof_Strong is coded 1 if respondents speak any other foreign languages with a high proficiency level in addition to their native language. Nweak_Pstrong is the interaction variable which equals to 1 if the respondents are weak-future language native speakers and can speak proficiently in at least one strong-future language.*

For more information, the full results for the fifth model variation of mosaic 2 are presented in Appendix 16. It is found that the cultural effect and linguistic effect do not independently influence RP such that one's cultural value impacts cross-linguistic difference in RP ($\beta_{Nweak\_COL\_IDV}$ = 2.683, p-value = 0.05). Specifically, a higher collectivistic score narrows down the RP gap between weak-future language speakers and strong-future language speakers. This may occur because the collectivistic mentality reduces RP of both linguistic groups (cultural effect) but the negative effect is stronger with individuals speaking strong-future languages. Noticeably, although culture influences the effect of language on RP (mosaic 2, Appendix 16), it does not have any impact on the effect of language on FRT (mosaic 1, Appendix 15, $\beta_{Nweak\_COL\_IDV}$ = 0.0992, n.s). This means that the moderating effect of culture on the cross-linguistic differences in RP is not resilient enough to cause cross-linguistic differences in FRT to change.

Remaining consistent with the previous two empirical studies, the same determinants of RP, in addition to language, with the same signs of influence are obtained. These include the respondents' culture (β_{COL_IDV} = -1.79), age (β_{Age} = 0.10), moderating effect of wealth on age effect ($\beta_{Age*LnW}$ = -0.03), unemployment (β_{Unemp} = 4.72), reported risk-averse (β_{RRA} = 1.54), expectation of the future economy (β_{Ecoexp} = 1.02), financial support availability ($\beta_{Finhelp}$ = 0.43), and help attitude ($\beta_{Helpatt}$ = -1.16). Putting these effects in different words, individuals who hold stronger collectivistic views, at younger age, wealthier, having a stable employment, risk-seeking in general, with more financial supports from others and are more willing to ask for those help, tend to perceive lower risks than otherwise.

According to the partial eta-square ($\eta^2_{partial}$), the interaction term, which takes into account the multilingual aspect, possesses a stronger explanation power than the monolingual variable per se ($\eta^2_{partial\_Nweak\_Pstrong}$ = 0.0108 > $\eta^2_{partial\_Nweak}$ = 0.0002). This indicates that the multilingual perspective of language should be accounted for as it significantly influences the linguistic effect on individual RP. Indeed, the Nweak_Pstrong variable is the second greatest factor as it accounts for the highest proportion of variance in RP, after the SRA variable. The cultural effect clinches the third place with $\eta^2_{partial}$ = 0.0103.

6.5.2.3 Mosaic 3: Does language influence individual RAtt?

H_{16}: Individuals speaking weak-future languages exhibit significantly higher RAtt than individuals speaking strong-future languages

Due to the obtained cross-linguistic difference in RP, the subjective RAtt (b_R) is chosen as the applicable measure of RAtt. Table 6.6 presents the results for the linguistic effect on RAtt. With the subjective RAtt (b_R), no significant linguistic effect on RAtt is found in the last three model variations C, D, and E (β_C = -13.22, β_D = -16.86, β_E = -17.06). Notably, as more factors are controlled for, language gradually loses its effect on RAtt (β_A = -16.93, p-value = 5%; β_B = -21.84, p-value = 10%). The almost zero adjusted-R^2 values of the five variations once again indicate the stable characteristic of RAtt, as indicated in the previous two empirical studies. Furthermore, according to the Appendix 17, which provides the full results for the fifth model variation E, virtually no factor reveals significant effect on RAtt.

Consequently, the cross-linguistic difference in FRT found by mosaic 1 (Section 6.5.2.1) is not associated with the cross-linguistic difference in RAtt, but instead mainly associated with cross-linguistic difference in RP.

Table 6.6: Determinants of Subjective RAtt. Dependent Variable: b_R

Mosaic 3	Centered-score Regression (Robust Standard Errors)				
	Subjective RAtt (b_R)				
Independent Variables	(A)	(B)	(C)	(D)	(E)
Intercept	-12.5382***	-3.43687	-26.53257	-25.10416	-22.72926
Native_Weak	-16.9339**	-21.83989*	-13.21914	-16.86212	-17.06213
Prof_Strong	0.62010	3.18757	-1.51592	1.06122	1.04579
Nweak_Pstrong	-5.69261	-2.26833	-3.87768	-1.49279	-1.58604
Group 2	NO	NO	YES	YES	YES
Group 3	NO	NO	YES	YES	YES
Group 4	NO	NO	YES	YES	YES
Group 5	NO	YES	NO	YES	YES
Group 6	NO	NO	NO	NO	YES
Sample size	1889	1889	1889	1889	1889
Adj. R-Square	0.0011	0.0031	0.0008	0.0020	0

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively. Native_weak equals to 1 if the native language one speaks is the weak-FRT language (futureless language) and zero otherwise. Prof_Strong is coded 1 if respondents speak any other foreign languages with a high proficiency level in addition to their native language. Nweak_Pstrong is the interaction variable which equals to 1 if the respondents are weak-future language native speakers and can speak proficiently in at least one strong-future language.*

To sum up, combining the three mosaics together, as expected, there is a significant cross-linguistic difference in FRT which is caused mainly by the cross-linguistic difference in RP. Specifically, weak-future language native speakers are more risk tolerant than strong-future language native speakers because they see the same financial investment as less risky. However, if those weak-future language speakers can speak proficiently in at least one strong-future language, their RP is increased to a higher level when compared to weak-future language monolinguals, and thus leading to their lower FRT.

6.6 Robustness test: GMM and Aggregating Bootstrap Estimators

This section displays the results for the robustness tests of this study as stated in Section 4.6. According to the results of GMM and bagging bootstrap method presented in Table 6.7, the final qualitative story remains unchanged. The picture depicts that individuals speaking weak-future languages are more risk tolerant (mosaic 1, β_{Native_Weak} = significant positive) as they perceive the investment options as less risky (mosaic 2, β_{Native_Weak} = significant negative) than those speaking strong-future languages. It is also found that if the weak-future language speakers are able to speak proficiently at least one strong-future language, their risk perceptions

increase (mosaic 2, $\beta_{Nweak\_Pstrong}$ = significant positive). Consequently, their FRT would reduce significantly (mosaic 1, $\beta_{Nweak\_Pstrong}$ = significant negative) when compared to individuals who only speak weak-future languages. The evidence suggests that even when using different derivations of RAtt (bagging estimators) and different analytical methods, individual RAtt is found to be constant across individuals who speak different languages. This constant RAtt across language is matched with previous studies (Section 4.2.2), which also found that RAtt is similar across age, culture, gender, and so on.

Table 6.7: Robustness Tests (GMM) and Aggregating Bootstrapping RAtt (b_{R_b})

	GMM Regression			**Bagging Bootstrap**
IVs	Coefficients (Mosaic 1: LnWTP)	Coefficients (Mosaic 2: RP)	Coefficients (Mosaic 3: b_R)	Coefficients (Mosaic 3: b_{R_b})
Intercept	4.6969***	45.832***	-22.73	-378.41
Native_Weak	0.71556***	-5.3598***	-17.06	88.149
Prof_Strong	-0.27495	-1.45188	1.046	-32.604
Nweak_Pstrong	-1.2649***	12.6193***	-1.586	-438.175
Group 2	YES	YES	YES	YES
Group 3	YES	YES	YES	YES
Group 4	YES	YES	YES	YES
Group 5	YES	YES	YES	YES
Group 6	YES	YES	YES	YES
Sample size	1889	1889	1889	1889
Adj. R-Square	0.1200	0.0734	0.0201	0.0023

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Thus far, the study has confirmed the cross-linguistic differences in FRT. Furthermore, the differences are mainly associated with cross-linguistic differences in RP rather than with cross-linguistic differences in RAtt. As discussed, the conjecture for this relationship starts from the influence of language of time perception of the individuals. Specifically, as individuals speaking weak-future languages perceive the distance between the future and the present to be closer than individuals speaking strong-future languages, they may perceive risk differently. As mentioned, the current study has made the first move into the language-FRT topic. Since it has been confirmed that language significantly influences FRT through RP, there is much future work to be done within this area. Nonetheless, this study would like to suggest a few conjectures for why cross-linguistic differences in RP exist through time perception. These are presented in the following section.

6.7 Time perception influences RP: Risk-time relationship

In essence, most conventional pricing models (such as CAPM and Fama-French) are conceived as normative and descriptive, which suggest the fundamental value of an investment under the assumption of rationality in investor's behaviour. Notably, since the work of Markowitz (1952), risk is operationalised most commonly as standard deviation (Klos et al., 2005). However, this operationalisation has been extensively questioned by many studies "from a descriptive perspective, showing that judgments of perceived risk that predict behaviour do not coincide with standard deviation or standard deviation estimates" (Klos et al., 2005, p. 1788, and Duxbury and Summers, 2004). Furthermore, findings obtained in research conducted by Nosic and Weber (2012) suggested that objective risk is a worse predictor of risk-taking behaviour than subjective risk measures. Basically, it would be unrealistic to say that everyone understands the concept and computation of standard deviation, or any other objective risk measures including mean excess loss, probability of loss, and Weber's coefficient of variation[45]. Therefore, subjective risk perception tends to be more pragmatic as Kritzman stated: "risk has no universal definition; rather, like beauty, it is in the eye of the beholder" (Kritzman, 1994, p. 67). As the study focuses on individual FRT (that is, subjective WTP), the main interest lies on how time influence one's RP subjectively, not objectively. There are two reasons for the association between time perception and RP: the uncertain nature of the future and the temporal resolution of uncertainty. Note that these underlying reasons remain conjectures for the linguistic-RP association. Their empirical tests are beyond the scope of this study, which can be considered in future research.

6.7.1 The uncertain nature of the future

In the financial context, when individuals assess and judge the riskiness of an investment, it is understandable for them to perceive higher risk for investment with longer maturity. Basically, the longer it takes for investors to access their investment funds and returns, the riskier they feel for their investment positions. The main reason for the increased RP lies at the uncertain nature of the future. For example, it is easier to predict what will happen in 1 year than in 10 years. A famous saying of Pascal (1910) stated that: "It is not certain that everything is uncertain". It means that nothing is certain, even the saying itself. Therefore, what you will definitely get in the future is not an answerable question as nothing is 'definite'. We are not futurists. No one knows what will happen. In the future, there are risks of natural disasters, changes in institutional policies as well as in the intense powers of market competition,

[45] Coefficient of variance (CV) of a lottery is calculated as its standard deviation divided by its expected return (Weber, 2004)

economic conditions: expansion or recession, peace or war, and many others unpredicted and unquantifiable risks. Consequently, it is possible that for the same type of investment, the longer the investment horizon, the higher risk is perceived.

6.7.2 The temporal resolution of uncertainty

To a great extent it can be seen that the notion of risk being mentioned mainly focuses on changes in outcomes (volatility of outcomes, and possibility of downside outcomes). However, the Allais paradox of Allais (1953), certainty effect of Kahneman and Tversky (1979) and Ellsberg's paradox of Ellsberg (1961) have pointed out that decision-makers are not only sensitive to risk related to outcomes but also to uncertainty and ambiguity. Generally, uncertainty or ambiguity imposes increased distress on decision-makers, and thus is repelled.

Krep and Porteus (1978) examined the notion of temporal resolution of uncertainty, which refers to the time that uncertainty of an investment is resolved, in the context of temporal lottery. In Krep and Porteus's recursive expected utility model, the timing of the resolution of uncertainty is intrinsically accounted for. They mathematically proved that a decision-maker is risk averse for lotteries resolving at any point of time, if she possesses a concave utility function for lotteries resolving immediately (t=0), and if she prefers earlier resolution of uncertainty. In the work by Robichek and Myers (1966), they suggested that security prices might be positively affected by early resolution of uncertainty as investors perceive the early resolution of uncertainty as valuable. Regarding risks of securities with different timing of resolution of uncertainty, Robichek and Myers (1966) considered two securities A and B which are identical in all aspects (expected dividends at time t = T, and the subjective probability). The only difference between them is that dividends are announced with certainty at t = 1 for A and t = T for B. In other words, the uncertainty of security A is resolved earlier than security B. Due to such difference, their study suggests that investors would value security A at higher price than security B because "the market value of the security B would be subject to greater fluctuation over time than A" (Robichek and Myers, 1966, p.226). In addition to the increased objective risk measured by volatility of security B, the study also conjectured an alternative explanation for the preference of A to B such that early uncertainty resolution allows investors more opportunities to adjust and revise their consumptions and investment decisions in case of adverse outcomes, and to take advantage of good outcomes. This advantage is referred to as a *gain in physical preparedness* by Wu (1999). Besides physical preparedness, Wu (1999) also mentioned about psychological preparedness as a reason why people prefer uncertainty to be resolved immediately regardless of the actual payoff time. With an early resolution of

uncertainty, a number of relevant psychological concerns such as anxiety, dread, anticipation, fear, hope, tension and impatience, can be avoided.

The relationship between time perception and risk perception may based on the concept of temporal resolutions of uncertainty. Specifically, it can be asserted that individuals would prefer to know the outcome as early as possible due to both physical and psychological reasons. Imagine two individuals, with one speaking a strong-future language and the other speaking a weak-future language, are considering the same investment with time horizon t = T (payoff time; objective time). Assuming that T_s and T_w denote their subjective perceptions in the timing of the investment's uncertainty to be resolved (T_s and $T_w \leq\geq T$) respectively. As the strong-future language speaker perceives T as larger than the weak-future language speaker ($T_s > T_w$). He is put into a state of emotional dis-satisfaction resulting from anxiety, dread, fear, and impatience for a longer period of time than the other person. Additionally, he also forgoes the opportunity to obtain the gains in physical preparedness provided by the earlier resolution of uncertainty. Consequently, the individual speaking strong-future language may perceive the risk as higher.

6.8 Summary and conclusion

The study has presented tests for the three hypotheses developed to provide findings for the third empirical research. Table 6.8 presents a summary of the hypothesis testing results.

Table 6.8: Empirical Study 3 – Summary of the Hypothesis Testing Results

Hypothesis	Expected Effect	Result
H_{13}	Individuals speaking weak-future languages exhibit significantly stronger focus on the future (stronger FuturePerspective) than individuals speaking strong-future languages	Supported
H_{14}	Individuals speaking weak-future languages exhibit significantly higher FRT than individuals speaking strong-future languages	Supported
H_{15}	Individuals speaking weak-future languages exhibit significantly lower RP than individuals speaking strong-future languages	Supported
H_{16}	Individuals speaking weak-future languages exhibit significantly higher RAtt than individuals speaking strong-future languages	Not Supported

Various research has been conducted within the financial risk tolerance (FRT) topic due to its importance in determining an individual's risk appetite. As a consequence, many factors have been found to influence one's risk tolerance. This study adds to the field an additional significant determinant of FRT, namely, language. Furthermore, the study also found that the underlying mechanism of language-FRT relationship is the perception on financial risk exhibited by individuals. Therefore, findings obtained in this study can be used as a proxy to assess one's FRT as well as altering it through an intervention in RP.

The linguistic-FRT hypothesis of this study developed based on the conjecture for linguistic-saving hypothesis developed by Chen (2013). According to his explanation, languages encode time in different ways. Some languages associate the future and the present, whilst others clearly differentiate between them. The former group is referred to as weak-future languages and the latter is strong-future languages. Chen (2013) projected that these differences in language structure cause differences in individual's perception of time. Particularly, strong-future languages enforce their speakers to distinguish the future from the present using grammatical markers. On the other hand, speakers of weak-future languages are not obligate to do so. Therefore, as strong-future speakers habitually specify the timing of events, they perceive future further away from the present than weak-future speakers do. Based on that difference, it is conjectured that language influences FRT through linguistic-induced bias in time perception and in the precision of timing. Whilst Chen (2013) only hypothesised the linguistic-time

perception association, this study attempts to provide some evidence to justify it. Based on the literature, the study projects an individual's time perception to be associated with their future time perspective (FuturePerspective). Specifically, if individuals see the future to be closer to the present, they tend to pay more focus in the future (stronger FuturePerspective). Consequently, although no study has developed a quantitative measure of time perception, the study employed the measure of FuturePerspective developed by Hershey et al. (2007) as its proxy. According to the results, it is found that weak-future native speakers tend to focus more in the future, thus may see the future as closer to the present when compared to strong-future native speakers and weak-future multilinguals in at least one strong-future language (weak-strong multilinguals).

Subsequently, the study empirically tested the linguistic-FRT hypothesis. The study found that with the same investment option, weak-future language speaking individuals are more willing to engage with the investment by offering a higher price (more risk tolerant) than strong-future language speaking individuals. The cross-linguistic difference in FRT can be explained mainly by the cross-linguistic differences in risk perception. In essence, individuals speaking weak-future languages perceive the investment as less risky than individuals speaking strong-future languages do. Nonetheless, if those weak-future language speakers can fluently speak at least one strong-future language, their risk perceptions will significantly increase. As a result, those weak-strong multilinguals are less risk tolerant when compared to weak-future language monolinguals.

Lastly, the moderating effect of multilingual aspect is anticipated. Although individuals speaking weak-future languages are not required to distinguish between the future and the present when they speak, they are forced to do so when acquiring and being able to speak proficiently in an additional strong-future language. That change lengthens the perceived investment maturity, perhaps, more than the time perceived by the strong-future language monolinguals because foreign speakers are required to pay greater attention to the temporal grammatical points.

Chapter Seven:
Conclusion and Implications

7.1 Overview of the research

The thesis is mainly concerned with exploring uncovered factors (age, culture and language) that influence individuals' financial risk tolerance (FRT), and examining risk perception (RP) and risk attitude (RAtt) as the two fundamental underlying psychological channels, through which those influences on FRT take place. Definitions of financial risk tolerance (FRT), risk perception (RP), and risk attitude (RAtt) are summarised in Figure 2.2 (Section 2.2). Based on solid theoretical foundations, the measures of these constructs are developed (Sections 2.3 and 2.4, respectively).

The objectives of this study include: **(1)** investigating the mediating roles of RP and RAtt on the age effect on FRT (study 1, Chapter 4), **(2)** testing for the moderating effect of age on the cross-cultural differences in FRT and its underlying mechanisms (RP and RAtt), **(3)** examining the reduction in cushion buffer across age as an explanation for (2) (study 2, Chapter 5), and **(4)** investigating the effect of language on FRT and its underlying mechanisms (study 3, Chapter 6). In brief, the study has successfully enhanced the understanding of the influences of age and culture on FRT and intriguingly discovered language as an important factor causing difference in FRT across individuals.

During the process of achieving the above objectives, certain choices and trade-offs were inevitably made regarding the research design (Sections 2.4 and 3.2), study sample (Section 3.3), and methodology (Section 3.4). The investigation was conducted in five diverse cultural and linguistic countries: The United States, The United Kingdom, Singapore, China and Vietnam. The justifications for these choices are discussed in Section 1.3.4. Overall, the implementation of the data collection stage was considered highly successful in achieving the thesis's objectives, with a final sample size of 1,889 individuals (at least 300 respondents from each country).

In terms of the quality of the obtained data, the study tested for its data's comparability with Weber and Hsee's (1998) data by employing the same methodology with them. Technically, this research thesis replicates the study of Weber and Hsee, one of the leading research in the cross-cultural context of FRT, in many aspects. These include the definitions, theoretical background, experimental task and computations of the main constructs. Besides, by employing the same statistical methods (mosaic bivariate analysis) as the baseline, the study obtained the same findings with those obtained by Weber and Hsee (Sections 4.5.1, 5.5.2.1, and 5.5.3). As

a result, it can be concluded that this study's data is comparable to that of Weber and Hsee. This provides the thesis with more credibility in terms of its final findings. Nonetheless, this baseline method is employed mainly for ensuring the data's quality before the main contributions of the thesis are achieved. Note that those empirical contributions significantly add values to the literature of the FRT topic (Table 2.1, Section 2.2.3).

Nevertheless, due to a number of limitations exposed to the bivariate approach, the study employed the model-based mosaic multivariate approach as the main statistical analysis to derive the final findings. According to the statistical results, individuals were consistently found to perceive risk differently from one another. Therefore, subjective RP is the main measure of RP. As individuals perceive risk subjectively, the applicable measure of RAtt is the subjective RAtt (b_R). To get a better insight into the main findings of the three empirical studies of this thesis, more information will be provided in the subsequent section.

7.2 Main findings of the study

7.2.1 Empirical study 1 (Chapter 4). Financial Risk Tolerance Across Age: An Examination of the Mediating roles of Risk Perception and Risk Attitude

Academic researchers increasingly pay attention on whether differences in willingness to take risk (FRT) across individuals is because they have different risk perception (RP) and/or different risk attitude (RAtt). Accordingly, the mediating roles of RP and RAtt on the influences of many factors on FRT have been investigated, *except for* age despite the fact that it has been widely accepted as one of the most prominent demographic determinants of FRT (Hallahan et al., 2003). As a result, the study contributes to this research gap by examining the two underlying mechanisms (RP and RAtt) of the age influence on FRT. Prior to this main contribution, an examination of the existence of age-FRT relationship was initially conducted:

H_1: *"There is a statistically significant difference in individual FRT across age"*, was supported and negative age effect was obtained.

The result for H_1 is consistent with the life-cycle risk aversion hypothesis. It indicates that age negatively influences one's level of FRT. More precisely, older individuals are less willing to engage in risky financial options. Subsequently, two additional hypotheses (H_2 and H_3) were tested to investigate the underlying reason for the finding of H_1.

H_2: *"There is a statistically significant difference in individual RP across age",* was supported and positive coefficient of age was obtained.

H_3: *"There is a statistically significant difference in individual RAtt across age"*, was not supported.

Among the two hypotheses, *only* H_2 was supported with a significant positive coefficient of age indicating that the attitudes toward financial risk of older and younger individuals are relatively similar (insignificant H_3). The reason for older individuals being more willing to take financial risk is that they subjectively perceive the same investment option as riskier comparing to younger individuals (significant H_2).

Conclusion: *Considering the same investment option, older individuals are less willing to engage in the option because they perceive the option as riskier and they dislike financial risk more than younger individuals.*

7.2.2 Empirical study 2 (Chapter 5). Does Age Influence Cross-cultural Difference in Financial Risk Tolerance? Reduction of Cushion Buffer in Older Individuals

The second empirical study started with the examination of cross-cultural differences in FRT through RP and/or RAtt **(H_4 to H_6)**, and the Weber and Hsee's (1998) cushion hypothesis **(H_7)**. Overall, regardless whether the study employs Weber and Hsee's (1998) approach (bivariate and national-level of culture analysis) or other approaches (multivariate and individual-level of culture analysis), the same findings were obtained.

H_4: *"More collectivistic individuals exhibit significantly lower RP than less collectivistic and individualistic individuals"*, was supported.

H_5: *"More collectivistic individuals exhibit significantly higher RAtt than less collectivistic and individualistic individuals"*, was not supported.

The negative effect of culture on RP was supported (H_4) indicating that with the same investment option, more collectivistic individuals perceive the investment as less risky. However, the effect of culture on RAtt were not supported (H_5). It implies that there is cross-cultural similarity in individual attitudes toward financial risks. The subsequent H_6 would indicate that whether the lower RP of more collectivistic causes them to be more risk tolerant.

H_6: *"More collectivistic individuals exhibit significantly higher level of FRT than less collectivistic and individualistic individuals"*, was supported.

The result of H_6 indicates that individuals with higher values of collectivism are willing to pay more to engage with the investment options than are less collectivistic or individualistic individuals. Combining all three hypotheses, it is concluded that cross-cultural difference in FRT is associated mainly with cross-cultural in RP but not in RAtt. The next hypothesis (H_7) is tested to clarify whether the cushion (access to financial help) possessed by more collectivistic individuals is the reason that makes them see lower financial risk.

H_7: *"More collectivistic individuals have significantly more access to financial support than do less collectivistic and individualistic individuals"*, was supported.

To test this hypothesis H_7, this study employs three different statistical methods: bivariate analysis, Baron and Kenny's four-step mediation model, and Structural Equation Modelling. It is consistently found that individuals with stronger collectivistic values tend to have greater access to financial support. As a result, they perceive smaller risk, which causes their higher level of risk tolerance. In other words, the cushion hypothesis is supported.

Note that these hypotheses are the main contributions of Weber and Hsee (1998). This study replicates their paper in many aspects: the definitions, theoretical background, experimental task and computations of the main constructs (FRT, RP and RAtt). By re-examining these contributions using exactly the same statistical method (mosaic bivariate analysis with the use of Hofstede's cultural classification as the proxy of individual culture), the same findings infer that the data of this thesis is comparable to that of Weber and Hsee (1998). Consequently, the reduction of the number of financial investment options (twelve to six) in the FRT task employed from Weber and Hsee (1998) is sufficient to conduct this study robustly.

According to findings obtained thus far in this second empirical study, the key point is that there is cross-cultural difference in FRT, which is mainly associated with cross-cultural in RP. Moving forward to the main research, subsequent hypotheses H_8 to H_{10} determine whether age influences the cultural difference in RP and/or RAtt, and whether such moderation age effect is strong enough to influence the cross-cultural difference in FRT.

H_8: *"Age significantly positively affects the cross-cultural difference in RP"*, was not supported.

H_9: *"Age significantly negatively affects the cross-cultural difference in RAtt"*, was not supported.

H_{10}: *"Age significantly negatively affects the cross-cultural difference in FRT"*, was supported.

Evidently, the first two hypotheses H_8 and H_9 were not supported. This indicates that cultural effects on RP and RAtt are independent of one's age. Recalling H_5, culture was found to not influence RAtt. Therefore, it was expected that the moderating effect of age in H_9 was insignificant. On the other hand, although cross-cultural differences in RP were evident from H_4, the age moderating effect on that difference is not statistically significant. In other words, the difference in RP across culture is constant with age.

Nevertheless, with the insignificant results of H_8 and H_9, hypothesis H_{10} was supported. Implicitly, this means that although age does not influence the cross-cultural differences in RP, it is found to reduce the cross-cultural difference in FRT. In other words, the FRT gap between collectivism and individualism reduces with age. To explain these findings, the study tested for the difference in individual cushion across age.

Particularly, the study initially conjectured that the development of shame, guilt, embarrassment, and self-esteem across age occurs strongly for collectivism. Therefore, older collectivistic individuals are less willing to ask for financial support, even if the support is the same with younger collectivistic individuals. In this case, there is financial support available, but it may not be considered/perceived as 'cushion'. Consequently, the study hypothesised H_{11} and H_{12} to examine whether the cushion gets thinner with age for the collectivism *exclusively*.

H_{11}: *"Older collectivistic individuals have significantly less access to financial support than younger collectivistic individuals"*, was not supported.

H_{12}: *"Older collectivistic individuals are significantly less willing to ask for financial help than younger collectivistic individuals"*, was supported.

The reduction in the social cushion of collectivism across age was empirically confirmed. As conjectured, that reduction was not caused by reduction in financial support availability (H_{11}) but by a reduction in individuals' willingness to seek for help (H_{12}). ***Nevertheless***, to explain for the insignificant moderating age effect on cross-cultural differences in RP (H_8), the study conducted an additional statistical test on the cushion of individualism across age. The result

indicated that the social cushion buffer of older individualistic individuals *also* reduced in a similar way to older collectivistic individuals. However, that reduction for individualistic individuals is because of the lower access to financial support due to the nature of individualism, not their attitude to seeking help. Indeed, their willingness to ask for help remains the same across age. This is expected since individualism is known for their independency upon the group.

Conclusion: *Individuals, who hold stronger collectivistic view, have more access to financial support from their society, than do less collectivistic or individualistic individuals. The greater financial support acts as a cushion buffering individuals from getting hurt by financial failure. As a result, with the same financial investment, more collectivistic individuals perceive the investment as less risky, but their attitudes toward financial risk are the same as those of less collectivistic or individualistic individuals. With lower risk perceptions, more collectivistic individuals are more willing to engage in the investment, showing their higher level of risk tolerance.*

Nonetheless, the higher level of risk tolerance exhibited by collectivistic individuals are reduced with age. However, that reduction may be caused through other channels rather than risk perception as expected. Specifically, the difference in risk perceptions between collectivism and individualism remains unchanged across age. The reason is that the cushions of both collectivism and individualism decline across age.

7.2.3 Empirical study 3 (Chapter 6). From Language to Financial Risk Tolerance through the Channels of Risk Perception and Risk Attitude

A review of the literature in the FRT topic revealed that this study is the first to investigate language as a factor influencing one's risk tolerance level. Building on the explanation of Chen (2013) for his linguistic-saving hypothesis, the linguistic-FRT hypothesis H_{14} is developed and tested:

H_{14}: *"Individuals speaking weak-future languages exhibit significantly higher FRT than individuals speaking strong-future languages"*, was supported.

The support for H_{14} indicates that individuals speaking weak-future languages exhibit higher levels of FRT when compared to strong-future language speakers. However, it is also found that FRT levels of weak-future language speakers, who can speak at least one strong-future language with high proficiency, are significantly lower than ones that only speak weak-future languages.

As linguistic effect on FRT is confirmed, its underlying mechanisms are investigated in hypotheses H_{15} and H_{16}.

H_{15}: *"Individuals speaking weak-future languages exhibit significantly lower RP than individuals speaking strong-future languages"*, was supported:

H_{16}: *"Individuals speaking weak-future languages exhibit significantly higher RAtt than individuals speaking strong-future languages"*, was not supported:

Among the two tested hypotheses, only H_{15} is supported. It confirmed that language does have a role to play in influencing one's risk perception. The results indicate that considering the same investment option, weak-future language speakers see the investment less risky than strong-future language speakers. Nonetheless, individuals speaking weak-future native languages with the proficiency in speaking at least one strong-future language, exhibit higher levels of RP when compared to individuals speaking weak-future language solely.

This supported hypothesis matches completely well with the first mosaic (H_{14}). Combining the three mosaics together, it implies that the cross-linguistic difference in FRT found in H_{18} is associated with the cross-linguistic difference in RP but not in RAtt.

Conclusion: *The study found that with the same investment option, weak-future language speaking individuals are more willing to engage with the investment by offering higher price (more risk tolerant) than strong-future language speaking individuals. The cross-linguistic difference in FRT can be explained mainly by cross-linguistic differences in risk perception. In essence, individuals speaking weak-future languages perceive the investment as less risky, than individuals speaking strong-future languages.*

Nonetheless, if those weak-future language speakers can fluently speak at least one strong-future language, their risk perceptions will significantly increase. As a result, those multilinguals are less risk tolerant when compared to weak-future language monolinguals.

7.3 Implications

Given the assessment and understanding of financial risk tolerance as a fundamental factor that highly impacts investor's risk-taking behaviour, the thesis can practically be of interest to a wide range of financial practitioners. These include (1) individual, (2) financial advisers (or financial planners) and investment managers, and (3) the financial service industry regulators.

7.3.1 Implications for Individual Investors

It is pertinent for individual investors, especially those not seeking financial advice and assistance from professionals, to be aware of their own financial risk tolerance. Failure to assess one's own FRT would lead to inappropriate portfolio allocation decisions, and hence, unnecessary losses may occur (Yao et al., 2011). This research supports investors in assessing their FRT based on their age, culture, and language. Furthermore, as RP is found to be the underlying mechanism of one's FRT formation, individuals can attempt to alter their RP by means of training and education in financial investments. Hopefully, with better understanding in finance, their RP and hence FRT can be adjusted to a more appropriate level.

7.3.2 Implications for Financial Advisers and Investment Managers

As addressed in Chapter 1 regarding the increasing need of better quality of financial services, financial advisers and investment managers are encouraged to enhance their assessment of the FRT of their clients.

Financial advisers and investment managers can use the findings reported in this thesis as proxies to estimate the clients' FRT. Specifically, they can recommend more risky investments to younger, or more collectivistic, or weak-future speaking individuals. Note that since age was found to moderate the cross-cultural difference in FRT, financial advisers should take into account both clients' cultural backgrounds and their age in the risk appetite estimation procedure. In the current era of globalisation, it may be necessary for financial planners to assess the clients' cultural values using an individual construal cultural scale (e.g. Singelis, 1994) and all the languages that they can speak (multilingual aspect). Because age, culture and language are measured at individual level, the generalisation of this research is applicable across many countries and at different time point.

Furthermore, the thesis's findings also suggest financial advisers to attempt to understand the risk perception of their clients. Given the results of this research, risk perception rather than risk attitude is the main mechanism causing individuals to either overstate or understate the riskiness of financial investments. If the advisers suspect ill-judged risk perception they can try to provide them with more financial basic knowledge and information, such as, risk-return relationship,

with the hope that their RP can be adjusted, and hence their FRT to more reasonable level. In the long term, future research can investigate and develop more robust mechanisms that allow practitioners to effectively alter individual FRT through RP to a more appropriate level and to tailor their advices to individual more precisely such that individual well-being and utility can be maximised.

Indeed, the assessment of RP in conjunction with FRT during the advisory process is mandatory even after having an accurate estimate of the client's FRT. The reason is that the risk perceptions of a financial professional and a financially naïve investor are not the same. If the advisers do not understand how much risk the clients perceive they may end up mismatching the portfolio with their clients' risk tolerance.

Furthermore, to expand the demand for financial services, financial advisors and investment managers should enhance their relationship with under-served client groups, such as, young investors, minorities (e.g. Vietnamese investors in the US), investors speaking different languages (e.g. investors living in the US but can only fluent in Chinese), and so on. They can develop and tailor new services and programs that are suitable and appeal to those minor groups, or hire advisors with different cultural and linguistic backgrounds that relate well to different clients.

Overall, this study would like to address a general recommendation to financial advisers such that more observations should be conducted. Financial advisers should spend more time with their clients to help both parties effectively assess the personal levels of FRT and RP of the clients as well as assisting the clients to understand more about the riskiness levels of the investment options.

7.3.3 Implications for Industry Regulators

Given the importance of investors' RP as an underlying process of FRT formation, further research on this topic should take place to assure the mediating role of RP. As a result, the findings of this thesis can be practically applied at richer level. In the long term, the industry leaders and professional organisations may consider revising the current guidelines requiring financial advisers and investment managers to assess their client risk perception in conjunction with their financial risk tolerance during the advisory process.

7.4 Suggestions for future research

With detailed discussions about the study's findings, contributions and implications, this final Section aims at identifying future directions and research opportunities in the area.

(1) By the employment of cross-sectional data, this research cannot explicitly draw on the changes in FRT, RP, and RAtt, as people age. Therefore, future research should consider using longitudinal study to examine the possible reduction in these constructs over the life-cycle.

(2) One potential issue of the risk perception (RP) measurement is that the difference in RP across individuals may be instead a result of different scaling being employed by each person. Therefore, future research should attempt to develop a new measure of RP that can tackle this issue.

(3) The survey approach has a limitation such that without the presence of the researcher, quality of the respondents' responses cannot be ensured, despite many quality check methods have been utilised (Section 3.3.2). Therefore, if possible, future research should employ mixed methods, including, survey, interview, and focus group, to confirm the findings obtained in this thesis.

(4) Using an online survey as the main data collection process may lead the data to subject to self-selection bias. Particularly, the characteristics of respondents who found the survey and decided to complete it may be different from others. Future research may consider collect their data from different sources: students, office working place, on the street, shopping mall, and online survey. With such data, a Heckman selection-bias correction can be employed to address this issue.

(5) Two potential controlling and moderating factors that are related to age and FRT should be taken into account in future research, namely, investment experience and cognitive ability across the life span. In essence, older people tend to accumulate more investment experience (Yao et al., 2011) but their cognitive ability is declined overtime (Fair, 1994).

(6) Although a myriad of research studied the effects of many factors on FRT, a scarcity of research was conducted on RP and RAtt to justify the channels through which those effects take place. This provides room for future research to fill in this gap. For example, mediating effects of RP and RAtt on effects of, such as wealth and income, on FRT.

(7) Thus far, the research explores the investors' minds or thoughts without any justifications on their actual behaviour. It is not a surprise if people act differently from what they think and are willing to do. Consequently, future research can be conducted

to examine whether financial risk tolerance accurately predicts one's actual investment behaviours.

(8) The linguistic-FRT hypothesis is built on the conjecture that language influences individual's time perception. Specifically, speakers of weak-future languages perceive the future closer when compared to speakers of strong-future languages. Up to now, quantitative measure of individual's time perception has yet been developed. Future research can focus on this gap and develop a measure for this psychological construct.

(9) Language was first found in this research as a factor influencing one's FRT through RP. Future investigation should attempt to identify the underlying reason of the findings. For example, the current thesis proposed two possible reasons. These are (1) the uncertain nature of the future (6.7.1), and (2) the temporal resolution of uncertainty (Section 6.7.2). Future research may try to test these two conjectures empirically, or identify alternative explanations.

(10) In terms of practical implications, as mentioned in Section 7.3, further research should be conducted to explore precise channels so that studies working on RP and FRT can be applied effectively in the real-world setting. So far, academic research has only suggested factors that can be used to predict one's FRT, and that FRT can change by altering RP. To apply these findings more effectively, it would be useful if future research can investigate the appropriate levels of FRT and RP for each individual. Accordingly, financial practitioners can decide if FRT should be adjusted through RP.

Appendices

Appendix 1: Information letter and Questionnaire

Research Information Sheet (English version)

Research project:

I would like to invite you to participate in this survey as part of my doctoral research project on *Effects of cultural ethos and language on financial risk tolerance across the life span* and ways of achieving a conceptual model for Behavioural Finance and Economics. It is entirely up to you whether you participate but your responses would be valued. This sheet provides you with information about why the research is being done, by whom and what is involved. This background information is to ensure that you are able to make an informed decision about whether or not to take part in the survey. This project has been approved by the Ethical Panel of the Newcastle University.

Who is the Researcher?

The research is conducted by Ngan Duong Cao (Rosie), a PhD candidate of Newcastle University in Finance and Economics; and is supervised by Professor Darren Duxbury and Professor Susan Chilton.

What is the research about?

My research is aimed at finding out changes in individual's financial risk tolerance across the life span. The primary aim of my research is to provide a unifying framework for the examination of cross-national differences in individuals' financial risk tolerance across the life course, drawing on and uniting contributions from a range of diverse fields, including finance, economics, psychology, linguistic, sociology and anthropology. At the heart of the research agenda is a desire to better understand individuals' decision making under risk and uncertainty and over time in the context of investment behaviour, how these may change over the life span.

Who are the participants? When is the project running?

Potential participants will be residents of the four countries of investigation: China, Vietnam, the UK and the US. Participants will be above the age of 18. Participants will be recruited entirely online. The project runs from October 2014 to October 2017.

Is this voluntary? What if you change your mind about taking part?

Your involvement in this research project is voluntary. You are free to withdraw from the research at any point you wish UP TO submission. If you do so, you do not have to give a reason. As the survey is completely anonymous, any wish of withdrawal after submission cannot be fulfilled.

What would be involved?

If you choose to participate, we would like to ask you a series of broad questions about your willingness to take on financial risk and actual financial investments, questions related to your psychological constructs; together with your personal information about your cultural values and beliefs. These broad questions are about the following: a) Your financial risk tolerance and perception of risk b) Your actual financial asset investments c) Your languages and cultural backgrounds d) Psychological-related questions e) Your demographic, socioeconomic and attitudinal information.

How will the survey data be treated?

The survey requires neither participant name nor any identifying details. The questionnaire will be completed anonymously. Responses from completed questionnaires will be collated for analysis using a statistical package (STATA); once this is complete the original questionnaires will be retained until *successful completion of a PhD. Up to this stage*, the data will then be transferred via spreadsheets on to a computer. The computer and research folder are password protected.

Will everything you say to me be kept private?

Yes, all information will be anonymous and thus minimise the issue of confidentiality.

The requirements of Newcastle University's ethical guidelines will be strictly observed. This means that at all times the researcher must observe the welfare of the research participants and respect the dignity and personal privacy of the individual. All data collected will also be stored securely and safely. All data to be published will be completely anonymous in order to protect the confidentiality of participants.

In practical terms, this means that:

- All data will be fully anonymised.
- This is achieved via the use of pseudonyms.

- This anonymity is extended to any other individual or organisation referred to.
- The data will be used to advance academic knowledge and/or professional practice only and will not be used for any other purpose.
- With this express aim, anonymised data may be incorporated into articles or presentations.

What next?

I will produce the general outcomes of our research on the website. If there are any areas that require further clarification, you are welcome to contact me via the 'Contact' page on the website. I will be pleased to answer any questions. If you choose not to take part in this research, I wish to thank you for your time. You need take no further action.

Contact: Rosie Cao (PhD candidate) Newcastle University Business School (Room 6.22)

Email: n.d.cao1@newcastle.ac.uk

Office number: (+44) 1912081601

Questionnaire (English version – The US survey)

Project: Effects of culture and language on financial risk tolerance

1	I have read and understood the information about the project, as provided in the information sheet	☐
2	I have been given the opportunity to ask questions about the project and my participation	☐
3	I voluntarily agree to participate in the project	☐
4	I understand that I can withdraw at any time without giving reasons and that I will not be penalised for withdrawing, nor will I be questioned on why I have withdrawn	☐
5	The procedures regarding confidentiality (e.g. the use of names, pseudonyms, anonymisation of data, etc.) have been clearly explained to me	☐
6	The use of data in research, publications, sharing and archiving has been explained to me	☐

I consent to participate in this project	YES	NO
I consent to any information I provide to the project being used in the writing up of the research, in publications, uploaded to websites and included in archives of research reports, **provided that** unless I give my express permission, my name and other identifying personal details will not be associated with the information I provide	YES	NO

PART I: GENERAL INFORMATION

1) In what year were you born?

2) What is your gender?

- ○ Male
- ○ Female

3) What is your marital status?

- ○ Single
- ○ Married
- ○ Separated
- ○ Divorced
- ○ Widow/Widower

4) Do you have any children?

- ○ Yes
- ○ No

5) How many family members do you have in your household, besides yourself?

6) What is the highest level of education you have completed or the highest degree you have received?

- ○ Less than high school degree
- ○ High school degree or equivalent (e.g., GED)
- ○ Some college but no degree (e.g. A Level)
- ○ Associate degree
- ○ Bachelor degree
- ○ Postgraduate degree
- ○ Other (please specify)

PART II: FINANCIAL RISK TOLERANCE

In the following question, you will be presented with an example question and guideline answer before answering the real questions.

EXAMPLE QUESTION and GUIDELINE ANSWER:

Assume that you have a maximum of $30,000 to invest in **each** investment product.

The investment product S has three potential outcomes. P1, P2, and P3 indicate the probabilities of obtaining outcome 1, outcome 2, and outcome 3, respectively.

Investment Product	Outcome 1	P1	Outcome 2	P2	Outcome 3	P3
S	$1000	59 %	-$500	30 %	-$2000	11%

Question: What is the **maximum** price you would be willing to pay for this investment product, rather than forgoing it? **[If you wouldn't buy it at any price, write 0]**

Answer: $X ⇒ You are happy to pay up to $X to buy this product S, which gives you 59% chance to win $1000; 30% chance of losing $500, and 11% chance of losing $2000. And remember that you **will not** get back the **$X** you paid. Therefore, with Outcome 1, you would **RECEIVE** $1000, and with Outcome 2 or Outcome 3, you would **PAY EXTRA** either $500 or $2000, respectively.

Note: $X is the highest price you would be willing to pay, not the lowest price.

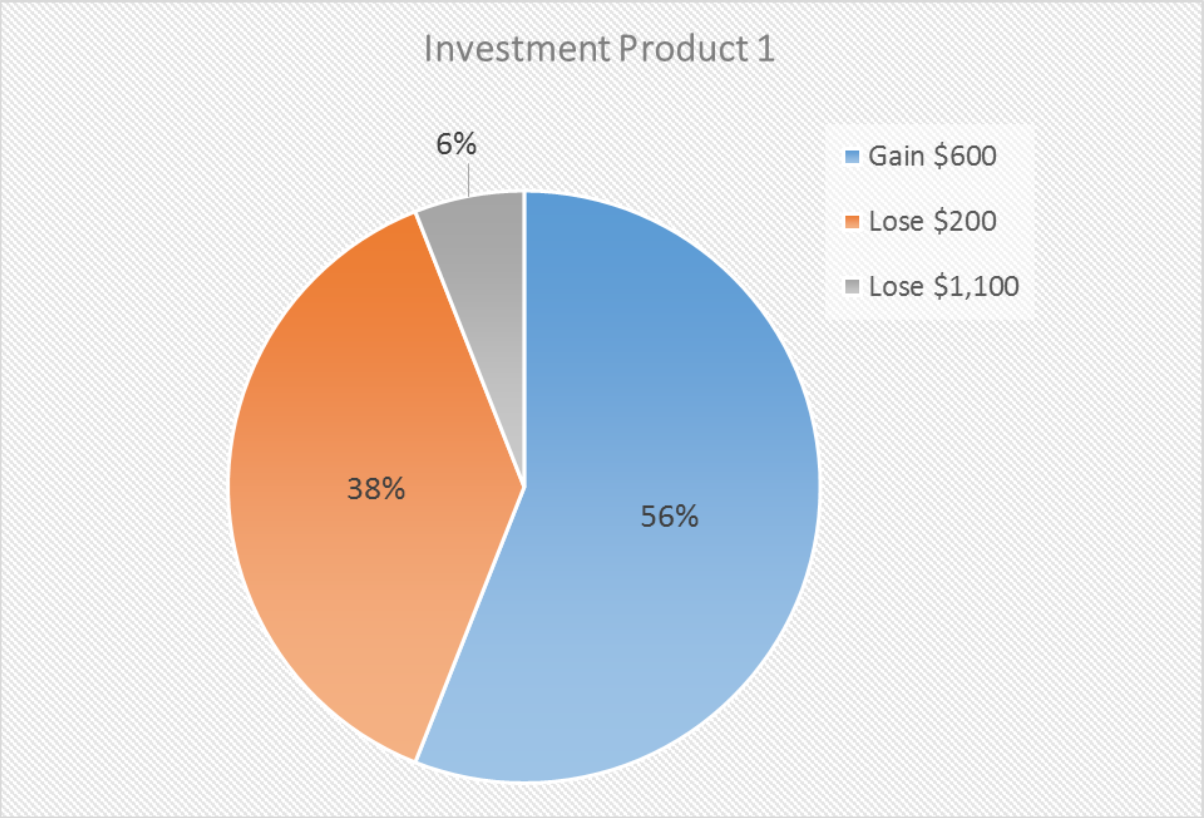
QUESTIONS:

You will now examine 6 investment products **separately**, considering the possible losses and gains.

REMEMBER:

- **You start EACH investment decision with $30,000**
- **You do not get the cost of investment back**
- **There are no right or wrong answers**

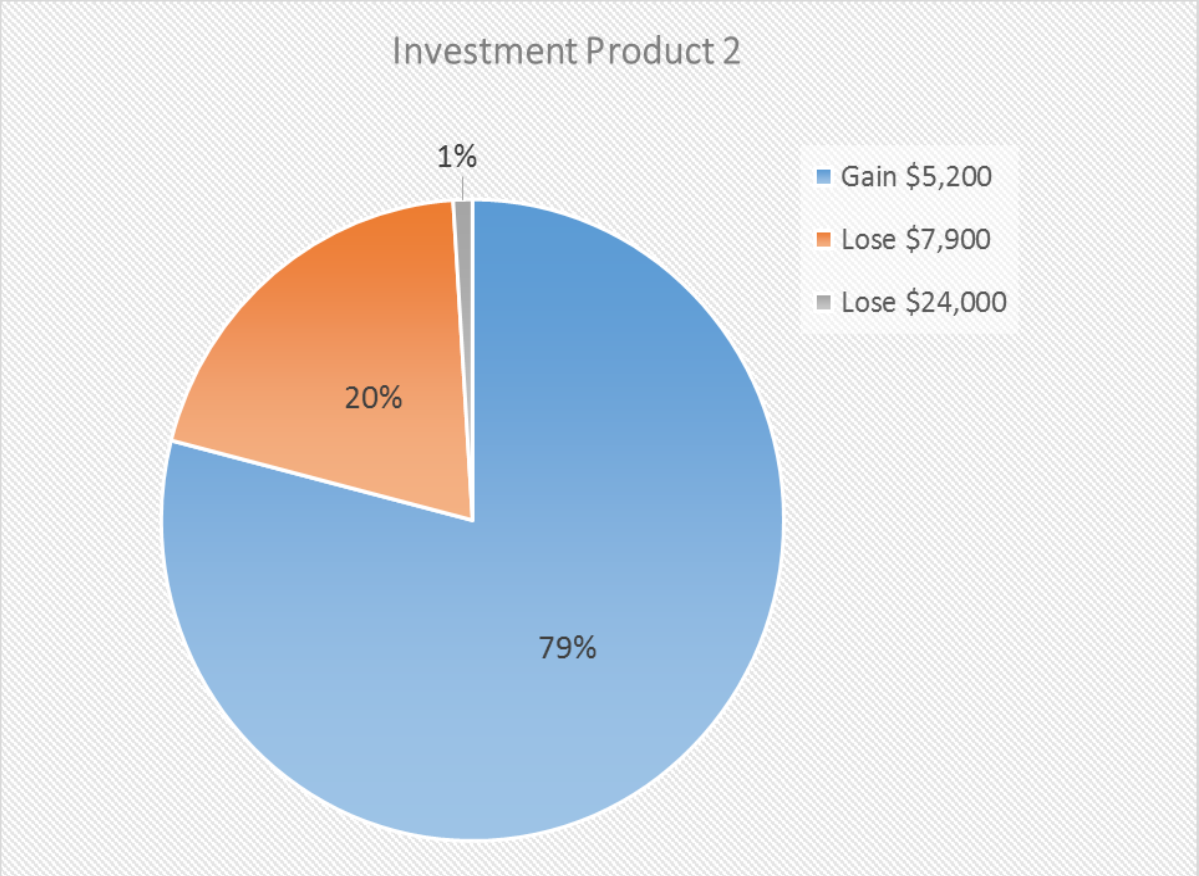
Investment Product	Outcome 1	P1	Outcome 2	P2	Outcome 3	P3
1	$600	56 %	-$200	38 %	-$1,100	6%



1. What is the **maximum** price you would be willing to pay for this investment product, rather than forgoing it? ***[If you wouldn't buy it at any price, write 0]***

2. On a scale of 0 to 100, how risky do you think this investment product is? ***[Where 0 is "Not at all risky" and 100 is "Extremely risky"]***

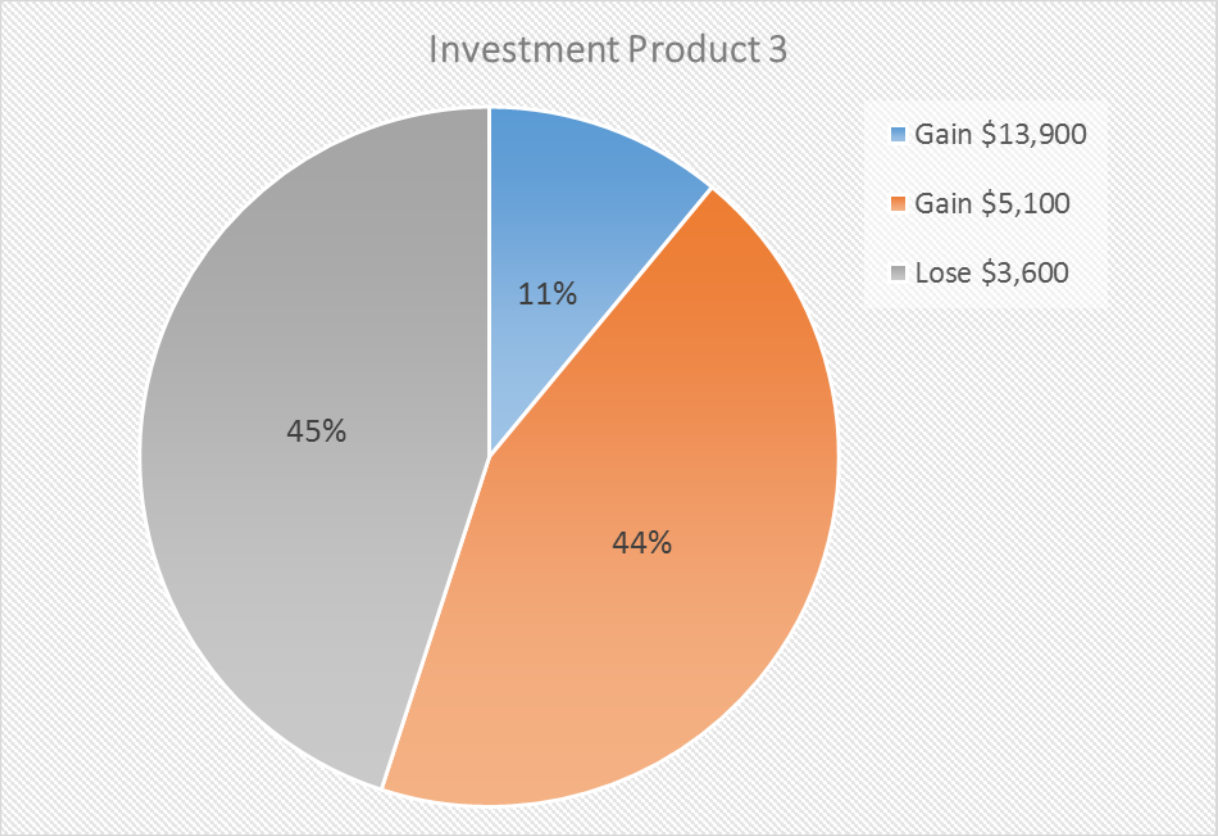
Investment Product	Outcome 1	P1	Outcome 2	P2	Outcome 3	P3
2	$5,200	79 %	-$7,900	20 %	-$24,000	1%



3. What is the **maximum** price you would be willing to pay for this investment product, rather than forgoing it? ***[If you wouldn't buy it at any price, write 0]***

4. On a scale of 0 to 100, how risky do you think this investment product is? ***[Where 0 is "Not at all risky" and 100 is "Extremely risky"]***

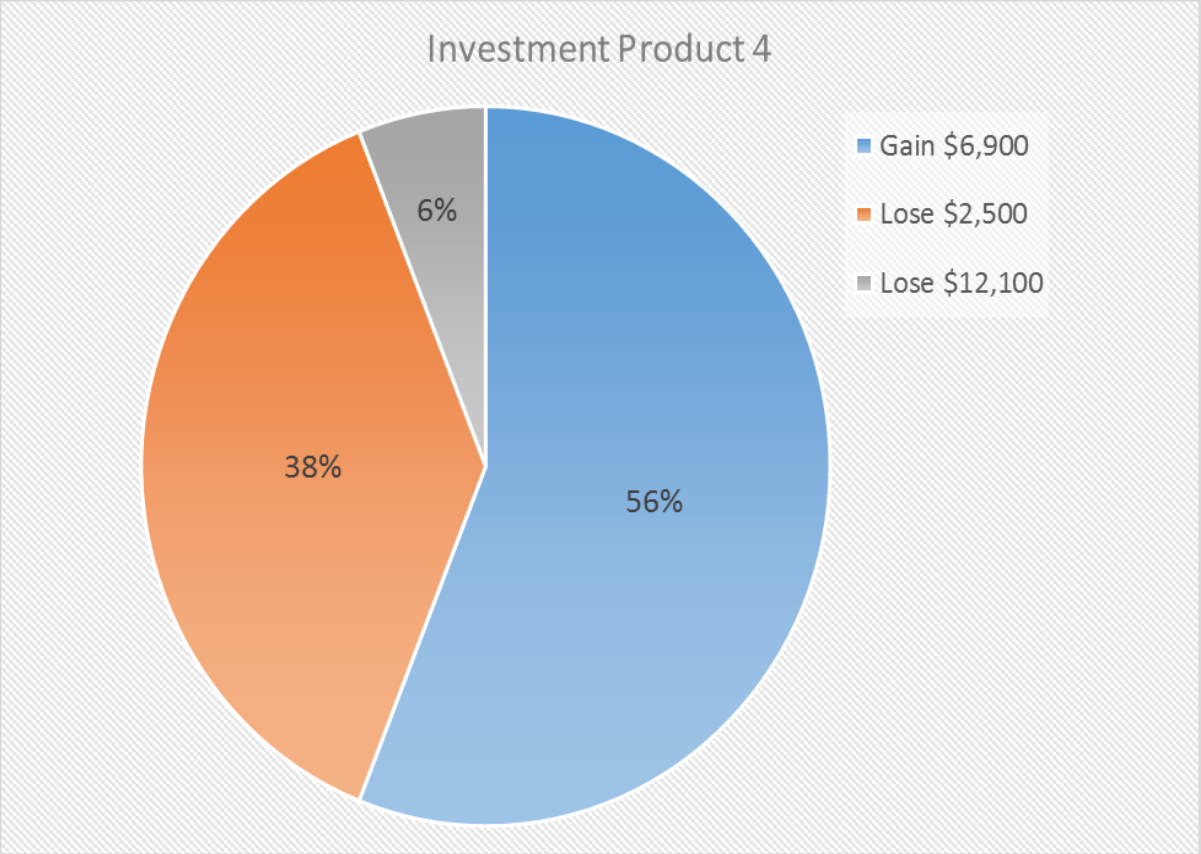
Investment Product	Outcome 1	P1	Outcome 2	P2	Outcome 3	P3
3	$13,900	11%	$5,100	44%	-$3,600	45%



5. What is the **maximum** price you would be willing to pay for this investment product, rather than forgoing it? ***[If you wouldn't buy it at any price, write 0]***

6. On a scale of 0 to 100, how risky do you think this investment product is? ***[Where 0 is "Not at all risky" and 100 is "Extremely risky"]***

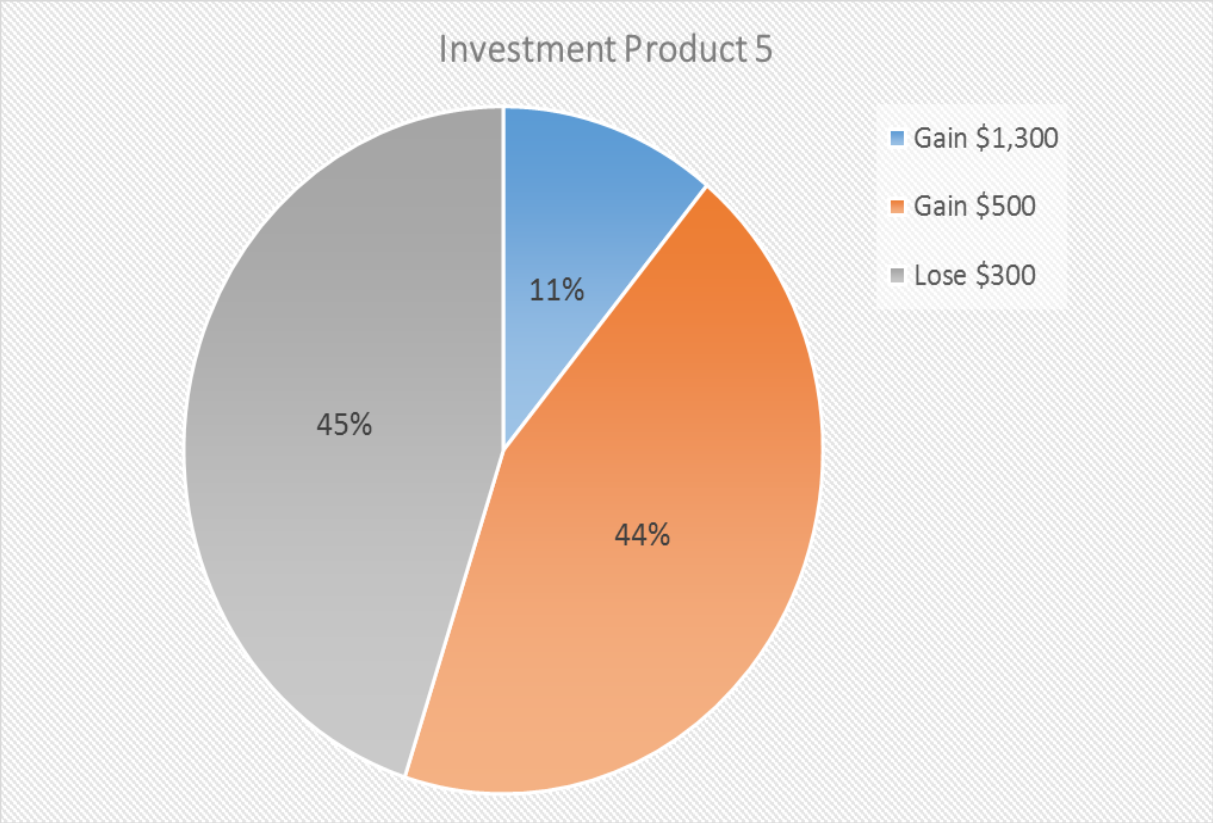
Investment Product	Outcome 1	P1	Outcome 2	P2	Outcome 3	P3
4	$6,900	56%	-$2,500	38%	-$12,100	6%



7. What is the **maximum** price you would be willing to pay for this investment product, rather than forgoing it? ***[If you wouldn't buy it at any price, write 0]***

8. On a scale of 0 to 100, how risky do you think this investment product is? ***[Where 0 is "Not at all risky" and 100 is "Extremely risky"]***

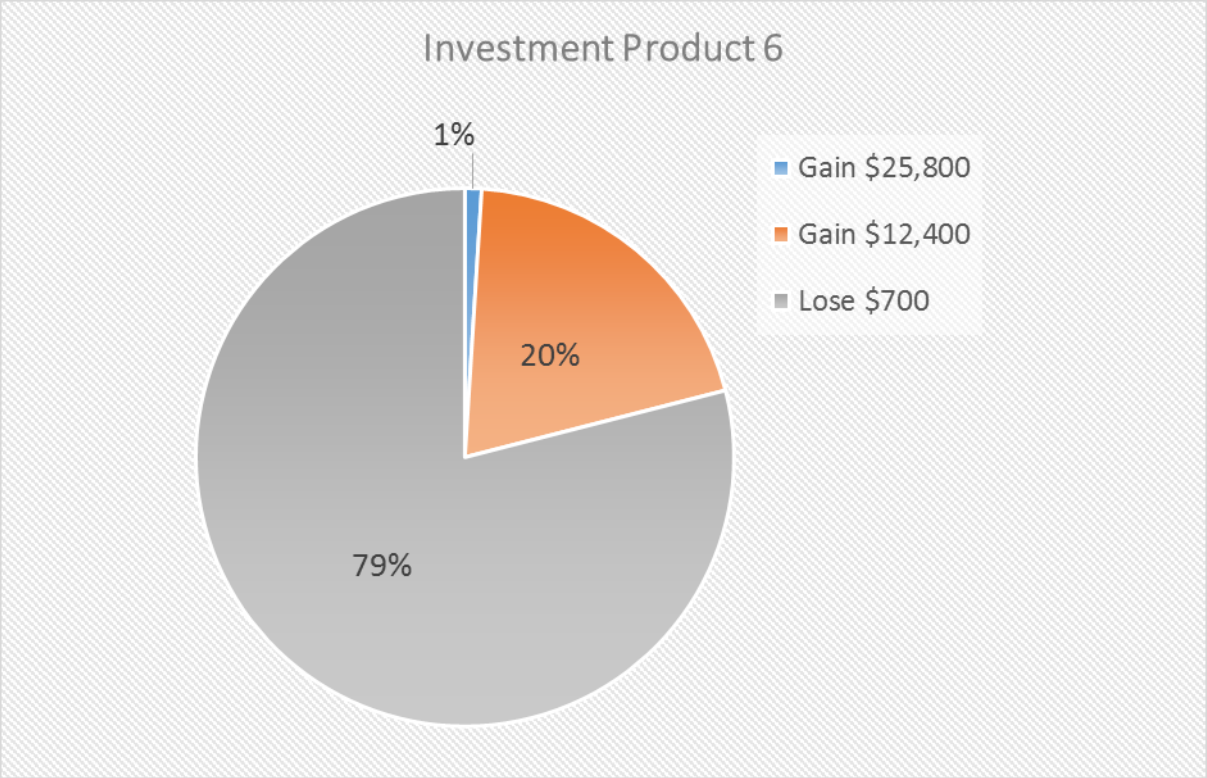
Investment Product	Outcome 1	P1	Outcome 2	P2	Outcome 3	P3
5	$1,300	11%	$500	44%	-$300	45%



9. What is the **maximum** price you would be willing to pay for this investment product, rather than forgoing it? ***[If you wouldn't buy it at any price, write 0]***

10. On a scale of 0 to 100, how risky do you think this investment product is? ***[Where 0 is "Not at all risky" and 100 is "Extremely risky"]***

Investment Product	Outcome 1	P1	Outcome 2	P2	Outcome 3	P3
6	$25,800	1%	$12,400	20 %	-$700	79%



11. What is the **maximum** price you would be willing to pay for this investment product, rather than forgoing it? ***[If you wouldn't buy it at any price, write 0]***

12. On a scale of 0 to 100, how risky do you think this investment product is? ***[Where 0 is "Not at all risky" and 100 is "Extremely risky"]***

PART III: SOCIOECONOMIC CHARACTERISTICS

1) Which of the following categories best describes your employment status?

- ○ In full time work
- ○ In part time work
- ○ Part time work, Part time student
- ○ Student only
- ○ Unemployed, looking for work
- ○ Unemployed, not looking for work
- ○ Incapacity, not able to work
- ○ Retired
- ○ Self-employed
- ○ Other (please specify)

2) Do you or someone in your household own as house/apartment?

- ○ Yes
- ○ Yes, but with a mortgage or loan
- ○ No

3) What is your total ***estimated*** net worth/wealth: what you own, including cash, investment, your home and other personal-use assets; **minus** what you owe? (***($ US Dollar)***

- ○ Under $10,000
- ○ $10,000 - $24,999
- ○ $25,000 - $49,999
- ○ $50,000 - $99,999
- ○ $100,000 - $149,999
- ○ $150,000 - $299,999
- ○ $300,000 - $499,999
- ○ $500,000 - $999,999
- ○ $1,000,000 - $1,999,999
- ○ $2,000,000 - $4,999,999
- ○ More than $5,000,000

4) Within the wealth band you have chosen above, please give the estimate of your net worth/wealth? ***($)***

5) What is your **personal** annual income before tax from all sources? This includes income from jobs; net income from business, farm, or rent; pensions; dividends; interest; social security payments; and any other money income received by **YOU**.

DO NOT SUBTRACT:

- Taxes
- National Insurance Contribution
- Superannuation Payments
- Health Insurance Payment

Per ***Month***	or	Per ***Year*** **(Approximately)**
Nil	◯	Nil
Up to $429	◯	Up to $5,199
$430 to $869	◯	$5,200 to $10,399
$870 to $1299	◯	$10,400 to $15,599
$1,300 to $1,729	◯	$15,600 to $20,799
$1,730 to $2,169	◯	$20,800 to $25,999
$2,170 to $2,599	◯	$26,000 to $31,199
$2,600 to $3,029	◯	$31,200 to $36,399
$3,030 to $3,469	◯	$36,400 to $41,599
$3,470 to $3,899	◯	$41,600 to $46,799
$3,900 to $4,329	◯	$46,800 to $51,999
$4,330 to $4,979	◯	$52,000 to $59,999
$4,980 to $5,849	◯	$60,000 to $69,999
$5,850 to $6,719	◯	$70,000 to $79,999
$6,720 to $7,579	◯	$80,000 to $89,999
$7,580 to $8,449	◯	$90,000 to $99,999
$8,450 or more	◯	$100,000 or more

6) Within the income band you have chosen above, please give the estimate of your personal annual income before tax from all source? ***($)***

7) Do you consider your current income stream to be stable or risky?

1: Extremely stable ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ 10: Extremely risky

PART IV: CULTURE

For each of the statements below, please indicate whether or not you agree with the statement

"1": Strongly disagree

"7": Strongly agree

1) I enjoy being unique and different from others in many respects

2) I can talk openly with a person who I meet for the first time, even when this person is much older than I am

3) Even when I strongly disagree with group members, I avoid an argument

4) I have respect for the authority figures with whom I interact

5) I do my own thing, regardless of what others think

6) I respect people who are modest about themselves

7) I feel it is important for me to act as an independent person

8) I will sacrifice my self-interest for the benefit of the group I am in

9) I'd rather say "No" directly, than risk being misunderstood

1: Strongly Disagree 7: Strongly Agree

10) Having a lively imagination is important to me

1: Strongly Disagree 7: Strongly Agree

11) I should take into consideration my parents' advice when making education/career plans

1: Strongly Disagree 7: Strongly Agree

12) I feel my fate is intertwined with the fate of those around me

1: Strongly Disagree 7: Strongly Agree

13) I prefer to be direct and forthright when dealing with people I've just met

1: Strongly Disagree 7: Strongly Agree

14) I feel good when I cooperate with others

1: Strongly Disagree 7: Strongly Agree

15) I am comfortable with being singled out for praise or rewards

1: Strongly Disagree 7: Strongly Agree

16) If my brother or sister fails, I feel responsible

1: Strongly Disagree 7: Strongly Agree

17) I often have the feeling that my relationships with others are more important than my own accomplishments

1: Strongly Disagree 7: Strongly Agree

18) Speaking up during a class (or a meeting) is not a problem for me

1: Strongly Disagree — 7: Strongly Agree

19) I would offer my seat in a bus to my professor (or my boss)

1: Strongly Disagree — 7: Strongly Agree

20) I act the same way no matter who I am with

1: Strongly Disagree — 7: Strongly Agree

21) My happiness depends on the happiness of those around me

1: Strongly Disagree — 7: Strongly Agree

22) I value being in good health above everything

1: Strongly Disagree — 7: Strongly Agree

23) I will stay in a group if they need me, even when I am not happy with the group

1: Strongly Disagree — 7: Strongly Agree

24) I try to do what is best for me, regardless of how that might affect others

1: Strongly Disagree — 7: Strongly Agree

25) Being able to take care of myself is a primary concern for me

1: Strongly Disagree — 7: Strongly Agree

26) It is important to me to respect decisions made by the group

1: Strongly Disagree — 7: Strongly Agree

27) My personal identity, independent of others, is very important to me

28) It is important for me to maintain harmony within my group

29) I act the same way at home that I do at school (or work)

30) I usually go along with what others want to do, even when I would rather do something different

PART V: LANGUAGE

1) What languages do you speak?

Rolling menu

	Language	Proficiency Level**
Language 1		
Language 2		
Language 3		
Language 4		

***Proficiency level:**

1) Native speaker;
2) Near native/Fluent;
3) Excellent command/Highly proficient in spoken and written;
4) Very good command;
5) Good command/Good working knowledge;
6) Basic communication skills;

PART VI: ATTITUDINAL CHARACTERISTICS

1) Do you have a strong religious belief?

- ○ Yes
- ○ No

2) How healthy are you in general?

1: Unhealthy, sick and unwell									10: Exceptionally healthy
○	○	○	○	○	○	○	○	○	○

3) Which of the statements below comes closest to the amount of financial risk that you (and your husband/wife) are willing to take when you save or make investments?

- ○ Take substantial financial risk expecting substantial returns
- ○ Take above-average financial risk expecting to earn above-average returns
- ○ Take average financial risk expecting to earn average returns
- ○ Take below-average financial risk expecting to earn below-average returns
- ○ Not willing to take any financial risks

4) What is your expectation for the economy over the next 5 years?

- ○ Much better
- ○ Better
- ○ Almost no change
- ○ A little worse
- ○ Much worse

5) What is your expectation for the interest rates in the next year?

- ○ Rise a lot
- ○ Rise a little
- ○ Almost no change
- ○ Reduce a little
- ○ Reduce a lot

PART VII: SOCIAL NETWORK

1) ***Excluding*** your spouse, with how many members of your family (parents, grandparents, siblings, aunts, uncles, cousins, children, etc.) do you live?

2) ***Except for*** the ones you live with, with how many members (parents, grandparents, siblings, aunts, uncles, cousins, children, etc.) of your family do you maintain contact (visiting, calling, or writing to them least ***once a month)****?*

3) How many of those ***could*** you approach if you needed financial help or material support?

4) How many of those ***would*** you approach if you needed financial help or material support?

PART VIII: HELP-SEEKING ATTITUDES

For each of the statements below, please indicate whether or not you agree with the statement

"1": Strongly disagree

"7": Strongly agree

1) If, for whatever reason, I were to have financial difficulties, I would do whatever possible to avoid asking help from anyone

1: Strongly Disagree 7: Strongly Agree

2) If I were to face a big sum of loss in investment, I would try to conceal this from my friends

1: Strongly Disagree 7: Strongly Agree

3) If a serious financial problem were to arise, I would be willing to talk about it with a professional, or with a friend or relative, but in any case I would not keep it to myself

1: Strongly Disagree 7: Strongly Agree

4) Financial problems are so distressing that they cannot be managed alone

1: Strongly Disagree 7: Strongly Agree

PART IX: INSTRUMENTAL VARIABLES

1) How long is your planning horizon for saving? (Years)

2) Do you fully or partially support your family?

- Fully support
- Partially support
- Not support

3) To what extent do you expect your children to support you financially in retirement?

1: No expectation — 10: Extremely high expectation

4) How long have you been investing in stocks? ***(months)***

5) How important to leave an inheritance?

1: Not at all important — 10: Extremely important

PART X: FUTURE TIME PERSPECTIVE VARIABLES

For each of the statements below, please indicate whether or not you agree with the statement

"1": Strongly disagree

"7": Strongly agree

1) I enjoy thinking about how I will live years from now in the future

1: Strongly Disagree						7: Strongly Agree
○	○	○	○	○	○	○

2) I follow the advice tosave for a rainy day

1: Strongly Disagree						7: Strongly Agree
○	○	○	○	○	○	○

3) The distant future is too uncertain to plan for

1: Strongly Disagree						7: Strongly Agree
○	○	○	○	○	○	○

4) The future seems very vague and uncertain to me

1: Strongly Disagree						7: Strongly Agree
○	○	○	○	○	○	○

Debriefing Form

Thanks for taking part in this survey

Researcher: Ngan D. Cao (Rosie)

Supervisors: Professor Darren Duxbury and Professor Susan Chilton

Institution: Newcastle University, the United Kingdom

Department: Newcastle University Business School

- What are the aims of the study?
  This is a cross-national study that investigates the impacts of one's psychological constructs on individual's financial risk tolerance and investment behaviour across the life course.
- What if I have any questions about the study that I would like to ask now?
  Online study contact provided on the "Contact page" of the website.
- How can I contact the researcher if I have any further questions or if, for any reason, I wish to withdraw my data once I have left?
  Researcher's email: n.d.cao1@newcastle.ac.uk
- Can I obtain a summary of the results of the study?
  To obtain details of the results contact the researcher at n.d.cao1@newcastle.ac.uk

Thank you again for your participation in this study!

Appendix 2: DETAILS ON CURRENCY EXCHANGE

Method 1: LPPI method

The first method uses the Local Purchasing Power Index (LPPI), which indicates the purchasing power in buying goods and services of inhabitants with an average salary in each countries relative to inhabitants with an average wage in the US. Table I provides summary for the market exchange rate and the LPPI in 2016. For illustration, the LPPI of the UK is 86.23, this means that the residents in the UK with the average salary can afford to buy 12.77% less typical goods and services than American residents with an average salary.

Table I: Exchange Rate and Local Purchasing Power Index (LPPI) in 2016[46]

Currency	Exchange rate	Countries	LPPI (2016)
USD	**1**	**The US**	**100**
USD/GBP	0.6858	The UK	86.23
USD/SGD	1.3969	Singapore	79.40
USD/CNY	6.5548	China	55.63
USD/VND	21,920	Vietnam	18.60

The calculation for currency exchange rates accounting for purchasing power using LPPI can be written as:

$$S_{\$/i\_adj} = S_{\$/i} * \frac{LPPI\ (i)}{LPPI\ (The\ US)}$$

where $S_{\$/i\_adj}$ and $S_{\$/i}$ are the exchange rates of target currency per US Dollar after and before adjusting for PPP, respectively.

Method 2: CPI+R method **[EMPLOYED METHOD]**

[INCLUDED IN THE MAIN TEXT SECTION 3.2.2]

[46] *Sources:*
Currency Conversion (Yahoo Finance, 2016)
Cost of Living Index for Countries in 2016 (Numbeo, 2016)

Method 3: PPP conversion factor method

The last currency conversion approach uses the Power Purchasing Parity (PPP) conversion factor, which is the amount of each currency required to purchase the same bundle of goods and services in their domestic market that one US Dollar would buy in the US market. Table II provides the PPP conversion factors for the five countries of investigation. The PPP conversion factor for the UK is 0.71, which indicates that £0.71 could buy the same amount of goods and services in the UK market as one US Dollar could buy in the US market. Consequently, the exchange rate of each target currency per US Dollar after adjusting for PPP is also the PPP conversion factor. The PPP conversion factors are provided for 47 economies by Eurostat and the Organisation for Economic Cooperation and Development (OECD).

Table II: Power Purchasing Parity (PPP) Conversion Factor in 2014[47]

Countries	Currency	PPP Conversion Factor (2014)
The US	**US Dollar ($)**	**1**
The UK	British Pound (£)	0.71
Singapore	Singaporean Dollar (S$)	0.86
China	Chinese Yuan (¥)	2.73
Vietnam	Vietnamese Dong (VND)	7710.48

CPI+R method as the main currency conversion approach

Considering advantages and drawbacks of each approach, the study chooses the second approach, that is, currency conversion based on the cost of living of each country relative to that of the United States. The rationale for the decision is based on the following four criteria:

1) Plausible and logically reasonable application.
2) One conversion rate is appropriate to use across the whole study.
3) Most up-to-date market exchange rate and power purchasing parity index.
4) Being supported by preceding literature.

[47] *Sources:*
Currency Conversion (Yahoo Finance, 2016)
Cost of Living Index for Countries in 2016 (Numbeo, 2016)

Table III provides summary for the evaluation of the three currency exchange method.

Table III: Criteria evaluation for each exchange conversion method

Criteria	Method 1 Local Purchasing Power Index (LPPI)	Method 2 Consumer Price Plus Rent Index (CPI+R)	Method 3 Power Purchasing Parity (PPP)
Appropriate and logically reasonable to apply		√	√
One conversion rate used across the whole study		√	√
Most up-to-date information	√	√	
Being consistent with previous literature		√[48]	

Among the three approaches, all the criteria set out were fulfilled if the CPI+R method is put into use. For the LPPI method, purchasing power of average salary earners in each targeted country relative to those in the US is taken into account. According to this method, the real value of the conversion rate for each currency to the average earning inhabitants in each country is the same with the real value of $1 to the US inhabitants with average earnings. Under such interpretation, this method is not plausible to apply as only perspectives of average salary earners are considered. For example, according to the LPPI method, if respondents are provided with a maximum investment endowment of $30,000 in the US survey, and £20,000 in the UK survey, it means that, to British respondents with average salary, £20,000 worth as much as $30,000 to American respondents with average earnings. Therefore, the purchasing parity can only be achieved for average earners but not for respondents with higher or lower salary than the average salary.

On the other hand, the CPI+R and PPP conversion factor methods are more appropriate. The two methods are based on the general cost of living of each country. For example, the conversion rates using these two methods indicate that £20,000 of income would be able to purchase the same bundle of goods and services in the UK market as would $30,000 of income in the US market. Therefore, comparability is feasible across individuals with different incomes

[48] Bontempo, Bottom, and Weber (1997), Rieger, Wang, and Hens (2014), Weber and Hsee (1998), Wang and Fischbeck (2008)

and wealth. Nevertheless, one drawback of the PPP conversion factor approach which makes it less favourable than the CPI+R method is that its latest information is in 2014; whilst CPI+R is available for 2016. Consequently, among the three proposed methods, the CPI+R method is the most appropriate and thus is employed in the current study.

Appendix 3: PILOT STUDY PROCESS

PART I: FEEDBACK SHEET

1. Is there any question that is unclear, ambiguous, and hard to understand?
2. Is there any question that you did not want to answer (either due to privacy, sensitivity, or because it is too difficult to understand or measure)? If yes, please kindly advise me on the reasons.
3. Is the survey layout and presentation clear and easy to follow?
4. In general, do you understand the instructions of the first experimental question? (i.e. the FRT question)
5. Is the order of the survey appropriate?
6. Does it create a positive impression that motivates people to respond?
7. Do you feel tired or bored while answering the survey (due to either the length or the topic of the survey)?
8. Are all given choices for multiple choice questions appropriate and sufficient?
9. Is the range of response choices actually used?
10. Is there any question that subjectively lead you to answer in a certain way?

PART II: FEEDBACK QUESTIONS FOR THE FRT TASK

1. Is the task instruction clear to you?
2. Can you interpret the investment product 1 and your answer?
3. How do you find the length of this task?
4. Is 12 investment products a good number? IF answer is 'NO'
5. How many investment products are good enough to maintain your focus and quality of your answers?
6. Do you understand whether £20,000 is the endowment for each investment option or is allocated among six investment options?
7. Do you understand whether you can get back the cost of investment?
8. Do the outcomes of the investment product 1 influence the price you are willing to pay for the investment product 2?
9. Are the costs you stated the maximum you would willing to pay? You will give up the investments if they turn out to be £1 more expensive?
10. In case the answer is inappropriate, the following question was asked:
11. Why are you willing to pay £X for this investment but you will only get back £Y (<X) for the best scenario?

PART III: QUALITY CHECK POINTS

1) For the FRT task, respondents answer must be:

- Lower than the given investment initial endowment.
- Lower than the highest possible gain.

➔ Respondents are excluded as they did not understand the question.

2) Logical follow-up questions were set:

- Respondents were asked to answer two questions:

Q1: How many people COULD you approach for financial help?

Q2: How many people WOULD you approach for financial help?

Plausibly, answer to Q2 must be less than or equal to answer to Q1

- For questions regarding respondent's wealth and income, respondents are first asked about the range of their income and wealth, and subsequently are asked to provide an estimate. If the estimates they provided do not lie within the ranges they previously stated, they will be disqualified.

3) For Vietnamese sample specifically, respondents that state monetary values of less than <1000 VND will be excluded. The reason is that there is no monetary value that is less than 1,000VND is used.

Appendix 4: Data Coding (Independent Factors and Interaction Terms)

The whole study contains 23 independent factors, which are claimed to have impacts on individual FRT. The 23 factors are divided into six groups: Explanatory factors, demographic factors, socioeconomic factors, attitudinal factors, geographical factors, and cushion hypothesis factors. This appendix briefly describes the questionnaires, measures and coding of those factors, together with a number of multiplicative terms used in the multivariate analysis.

Factors influencing FRT			
VARIABLE GROUP	MEASURE (Questionnaire in Appendix 1)	DESCRIPTION	TYPE/SCALE
Group 1: Explanatory factors	Age P.I (Q1)	Age of respondents (in years) capturing linear effect of age. It is constructed as: Age = 2016 – Year of birth	Ratio (19-65)
	COL_IDV P.IV (Q1 – Q30)	The main cultural measure is the Singelis self-construal scale, which forms an ordinal variable ranged from -6 (most individualistic) to 6 (most collectivistic).	Ordinal (1-7)
	Native_Weak P.V (Q1)	This variable captures the native language of respondents. Native_Weak = 1 if the language is weak future language	Binary (0-1)
	Prof_Strong P.V (Q1)	This variable captures other languages that respondents speak with high proficiency level besides their native language. Prof_Strong = 1 if respondents speak **AT LEAST** one strong future language professionally	Binary (0-1)
	Wealth P.III (Q3&4)	A measure of household wealth in US Dollar	Ratio (0-5,000,000)

Group 2: Demographic factors	Single P.I (Q3)	This variable captures one's marital status. Single = 1 if respondent is single	Binary (0-1)
	Gender P.I (Q2)	Gender = 1 if respondent is male	Binary (0-1)
	Child P.I (Q4)	Child = 1 if respondent has at least one child	Binary (0-1)
	Highschl P.I (Q6)	This variable captures one's education level. Highschl = 1 if respondent completed high school	Binary (0-1)
	HhSize P.I (Q5)	Number of family members living in respondent's household	Ratio (1-16)
	Income P.III (Q5&6)	A measure of respondent's personal annual income in US Dollar	Ratio (0-864,000)
Group 3: Socioeconomic factors	Unemp P.III (Q1)	Unemp = 1 if respondent is unemployed	Binary (0-1)
	Selfemp P.III (Q1)	Selfemp = 1 if respondent is self-employed	
	Homeown P.III (Q2)	Homeown = 1 if respondent has at least one house	
	Rbelief P.VI (Q1)	Rbelief = 1 if respondent has a strong religious belief	Binary (0-1)

Group 4: Attitudinal factors	IncStab P.III (Q7)	A measure of income stability which is subjectively reported by respondent	Ordinal (1-10)
	Health P.VI (Q2)	A measure of respondent's health condition which is subjectively reported by respondent	Ordinal (1-10)
	SRA P.VI (Q3)	SRA stands for self-reported risk aversion. A measure of respondent's risk aversion in general which is subjectively reported	Ordinal (1-5)
	Ecoexp P.VI (Q4)	A measure captures respondent's expectation on the economy over the next five years	Ordinal (1-5)
	Interestexp P.VI (Q5)	A measure captures respondent's expectation on future interest rate	Ordinal (1-5)
Group 5: Geographical factors	US	US = 1 if respondents are from the United State	Binary (0-1)
	UK	UK = 1 if respondents are from the United Kingdom	
	VN	VN = 1 if respondents are from Vietnam	
	SG	SG = 1 if respondents are from Singapore	
Group 6: Cushion hypothesis factors	Finhelp P.VII	This variable measures one's financial support availability. Specifically, it reveals the number of people one can approach for help in financial difficulty	Ratio (0-40)
	Helpatt P.VIII	A measure of one's attitudes toward financial help which is calculated as the mean score of the answers to four questions	Ordinal (1-7)

Multiplicative terms	Nweak_Pstrong	The interaction variable examines the moderating effect of speaking professionally in at least one strong future language on the effect of speaking weak future native language
	Nweak_Age	The interaction variable examines the moderating effect of age on the effect of speaking weak future native language
	Nweak_COL_IDV	The interaction variable examines the moderating effect of culture on the effect of speaking weak future native language
	COL_IDV*Age	The interaction variable examines the moderating effect of age on the cultural effect
	Age*LnW	The interactive term between respondents' age and wealth is used to test for moderation effects of wealth
	Age*Finhelp	A measure of moderating effect of financial help availability (Finhelp) on age effect
	COL_IDV*Finhelp	A measure of moderating effect of financial help availability (Finhelp) on cultural effect
	Age*Helpatt	A measure of moderating effect of help attitude (Helpatt) on age effect
	COL_IDV*Helpatt	A measure of moderating effect of help attitude (Helpatt) on cultural effect
	Finhelp*Helpatt	A measure of moderating effect of help attitude (Helpatt) on the effect of financial help availability (Finhelp)
	The last two variables are three-way interaction variables. Though they are not directly explained the research question, if significant results are obtained for other interaction terms in which Finhelp and Helpatt are one of the components, it is appropriate to take into account these three-way interaction terms to improve the model fit	
	COL_IDV*Age*Finhelp	Three-way interaction between culture, age, and financial help availability
	COL_IDV*Age*Helpatt	Three-way interaction between culture, age, and financial help attitude

Appendix 5: Extant Studies on Influences of Demographic, Socio-Economic and Attitudinal Factors on FRT

Factors	Variables	Literature
Demographic	Age P.I (Q1)	Grable (2000); Cohn et al. (1975), Yao et al. (2011); Wang and Hanna (1997); Harlow and Brown (1990); Hallahan et al. (2003); Hallahan et al. (2004); Summers et al. (2006); Bellante and Green (2004); Tanaka et al. (2010); Halek and Eisenhauer (2001); Morin and Suarez (1983); Grable et al. (2004); Riley and Chow (1992); Faff et al. (2008); Schooley and Worden (1996); Palsson (1996); Jianakoplos and Bernasek (2006); Faff et al. (2011)
	Gender P.I (Q2)	Grable (2000); Yao et al. (2011); Harlow and Brown (1990); Hallahan et al. (2003); Hallahan et al. (2003); Hallahan et al. (2004); Bellante and Green (2004); Tanaka et al. (2010); Halek and Eisenhauer (2001); Grable et al. (2004); Faff et al. (2008); Schooley and Worden (1996); Palsson (1996); Jianakoplos and Bernasek (2006); Faff et al. (2011)
	Marital status P.I (Q3)	Cohn et al. (1975); Grable (2000); Yao et al. (2011); Wang and Hanna (1997); Hallahan et al. (2003); Hallahan et al. (2004); Halek and Eisenhauer (2001); Grable et al. (2004); Faff et al. (2008); Palsson (1996); Jianakoplos and Bernasek (2006)
	Child P.I (Q4)	Bellante and Green (2004); Halek and Eisenhauer (2001); Palsson (1996); Jianakoplos and Bernasek (2006)
	Education P.I (Q6)	Cohn et al. (1975); Grable (2000); Yao et al. (2011); Wang and Hanna (1997); Bellante and Green (2004); Hallahan et al. (2003); Tanaka et al. (2010); Halek and Eisenhauer (2001); Grable et al. (2004); Riley and Chow (1992); Faff et al. (2008); Faff et al. (2011)
	Household size P.I (Q5)	Hallahan et al. (2004); Faff et al. (2008)
	Wealth P.III (Q3&4)	Wang and Hanna (1997); Hallahan et al. (2003); Hallahan et al. (2004); Halek and Eisenhauer (2001); Morin and Suarez (1983); Riley and Chow (1992); Faff et al. (2008); Schooley and Worden (1996); Palsson (1996); Jianakoplos and Bernasek (2006); Faff et al. (2011)

	Income P.III (Q5&6)	Cohn et al. (1975); Grable (2000); Yao et al. (2011); Wang and Hanna (1997); Hallahan et al. (2003); Hallahan et al. (2003); Hallahan et al. (2004); Tanaka et al. (2010); Grable et al. (2004); Riley and Chow (1992); Faff et al. (2008); Schooley and Worden (1996); Palsson (1996); Faff et al. (2011)
Socioeconomic	Unemployed P.III (Q1)	Yao et al. (2011); Halek and Eisenhauer (2001); Palsson (1996)
	Self-employed P.III (Q1)	Yao et al. (2011); Halek and Eisenhauer (2001); Palsson (1996); Jianakoplos and Bernasek (2006)
	Home owner P.III (Q2)	Palsson (1996); Jianakoplos and Bernasek (2006)
Attitudinal	Religious belief P.VI (Q1)	Halek and Eisenhauer (2001)
	Health P.VI (Q2)	Yao et al. (2011); Wang and Hanna (1997); Bellante and Green (2004); Jianakoplos and Bernasek (2006)
	SRA P.VI (Q3)	Schooley and Worden (1996)
	Macroeconomic expectations P.VI (Q4&5)	Grable (2000); Schooley and Worden (1996)

Appendix 6: EMPIRICAL STUDY 1 - MOSAIC 1 - Regression Result for the Full Model

Determinants of FRT. Dependent Variable: LnWTP

Mosaic 1	**Uncentered Regression**			**Centered-score Regression**			
IVs	Coefficient	t-statistic	VIF	Coefficient	t-statistic	VIF	$\eta^2_{partial}$
Intercept	6.94567	5.69***	0	5.42089	8.17***	0	
Age	-0.09281	-2.16**	70.53381	-0.02712	-4.16***	1.70555	0.0061
Age²	0.00052720	1.09	61.56238	0.00052720	1.09	1.24277	0.0002
*Age*LnW*	0.00224	1.11	33.24472	0.00224	1.11	1.07151	0.0012
Single	-0.31941	-1.71*	2.22304	-0.31941	-1.71*	2.22304	0.0128
Gender	-0.00983	-0.08	1.07307	-0.00983	-0.08	1.07307	0.0014
Child	0.19115	1.06	2.16559	0.19115	1.06	2.16559	0.0025
Highschl	0.19085	1.10	1.18021	0.19085	1.10	1.18021	0.0072
Hhsize	-0.00493	-0.11	1.39954	-0.00493	-0.11	1.39954	0.0000
LnW	0.03510	0.41	13.70295	0.12367	4.21***	1.55101	0.0242
LnInc	0.03864	1.17	1.36457	0.03864	1.17	1.36457	0.0007
Unemp	0.21828	0.89	1.27754	0.21828	0.89	1.27754	0.0001
Selfemp	-0.32554	-1.17	1.05000	-0.32554	-1.17	1.05000	0.0011
Homeown	-0.06728	-0.40	1.28042	-0.06728	-0.40	1.28042	0.0001
Rbelief	0.08770	0.63	1.25444	0.08770	0.63	1.25444	0.0003
Incstab	-0.00540	-0.20	1.10021	-0.00540	-0.20	1.10021	0.0000
Health	0.03980	1.10	1.17097	0.03980	1.10	1.17097	0.0016
SRA	-0.27627	-4.73***	1.26187	-0.27627	-4.73***	1.26187	0.0132
Ecoexp	0.05170	0.80	1.30972	0.05170	0.80	1.30972	0.0001

Interestexp	-0.00178	-0.02	1.29324	-0.00178	-0.02	1.29324	0.0003
US	-0.34686	-1.64*	2.21336	-0.34686	-1.64*	2.21336	0.0000
UK	-0.57199	-2.81***	1.89681	-0.57199	-2.81***	1.89681	0.0020
VN	-0.25442	-1.03	1.98272	-0.25442	-1.03	1.98272	0.0000
SG	-0.49918	-2.20**	2.17096	-0.49918	-2.20**	2.17096	0.0026

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Appendix 7: EMPIRICAL STUDY 1 - MOSAIC 2 - Regression Result for the Full Model

Determinants of Risk Perception (RP). Dependent Variable: RP

Mosaic 2	**Uncentered Regression**			**Centered-score Regression**			
IVs	Coefficient	t-statistic	VIF	Coefficient	t-statistic	VIF	$\eta^2_{partial}$
Intercept	21.77842	2.50***	0	41.04004	7.43***	0	
Age	0.77130	2.44**	70.53381	0.09726	2.06**	1.70555	0.0023
Age²	-0.00420	-1.18	61.56238	-0.00420	-1.18	1.24277	0.0007
*Age*LnW*	-0.03190	-2.26**	33.24472	-0.03190	-2.26**	1.07151	0.0033
Single	-0.13736	-0.09	2.22304	-0.13736	-0.09	2.22304	0.0035
Gender	-1.37745	-1.54	1.07307	-1.37745	-1.54	1.07307	0.0055
Child	-1.70839	-1.19	2.16559	-1.70839	-1.19	2.16559	0.0038
Highschl	2.20649	1.75*	1.18021	2.20649	1.75*	1.18021	0.0000
Hhsize	0.13115	0.39	1.39954	0.13115	0.39	1.39954	0.0000
LnW	0.82454	1.41	13.70295	-0.43854	-2.12**	1.55101	0.0099
LnInc	0.06168	0.22	1.36457	0.06168	0.22	1.36457	0.0002
Unemp	4.94369	2.76***	1.27754	4.94369	2.76***	1.27754	0.0064
Selfemp	1.99551	0.97	1.05000	1.99551	0.97	1.05000	0.0006
Homeown	1.92184	1.39	1.28042	1.92184	1.39	1.28042	0.0003
Rbelief	-1.13388	-1.14	1.25444	-1.13388	-1.14	1.25444	0.0013
Incstab	0.27193	1.42	1.10021	0.27193	1.42	1.10021	0.0014
Health	-0.05328	-0.18	1.17097	-0.05328	-0.18	1.17097	0.0012
SRA	1.61833	3.62***	1.26187	1.61833	3.62***	1.26187	0.0113
Ecoexp	1.23349	2.55***	1.30972	1.23349	2.55***	1.30972	0.0078

Interestexp	0.54037	0.99	1.29324	0.54037	0.99	1.29324	0.0005
US	0.88001	0.57	2.21336	0.88001	0.57	2.21336	0.0000
UK	1.28466	0.86	1.89681	1.28466	0.86	1.89681	0.0002
VN	-1.63724	-1.02	1.98272	-1.63724	-1.02	1.98272	0.0028
SG	2.82440	1.79*	2.17096	2.82440	1.79*	2.17096	0.0016

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Appendix 8: EMPIRICAL STUDY 1 - MOSAIC 3 - Regression Result for the Full Model

Determinants of RAtt – Subjective RAtt. Dependent Variable: b_R

Mosaic 3	**Uncentered Regression**			**Centered-score Regression**			
IVs	Coefficient	t-statistic	VIF	Coefficient	t-statistic	VIF	$\eta^2_{partial}$
Intercept	-9.25629	-0.18	0	-42.66406	-1.71*	0	
Age	-1.78128	-0.95	70.53381	0.10580	0.29	1.70555	0.0000
Age²	0.02139	1.06	61.56238	0.02139	1.06	1.24277	0.0002
*Age*LnW*	0.01801	0.28	33.24472	0.01801	0.28	1.07151	0.0000
Single	0.73087	0.09	2.22304	0.73087	0.09	2.22304	0.0001
Gender	13.16070	1.90**	1.07307	13.16070	1.90*	1.07307	0.0023
Child	-0.06887	-0.01	2.16559	-0.06887	-0.01	2.16559	0.0003
Highschl	0.97388	0.11	1.18021	0.97388	0.11	1.18021	0.0000
Hhsize	3.69850	1.68*	1.39954	3.69850	1.68	1.39954	0.0004
LnW	-0.37861	-0.14	13.70295	0.33456	0.39	1.55101	0.0002
LnInc	0.95807	0.88	1.36457	0.95807	0.88	1.36457	0.0002
Unemp	10.69264	1.54	1.27754	10.69264	1.54	1.27754	0.0010
Selfemp	-21.68656	-0.93	1.05000	-21.68656	-0.93	1.05000	0.0012
Homeown	6.24811	0.64	1.28042	6.24811	0.64	1.28042	0.0000
Rbelief	-2.36443	-0.27	1.25444	-2.36443	-0.27	1.25444	0.0001
Incstab	1.95929	1.51	1.10021	1.95929	1.51	1.10021	0.0008
Health	-0.21381	-0.14	1.17097	-0.21381	-0.14	1.17097	0.0000
SRA	-1.58684	-0.51	1.26187	-1.58684	-0.51	1.26187	0.0005
Ecoexp	-5.40503	-1.56	1.30972	-5.40503	-1.56	1.30972	0.0023

Interestexp	-1.89481	-0.46	1.29324	-1.89481	-0.46	1.29324	0.0002
US	21.08339	1.78*	2.21336	21.08339	1.78*	2.21336	0.0030
UK	8.93014	0.77	1.89681	8.93014	0.77	1.89681	0.0011
VN	-1.73153	-0.13	1.98272	-1.73153	-0.13	1.98272	0.0001
SG	-11.47046	-1.00	2.17096	-11.47046	-1.00	2.17096	0.0004

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Appendix 9: Heteroskedasticity and Error Normality Tests

PART 1: Empirical study 1			
Equation	**Test**	**DF**	**Statistic**
lnWTP	White's Test	141	335.0**
	Breusch-Pagan	11	124.2**
	Shapiro-Wilk		0.9386***
RP	White's Test	141	406.7**
	Breusch-Pagan	11	60.81**
	Shapiro-Wilk		0.9844***
b_{VAR}	White's Test	141	343.0**
	Breusch-Pagan	11	40.94*
	Shapiro-Wilk		0.8021***
b_{R}	White's Test	141	269.5
	Breusch-Pagan	11	24.23
	Shapiro-Wilk		0.4571***

*Note: * and ** denotes the result is statistically significant at the 5% and 1% level, respectively.*

PART 2: Empirical study 2			
Equation	**Test**	**DF**	**Statistic**
lnWTP	White's Test	289	625.8***
	Breusch-Pagan	17	132.7***
	Shapiro-Wilk		0.952***
RP	White's Test	289	638.4***
	Breusch-Pagan	17	83.60***
	Shapiro-Wilk		0.985***
b_{VAR}	White's Test	289	603.8***
	Breusch-Pagan	17	56.05***
	Shapiro-Wilk		0.805***
b_{R}	White's Test	289	427.5***
	Breusch-Pagan	17	26.29*
	Shapiro-Wilk		0.460***

*Note: * and ** denotes the result is statistically significant at the 5% and 1% level, respectively.*

PART 3: Empirical study 3			
equation	**Test**	**DF**	**Statistic**
lnWTP	White's Test	360	794.1***
	Breusch-Pagan	19	148.2***
	Shapiro-Wilk		0.9579***
RP	White's Test	360	769.4***
	Breusch-Pagan	19	92.20***
	Shapiro-Wilk		0.9841***
b_{VAR}	White's Test	360	725.6***
	Breusch-Pagan	19	60.81***
	Shapiro-Wilk		0.8069***
b_{R}	White's Test	360	533.9***
	Breusch-Pagan	19	31.59**
	Shapiro-Wilk		0.4632***

*Note: * and ** denotes the result is statistically significant at the 5% and 1% level, respectively.*

Appendix 10: Endogeneity Tests (2SLS Analysis)

PART 1: Empirical Study 1

Variables	Instrumental variables	Rho t-value (p-value)
Wealth	SavHorizon	0.01 (0.9916)
	Fsupport	0.21 (0.8325)
	Retsupport	N/A
	Investhorizon	-0.05 (0.9631)
	Inheritimp	0.15 (0.8812)
Income	SavHorizon	0.00 (0.9999)
	Fsupport	0.21 (0.8340)
	Retsupport	1.18 (0.2390)
	Investhorizon	-0.00 (0.9992)
	Inheritimp	
Self-reported risk aversion (SRA)	SavHorizon	-0.40 (0.6919)
	Fsupport	-0.21 (0.8342)
	Retsupport	1.09 (0.2738)
	Investhorizon	0.02 (0.9876)
	Inheritimp	-0.01 (0.9937)

PART 2: Empirical Study 2		
Variables	Instrumental variables	Rho t-value (p-value)
Wealth	SavHorizon	0.01 (0.9922)
	Fsupport	0.01 (0.9919)
	Retsupport	N/A
	Investhorizon	-0.24 (0.8081)
	Inheritimp	0.58 (0.5596)
Income	SavHorizon	0.00 (0.9999)
	Fsupport	0.21 (0.8358)
	Retsupport	0.81 (0.4199)
	Investhorizon	-0.00 (0.9980)
	Inheritimp	N/A
Self-reported risk aversion (SRA)	SavHorizon	-0.31 (0.7601)
	Fsupport	-0.21 (0.8361)
	Retsupport	0.77 (0.4395)
	Investhorizon	0.24 (0.8078)
	Inheritimp	-0.60 (0.5488)

PART 3: Empirical Study 3		
Variables	Instrumental variables	Rho t-value (p-value)
Wealth	SavHorizon	0.47 (0.6377)
	Fsupport	-0.00 (0.9997)
	Retsupport	N/A
	Investhorizon	-0.30 (0.7608)
	Inheritimp	0.25 (0.8021)
Income	SavHorizon	0.00 (0.9999)
	Fsupport	-0.00 (0.9973)
	Retsupport	1.00 (0.3167)
	Investhorizon	-0.00 (0.9979)
	Inheritimp	-0.00 (0.9999)
Self-reported risk aversion (SRA)	SavHorizon	-0.46 (0.6484)
	Fsupport	0.00 (0.9977)
	Retsupport	0.94 (0.3461)
	Investhorizon	0.30 (0.7606)
	Inheritimp	-0.25 (0.8016)

Appendix 11: EMPIRICAL STUDY 2 - MOSAIC 1 - Regression Result for the Full Model

Determinants of Risk Perception (RP). Dependent Variable: RP

Mosaic 1	**Uncentered Regression**			**Centered-score Regression**			
IVs	Coefficient	t-statistic	VIF	Coefficient	t-statistic	VIF	$\eta^2_{partial}$
Intercept	16.50361	1.45	0	42.11438	7.65***	0	
COL_IDV	-4.90840	-0.95	111.57565	-1.35612	-2.71***	1.20101	0.0082
*COL_IDV*Age*	0.04385	0.33	101.27800	0.01589	0.43	1.18410	0.0000
Age	1.06103	2.89***	100.83186	0.08882	1.83*	1.80036	0.0022
Age^2	-0.00573	-1.60	63.73569	-0.00573	-1.60	1.28665	0.0013
*Age*LnW*	-0.03102	-2.15**	33.98732	-0.03102	-2.15**	1.09545	0.0036
Single	-0.31673	-0.21	2.23671	-0.31673	-0.21	2.23671	0.0028
Gender	-1.50552	-1.69*	1.08518	-1.50552	-1.69*	1.08518	0.0059
Child	-1.75016	-1.24	2.19835	-1.75016	-1.24	2.19835	0.0031
Highschl	2.14355	1.71*	1.18801	2.14355	1.71*	1.18801	0.0000
Hhsize	0.21718	0.65	1.41105	0.21718	0.65	1.41105	0.0001
LnW	0.87171	1.47	14.00043	-0.35670	-1.73*	1.56811	0.0094
LnInc	-0.00337	-0.01	1.37673	-0.00337	-0.01	1.37673	0.0005
Unemp	4.98927	2.83***	1.28085	4.98927	2.83***	1.28085	0.0062
Selfemp	1.61347	0.78	1.06683	1.61347	0.78	1.06683	0.0006
Homeown	2.03160	1.46	1.28769	2.03160	1.46	1.28769	0.0004
Rbelief	-0.95952	-0.97	1.26616	-0.95952	-0.97	1.26616	0.0014
Incstab	0.25680	1.35	1.11069	0.25680	1.35	1.11069	0.0014
Health	-0.01963	-0.07	1.17926	-0.01963	-0.07	1.17926	0.0012

SRA	1.57479	3.57***	1.26604	1.57479	3.57***	1.26604	0.0115
Ecoexp	1.04167	2.17**	1.32726	1.04167	2.17**	1.32726	0.0070
Interestexp	0.65916	1.22	1.30217	0.65916	1.22	1.30217	0.0006
US	-0.38723	-0.25	2.31916	-0.38723	-0.25	2.31916	0.0001
UK	0.46544	0.31	1.98380	0.46544	0.31	1.98380	0.0000
VN	-1.14325	-0.71	2.00716	-1.14325	-0.71	2.00716	0.0023
SG	1.87097	1.17	2.24255	1.87097	1.17	2.24255	0.0014
Finhelp	1.44378	3.23***	21.55264	-0.44376	-3.05***	1.28381	0.0025
Helpatt	0.41578	0.25	15.41817	-1.10466	-2.45**	1.09744	0.0041
*Age*Finhelp*	-0.02905	-2.64***	11.58109	-0.02905	-2.64***	1.19230	0.0020
*COL_IDV*Finhelp*	0.51360	1.06	20.29819	-0.20409	-1.35	1.10464	0.0010
*Age*Helpatt*	-0.02475	-0.64	30.47115	-0.02475	-0.64	1.16056	0.0001
*COL_IDV*Helpatt*	0.34478	0.26	111.37070	0.59774	1.37	1.14390	0.0009
*Finhelp*Helpatt*	-0.18188	-1.91*	13.35542	-0.18188	-1.91*	1.17336	0.0009
*COL_IDV*Age*Finhelp*	-0.01812	-1.62	19.09581	-0.01812	-1.62	1.16992	0.0011
*COL_IDV*Age*Helpatt*	0.00639	0.19	101.43040	0.00639	0.19	1.16647	0.0000

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Appendix 12: EMPIRICAL STUDY 2 - MOSAIC 2 - Regression Result for the Full Model

Determinants of RAtt –Subjective RAtt. Dependent Variable: b_R

Mosaic 2	**Uncentered Regression**			**Centered-score Regression**			
IVs	Coefficient	t-statistic	VIF	Coefficient	t-statistic	VIF	$\eta^2_{partial}$
Intercept	-50.00693	-0.62	0	-38.86251	-1.57	0	
COL_IDV	-15.06364	-0.61	111.57565	-2.26310	-0.62	1.20101	0.0007
*COL_IDV*Age*	0.15798	0.26	101.27800	0.42939	1.73*	1.18410	0.0009
Age	-1.35928	-0.54	100.83186	0.20286	0.52	1.80036	0.0001
Age^2	0.01954	0.93	63.73569	0.01954	0.93	1.28665	0.0001
*Age*LnW*	0.01033	0.16	33.98732	0.01033	0.16	1.09545	0.0000
Single	-0.02885	-0.00	2.23671	-0.02885	-0.00	2.23671	0.0001
Gender	12.80147	1.83*	1.08518	12.80147	1.83*	1.08518	0.0023
Child	-0.65031	-0.08	2.19835	-0.65031	-0.08	2.19835	0.0003
Highschl	1.22746	0.14	1.18801	1.22746	0.14	1.18801	0.0000
Hhsize	3.66665	1.67*	1.41105	3.66665	1.67*	1.41105	0.0004
LnW	0.04294	0.02	14.00043	0.45206	0.52	1.56811	0.0002
LnInc	0.93647	0.86	1.37673	0.93647	0.86	1.37673	0.0002
Unemp	12.07834	1.69*	1.28085	12.07834	1.69*	1.28085	0.0010
Selfemp	-20.34141	-0.90	1.06683	-20.34141	-0.90	1.06683	0.0012
Homeown	6.57330	0.67	1.28769	6.57330	0.67	1.28769	0.0000
Rbelief	-2.74611	-0.31	1.26616	-2.74611	-0.31	1.26616	0.0001
Incstab	1.96404	1.53	1.11069	1.96404	1.53	1.11069	0.0008
Health	-0.22622	-0.15	1.17926	-0.22622	-0.15	1.17926	0.0001

SRA	-1.77856	-0.58	1.26604	-1.77856	-0.58	1.26604	0.0005
Ecoexp	-5.74035	-1.68*	1.32726	-5.74035	-1.68*	1.32726	0.0024
Interestexp	-1.85837	-0.45	1.30217	-1.85837	-0.45	1.30217	0.0002
US	18.03682	1.49	2.31916	18.03682	1.49	2.31916	0.0027
UK	6.20786	0.51	1.98380	6.20786	0.51	1.98380	0.0010
VN	-0.43545	-0.03	2.00716	-0.43545	-0.03	2.00716	0.0001
SG	-13.41159	-1.14	2.24255	-13.41159	-1.14	2.24255	0.0005
Finhelp	7.37218	1.39	21.55264	-1.03453	-0.67	1.28381	0.0001
Helpatt	7.60718	0.63	15.41817	3.23824	0.92	1.09744	0.0002
*Age*Finhelp*	-0.04707	-0.47	11.58109	-0.04707	-0.47	1.19230	0.0001
*COL_IDV*Finhelp*	0.77227	0.21	20.29819	-0.30250	-0.25	1.10464	0.0002
*Age*Helpatt*	0.01080	0.04	30.47115	0.01080	0.04	1.16056	0.0000
*COL_IDV*Helpatt*	-1.60295	-0.25	111.37070	1.83676	0.69	1.14390	0.0000
*Finhelp*Helpatt*	-1.61448	-1.72*	13.35542	-1.61448	-1.72*	1.17336	0.0015
*COL_IDV*Age*Finhelp*	-0.02714	-0.34	19.09581	-0.02714	-0.34	1.16992	0.0000
*COL_IDV*Age*Helpatt*	0.08687	0.56	101.43040	0.08687	0.56	1.16647	0.0001

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Appendix 13: EMPIRICAL STUDY 2 - MOSAIC 3 - Regression Result for the Full Model

Determinants of FRT. Dependent Variable: LnWTP

Mosaic 3	**Uncentered Regression**			**Centered-score Regression**			
IVs	Coefficient	t-statistic	VIF	Coefficient	t-statistic	VIF	$\eta^2_{partial}$
Intercept	10.23374	6.66***	0	5.22457	8.05***	0	
COL_IDV	1.72302	3.22***	111.57565	0.29335	4.36***	1.20101	0.0182
*COL_IDV*Age*	-0.04231	-2.84***	101.27800	-0.01450	-3.06***	1.18410	0.0036
Age	-0.20987	-4.30***	100.83186	-0.02714	-4.16***	1.80036	0.0087
Age^2	0.00079059	1.68*	63.73569	0.00079059	1.68*	1.28665	0.0000
*Age*LnW*	0.00267	1.41	33.98732	0.00267	1.41	1.09545	0.0019
Single	-0.25840	-1.39	2.23671	-0.25840	-1.39	2.23671	0.0115
Gender	0.02931	0.23	1.08518	0.02931	0.23	1.08518	0.0015
Child	0.21500	1.19	2.19835	0.21500	1.19	2.19835	0.0021
Highschl	0.16174	0.95	1.18801	0.16174	0.95	1.18801	0.0062
Hhsize	-0.01625	-0.37	1.41105	-0.01625	-0.37	1.41105	0.0002
LnW	0.00124	0.02	14.00043	0.10702	3.77***	1.56811	0.0239
LnInc	0.04788	1.45	1.37673	0.04788	1.45	1.37673	0.0012
Unemp	0.20562	0.87	1.28085	0.20562	0.87	1.28085	0.0001
Selfemp	-0.15660	-0.58	1.06683	-0.15660	-0.58	1.06683	0.0011
Homeown	-0.05883	-0.36	1.28769	-0.05883	-0.36	1.28769	0.0001
Rbelief	0.08487	0.62	1.26616	0.08487	0.62	1.26616	0.0004
Incstab	0.00013270	0.01	1.11069	0.00013270	0.01	1.11069	0.0000
Health	0.02487	0.70	1.17926	0.02487	0.70	1.17926	0.0016

SRA	-0.25980	-4.53***	1.26604	-0.25980	-4.53***	1.26604	0.0136
Ecoexp	0.08337	1.29	1.32726	0.08337	1.29	1.32726	0.0003
Interestexp	-0.02312	-0.31	1.30217	-0.02312	-0.31	1.30217	0.0003
US	-0.09997	-0.47	2.31916	-0.09997	-0.47	2.31916	0.0004
UK	-0.38175	-1.85*	1.98380	-0.38175	-1.85*	1.98380	0.0012
VN	-0.34621	-1.43	2.00716	-0.34621	-1.43	2.00716	0.0000
SG	-0.30005	-1.31	2.24255	-0.30005	-1.31	2.24255	0.0024
Finhelp	-0.18784	-3.04***	21.55264	0.11773	5.47***	1.28381	0.0126
Helpatt	-0.61686	-2.53***	15.41817	0.22608	3.36***	1.09744	0.0087
*Age*Finhelp*	0.00474	2.89***	11.58109	0.00474	2.89***	1.19230	0.0026
*COL_IDV*Finhelp*	-0.07007	-0.92	20.29819	0.05342	2.42**	1.10464	0.0040
*Age*Helpatt*	0.01911	3.45***	30.47115	0.01911	3.45***	1.16056	0.0049
*COL_IDV*Helpatt*	-0.15969	-1.16	111.37070	0.02142	0.40	1.14390	0.0002
*Finhelp*Helpatt*	0.02906	2.48***	13.35542	0.02906	2.48**	1.17336	0.0012
*COL_IDV*Age*Finhelp*	0.00312	1.60	19.09581	0.00312	1.60	1.16992	0.0021
*COL_IDV*Age*Helpatt*	0.00457	1.19	101.43040	0.00457	1.19	1.16647	0.0007

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Appendix 14: Minimum stationery point (Table 8, Variation E)

LnWTP = 5.22457 - 0.027*Age_c + 0.0008*(Age_c)^2 – 0.015*COL_IDV*Age_c + 0.10702*LnW - 0.25980*SRA + 0.11773*Finhelp + 0.22608*Helpatt + 0.0047*Finhelp_c*Age_c + 0.05342*COL_IDV*Finhelp + 0.02*Helpatt_c*Age_c + 0.02906*Finhelp*Helpatt

$\Leftrightarrow \frac{\delta lnWTP}{\delta Age\_c}$ = -0.027 + 0.002*Age_c – 0.015*COL_IDV + 0.005*Finhelp_c + 0.02*Helpatt_c

$\Leftrightarrow \frac{\delta lnWTP}{\delta Age}$ = -0.027 + 0.002*(Age-39.6) – 0.015*COL_IDV + 0.005*(Finhelp-2.98) + 0.02*(Helpatt-4.05)

= -0.027 + 0.002*Age – 0.079 – 0.015*COL_IDV + 0.005*Finhelp – 0.015 + 0.02*Helpatt – 0.081

$\Leftrightarrow \frac{\delta lnWTP}{\delta Age}$ = 0 @ the stationery point

$\Leftrightarrow$ -0.027 + 0.002*Age – 0.079 – 0.015*COL_IDV + 0.005*Finhelp – 0.015 + 0.02*Helpatt – 0.081 = 0

$\Leftrightarrow$ 0.002*Age – 0.202 – 0.015*COL_IDV + 0.005*Finhelp + 0.02*Helpatt = 0

Pure age effect on FRT @ the stationery point given other factors = 0

$\Leftrightarrow$ 0.002*Age – 0.202 = 0

$\Leftrightarrow$ 0.002*Age = 0.202

$\Leftrightarrow$ Age_{min} = 101 (years old)

Appendix 15: EMPIRICAL STUDY 3 - MOSAIC 1 - Regression Result for the Full Model

Determinants of FRT. Dependent Variable: LnWTP

Mosaic 1	**Uncentered Regression**			**Centered-score Regression**			
IVs	Coefficient	t-statistic	VIF	Coefficient	t-statistic	VIF	$\eta^2_{partial}$
Intercept	9.87760	6.34***	0	4.69690	6.86***	0	
Native_Weak	-0.53467	-1.02	15.32860	0.71556	2.76***	3.63170	0.0074
Prof_Strong	-0.27495	-1.61	1.45503	-0.27495	-1.61	1.45503	0.0052
Nweak_Pstrong	-1.26487	-3.40***	1.65593	-1.26487	-3.40***	1.65593	0.0080
Nweak_age	0.03157	2.69***	13.18135	0.03157	2.69***	1.43661	0.0009
Nweak_COL_IDV	-0.07846	-0.46	1.21860	-0.07846	-0.46	1.21860	0.0009
COL_IDV	1.78333	3.36***	111.65852	0.30554	4.20***	1.41898	0.0159
*COL_IDV*Age*	-0.04430	-3.00***	101.40248	-0.01403	-3.01***	1.19812	0.0032
Age	-0.21219	-4.38***	101.13818	-0.03417	-4.79***	2.18328	0.0153
Age^2	0.00075423	1.61	63.94237	0.00075423	1.61	1.29082	0.0000
*Age*LnW*	0.00231	1.18	34.49971	0.00231	1.18	1.11196	0.0011
Single	-0.23579	-1.27	2.24628	-0.23579	-1.27	2.24628	0.0088
Gender	0.01739	0.14	1.08882	0.01739	0.14	1.08882	0.0014
Child	0.18294	1.01	2.22923	0.18294	1.01	2.22923	0.0016
Highschl	0.17776	1.06	1.19118	0.17776	1.06	1.19118	0.0057
Hhsize	-0.02530	-0.58	1.41330	-0.02530	-0.58	1.41330	0.0001
LnW	0.01651	0.20	14.23443	0.10795	3.81***	1.57815	0.0227
LnInc	0.05762	1.72*	1.38344	0.05762	1.72*	1.38344	0.0018
Unemp	0.25878	1.11	1.28628	0.25878	1.11	1.28628	0.0005

Selfemp	-0.12822	-0.48	1.06966	-0.12822	-0.48	1.06966	0.0008
Homeown	-0.02416	-0.15	1.29062	-0.02416	-0.15	1.29062	0.0001
Rbelief	0.13105	0.96	1.27229	0.13105	0.96	1.27229	0.0020
Incstab	-0.00185	-0.07	1.11861	-0.00185	-0.07	1.11861	0.0000
Health	0.02732	0.78	1.18267	0.02732	0.78	1.18267	0.0014
SRA	-0.25797	-4.51***	1.27575	-0.25797	-4.51***	1.27575	0.0138
Ecoexp	0.09542	1.49	1.34207	0.09542	1.49	1.34207	0.0006
Interestexp	-0.04239	-0.56	1.30672	-0.04239	-0.56	1.30672	0.0000
US	0.37154	1.26	4.46328	0.37154	1.26	4.46328	0.0009
UK	0.08932	0.31	4.11704	0.08932	0.31	4.11704	0.0002
VN	0.12338	0.38	3.91307	0.12338	0.38	3.91307	0.0002
SG	0.17740	0.68	3.40654	0.17740	0.68	3.40654	0.0000
Finhelp	-0.18807	-3.00***	21.59022	0.11559	5.53***	1.28565	0.0123
Helpatt	-0.65296	-2.69***	15.48212	0.22790	3.42***	1.09904	0.0089
*Age*Finhelp*	0.00441	2.80***	11.65658	0.00441	2.80***	1.20007	0.0021
*COL_IDV*Finhelp*	-0.08765	-1.21	20.38874	0.05438	2.58***	1.11712	0.0042
*Age*Helpatt*	0.01986	3.60***	30.59770	0.01986	3.60***	1.16538	0.0053
*COL_IDV*Helpatt*	-0.16335	-1.20	111.48846	0.02834	0.54	1.14636	0.0003
*Finhelp*Helpatt*	0.03184	2.69***	13.38041	0.03184	2.69***	1.17556	0.0014
*COL_IDV*Age*Finhelp*	0.00359	2.01**	19.23203	0.00359	2.01**	1.17827	0.0028
*COL_IDV*Age*Helpatt*	0.00484	1.29	101.49573	0.00484	1.29	1.16722	0.0008

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Appendix 16: EMPIRICAL STUDY 3 - MOSAIC 2 - Regression Result for the Full Model

Determinants of Financial Risk Perception. Dependent Variable: Risk perception (RP)

Mosaic 2	**Uncentered Regression**			**Centered-score Regression**			
IVs	Coefficient	t-statistic	VIF	Coefficient	t-statistic	VIF	$\eta^2_{partial}$
Intercept	18.47588	1.60	0	45.83202	8.26***	0	
Native_Weak	-2.53498	-0.70	15.32860	-5.35976	-3.06***	3.63170	0.0002
Prof_Strong	-1.45188	-1.07	1.45503	-1.45188	-1.07	1.45503	0.0018
Nweak_Pstrong	12.61932	4.53***	1.65593	12.61932	4.53***	1.65593	0.0108
Nweak_age	-0.07134	-0.89	13.18135	-0.07134	-0.89	1.43661	0.0006
Nweak_COL_IDV	2.68305	2.53**	1.21860	2.68305	2.53**	1.21860	0.0002
COL_IDV	-5.27818	-1.03	111.65852	-1.79352	-3.22***	1.41898	0.0103
*COL_IDV*Age*	0.04983	0.37	101.40248	0.00472	0.13	1.19812	0.0001
Age	1.09588	2.99***	101.13818	0.09959	1.84*	2.18328	0.0044
Age^2	-0.00570	-1.60	63.94237	-0.00570	-1.60	1.29082	0.0015
*Age*LnW*	-0.03248	-2.28**	34.49971	-0.03248	-2.28**	1.11196	0.0031
Single	-0.38733	-0.26	2.24628	-0.38733	-0.26	2.24628	0.0021
Gender	-1.51713	-1.72*	1.08882	-1.51713	-1.72*	1.08882	0.0058
Child	-1.77869	-1.25	2.22923	-1.77869	-1.25	2.22923	0.0025
Highschl	2.17705	1.75*	1.19118	2.17705	1.75*	1.19118	0.0000
Hhsize	0.26037	0.79	1.41330	0.26037	0.79	1.41330	0.0001
LnW	0.97277	1.65*	14.23443	-0.31330	-1.54	1.57815	0.0087
LnInc	-0.07693	-0.28	1.38344	-0.07693	-0.28	1.38344	0.0008
Unemp	4.71597	2.69***	1.28628	4.71597	2.69***	1.28628	0.0060

Selfemp	1.56797	0.76	1.06966	1.56797	0.76	1.06966	0.0007
Homeown	1.84448	1.35	1.29062	1.84448	1.35	1.29062	0.0003
Rbelief	-1.13328	-1.14	1.27229	-1.13328	-1.14	1.27229	0.0018
Incstab	0.28672	1.51	1.11861	0.28672	1.51	1.11861	0.0018
Health	-0.01103	-0.04	1.18267	-0.01103	-0.04	1.18267	0.0011
SRA	1.54162	3.52***	1.27575	1.54162	3.52***	1.27575	0.0115
Ecoexp	1.01576	2.14**	1.34207	1.01576	2.14**	1.34207	0.0062
Interestexp	0.79530	1.48	1.30672	0.79530	1.48	1.30672	0.0012
US	-3.36738	-1.63	4.46328	-3.36738	-1.63	4.46328	0.0002
UK	-2.70148	-1.33	4.11704	-2.70148	-1.33	4.11704	0.0000
VN	-4.19542	-1.99**	3.91307	-4.19542	-1.99**	3.91307	0.0041
SG	-0.63355	-0.34	3.40654	-0.63355	-0.34	3.40654	0.0000
Finhelp	1.41864	3.19***	21.59022	-0.43284	-2.96***	1.28565	0.0024
Helpatt	0.51969	0.31	15.48212	-1.16403	-2.58***	1.09904	0.0045
*Age*Finhelp*	-0.02762	-2.51**	11.65658	-0.02762	-2.51**	1.20007	0.0016
*COL_IDV*Finhelp*	0.58025	1.20	20.38874	-0.24761	-1.63	1.11712	0.0015
*Age*Helpatt*	-0.02849	-0.74	30.59770	-0.02849	-0.74	1.16538	0.0001
*COL_IDV*Helpatt*	0.38835	0.30	111.48846	0.55452	1.29	1.14636	0.0008
*Finhelp*Helpatt*	-0.18697	-1.99**	13.38041	-0.18697	-1.99**	1.17556	0.0010
*COL_IDV*Age*Finhelp*	-0.02091	-1.86*	19.23203	-0.02091	-1.86*	1.17827	0.0015
*COL_IDV*Age*Helpatt*	0.00420	0.13	101.49573	0.00420	0.13	1.16722	0.0000

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

Appendix 17: EMPIRICAL STUDY 3 - MOSAIC 3 - Regression Result for the Full Model

Determinants of RAtt – Relative Subjective RAtt. Dependent Variable: b_R

Mosaic 3	**Uncentered Regression**			**Centered-score Regression**			
IVs	Coefficient	t-statistic	VIF	Coefficient	t-statistic	VIF	$\eta^2_{partial}$
Intercept	-31.44399	-0.37	0	-22.72926	-0.86	0	
Native_Weak	-8.96349	-0.30	15.32860	-17.06213	-1.25	3.63170	0.0027
Prof_Strong	1.04579	0.08	1.45503	1.04579	0.08	1.45503	0.0000
Nweak_Pstrong	-1.58604	-0.06	1.65593	-1.58604	-0.06	1.65593	0.0000
Nweak_age	-0.20453	-0.33	13.18135	-0.20453	-0.33	1.43661	0.0001
Nweak_COL_IDV	16.86484	1.59	1.21860	16.86484	1.59	1.21860	0.0008
COL_IDV	-16.78540	-0.68	111.65852	-4.84363	-1.44	1.41898	0.0013
*COL_IDV*Age*	0.15935	0.26	101.40248	0.40018	1.67*	1.19812	0.0009
Age	-1.48971	-0.59	101.13818	0.24831	0.60	2.18328	0.0000
Age^2	0.02081	1.00	63.94237	0.02081	1.00	1.29082	0.0002
*Age*LnW*	0.00603	0.10	34.49971	0.00603	0.10	1.11196	0.0000
Single	0.89019	0.10	2.24628	0.89019	0.10	2.24628	0.0001
Gender	12.71042	1.81*	1.08882	12.71042	1.81*	1.08882	0.0022
Child	-0.64688	-0.09	2.22923	-0.64688	-0.09	2.22923	0.0002
Highschl	1.99280	0.23	1.19118	1.99280	0.23	1.19118	0.0001
Hhsize	3.71736	1.72*	1.41330	3.71736	1.72*	1.41330	0.0004
LnW	0.33154	0.12	14.23443	0.57043	0.66	1.57815	0.0004
LnInc	0.75068	0.68	1.38344	0.75068	0.68	1.38344	0.0001
Unemp	10.80859	1.52	1.28628	10.80859	1.52	1.28628	0.0006

Selfemp	-20.27149	-0.90	1.06966	-20.27149	-0.90	1.06966	0.0013
Homeown	6.35248	0.65	1.29062	6.35248	0.65	1.29062	0.0001
Rbelief	-2.70744	-0.31	1.27229	-2.70744	-0.31	1.27229	0.0000
Incstab	1.94357	1.51	1.11861	1.94357	1.51	1.11861	0.0007
Health	-0.37390	-0.24	1.18267	-0.37390	-0.24	1.18267	0.0000
SRA	-1.93217	-0.63	1.27575	-1.93217	-0.63	1.27575	0.0005
Ecoexp	-5.58291	-1.61	1.34207	-5.58291	-1.61	1.34207	0.0021
Interestexp	-1.47526	-0.36	1.30672	-1.47526	-0.36	1.30672	0.0000
US	2.43205	0.15	4.46328	2.43205	0.15	4.46328	0.0019
UK	-9.18348	-0.55	4.11704	-9.18348	-0.55	4.11704	0.0004
VN	-14.51655	-0.83	3.91307	-14.51655	-0.83	3.91307	0.0000
SG	-24.18622	-1.74*	3.40654	-24.18622	-1.74*	3.40654	0.0011
Finhelp	7.13899	1.36	21.59022	-0.96169	-0.63	1.28565	0.0001
Helpatt	6.41683	0.53	15.48212	3.10265	0.89	1.09904	0.0002
*Age*Finhelp*	-0.04098	-0.41	11.65658	-0.04098	-0.41	1.20007	0.0000
*COL_IDV*Finhelp*	1.16150	0.32	20.38874	-0.52351	-0.44	1.11712	0.0003
*Age*Helpatt*	0.03623	0.15	30.59770	0.03623	0.15	1.16538	0.0001
*COL_IDV*Helpatt*	-1.81487	-0.28	111.48846	1.77347	0.68	1.14636	0.0000
*Finhelp*Helpatt*	-1.59841	-1.71*	13.38041	-1.59841	-1.71*	1.17556	0.0014
*COL_IDV*Age*Finhelp*	-0.04255	-0.53	19.23203	-0.04255	-0.53	1.17827	0.0001
*COL_IDV*Age*Helpatt*	0.09062	0.59	101.49573	0.09062	0.59	1.16722	0.0001

*Note: *, **, and *** denotes the result is statistically significant at the 10%, 5% and 1% level, respectively.*

References

Ackert, L. and Deaves, R. (2010). *Behavioral Finance: Psychology, Decision-Making, and Markets*. South-Western: Cengage Learning, pp.97-99.

Afshartous, D. and Preston, R. (2011) Key Results of Interaction Models With Centering. *Journal of Statistics Education*, 19(3), pp. 1-24. Available at: (Accessed: 7 November 2016).

Aguinis, H., Edwards, J.R. and Bradley, K.J. (2017) Improving our understanding of moderation and mediation in strategic management research. *Organizational Research Methods*, *20*(4), pp.665-685.

Aiken, L.S. & West, S.G. (1991) Multiple Regression: Testing and Interpreting Interactions. Sage Publications: Thousand Oaks, CA.

Albert, S. and Duffy, (2012) Differences in risk aversion between young and older adults. *Neuroscience and Neuroeconomics*, p.3.

Alderfer, C. and Bierman, Jr., H. (1970) Choices with Risk: Beyond the Mean and Variance. *The Journal of Business*, 43(3), pp. 341-353.
Allais, M. (1953) Le Comportement de l'Homme Rationnel devant le Risque: Critique des Postulats et Axiomes de l'Ecole Americaine. *Econometrica*, 21(4), p. 503.

Amsterdam, B.K. and Levitt, M. (1980) Consciousness of self and painful self-consciousness. *The Psychoanalyic Study of the Child*, 35(1), pp.67-83.

Anon (2015) [Online]. Available at: https://www.wto.org/english/res_e/booksp_e/wtr14-1_e.pdf. (Accessed: 3 April 2015).

Anon (2015b) [Online]. Available at: https://www.wto.org/english/res_e/booksp_e/wtr14-2b_e.pdf. (Accessed: 3 April 2015).

Arrow, K. (1974) *Essays in the theory of risk-bearing*. Amsterdam: North-Holland.

Athanasopoulos, P. (2011) Color and bilingual cognition. In V. Cook and B. Bassetti (Eds.), *Language and bilingual cognition.* New York, NY: Psychology press, pp. 241-261.

Au, T. (1983) Chinese and English counterfactuals: The Sapir-Whorf hypothesis revisited. *Cognition*, 15(1-3), pp. 155-187.

Bajtelsmit, V.L., and Vanderhei, J.L. (1997) Risk Aversion and Pension Investment Choices, in Michael, S.G., Mitchell, O.S. and Twinney, M.M. ed. 1997. *Positioning*

Pensions for the Twenty-first Century [Online]. Philadelphia: University of Pennsylvania Press. [Assessed 11th October 2014]. Available from: http://books.google.co.uk/books?hl=en&lr=&id=0d0Hf2dlShwC&oi=fnd&pg=PA45&dq=Risk+Aversion+and+Pension+Investment&ots=2-Iq_HDXoU&sig=6ykgqh_prfwd21Hg45fe4Bol1MM#v=onepage&q=Risk%20Aversion%20and%20Pension%20Investment&f=false

Bakshi, G.S. and Chen, Z. (1994) Baby boom, population aging, and capital markets. *Journal of Business*, 67(2), pp.165-202.

Barberis, N. and Thaler, R. (2003) A Survey of Behavior Finance. In G. Constantinides (EDs.), *Handbook of the Economics of Finance*, Elsevie, Chapter 18, pp. 1053-1123.

Baron, R. and Kenny, D. (1986) The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology*, *51*(6), p.1173.

Barrett, L., Lindquist, K., and Gendron, M. (2007) Language as context for the perception of emotion. *Trends in Cognitive Sciences*, 11(8), pp. 327-332.

Baumeister, R. F. (2003): 'The Psychology of Irrationality: Why people make foolish, self-defeating choices', in I. Brocas and J.D. Carrillo: *The Psychology of Economic Decisions: Rationality and well-being*. Oxford University Press, New York, 1–15.

Beck, U. and Beck-Gernsheim, E. (2010): 'Foreword: Varieties of Individualization'. In M. Hansen and R. Svarverud: The rise of the individual in modern Chinese society (eds., pp.xiii-xx). Denmark: NIAS Press.

Bedford, O. (1990) Guilt, shame and religious orientation. Unpublished Master's Thesis. University of Colorado, Boulder, Colorado.

Bedford, O. and Hwang, K. (2003) Guilt and Shame in Chinese Culture: A Cross-cultural Framework from the Perspective of Morality and Identity. *Journal for the Theory of Social Behaviour*, 33(2), pp. 127-144.

Bellante, D. and Green, C. (2004) Relative risk aversion among the elderly. *Review of Financial Economics*, 13(3), pp. 269-281.

Benedict, R. (1974) *The chrysanthemum and the sword: Patterns of Japanese Culture*. New York, NY: New American Library.

Bengtson, V.L., Reedy, M.N. and Gordon, C. (1985) *Aging and self-conceptions: Personality processes and social contexts*. Van Nostrand Reinhold Co.

Bernstein, P.L., (1995) Risk as a History of Ideas. *Financial Analysts Journal*, *51*(1), pp.7-11.

Blais, A. and Weber, E. (2006) A Domain-Specific Risk-Taking (DOSPERT) scale for adult populations. *Judgment and Decision Making*, 1(1), pp.33-47.

Bontempo, R., Bottom, W., and Weber, E. (1997) Cross-Cultural Differences in Risk Perception: A Model-Based Approach. *Risk Analysis*, 17(4), pp. 479-488.

Boroditsky, L. (2001) Does Language Shape Thought?: Mandarin and English Speakers' Conceptions of Time. *Cognitive Psychology*, 43(1), pp. 1-22.

Boroditsky, L., Fuhrman, O., and McCormick, K. (2011) Do English and Mandarin speakers think about time differently?. *Cognition*, 118(1), pp. 123-129.

Bowerman, M. (1996) The origins of children's spatial semantic categories: Cognitive versus linguistic determinants. In *Rethinking linguistic relativity*. 1st edn. Cambridge: Cambridge University Press, pp.145-176.

Breiman, L. (1996) Bagging predictors. *Machine Learning*, 24(2), pp.123-140.

Breuer, W., Riesener, M., and Salzmann, A. (2012) Risk aversion vs. individualism: what drives risk taking in household finance?. *The European Journal of Finance*, 20(5), pp. 446-462.

Brislin, R. (1986): 'The wording and translation of research instruments'. In W. J. Lonner and J. W. Berry: *Field Methods in Cross-Cultural Research and Methodology Series* (eds). Sage Publications, Beverly Hills, CA, 8, 137–164.

Brown, B.B., (1978) Social and psychological correlates of help-seeking behavior among urban adults. *American Journal of Community Psychology*, *6*(5), pp.425-439.

Brown, R. (1976) Reference in memorial tribute to Eric Lenneberg. *Cognition*, 4(2), pp. 125-153.

Bühlmann, P. and Yu, B. (2002). Analyzing bagging. *The Annals of Statistics*, 30(4), pp.927-961.

Button, K.S., Ioannidis, J.P., Mokrysz, C., Nosek, B.A., Flint, J., Robinson, E.S. and Munafò, M.R. (2013) Power failure: why small sample size undermines the reliability of neuroscience. *Nature Reviews Neuroscience*, *14*(5), pp.365-376.

Byrne, K. (2005) How do consumers evaluate risk in financial products?. *Journal of Financial Services Marketing*, 10(1), pp.21-36.

Cao, J.X., (2009) The analysis of tendency of transition from collectivism to individualism in China. *Cross-Cultural Communication*, *5*(4), p.42.

Chan, S. (2013) Multiculturalism in Singapore: The way to a harmonious society. *Singapore Academy of Law Journal*, 25, pp. 84-109. Available at: (Accessed: 15 May 2017).

Chaulk, B., Johnson, P., and Bulcroft, R. (2003) Effects of marriage and children on financial risk tolerance: A synthesis of family development and prospect theory. *Journal of Family and Economic Issues*, 24(3), pp. 257-279. Available at: (Accessed: 5 January 2015).

Chen, J. and Su, J. (2011) Chinese-English bilinguals' sensitivity to the temporal phase of an action event is related to the extent of their experience with English. In V. Cook and B. Bassetti (Eds.), *Language and bilingual cognition.* New York, NY: Psychology press, pp. 341-356.

Chen, M. (2013) The Effect of Language on Economic Behavior: Evidence from Savings Rates, Health Behaviors, and Retirement Assets. *American Economic Review*, 103(2), pp. 690-731.

Cheung, H., Wu, J., and Tao, J. (2012) Risk Perception and Risk-Taking Attitude: A Comparison Between Hong Kong and Mainland Chinese Undergraduate Students. *The Asia-Pacific Education Researcher*, 22(4), pp. 497-506.

Cohen, B. (1999) Measuring the Willingness to Seek Help. *Journal of Social Service Research*, 26(1), pp. 67-82.

Cohn, R., Lewellen, W., Lease, R., and Schlarbaum, G. (1975) Individual Investor Risk Aversion and Investment Portfolio Composition. *The Journal of Finance*, 30(2), p. 605.

Cooper, A., Woo, C., and Dunkelberg, W. (1988) Entrepreneurs' perceived chances for success. *Journal of Business Venturing*, 3(2), pp. 97-108.

Cozma, I., (2011) How are individualism and collectivism measured?. *Romanian Journal of Applied Psychology*, *13*(1), pp.11-17.

Dahl, O. (2000) The grammar of future time reference in European Languages. In: Dahl, O. (ed.). *Tense and Aspect in the Languages of Europe*. Berlin: Mouton de Gruyter, pp. 309-328.

Dalal, D.K. and Zickar, M.J., 2012. Some common myths about centering predictor variables in moderated multiple regression and polynomial regression. *Organizational Research Methods*, *15*(3), pp.339-362.

Demo, D. (1992) The Self-Concept Over Time: Research Issues and Directions. *Annual Review of Sociology*, 18(1), pp. 303-326.

Deutscher (2012): 'Whorf revisited: You are what you speak". In J. Spradley and D. McCurdy: *Conformity and Conflict*. Pearson, Upper Saddle River, N.J, pp.49-56.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., and Wagner, G. (2009) Individual risk attitudes: measurement, determinants, and behavioral consequences. *Journal of the European Economic Association*, 9(3), pp. 522-550.

Droms, W. G. (1987) Investment asset allocation for PFP clients. *Journal of Accountancy*, 163(4), pp.114–118.

Dudoit, S. and Fridlyand, J. (2003) Bagging to improve the accuracy of a clustering procedure. *Bioinformatics*, 19(9), pp.1090-1099.

Duxbury, D. and Summers, B. (2004) Financial risk perception: Are individuals variance averse or loss averse?. *Economics Letters*, *84*(1), pp.21-28.

Ellsberg, D. (1961) Risk, Ambiguity, and the Savage Axioms. *The Quarterly Journal of Economics*, 75(4), p. 643.

Faff, R., Hallahan, T. and McKenzie, M. (2011) Women and risk tolerance in an aging world. *International Journal of Accounting & Information Management*, *19*(2), pp.100-117.

Faff, R., Mulino, D. and Chai, D. (2008) On the linkage between financial risk tolerance and risk aversion. *Journal of Financial Research*, *31*(1), pp.1-23.

Fan, J. and Xiao, J. (2006) A Cross-Cultural Study in Risk Tolerance: Comparing Chinese and Americans. *Journal of Personal Finance*, 5(3), pp. 54-75.

Fink, A. (2013) *How to conduct surveys: A step-by-step guide*. 5th edn. California: SAGE publication Ltd.

Franklin, A., Drivonikou, G. V., Bevis, L., Davie, I. R. L., Kay, P., & Regier, T. (2008) Categorical perception of color is lateralized to the right hemisphere in infants, but to the left hemisphere in adults. PNAS, 105(9), 3221–3225.

Fraser-Mackenzie, P., Sung, M.C. and Johnson, J.E. (2014) Toward an Understanding of the Influence of Cultural Background and Domain Experience on the Effects of Risk-Pricing Formats on Risk Perception. *Risk analysis*, *34*(10), pp.1846-1869.

Friend, I. and Blume, M. E. (1975) The demand for risky assets. *The American Economic Review*, pp.900-922.

Gathergood, J. (2012) Self-control, financial literacy and consumer over-indebtedness. *Journal of Economic Psychology*, 33(3), 590–602.

Gell, A. (1992) *The Anthropology of Time*. Bridgend, Mid-Glamorgan: WBC Book Manufacturers.

Gerrans, P., Faff, R., and Hartnett, N. (2013) Individual financial risk tolerance and the global financial crisis. *Accounting & Finance*, 55(1), pp. 165-185.

Giarrusso, R., Mabry, J., and Bengtson, V. (2001) The aging self in social contexts. In: Binstock, R. and Geogre, L. (ed.). *Handbook of aging and social sciences*. San Diego, CA: Academic Press, pp. 295-312.

Gibson, R.J., Michayluk, D. and Van de Venter, G. (2013) Financial risk tolerance: An analysis of unexplored factors. *Financial Services Review*, 22(1), pp.23-50.

Grable, J. (2000) Financial risk tolerance and additional factors that affect risk taking in everyday money matters. *Journal of Business and Psychology*, 14(4), pp. 625-630. Available at: (Accessed: 5 January 2015).

Grable, J. (2016): 'Financial risk tolerance'. In J. J. Xiao: *Handbook of Consumer Finance Research* (eds.). Switzerland: Springer International Publishing.

Grable, J. and Lytton, R. (1999) Financial risk tolerance revisited: the development of a risk assessment instrument. *Financial Services Review*, 8(3), pp. 163-181.

Grable, J. E. and Joo, S. (1997) Determinants of risk preference: Implications for family and consumer science professionals. *Family Economics and Resource Management Biennial, 2*, pp.19-24.

Grable, J. E. and Lytton, R. H. (2003) The development of a risk assessment instrument: A follow-up study. *Financial services review*, *12*(3), pp.257.

Gujarati, D. (2003) *Basic econometrics*. 4th edn. New York: McGraw Hill Education.

Gunnarsson, J. and Wahlund, R. (1997) Household financial strategies in Sweden: An exploratory study. *Journal of Economic Psychology*, 18(2-3), pp. 201-233.

Halek, M. and Eisenhauer, J. (2001) Demography of risk aversion. *Journal of Risk and Insurance*, pp.1-24.

Hallahan, T., Faff, R. and McKenzie, M. (2004) An empirical investigation of personal financial risk tolerance. *Financial Services Review*, *13*(1), p.57.

Hallahan, T., Faff, R., and McKenzie, M. (2003) An exploratory investigation of the relation between risk tolerance scores and demographic characteristics. *Journal of Multinational Financial Management*, 13(4-5), pp. 483-502.

Hanna, S. and Chen, P. (1997) Subjective And Objective Risk Tolerance: Implications For Optimal Portfolios. *Financial Counseling and Planning*, 8(2), pp. 27-32.

Hardin, E., Leong, F., and Bhagwat, A. (2004) Factor Structure of the Self-Construal Scale Revisited: Implications for the Multidimensionality of Self-Construal. *Journal of Cross-Cultural Psychology*, 35(3), pp. 327-345.

Harel, Z., Ehrlich, P., and Hubbard, R. (1990) *The Vulnerable aged: People, services, and policy*. New York: Springer.

Harlow, W. and Brown, K. (1990) Understanding and Assessing Financial Risk Tolerance: A Biological Perspective. *Financial Analysts Journal*, 46(6), pp. 50-62.

Harrison, X., Blount, J., Inger, R., Norris, D., and Bearhop, S. (2011) Carry-over effects as drivers of fitness differences in animals. *Journal of Animal Ecology*, 80(1), pp. 4-18.

Hershey, D., Henkens, K., and Van Dalen, H. (2007) Mapping the Minds of Retirement Planners: A Cross-Cultural Perspective. *Journal of Cross-Cultural Psychology*, 38(3), pp. 361-382.

Hoffmann, A., Post, T., and Pennings, J. (2013) Individual investor perceptions and behavior during the financial crisis. *Journal of Banking & Finance*, 37(1), pp. 60-74.

Hofstede, G. (2001) *Culture's consequences*. Thousand Oaks, Calif.: Sage Publications.

Holt, C. and Laury, S. (2002) Risk Aversion and Incentive Effects. *American Economic Review*, 92(5), pp. 1644-1655.

Hsee, C. and Weber, E. (1999) Cross-national differences in risk preference and lay predictions. *Journal of Behavioral Decision Making*, 12(2), pp. 165-179.

Hwang, K. (2001) The Deep Structure of Confucianism: A social psychological approach. *Asian Philosophy*, 11(3), pp. 179-204.

Indexmundi (2017a). *China Demographics Profile 2017*. [online] Indexmundi.com. Available at: https://www.indexmundi.com/China/demographics_profile.html [Accessed 28 Dec. 2017].

Indexmundi (2017b). *Vietnam Demographics Profile 2017*. [online] Indexmundi.com. Available at: https://www.indexmundi.com/vietnam/demographics_profile.html [Accessed 28 Dec. 2017].

Investopedia, (2003) *Investment Definition | Investopedia*. [Online]. 2003. Investopedia. Available at: http://www.investopedia.com/terms/i/investment.asp. (Accessed: 26 January 2016).

Irwin, C. E. (1993): 'Adolescence and risk taking: How are they related?'. In N. J. Bell and R. W. Bell: *Adolescence risk taking* (eds.). Newbury Park, CA: Sage.

Iversen, G. and Norpoth, H. (2002) *Analysis of variance*. Newbury Park: Sage Publ.

IWS (2017). *World Internet Users Statistics and 2017 World Population Stats*. [online] Internetworldstats. Available at: http://www.internetworldstats.com/stats.htm [Accessed 22 Oct. 2017].

Izard, C. (1997) *Human emotion*. New York: Plenum.

Jaccard, J., Turrisi, R. and Wan, K. (1990) Interaction Effects in Multiple Regression. Newbury Park, CA: Sage.

Jacobs, B. I., and Levy, K. N. (1996) Residual risk: how much is too much? *Journal of Portfolio Management*, 22(3), pp.10–16.

Jacobs-Lawson, J. M. and Hershey, D. A. (2005) Influence of future time perspective, financial knowledge, and financial risk tolerance on retirement saving behaviors. *Financial Services Review*, *14*(4), pp.331-344

Jakobson, R. (1959) *On Linguistic Aspects Of Translation*. [Online]. 1959. Standford. Available at: https://web.stanford.edu/~eckert/PDF/jakobson.pdf. (Accessed: 20 January 2017).

Jianakoplos, N. and Bernasek, A. (2006) Financial Risk Taking by Age and Birth Cohort. *Southern Economic Journal*, 72(4), pp. 981-1001.

Johnson, J., Wilke, A. and Weber, E. U. (2004) Beyond a trait view of risk taking: A domain-specific scale measuring risk perceptions, expected benefits, and perceived-risk attitudes in German-speaking populations. *Polish Psychological Bulletin*, *35*, pp.153-172.

Kahneman, D. and Tversky, A. (1979) Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, 47(2), p. 263.

Kay, P. and Kempton, W. (1984) What Is the Sapir-Whorf Hypothesis?. *American Anthropologist*, 86(1), pp. 65-79.

Kay, P. and Regier, T. (2006) Language, thought and color: recent developments. *Trends in Cognitive Sciences*, 10(2), pp. 51-54.

Kelley, K., Clark, B., Brown, V., and Sitzia, J. (2003) Good practice in the conduct and reporting of survey research. *International Journal for Quality in Health Care*, 15(3), pp. 261-266.

Kennedy, P. (2008) *A guide to econometrics.* Blackwell Publishing: Malden Massachusetts.

Kirkman, B., Lowe, K., and Gibson, C. (2006) A quarter century of Culture's Consequences: a review of empirical research incorporating Hofstede's cultural values framework. *Journal of International Business Studies*, 37(3), pp. 285-320.

Klos, A., Weber, E., and Weber, M. (2005) Investment Decisions and Time Horizon: Risk Perception and Risk Behavior in Repeated Gambles. *Management Science*, 51(12), pp. 1777-1790.

Kreps, D. and Porteus, E. (1978) Temporal Resolution of Uncertainty and Dynamic Choice Theory. *Econometrica*, 46(1), p. 185.

Kritzman, M. (1994) What Practitioners Need to Know…About Time Diversification. *Financial Analysts Journal*, 50(1), pp. 14-18.

Levison, S. (1996) Frames of reference and Molyneux's question: Crosslinguistic evidence. In P. Bloom and M. Peterson (Eds.), *Language and space.* Cambridge, MA: MIT press, pp. 109-169.

Lewis, M., Stanger, C., Sullivan, M., and Barone, P. (1991) Changes in embarrassment as a function of age, sex and situation. *British Journal of Developmental Psychology*, 9(4), pp. 485-492.

Lewis, M., Sullivan, M.W., Stanger, C. and Weiss, M., (1989) Self development and self-conscious emotions. *Child development*, pp.146-156.

Li, P. and Gleitman, L. (2002) Turning the tables: language and spatial reasoning. *Cognition*, 83(3), pp. 265-294.

Lopes, L. (1987) Between hope and fear: The psychology of risk. *Advances in experimental social psychology*, 20(3), pp. 255-295.

Luce, R.D. and Weber, E.U. (1986) An axiomatic theory of conjoint, expected risk. *Journal of Mathematical Psychology*, *30*(2), pp.188-205.

Malmendier, U. and Nagel, S. (2011) Depression Babies: Do Macroeconomic Experiences Affect Risk Taking?. *The Quarterly Journal of Economics*, 126(1), pp. 373-416.

Mandel, N. (2003) Shifting Selves and Decision Making: The Effects of Self-construal Priming on Consumer Risk-taking. *Journal of Consumer Research*, 30(1), pp. 30-40.

Markowitz, H., 1952. Portfolio selection. *The journal of finance*, *7*(1), pp.77-91.

Matsumoto, D. (1996) Culture and psychology. Pacific Grove, CA: Brooks Cole

Maylor, H. and Blackmon, K. (2005) *Researching Business and Management: A Roadmap For Success*. 1st edn. New York: Palgrave Macmillan.

McSweeney, B. (2002) Hofstede's model of national cultural differences and their consequences: A triumph of faith-a failure of analysis. *Human relations*, *55*(1), pp.89-118.

Mellers, B.A., Schwart, A., and Weber, E.U. (1997) Do risk attitudes reflect in the eye of the beholder?, in Luce, R. and Marley, A. (1997) *Choice, decision, and measurement*. Mahwah, N.J.: L. Erlbaum.

Migrationpolicy.org, (2015) *Chinese Immigrants in the United States*. [Online]. 2015. Available at: http://www.migrationpolicy.org/article/chinese-immigrants-united-states. (Accessed: 3 April 2015).

Miles, L., Tan, L., Noble, G., Lumsden, J., and Macrae, C. (2011) Can a mind have two time lines? Exploring space–time mapping in Mandarin and English speakers. *Psychonomic Bulletin & Review*, 18(3), pp. 598-604.

Mirowsky, J. and Ross, C.E. (1992) Age and depression. *Journal of Health and Social Behavior*, pp.187-205.

Morin, R. and Suarez, A. (1983) Risk Aversion Revisited. *The Journal of Finance*, 38(4), pp. 1201-1216.

NIA, (2016) *Living Longer*. [Online]. National Institute on Aging. Available at: https://www.nia.nih.gov/research/publication/global-health-and-aging/living-longer. (Accessed: 7 March 2016).

Nosic, A. and Weber, M. (2010) How Riskily Do I Invest? The Role of Risk Attitudes, Risk Perceptions, and Overconfidence. *Decision Analysis*, 7(3), pp. 282-301.

Numbeo, (2016) *Cost of Living Index by Country 2016*. [Online]. Numbeo.com. Available at: http://www.numbeo.com/cost-of-living/rankings_by_country.jsp. (Accessed: 19 January 2016).

Nunnally, J. C., & Bernstein, I. H. (1994) Psychometric theory (3rd ed.). New York: McGraw-Hill.

Olsen, R.A. and Cox, C.M. (2001) The influence of gender on the perception and response to investment risk: The case of professional investors. *The journal of psychology and financial markets*, *2*(1), pp.29-36.

Orth, U., Trzesniewski, K., and Robins, R. (2010) Self-esteem development from young adulthood to old age: A cohort-sequential longitudinal study. *Journal of Personality and Social Psychology*, 98(4), pp. 645-658.

Ortiga, Y.Y. (2015) Multiculturalism on its head: Unexpected boundaries and new migration in Singapore. *Journal of International Migration and Integration*, *16*(4), pp.947-963.

Oxford Dictionaries, (2016) *investment - definition of investment in English from the Oxford dictionary*. [Online]. Oxforddictionaries.com. Available at: http://www.oxforddictionaries.com/definition/english/investment. (Accessed: 26 January 2016).

Paccagnella, O. (2006) Centering or not centering in multilevel models?: the role of the group mean and the assessment of group effects. *Evaluation Review*, 30(1), pp.66-85.

Palsson, A. (1996) Does the degree of relative risk aversion vary with household characteristics?. *Journal of Economic Psychology*, 17(6), pp. 771-787.

Papafragou, A., Li, P., Choi, Y., and Han, C. (2007) Evidentiality in language and cognition. *Cognition*, 103(2), pp. 253–299.

Pascal, Blaise et al. (1910) *Thoughts*. 1st ed. New York: P.F. Collier & Son.

Potter, M., So, K., Eckardt, B., and Feldman, L. (1984) Lexical and conceptual representation in beginning and proficient bilinguals. *Journal of Verbal Learning and Verbal Behavior*, 23(1), pp. 23-38.

Pratt, J. (1964) Risk Aversion in the Small and in the Large. *Econometrica*, 32(1/2), p. 122.

Quandl.com, (2015) *GDP as Share of World GDP at PPP By Country - Data from Quandl*. [Online]. 2015. Available at: https://www.quandl.com/c/economics/gdp-as-share-of-world-gdp-at-ppp-by-country. (Accessed: 3 April 2015).

Regier, T. and Kay, P. (2009) Language, thought, and color: Whorf was half right. *Trends in Cognitive Sciences*, 13(10), pp. 439-446.

Renn, O. and Rohrmann, B. (2000): 'Cross-cultural risk perception: state and challenge'. In O. Renn and B. Rohrmann: *Cross-cultural risk perception: A survey of empirical studies* (eds.). The Netherlands: Kluwer Academic Publishers.

Rhee, E., Uleman, J., and Lee, H. (1996) Variations in collectivism and individualism by ingroup and culture: Confirmatory factor analysis. *Journal of Personality and Social Psychology*, 71(5), pp. 1037-1054.

Rieger, M., Wang, M. and Hens, T. (2014) Risk preferences around the world. *Management Science*, *61*(3), pp.637-648.

Riley, W. and Chow, K. (1992) Asset Allocation and Individual Risk Aversion. *Financial*

Analysts Journal, 48(6), pp. 32-37.

Roberson, D. (2005) Color Categories Are Culturally Diverse in Cognition as Well as in Language. *Cross-Cultural Research*, 39(1), pp. 56-71.

Roberson, D. and Hanley, J. (2007) Color Vision: Color Categories Vary with Language after All. *Current Biology*, 17(15), pp. R605-R607.

Roberson, D., Davidoff, J., & Braisbyb, N. (1999) Similarity and categorization: Neuropsychological evidence for a dissociation in explicit categorization tasks. Cognition, 71, 1–42.

Robichek, A. and Myers, S. (1966) Valuation of the Firm: Effects of Uncertainty in a Market Context. *The Journal of Finance*, 21(2), p. 215.

Robins, R., Trzesniewski, K., Tracy, J., Gosling, S., and Potter, J. (2002) Global self-esteem across the life span. *Psychology and Aging*, 17(3), pp. 423-434.

Rosow, I. (1985) Status and role change through the life cycle. In: Binstock, R. and Shanas, E. (ed.). *Handbook of aging and social sciences*. New York: Van Nostrand Reinhold, pp. 62-93.

Roszkowski, M. J. and Davey, G. (2010) Risk perception and risk tolerance changes attributable to the 2008 economic crisis. *Journal of Financial Service professionals*, 64(4), pp. 42-53.

Roszkowski, M. J., Snelbecker, G. E., and Leimberg, S. R. (1993): Risk-tolerance and risk aversion. In S. R. Leimberg, M. J. Satinsky, R. T. LeClair, & R. J. Doyle, Jr. (eds.), The tools and techniques of financial planning (4th ed., pp. 213-225). Cincinnati, OH: National Underwriter

RUBIN, P. and PAUL II, C. (1979) AN EVOLUTIONARY MODEL OF TASTE FOR RISK. *Economic Inquiry*, 17(4), pp. 585-596.

Sapir, E. (1929) The Status of Linguistic as a Science'. In E. Sapir (1958), *Culture, Language and Personality* (Eds.). Berkeley, CA: University of California Press.

Sapir, E. and Mandelbaum, D. (1949) *Selected writings of Edward Sapir in language, culture and personality*. 1st edn. Berkeley: University of California Press.

Sarin, R. K. and Weber, M. (1993) Risk-value models. *European Journal of Operational Research*, *70*(2), pp.135-149.

Schneider, C.R., Fehrenbacher, D.D. and Weber, E.U. (2017) Catch me if I fall: Cross-national differences in willingness to take financial risks as a function of social and state 'cushioning'. *International Business Review, 26*(6), pp.1023-1033.

Scholz, B., Pelletier, F., and Pullum, G. (2015) *Philosophy of Linguistics (Stanford Encyclopedia of Philosophy/Winter 2011 Edition)*. [Online]. 2015. Plato.stanford.edu. Available at: http://plato.stanford.edu/archives/win2011/entries/linguistics/. (Accessed: 11 March 2015).

Schooley, D., and Worden, D. (1996) Risk aversion measures: comparing attitudes and asset allocation. *Financial Services Review*, 5(2), pp. 87-99.

Schwartz, S.H., 1994. *Beyond individualism/collectivism: New cultural dimensions of values*. [S.I]:Sage Publications, Inc.

Shaw, B., Liang, J., and Krause, N. (2010) Age and race differences in the trajectories of self-esteem. *Psychology and Aging*, 25(1), pp. 84-94.

Sherman, R. (1974) *The economics of industry*. Boston: Little Brown.

Singelis, T.M., 1994. The measurement of independent and interdependent self-construals. *Personality and social psychology bulletin*, *20*(5), pp.580-591.

Sitkin, S. and Weingart, L. (1995) Determinants Of Risky Decision-Making Behavior: A Test Of The Mediating Role Of Risk Perceptions And Propensity. *Academy of Management Journal*, 38(6), pp. 1573-1592.

Slovic, P. (1999) Trust, Emotion, Sex, Politics, and Science: Surveying the Risk-Assessment Battlefield. *Risk Analysis*, 19(4), pp. 689-701. Available at: (Accessed: 6 April 2017).

Slovic, P., Fischhoff, B., and Lichtenstein, S. (1982) Why Study Risk Perception?. *Risk Analysis*, 2(2), pp. 83-93.

Smith, D. (2004) Ideology, Science and Social Relations: A Reinterpretation of Marx's Epistemology. *European Journal of Social Theory*, 7(4), pp. 445-462.

Smith, P. and Bond. M. (1999) *Social Psychology across Cultures*. Boston: Allyn & Bacon.

Snelbecker, G. E., Roszkowski, M. J., and Cutler, N. E. (1990) Investors' risk tolerance and return aspirations, and fi nancial advisors' interpretations: A conceptual model and

exploratory data. *The Journal of Behavioral Economics*, 19 (4), 377–393.

Statista (2017a). *Age distribution of internet users in Vietnam 2013 | Statistic*. [online] Statista. Available at: https://www.statista.com/statistics/262216/age-distribution-of-internet-network-users-in-vietnam/ [Accessed 22 Oct. 2017].

Statista (2017b). *Singapore: age distribution of internet users 2013 | Statistic*. [online] Statista. Available at: https://www.statista.com/statistics/281120/age-distribution-of-internet-users-in-singapore/ [Accessed 22 Oct. 2017].

Statman, M. (2008) Countries and Culture in Behavioral Finance. *CFA Institute Conference Proceedings Quarterly*, [online] 25(3), pp.38-44. Available at: https://www.cfapubs.org/doi/pdf/10.2469/cp.v25.n3.6 [Accessed 6 Jun. 2016].

Statman, M. (2010) The Cultures of Risk Tolerance. *SSRN Electronic Journal*. [online] Available at: http://innovbfa.viabloga.com/files/Meir_Statman___The_Cultures_of_Risk_Tolerance___2010.pdf [Accessed 6 Jun. 2016].

Steele, L.G. and Lynch, S.M. (2013) The pursuit of happiness in China: Individualism, collectivism, and subjective well-being during China's economic and social transformation. *Social indicators research*, *114*(2), pp.441-451.

Stone, R.N. and Winter, F.W. (1987): 'Risk: is it still uncertainty times consequences?'. In R.W. Belk et al. (Eds), Proceedings of the American Marketing Association, Winter Educators Conference, Chicago, IL, pp. 261-5

Sulaiman, E. (2012) An empirical analysis of financial risk tolerance and demographic features of individual investors. *Procedia Economics and Finance*, *2*, pp.109-115.

Summers, B., Duxbury, D., Hudson, R. and Keasey, K. (2006) As time goes by: An investigation of how asset allocation varies with investor age. *Economics Letters*, *91*(2), pp. 210-214.

Tanaka, T., Camerer, C., and Nguyen, Q. (2010) Risk and Time Preferences: Linking Experimental and Household Survey Data from Vietnam. *American Economic Review*, 100(1), pp. 557-571.

The World Bank, (2016) *World Development Indicators| World DataBank*. [Online]. 2016. Databank.worldbank.org. Available at:

http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators. (Accessed: 19 January 2016).

Thieroff, R. (2000) On the Areal Distribution of Tense-Aspect Categories in Europe. In: Dahl, O. (ed.). *Tense and Aspect in the Languages of Europe*. Berlin: Mouton de Gruyter, pp. 309-328.

ThoughtCo (2017) [Online]. Available at: https://www.thoughtco.com/singapores-economic-development-1434565. (Accessed: 15 May 2017).

Un.org, (2015) *World Population Ageing*. [Online]. Available at: http://www.un.org/esa/population/publications/worldageing19502050/. (Accessed: 11 March 2015).

Van de Venter, G., Michayluk, D., and Davey, G. (2012) A longitudinal study of financial risk tolerance. *Journal of Economic Psychology*, 33(4), pp. 794-800.

Veroff, J. B. (1981) The dynamics of help-seeking in men and women: A national survey study. *Psychiatry*, *44*(3), 189-200.

Von Neumann, J. and Morgenstern, O. (1947) *Theory of Games and Economic Behavior. (Second edition.)*. Princeton: Princeton University Press.

Wallace, M. (1956). Future time perspective in schizophrenia. *The Journal of Abnormal and Social Psychology*, 52(2), pp.240-245.

Wang, H. and Hanna, S. (1997) Does Risk Tolerance Decrease With Age?. *Financial Counseling and Planning*, 8(2), pp. 27-31.

Wang, M. and Fischbeck, P. (2008) Evaluating lotteries, risks, and risk-mitigation programs. *Journal of Risk Research, 11*(6), pp.775-795.

Weber, C. (2014) Determinants of Risk Tolerance. *International Journal of Economics, Finance and Management Sciences*, 2(2), p. 143.

Weber, E. and Hsee, C. (1998) Cross-Cultural Differences in Risk Perception, but Cross-Cultural Similarities in Attitudes Towards Perceived Risk. *Management Science*, 44(9), pp. 1205-1217.

Weber, E. and Hsee, C. (1999) Models and mosaics: Investigating cross-cultural differences in risk perception and risk preference. *Psychonomic Bulletin & Review*, 6(4), pp. 611-617.

Weber, E. and Milliman, R. (1997) Perceived Risk Attitudes: Relating Risk Perception to Risky Choice. *Management Science*, 43(2), pp. 123-144.

Weber, E., Blais, A., and Betz, N. (2002) A domain-specific risk-attitude scale: measuring risk perceptions and risk behaviors. *Journal of Behavioral Decision Making*, 15(4), pp. 263-290.

Weber, E., Hsee, C., and Sokolowska, J. (1998) What Folklore Tells Us about Risk and Risk Taking: Cross-Cultural Comparisons of American, German, and Chinese Proverbs. *Organizational Behavior and Human Decision Processes*, 75(2), pp. 170-186.

Weber, E., Shafir, S., and Blais, A. (2004) Predicting Risk Sensitivity in Humans and Lower Animals: Risk as Variance or Coefficient of Variation. *Psychological Review*, 111(2), pp. 430-445.

Weber, M., Weber, E., and Nosic, A. (2012) Who takes Risks When and Why: Determinants of Changes in Investor Risk Taking. *Review of Finance*, 17(3), pp. 847-883.

Whorf, B. (1956). *Language, thought, and reality*. New York: Wiley.

Widhiarso, W. (2009) *The influence of language on thought Study Benjamin Whorf Hypothesis and Edward Sapir*. [Online]. 2009. Available at: http://widhiarso.staff.ugm.ac.id/files/widhiarso_-_language_and_thought.pdf. (Accessed: 17 January 2017).

Winawer, J., Witthoft, N., Frank, M., Wu, L., Wade, A., & Boroditsky, L. (2007) Russian blues reveal effects of language on color discrimination. PNAS, 104(19), 7780–7785. doi:10.1073/pnas.0701644104.

World Languages (2017) [Online]. Available at: http://www.internetworldstats.com/languages3.htm. (Accessed: 21 April 2017).

Wu, G. (1999) anxiety and decision making with delayed resolution of uncertainty. *theory and decision*, 46(2), pp. 159-199. Available at: (Accessed: 27 March 2017).

Yahoo Finance, (2016) *USD/GBP Currency Conversion- Yahoo! UK & Ireland Finance*. [Online]. Available at: https://uk.finance.yahoo.com/q?s=GBP=X&ql=1. (Accessed: 19 January 2016).

Yan, Y. (2010): 'Introduction: Conflicting images of the individual and contested process of individualization'. In M. Hansen and R. Svarverud: The rise of the individual in modern Chinese society (eds., pp.1-38). Denmark: NIAS Press.

Yao, R., Sharpe, D.L. and Wang, F. (2011) Decomposing the age effect on risk tolerance. *The Journal of Socio-Economics*, *40*(6), pp.879-887.

Yates, J. and Stone, E. (1992) The risk construct. In: Yates, J. (ed.). *Risk-taking behavior*. New York: John WIley.

Yoo, P. S. (1994) Age dependent portfolio selection. *Federal Reserve Bank of St. Louis Working Paper Series*, (1994-003).

Zeng, R. and Greenfield, P.M. (2015) Cultural evolution over the last 40 years in China: Using the Google Ngram Viewer to study implications of social and political change for cultural values. *International Journal of Psychology*, *50*(1), pp.47-55.

Zimbardo, P. and Boyd, J. (1999). Putting time in perspective: A valid, reliable individual-differences metric. *Journal of Personality and Social Psychology*, 77(6), pp.1271-1288.

Zimbardo, P., and Leippe, M. (1991) *The psychology of attitude change and social influence.* Philadelphia, PA: Temple University Press.