A TEST OF THE EFFECTS OF BIOPSYCHOSOCIAL AND ENVIRONMENTAL, SOCIAL SUPPORT, AND MACROECONOMIC FACTORS ON FINANCIAL RISK TOLERANCE

By

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(Under the Direction of John E. Grable)

ABSTRACT

Risk tolerance will continue to be an important factor shaping consumer and household decision making. This study has added to the risk-tolerance literature by showing how, while generally stable, risk-tolerance can change over time. The overarching purposes of this study were to (a) identify the macroeconomic variables that influence individual risk tolerance, (b) clarify the relationship between biopsychosocial and environmental factors that influence risk tolerance, (c) and determine whether social support influences a person's risk tolerance. The final goal of the dissertation was to provide a substantial contribution to the risk-tolerance literature and offer insights into which, if any, variables influence an individual's change in risk tolerance over time. The sample, provided by FinaMetrica, contained approximately 4,983 individuals who completed at least two financial risk-tolerance assessments from the period between 2010 and 2014. The results of the regression analysis show strong similarities to previous studies examining the relationship between risk tolerance and biopsychosocial and environmental factors. Age, gender, education level, income, and net worth all showed significant relationships to financial risk-tolerance scores. Specifically, older respondents exhibited lower scores and females reported a lower risk tolerance than men. Income, household

size, and net worth were all positively associated with an increase in risk-tolerance scores. The most interesting aspect of the macroeconomic analysis was the negative relationship between GDP and risk-tolerance score. GDP had a negative coefficient, indicating that a rise in GDP was associated with lower risk-tolerance scores. In addition, the results suggest that as spending on social support, as a percentage of a country's gross domestic product, goes up, risk tolerance decreases. Finally, based on the results of the logistic regression, individuals who scored extremely low or high on risk assessments, older individuals, and those with lower education levels were most likely to exhibit change over a four-year window.

INDEX WORDS: Risk Tolerance, Financial Risk Tolerance, Macroeconomic, Social Support, Factors, Multinomial Logistic

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CHAPTER I

INTRODUCTION

Introduction and Statement of Problem

The field of financial planning continues to grow, evolve, and expand in response to the consumer demand for an emerging number of financial products, resources, investment choices, and opportunities. Although currently in the minority, financial professionals operating under the fiduciary standard are slowly gaining influence and government agencies are considering dramatic policy changes as evident by the newest Department of Labor regulations requiring fiduciary actions for many professionals representing tax advantaged retirement plans (DOL, 2015). Understanding the appropriate investment options and allocating a client's assets accordingly is a key component of any comprehensive financial plan. Accurate assessment of risk tolerance is generally accepted as an essential condition to developing a suitable and quality financial plan for individuals (CFP Board, 2015). For those working under a fiduciary standard, appropriate risk-tolerance assessment is mandatory.

Risk tolerance can be defined parsimoniously as an individual's willingness to take risk (Dalton & Dalton, 2004). In the information gathering stage of client work, a suitable risk assessment must be used to meet most regulatory requirements, as well as to formulate the best plan for an individual (Roszkowski & Davey, 2010). Understanding how a person's risk tolerance influences decision making and behavior is becoming an increasingly important aspect of how financial planners formulate and execute recommendations. For researchers,

practitioners, policy makers, economists, and financial professionals, understanding the role of risk and risk tolerance is imperative to examining the mechanics that combine to impact an individual's behavior (Xiao, 2008).

Risk-tolerance assessment serves as a foundation for nearly all financial planning models, frameworks, and recommendations. Both in the private and public sector, understanding the fundamental principles that underlie risk measurement and risk tolerance are necessary to accurately anticipate an individual's decisions, determine optimal choices, and maximize utility under the constraint of imperfect knowledge. The underlying principle of risk tolerance is based on the intuitive knowledge that individuals are unable to accurately predict the future. One must process currently available information to assess the likelihood of future events and scenarios. Historically, economists often assumed risk attitudes away or deemphasized the notion based on the assumption of perfect consumer knowledge and complete individual rationality. However, it can be readily seen that individuals exhibit risk aversion and do not always make decisions consistent with the traditional construct of economic rationality (Kahneman & Tversky, 1979).

Growth in Financial Planning

The landscape of personal financial planning has changed dramatically over the last 40 years. The traditional model of employer provided pension plans are becoming increasingly rare and significantly more individuals are being nudged to defined contribution plans invested in public markets. As of 2015, almost 60% of individuals retirement plans were markets based and less than 30% of civilian workers had access to defined benefit plans (BLS, 2014). That is almost a complete reversal from the 1960s when pension plans were the norm and defined contribution plans were still rare**.** In addition, Social Security has come under increased stress. There are many unanswered questions about the steps that will be made to make the program financially

and politically sustainable long term (Congressional Budget Office, 2015). The financial landscape has also become more complicated. Each year many new products are added to investment possibilities lists. International investment options continue to increase as globalization expands access to international markets. Financial planners will continue to be in demand to deal with the dramatic increase of individuals needing help making simple and complex financial decisions. According to the *United States Occupational Outlook Handbook*, employment of personal financial advisors is expected to increase at a projected rate of 30% over the next 10 years versus 7% for all other occupations (Bureau of Labor Statistics, 2014). As part of a growing and increasingly complicated field, individuals need to understand the risks involved with market driven investments and accurately assess their own risk-taking propensity before developing a portfolio of investments that match their long-term goals.

Stability of Financial Risk Tolerance

One question related to the study of financial risk tolerance is of particular importance, specifically: Does risk tolerance change over time? The concept of risk tolerance "traitedness" is gaining traction as a way to answer the question of how much an individual's risk tolerance actually deviates over time (Roszkowski & Delaney, 2009). The extent to which people will exhibit a personality trait in behaviors across different situations and contexts defines traitedness (Baumeister & Tice, 1988). For financial planners, policy makers, and researchers, answering the question of how much an individual's risk tolerance changes (if at all) over time is needed to fully understand how clients will react in a variety of situations and within many different types of macroeconomic environments. However, it can be difficult to find large public datasets containing appropriate data due to the fact that the same individuals need to be measured multiple times to make intrapersonal assessments. Many large datasets measure aggregate risk

tolerance over different time periods (Hanna & Sung, 1996; Kuzniak, Rabbani, Heo, Ruiz-Menjivar & Grable, 2015), but these datasets do not necessarily measure the same individuals across time. Understanding, measuring, and evaluating a collection of specific individuals' risk tolerance over time can add needed depth to the body of research regarding financial risk tolerance.

Traditional Financial Risk-Tolerance Assessment

Attempts to understand financial risk tolerance have largely been defined by examining the factors that influence risk tolerance. Factors can be broken down into two broad categories, each of which has an interdependent relationship with risk tolerance: biopsychosocial and environmental (Irwin, 1993). Biopsychosocial factors include age, gender, locus of control, time preference, and other similar factors. Environmental factors generally refer to items such as family situation, peer behavior, social transitions, and socioeconomic status. Combined, these precipitating factors contribute to experience, knowledge, cognition, and financial satisfaction. To date, nearly all previous research has focused on individual characteristics that influence an individual's willingness to take risk (e.g., Bajtelsmit & Bernasek, 1996; McInish, 1982). Applying a multinational perspective, using a combination of biopsychosocial and environmental variables, on risk tolerance is still a major gap in the literature. Little research has been conducted to consider the topic. In his 2006 work, Goetz addressed financial risk tolerance by looking at international differences specifically between five different nations. While the results showed some significant findings, specifically, Goetz called for additional research on the changes in an individual's risk tolerance over time. Goetz also called for more work examining the differences between cultural risk attitudes throughout the world.

Financial Risk Tolerance: A Global Perspective

As communication, trade, and the speed of information continue to evolve, world economies are becoming increasingly interdependent (Friedman, 2005). Globalization is expanding opportunities for individuals in countries around the world to work, invest, trade, and remain informed about global economic conditions. Global exchange traded funds (ETFs), actively managed mutual funds, and index funds continue to make international investing increasingly accessible and easy for both consumers and financial professionals. By increasing the scope and possibility of investment options, the global marketplace provides new opportunities to invest in different types of risky assets (Sachs, Tornell, & Velasco, 1996). In addition to the ability to easily invest in global markets, there is also concern that international economic factors may increasingly influence local markets. Due to the interdependent nature of the global economy, changes outside investors' countries of origin often influence domestic markets. For example, international investment options provide opportunities for diversification of risk and reward; however, little research has been conducted to test the influence of international economic fluctuations on the risk tolerance of domestic investors (Goetz, 2006). Understanding the relationship dynamic between domestic and international markets will become more important as international investment options continue to increase. Rieger, Wang, and Hens (2014) suggested that there are substantial cross-country differences in risk attitudes that depend on both economic conditions and cultural factors and that more exploration needs to be conducted concerning international differences. In addition, many large investment firms deal with clients from different regions and countries across the world. Grasping the interactions between markets and the impact on investment decisions of domestic investors is an important area for further study. This study helps address these gaps in the literature.

Although every developed nation has some level of social safety net, the degree to which individuals are protected varies greatly (Deacon, 2005). Health care, food aid programs, retirement/pension benefits, and insurance availability are all factors that significantly contribute to the financial stability of a household. As will be discussed in Chapter Two, a number of research suggestions emerge from any comprehensive review of the existing literature that consider an international perspective of risk attitudes and risk taking behavior. Of primary importance is obtaining a better understanding of the relationship between a strong social safety net and an individual's willingness to take risk. There is some evidence to suggest that the relationship between an individual's willingness to take risk and their risk need can partially be influenced by the social and cultural protections in place for major life events such as disability, retirement, or medical emergencies. Even if individuals are uncomfortable taking additional risk, they may be guided by an advisor into riskier investments to meet their portfolio goals. This is based on the assumption that, should a significant loss occur, the safety net imbedded in the investor's home country can soften any potential short- and long-term losses. Comparing the risk tolerance of individuals across countries with different levels of social support can highlight the relationship between an individual's willingness to take risk and available safety nets.

Macroeconomic Variables and Financial Risk Tolerance

Of the factors that are associated with financial risk tolerance, market conditions have been theorized to influence risk tolerence (Rabbani, Heo, & Kuzniak, 2015). However, the extent and direction of the relationship is still up for debate. Although some research has been done on this topic (e.g., Santacruz, 2009), the impact of traditional economic indicators' influence on someone's risk tolerance is generally lacking. In order to fill this gap in the literature, the relationship between global macroeconomic variables and an individual's risk tolerance was

explored in this study. Country specific macroeconomic variables including unemployment rates, interest rates, national production (GDP), commodity prices, and market pricing were examined to measure any effect on an individual's willingness to take risk. As will be discussed later in this dissertation, understanding how international and domestic markets influence cross-cultural risk tolerance can provide even more insight into new frontiers of risk assessment research. The relationship between macroeconomic variables and risk tolerance needs to be clarified as an aid in assisting financial planners and their clients, especially in times of high market volatility. Results from this study can be used to better understand these relationships.

Wealth and Financial Risk Tolerance

Traditionally, as an individual earns more income they increasingly become more risk tolerant. That is, as wealth increases, individuals are more likely to take additional risk or invest in risky assets (Baker & Haslem, 1974; Shaw, 1996). In 1952, Harry Markowitz popularized the idea of Modern Portfolio Theory (MPT). By examining the volatility of an individual asset and its expected return, an efficient frontier of investment allocation options may be developed. According to MPT, there is a distinct relationship between the riskiness of an asset and its expected return. Generally, for efficient investment options, the expected return will increase as the volatility or risk of an asset class increases. Wealthy investors are often willing to accept higher levels of volatility when the expected payout is high (Sung & Hanna, 1996). Risk capacity, defined as a client's financial ability to withstand a potential loss resulting from a risky behavior (Nobre & Grable, 2015), is often much higher for wealthy individuals. Having the capacity to withstand volatility or take a loss, gives wealthier investors the opportunity to potentially invest in assets with higher expected returns.

Risk capacity is often associated with wealth or income. Typically, net worth and disposable income are used as a proxy for an individual's capacity to accept a loss. However, less research has been completed internationally to help understand additional components of the risk capacity equation. In addition to understanding risk capacity, financial planners often introduce the concept of risk need when developing client strategies for meeting specific investing or retirement goals. Risk need is generally defined as the level of risk needed for an individual to meet their investment goals (Carr, 2014; Grable & Lytton, 1999). While not theoretically ideal, investing assets according to the return needed may place individuals in portfolio allocations outside their risk-tolerance comfort zone. However, in order to put realistic expectations around future goals, clients must often add riskier assets in order to obtain an acceptable required rate of return. This study adds to the discussion regarding risk capacity by evaluating the role social support plays in shaping risk attitudes.

Purpose and Justification of Study

The study of risk tolerance and risk assessment has developed over the last thirty years and continues to evolve as new observations are made. It is widely understood that financial risk tolerance underlays many of the financial decisions individuals make (Hanna, Waller, & Finke, 2011). Current research continues to expand with the goal of explaining human behavior and even moving to prediction and optimal strategies to expand or mitigate risk. Historical studies have built a strong foundation regarding the factors that are associated with risk tolerance and accurate psychometric tools to measure an individual's financial risk tolerance. The changes that individuals exhibit in their own risk tolerance over time, across cultural and international boundaries, has rarely been reported at length in the academic literature. This is puzzling because risk-tolerance assessment serves as a foundation for nearly all financial planning models,

frameworks, and recommendations. Both in the private and public sector, understanding the fundamental principles that underlie risk tolerance are necessary to accurately anticipate an individual's decisions, determine optimal choices, and maximize utility under the constraint of imperfect knowledge (Friedman & Savage, 1948). Understanding an individual's financial risk tolerance is an aspect to consider when developing comprehensive financial planning recommendations. In order to determine appropriate investment allocations, adequate measuring, recording, and blending of risk tolerance with a client's objectives is required by most governing boards of financial planning to maintain a fiduciary standard (CFP Board, 2015). By more fully understanding a client's financial risk tolerance, financial planners can be in a position to better help clients make choices consistent with the client's long-term goals.

If it is understood that risk-tolerance assessment is a fundamental building block to personal financial decision-making, then a comprehensive understanding of the topic is desirable. By identifying what exactly drives risky human behavior, society will be able to more accurately assess the behavior individuals and groups will make when evaluating choices with uncertain outcomes**.** An additional important component of risk tolerance is understanding if, and how much, a person's risk tolerance changes over time. There is academic uncertainty about whether or not individuals exhibit constant risk tolerance over time or if environmental circumstances have a major influence on risk tolerance. Roszkowski and Davey (2010) even suggested that risk tolerance is largely a fixed personality trait and stable, yet it is nonetheless marginally subject to situational influences and may change due to life circumstances (e.g., aging). It has also been suggested that agents have significant incentives to demonstrate different risk preferences when market conditions are fluctuating (Niendorf & Ottaway, 2002). Most academic models incorporate many different variables into the complete set of factors that

influence risk tolerance. There is still limited understanding of what causes individuals to make changes in their risk tolerance when they are given repeated assessments to measure their risk tolerance over multiple time intervals. In addition to determining how consistent risk tolerance is over time, it is also useful to understand the magnitude of the change and to isolate specific variables that lead to consistent or inconsistent risk-assessment outcomes. The results from this study will help answer these questions.

The overarching purposes of this study were to (a) identify the macroeconomic variables that influence individual risk tolerance, (b) clarify the relationship between biopsychosocial and environmental factors that influence risk tolerance, (c) and determine whether country of residence influences a person's risk tolerance. The final goal of the dissertation was to provide a substantial contribution to the risk-tolerance literature and offer insights into which, if any, macroeconomic and country or residence variables influence an individual's change in risk tolerance over time. Specifically, the study was guided by the following objectives:

1. *Identify the level of influence macroeconomic variables and market conditions have on an individual's risk tolerance.*
    a. *Identify the level of influence individual macroeconomic variables have on an individual's risk tolerance.*
2. *Further clarify the relationship biopsychosocial and environmental factors have on an individual's willingness to take risk.*
    a. *Further understand and clarify the relationship biopsychosocial and environmental factors have on an individual's willingness to take risk over time.*

3. *Examine the relationship between country specific social support and an individual's risk tolerance.*
    a. *Examine the relationship between country specific social support and the change in an individual's risk tolerance over time.*
4. *Identify the unique characteristics of individuals that exhibit significant fluctuations in risk tolerance over time.*

Results from this study are expected to clarify and expand the existing literature on how (and if) financial risk tolerance changes over time. Furthermore, results are expected to provide a better understanding of the role macroeconomic and household level variables play in shaping changes in risk tolerance. In addition to furthering the field's understanding of financial risk tolerance, policy makers, advisory firms, financial planners, and individuals can all benefit by utilizing the information provided in this dissertation to better understand consumer behavior and develop strategies for individual utility maximization. By fully incorporating valid risk assessments into one's financial planning, individuals should be able to increase their financial satisfaction and allocate their investments congruent with their willingness to take financial risk.

Introduction to Conceptual and Theoretical Framework

As globalization continues to increase, opportunities for cross-border financial planning and investing will become increasingly common for large financial planning firms and individual investors (Solnik & McLeavey, 2013). Understanding how populations of different countries may vary systematically in their willingness to take financial risk is crucial to the development of a complete and accurate risk profile (Goetz, 2006), which is defined as the comprehensive evaluation of an individual's complete financial risk-assessment (Carr, 2014). A multinational examination of financial risk tolerance can be used to provide insights into whether the

underlying cultural values clients live with on a day-to-day basis result in different attitudes and behaviors related to the individual's willingness to take financial risk. In addition, macroeconomic conditions vary locally, regionally, and internationally despite being influenced by global macroeconomic trends. Beyond global economic trends, governmental structures around the world develop, implement, and manage different policies that impact the environment in which individuals live, do business, and invest. The influences of social programs and social safety nets differ widely across international borders (The World Bank, 2015). These influences on an individual's financial risk tolerance have yet to be fully examined.

Rather than relying on one conceptual framework, this dissertation was based on a model that includes aspects from a number of existing models, including Expected Utility Theory, Irwin's (1993) Model of Risk Taking, and the Cushion Hypothesis. Each of these models is described below. This discussion is followed by the presentation of the framework used to guide the methodology used in this study.

Expected Utility Theory

The most common normative approach to understanding an individual's willingness to take risk is approached using the classic perspective of Expected Utility Theory (EUT). According to EUT, individual households will make decisions to maximize their own expected utility. Yao, Hanna, and Lindamood (2004) used EUT as a theoretical basis to examine changes in risk tolerance over time, while Hanna and Chen (1997) used EUT to illustrate distinctions between subjective and objective risk tolerance. Relative risk aversion has also been included as a tool to estimate parameters of the utility function (Schoemaker, 1982) that influence optimal portfolios. Studies that apply expected utility generally draw conclusions about risk attitudes by constructing utility curves to complement them (Carr, 2014). One drawback associated with the

use of EUT is that the theory describes how people should act in a given situation but not necessarily how they actually behave (Hanna & Chen, 1997). An additional criticism of the EUT approach is that nearly all models that rely on EUT use estimates of risk aversion, based on income or asset gambles that are not well connected to actual choices faced by investors on a daily basis.

Irwin's (1993) Model

As noted previously, and as shown in Figure 1.1, there are many different factors that affect and shape personal attitudes. Factors that influence financial risk tolerance can be conceptualized into three different categories: (1) biopsychosocial, (2) environmental factors, and (3) precipitating factors. Genetics and personality are typically understood to be predisposing biopsychosocial factors. In 2006, Goetz suggested that environmental factors associated with a client's financial risk tolerance may refer to everything in the current and immediate environment including someone's family, financial markets, and current economic conditions. Finally, precipitating factors can include an individual's level of education, cognition, financial satisfaction, and previous investment experience (Grable & Joo, 2004; Irwin, 1993).

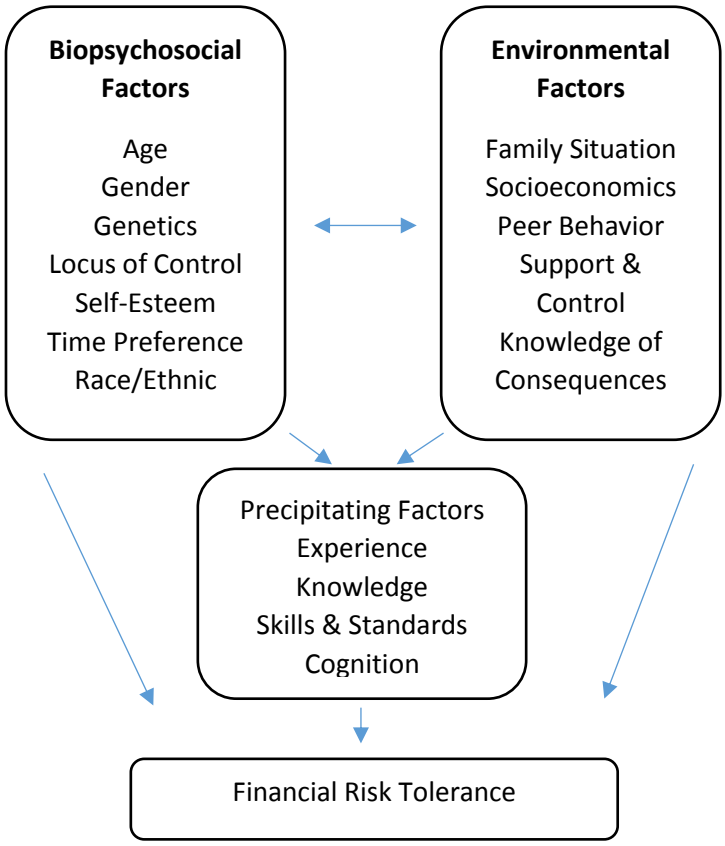

Figure 1.1 Factors Associated with Financial Risk Tolerance. Adapated and Modified from Irwin (1993)

The Cushion Hypothesis

The Cushion Hypothesis is a theoretical framework that explains differences in risk-seeking behavior by individuals living in different environmental circumstances or counties with differing levels of social support (Hsee & Weber, 1999). In socially collectivist cultures like China, family or community members are more likely to help each other if an individual suffers a catastrophic loss after investing in a risky asset or venture. By comparison, in individualist cultures, like the United States, a person making a risky decision is typically expected to bear the consequences (positive or negative) of their decision (Traindis, 1989). The Cushion Hypothesis

suggests that collectivism thus acts as a cushion against possible losses, and that there is inherent social diversification related to the selection of risky options. Similar to the way insurance functions, social diversification or downside risk, objectively reduces the risk for decision makers in collectivist cultures. Similarly, in countries where more communal preferences dominate, social predilections often reflect themselves in policy that strives to provide a public safety net for all members of society. The level of a country's social safety net should therefore, theoretically, translate into an effective cushion for individual's making risky decisions (Rieger et al., 2014). Cultural backgrounds and country of origin have been linked as determinants of risk perception by comparing the perception of the riskiness of financial gambles (Bontempo, Bottom, & Weber, 1997), suggesting this may hold true for the assessment of cross-cultural risk tolerance.

Research Framework

If risk tolerance is an essential element in the development of an accurate and acceptable comprehensive financial plan, understanding its malleability over time is an important aspect to consider in the financial planning process. Roszkowski and Davey (2010) delved deeply into how major events, like the Great Recession, can impact an individual's measured risk tolerance. They noted that some view risk tolerance as a completely stable characteristic, while others view it as something variable that changes depending on the mood or environment of the assessment taker. However, they concluded, based on a review of the literature and their own experience, that risk tolerance is relatively stable over time but somewhat susceptible to situational influences and life circumstances. The implications of this insight are important for financial planners to contemplate, especially considering the unique nature of the field in which multi-decade relationships are common.

The difficultly of doing research about changes in an individual's risk tolerance over time stems from the need for required testing and retesting of the same individuals over different intervals of time. Conceptually, the value in multiple assessments of risk tolerencce with the same individuals shows depth of the assessment and provides insight into "traitedness" across time, international differentiators, and evaluation across a variety of macroeconomic conditions. Understanding how risk changes over time has been explored, but gaps in the literature exist concerning the relationship between international markets, variable global economies, and individuals living in countries with differing levels of social support.

To fully understand the impact different variable relationships have on an individual's willingness to take risk, a model was developed specifically for this study. This model uniquely includes propositions about how macroeconomic variables, demographic factors, and social support (as measured by country of origin) influence an individual's willingness to take risk. The model is shown in Figure 1.2. In expected utility theory, an individual would make decisions that would maximize their own expected utility. By combining economic conditions, social support, and external factors, an individual may be able to create a framework that would best maximize the risk they would be willing to take for a given set of rewards.

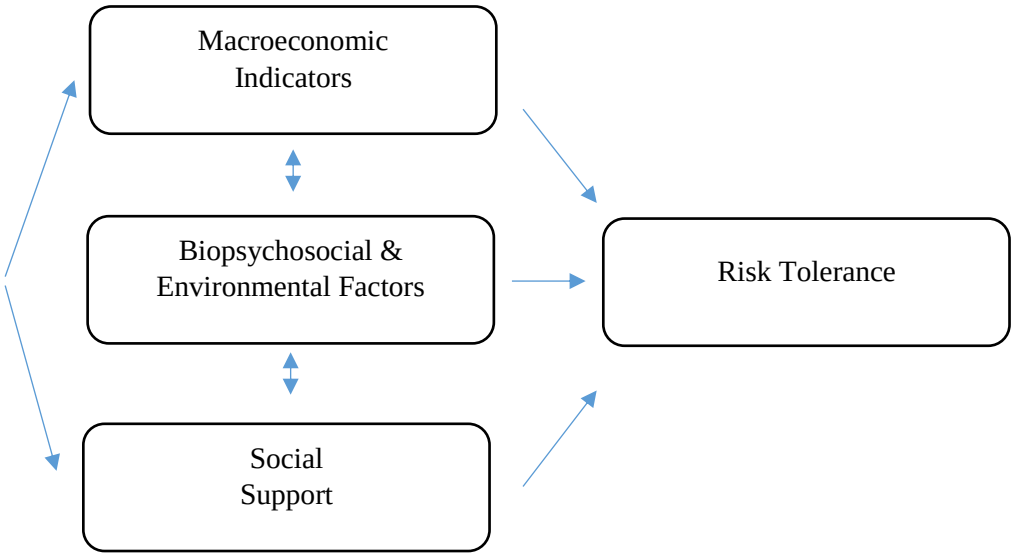

Figure 1.2 A Model Showing the Factors Associated with Financial Risk Tolerance

As shown in Figure 1.2, three variable categories are thought to be directly associated with shaping someone's financial risk tolerance: macroeconomic indicators, biopsychosocial indicators, and social support. These relationships are denoted with the single headed arrows running from the boxes on the left side of the model to the outcome variable box called risk tolerance. The model was also built on the assumption that each of the variable categories are related. These relationships are represented by the dual headed arrows. Essentially, each of the variable categories represents elements from the three foundational frameworks presented above: EUT, Irwin's (1993) model, and the Cushion Hypothesis. Figure 1.3 shows the same research framework with a different outcome variable: change in risk tolerance. Together, these two models were used to guide the methodical elements of this study.

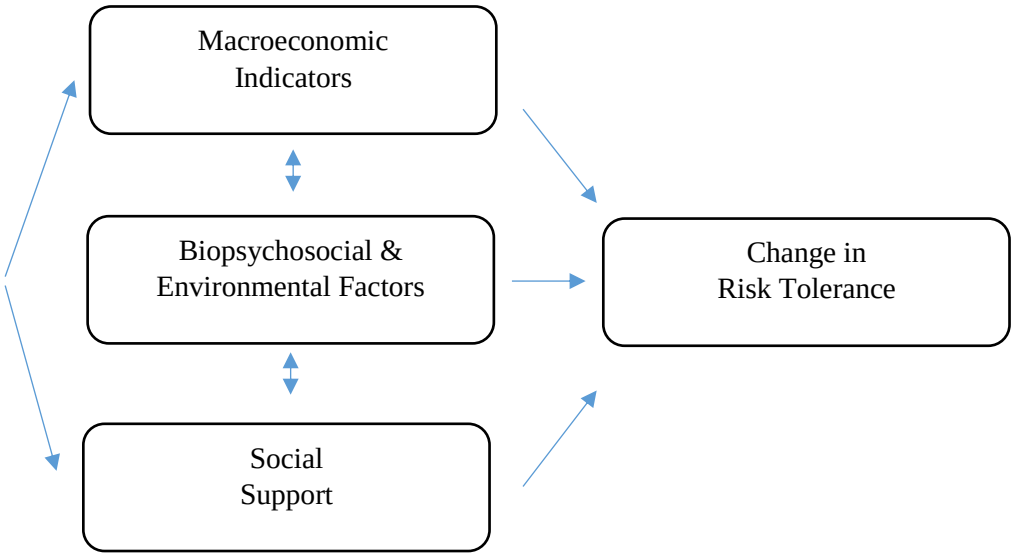

Figure 1.3 The Financial Risk-Tolerance Model Based on Changes in Risk Tolerance

Definition of Terms

The following terms are used throughout this dissertation. Given the nuances of risk terms used in the field, the following definitions were used to provide clarity in this study. The definitions were based on the nomenclature of Carr (2014), Dalton and Dalton (2014), and Nobre and Grable (2015).

Risk Tolerance: An individual's willingness to accept a degree of uncertainty when making a risky decision. Financial risk tolerance extends this definition to situations when a financial decision is made.

Risk Aversion: An individual's natural preference to avoid a risky decision when given choices. Risk aversion can also be defined as an individual's lack of willingness to take risk or simply the inverse of risk tolerance.

Risk Capacity: A client's financial ability to withstand a potential loss resulting from risky behavior.

Risk Composure: A person's propensity to behave in a consistent manner when making decisions involving risk.

Risk Knowledge: An individual's understanding, or aptitude, of risk.

Risk Need: The level of risk a client needs to take to reach their financial goal.

Risk Preference: A client's general feeling that one situation or choice is better than another, regardless of whether this feeling is objectively true or false.

Risk Perception: The subjective appraisal of the riskiness of a contemplated action.

Risk Profile: The comprehensive evaluation of an individual's complete financial risk-assessment.

Risk Tolerance Score (RTS): Composite risk tolerance score developed by FinaMetrica in 2005 using a 25-item questionnaire.

Study Delimitations

There are a few delimitations applicable to this study. Although the sample size, as discussed in Chapter Three, was robust (N = 9,692), the sample frame was delimited to include primarily individuals who were engaged in the financial planning process. As such, the sample does not represent a full cross section of the general population. The sample used contained

individuals seeking or working with financial professionals. While the results may not be generalizable to the entire population, the results can, nonetheless, help financial planners working with clients or individuals who are actively seeking information about risk tolerance and market conditions. The sample was also delimited to respondents who were generally better educated and had higher than an average net worth. These two factors are known to influence the baseline measurement of risk tolerance for individuals.

Additionally, the country of origin variable used to measure social support only measured respondents based on the location where they took the assessment. While this provides a good indicator of the effects of in country social support, the choice to use this proxy variable means that other external factors associated with birthplace, socialization, or social collectivism may not be fully represented.

Measuring the economic health, or perceptions of economic health, for an entire economy or country can be notoriously difficult. Hundreds of individual variables combine to influence the total effect on any market driven economy. Given the purposes of this study, the number of macroeconomic variables used in the models was delimited to include only a selection of variables generally known to be indicators of economic change. This variable selection was done intentionally to provide data that was globally assessable as a means to extend the models to other counties around the world.

Chapter Summary

This chapter outlined the basic concepts that were examined in this dissertation. In addition, defining a need for new research in the area of financial risk tolerance was outlined and the purpose and justification for study was examined. A new model was introduced to test the combined effects of macroeconomic indicators, biopsychosocial and environmental factors, and

social support on risk tolerance. As noted in this chapter, The Financial Planning Association (2001), Goetz (2006), and Weber and Hsee (1999) have all suggested the need for greater research into cross cultural differences in risk tolerance and precipitating factors that influence change. This chapter introduces the background factors that were used to shape the study. Specifically, the discussion highlighted how this dissertation examines cross cultural differences of risk tolerance by country by evaluating changes in financial risk tolerance over time. The next chapter will provide a comprehensive review of seminal and current research in the area of risk-tolerance assessment. Next, Chapter Three will provide a thorough look at the methodology that was used to explore the research questions. Attention to variable operationalization is presented in Chapter Three. The results of the analyses are presented in Chapter Four. The dissertation concludes with a description and discussion of the findings with an emphasis on financial planning implications.

CHAPTER II

REVIEW OF LITERATURE

According to Markowitz (1968), the fundamental principle that influences the return on efficient frontier investments is the volatility or risk associated with the asset. Financial planners generally understand there is a relationship between expected return and the riskiness of any investment. Due to the nature of financial planning, accurately assessing risk tolerance is one of the most practical, informational tools that can be used to help allocate assets for an optimal portfolio. Understanding choices involving risk is an important part of the decision making process. A comprehensive approach to assessing and evaluating risk tolerance gives researchers and practitioners insight into the needs and understanding of their stakeholders and clientele, respectively. Many studies have been completed using measures of risk tolerance of individuals based on a large variety of factors (e.g., Grable & Lytton, 2001; Palsson, 1996; Roszkowski, Delaney, & Cordell, 2004). Historical studies have developed a strong foundation for the basic characteristics that influence risk tolerance, but expansion and clarification are still needed to fully understand what influences an individual's willingness to take financial risk.

This literature review is outlined based on three general topics. The first concept explored is the historical study of risk, risk tolerance, and risk assessment. Next, conceptual and theoretical frameworks are discussed. This builds a basis for understanding the relationships between and among risk tolerance and macroeconomic, biopsychosocial and environmental, and

cultural variables. Finally, the discussion turns to examining the specific variables utilized in this study and key relationships garnered from previous studies.

For the purpose of this study, risk tolerance was defined as an individual's willingness to accept a degree of uncertainty when making a risky decision or simply, as an individual's willingness to take risk. Individuals must constantly make choices where risk is involved. Nearly all daily decisions involve a variety of outcomes that are uncertain and unpredictable. Financial decisions often involve anticipating future events, and estimating uncertainty is part of the analytical process.

Daniel Bernoulli's seminal work in 1738 described a simple coin flip betting game where individuals wager money based on an expected outcome (Bernoulli, 1954). Later dubbed the St. Petersburg Paradox, the game itself led to the fitful conclusion that individuals are not only wealth maximizers but they also consider the probability and magnitudes of different acceptable outcomes when approaching financial decisions (Finke & Guillemette, 2016). Extending the conceptualization further, individuals place differing values on risky bets and generally exhibit risk aversion. Since individuals are generally risk averse (Holt & Laury, 2002), given a choice of outcomes, asset pricing is heavily influenced by volatility or riskiness over time. The Capital Asset Pricing Model, built using Modern Portfolio Theory principles, explains that the aggregated risk tolerance of all investors will determine the premium placed on volatile investments, in the context of a risk-free rate of return (Merton, 1973). For individual portfolio allocation, understating the relationship between an individuals' risk tolerance, the risk premiums of different assets classes, and the overall expected volatility of different investment opportunities allows individuals and financial planners to optimally select investments to maximize overall return versus risk free asset pricing.

Risk aversion, defined as an individual's natural preference to avoid a risky decision (Carr, 2014), is an important aspect of the risk-tolerance literature. In 1964, Pratt presented ideas about risk aversion. He explained the idea of risk aversion as the amount of money one would be willing to exchange to minimize or eliminate a risk. In the context of insurance, the amount someone is willing to pay to offset a particular risk is measured as a premium. By mathematically defining risk aversion, Pratt was able to compare and contrast individuals to determine a construct of fundamental individual risk aversion. Measuring risk aversion is simply another way to understand the dynamics of choices involving risky decisions. Quattlebaum (1988) even suggested that measuring risk and risk tolerance is really about measuring an individual's willingness to lose money. Financial risk can potentially be measured simply as the amount that someone is actually prepared to lose instead of what may be gained (Quattlebaum). Research has commonly suggested that risk aversion also changes significantly—generally falling—with age but often stops at some point (Riley & Chow, 1992). Therefore, understanding risk aversion, risk tolerance, and the way these personal characteristics change over time is an important aspect to understanding what drives individual financial behavior.

Prospect Theory

Prospect Theory is a behavioral economics framework that can be used to evaluate the way people choose between probabilistic alternatives that involve risk. In contrast to rational expected theory (Muth, 1961), individuals often make decisions based on both the expected outcome and the risk associated with losses or gains. In particular, individuals tend to underweight outcomes that are merely probable in comparison with outcomes that are obtained with certainty (Kahneman & Tversky, 1979).

The basic concept underlying Prospect Theory is that, given a set of alternative choices, individuals will make a decision based on the expected utility and the risk associated with each outcome. Classical economic theory only takes into account overall utility and assumes that individuals will make rational decisions that will provide the greatest amount of utility in any circumstance (Smith & Garnier, 1838). Through a series of tests in the late seventies, Kahneman and Tversky (1979) determined that individuals show a revealed preference for surety over slightly greater mathematical returns with risk. Using a series of probabilistic alternatives, individuals were given choices with outcomes and associated risk probabilities. By observing their actual choices, the researchers determined that people underweight outcomes that are merely probable in comparison with outcomes that are obtained with certainty. In addition, preferences between negative and positive prospects of preferences showed an opposite pattern. They labeled this phenomenon the reflection effect. A unique counter example of expected utility theory is when probabilities are very small, individuals will choose the probability with the highest potential positive outcome (e.g., lotteries). One assumption imbedded within Prospect Theory is gain-loss separatability; but nearly all of the research assumes little and is thus based on observed actual behavior.

Prospect Theory was built upon the basis of utility maximization and expected utility theory (Von Neuman & Morgenstern, 1947). While expected utility theory is extremely consistent, Prospect Theory suggests that individuals will behave differently in different types of situations based on the evaluation of risk and gain-loss separatability. Prospect Theory delves deeper into psychology and has practicality in financial marketing with the introduction of concepts such as framing and sequential decision formulations. While not specifically incorporated into this study, the concepts imbedded in Prospect Theory inform the work of this

dissertation by showing that people are not universally risk seeking or avoiding. As suggested in Prospect Theory, someone's tolerance for financial risk may, in fact, be more malleable than previously thought.

Measuring Risk Tolerance

As Roszkowski, Snelbecker, and Leimberg noted in 1993, there were, and continue to be, few generally recognized instruments to collect and evaluate an individual's financial risk tolerance. In addition, almost all financial risk-tolerance assessment tools were created by financial advisory firms and built on observations of local clients. At the time of their publication, Roszkowski and his associates stated that there was not a true standard for measuring individual's financial risk tolerance. The situation has improved quite a bit since the early 1990s, although no single measure is considered to be the gold standard of evaluation.

Historically, choice dilemmas have been one of the most popular methods for assessing risk tolerance. Choice dilemmas were universally used until the mid-1970s. Choice dilemmas typically provide a set of scenarios where respondents are asked to choose the scenario that best represents the way they expect to act in a given situation. While useful in a limited context, risk tolerance is now considered multi-dimensional, which makes older choice dilemma methodologies less generalizable today. Many of the early works on risk assessment were one dimensional and failed to give an idea of general risk-taking propensities (Grable & Lytton, 1999).

Another popular method for assessing risk tolerance by financial professional involves simply using basic heuristics. By looking at a client's age, life stage, or asset holding, a financial professional can sometimes quickly estimate an individual's risk tolerance (Roszkowski,

Leimberg, & McFadden, 1993). For example, if an individual held a portfolio entirely constructed of US Treasuries, some financial planners may infer that the client has an extremely low risk tolerance. It is also often assumed that an individual approaching retirement, or possibly drawing on their portfolio to sustain their lifestyle, will need to be in a less volatile portfolio regardless of their risk tolerance. The problem, of course, is that heuristics work only on the average. Heuristic judgements can be misleading because they tend to be based on broad stereotypes. Additionally, although potentially useful, heuristics do not necessarily translate into future investor behavior. Much of the existing literature is dismissive of risk-tolerance heuristics (Grable & Lytton, 1999).

Constant Relative Risk Aversion (CRRA) has been a foundational tool used by financial planning researchers for a number of decades. The use of CRRA seems to ebb and flow in popularity. As an additional way to conceptually measure risk tolerance, CRRA has many useful applications but the strong set of assumptions underlying the model makes it less nimble than many other competing theoretical frameworks. Typically, CRRA is administered as a set of questions about income gambles. A typical set of questions in a CRRA include the following:

- Would you prefer an income of $50,000 or a 50% change to increase your income to $100,000 and a 50% chance to decrease your income to $0.
- Would you prefer an income of $50,000 or a 50% change to increase your income to $100,000 and a 50% chance to decrease your income to $25,000.
- Would you prefer an income of $50,000 or a 50% change to increase your income to $100,000 and a 50% chance to decrease your income to $35,000.
- Would you prefer an income of $50,000 or a 50% change to increase your income to $100,000 and a 50% chance to decrease your income to $45,000.

Barsky, Kimball, Juster, and Shapiro (1995) are generally credited with developing a scale that measures CRRA and produces a risk-aversion output on an approximate scale of 0 to 15. Their 1995 working paper compiled a detailed list of potential outcomes from a set of questions to mathematically calculate a CRRA score. Based on their methodology, CRRA can be calculated using the amount of change needed in income relative to the risk/reward payoff. Although there has been movement for modernization, the original scale still serves as a foundational estimate of risk aversion. For individuals exhibiting extremely high levels of risk tolerance, their measurement would actually show on the scale as quite low where increases in the scale represent the relative amount of required payoff it would take to make an income gamble. One of the strongest assumptions within CRRA is that it is possible to measure risk aversion based on a simple set of questions predicated on income gambles. In addition, CRRA choices are almost always based on a 50/50 gamble where in real life many probabilities have a diverse likelihood of success or failure. In addition, many variables are explicitly left out of traditional CRRA analyses. Net worth, family stability, age, and current income are most often excluded from analyses. If not addressed, other confounding factors can create inaccuracy in the estimated risk-aversion score. The reason CRRA is used at all is that the procedure is simple to administer and widely used in large national databases. For some researchers, CRRA provides a way to account for risk attitudes without actually needing to measure someone's willingness to take risk. In practice, however, few financial planners use CRRA methods. For those wanting a more precise estimate of someone's willingness to engage in a risky financial behavior, psychometricians recommend that financial planners and researchers use more robust multi-dimensional risk-tolerance assessment tools (Roszkowski, Davey, & Grable, 2005).

The US Federal Reserve began measuring the financial characteristics of domestic households utilizing two unique surveys beginning in 1962 with the Survey of Financial Characteristic of Consumers followed by the 1963 Survey of Changes in Family Finances. The Federal Reserve recorded responses of individual households and their financial decisions (Federal Reserve, 2016). In 1983, the Survey of Consumer Finance (SCF) was launched as a triennial cross-sectional survey of US families to ascertain balance sheet holdings, pensions, incomes, and demographic characteristics. The SCF contains a basic question about the general risk tolerance of each individual survey participant. Up until recently, the SCF risk tolerance question was:

> Which of the statements on this page comes closest to the amount of financial risk that you and your (spouse/partner) are willing to take when you save or make investments?
>
> 1. Take substantial financial risks expecting to earn substantial returns.
> 2. Take above average financial risks expecting to earn above average returns.
> 3. Take average financial risks expecting to earn average returns.
> 4. Not willing to take any financial risks.

While the question itself is quite limited and has been critiqued over the years (Grable & Lytton, 2001), the inherent value of the question is its simplicity and the long track record of responses. The large sample of cross-sectional respondents adds to the value of the item. Many different authors have produced scholarly articles based on the item (e.g., Ding & DeVaney 2000; Haliassos & Bertaut, 1995; Huston & Chang, 1997; Yao, Hanna, & Lindamood, 2004).

From the early 1980s through the 1990s most financial planners relied on their subjective judgements or on self-developed financial risk-tolerance measures to evaluate the willingness of their clients to take on financial risk. Inconsistent results and general lack of predictive validity led some researchers to conclude that practitioner developed approaches could be improved. In 1999, Grable and Lytton released their innovative paper on the development of a multi-dimensional financial risk tolerance assessment instrument. Based on the process published by Babbie in the 1980s, over 100 assessment items were selected by Grable and Lytton for the initial review. By eliminating items that appeared to measure anything other than financial risk tolerance, the list was culled down to 50 items. After a pilot study, the number of questions was eventually reduced to 20 items by examining the relationships between the items and the final composite score. The final phase of instrument development included administration to approximately 1,000 university faculty and staff participants. Finally, aspects of classical test theory were used to further reduce the list of useable items to 13 questions. The final items measured financial risk tolerance based on three constructs: investment risk, risk comfort and experience, and speculative risk. Since its introduction, the Grable and Lytton assessment has been used by individuals, financial planners, and researchers as a base for understanding individual financial risk tolerance. Fifteen years after its original publication Kuzniak et al. (2015) preformed a retrospective study to assess the reliability and validity of the instrument based on 160,000 responses. They concluded that the assessment was indeed both valid and reliable. One problem associated with the measure, in the context of this dissertation, is that data collected by Kuzniak et al. was cross sectional and based almost entirely on US respondents.

At approximately the same time that Grable and Lytton (1999) were working on their academic open-access risk-tolerance instrument a commercial firm was unveiling a robust

financial risk-tolerance tool. FinaMetrica, formally ProQuest, developed a 25-Question risk tolerance assessment that is now used by financial planning firms worldwide. With almost one million completed assessments, multiple translations, and service to over 20 countries, FinaMetrica has become one of the leading collectors of risk tolerance information. Academically tested to be both valid and reliable (Gilliam, Chatterjee, & Zhu, 2010), the FinaMetrica risk-tolerance assessment is one of the most influential risk-tolerance measurements available to consumers and financial planners seeking an actionable risk-tolerance score. Historically, for example, the reported Cronbach's alpha, across countries, has averaged .90 or higher. From a research perspective, data from FinaMetrica are intriguing because the firm is often able to track risk scores by individual respondent over time rather than cross sectionally.[1]

Assessment

Understanding reliability is imperative to understanding how accurate an assessment works in practice. Reliability refers to the extent to which a measurement tool is consistent over time. Consider an average bathroom scale as an example. If someone weighs 130 pounds, it is important that a scale measure that person at 130 pounds when weighed. One should be able to weigh today, tomorrow, or next year and still obtain an accurate measurement of body weight, assuming that the person has neither gained nor lost weight. Similarly, a risk-tolerance scale should measure accurately today, tomorrow, and in future years. Reliability is typically measured in three ways: Test-Retest, Split Grouping, and Inter-Assessment Consistency. Test-retest simply refers to having an individual take an assessment and then taking the assessment again at another

[1] It is important to note that over the past decade several commercial firms have entered the risk-tolerance assessment marketplace. Products include instruments based on traditional psychometric principles, tools using CRRA techniques, and products relying on choice dilemmas. While each firm and instrument is potentially valid, few firms have the broad evaluation expertise of FinaMetrica or the willingness to share data with independent researcher teams.

date. The results should be consistent across the two time periods. Split grouping allows a researcher to split a sample into two and measure the assessment across two groups. By matching a collection of variables in the two groups, the researcher should be able to determine if the test itself is measuring the desired independent variable. Finally, inter-assessment consistency often looks at similar or redundant questions in an assessment to make sure people are consistent even in the context of a single test. If a researcher asks someone how much a hamburger costs at the beginning of an assessment, they should have a similar response at the end.

Once a scale or assessment tool has been developed, measuring its accuracy over time is a necessary step to ensure the tool is meeting its objective. Since a primary goal of assessment is often consistency over time, the seminal work and theoretical framework developed by Cronbach in 1951 is often used to estimate scale stability. Cronbach explained the context behind a coefficient alpha and the internal structure of tests. Now dubbed Cronbach's alpha, reliability refers to the inter-item homogeneity of scale items. Alpha is often used to determine the internal consistency of a scale. Typically, alpha scores range from 0.00 to 1.00. Generally a score of .70 is deemed to be acceptable when evaluating attitudes (Nunnally, Bernstein, & Berge, 1967). The fundamental idea underlying Cronbach's alpha is that if a scale is reliable, it should measure consistently across time and subjects. It is important to note that alpha is a tool associated with classical test theory or what is known as traditional psychometric modeling. Instruments based on CRRA or other forms of scale development (e.g., Rasch models and item response theory) do not lend themselves easily to alpha estimates.

In practice, nearly all financial risk-tolerance measures used by financial planners have been developed using classical test theory. This means that Cronbach's alpha can be used to estimate reliability across instruments. By taking the differences in responses across consistent

measures, then applying Cronbach's formula to a scalier, researchers produce a commonly understood mechanism for determining how likely a measurement tool is to deliver consistent outcomes over time.

In addition to being reliable, a scale must also be valid. As explained by Roszkowski and Grable (2005), for an assessment to be valid, it must capture the full extent of the construct. A valid instrument, therefore, needs to consist of a variety of question types, such as: preferences between guaranteed versus probable gambles, minimal required probability of success, minimal returns required to undertake a risky venture, investment preferences, reactions to sample portfolios, life style preferences, probability and payoff preferences, etc. Different types of questions are needed to fully assess an individual's risk tolerance.

Validity, for the purpose of this study, can be split into two different elements: Concept Validity and Content Validity. The goal of validity involves measuring what actually needs to be measured. It does not matter how reliable a scale is if it is invalid. If one desires to know how fast their car will go, the weight of the car alone will not be helpful. Other questions must be asked to fully estimate exactly how fast a vehicle should travel. For a valid assessment, it is necessary to answer the following questions: Are the items in the instrument accurate and clear? and do respondents understand what is being asked? Once answers to these questions have been obtained, the test can be further studied. Once a test has been determined to be valid and reliable, the results can be interpreted and generalized to broader populations. Given the outstanding reliability and validity of the FinaMetrica risk-tolerance tool, and the fact that intraperson estimates exist, this measure was adopted in this study.

Frameworks Used to Understand Risk Attitudes

In 2004, Grable and Joo reported, in concordance with Hanna and Gutter (1998), that "There is currently a paucity of specific theory related to the assessment and prediction of financial risk tolerance" (p. 73). In economics and game theory, the Expected Utility Hypothesis (EUH) is a set of premises related to an individual's preference regarding choices with uncertain outcomes (Machina, 1990). Machina (1990) described it well when he suggested that behavior in the context of risk is essentially the way individuals possesses a von Neumann-Morgensten (1953) utility function defined over a set of outcomes (or risky propositions) by choosing the prospect that is anticipated to maximize expected value. The EUH can be applied to theoretical research situations, such as optimal trade, economics of uncertainty, investments, and search functions under ambiguity. A choice or investment can be construed as a decision about the relationship between the potential for loss and the possibility for gain. Integrating financial risk tolerance into the decision-making process allows one to gauge the level of expected utility given situations of either loss or gain.

One disadvantage associated with EUH models is that they often fail to account for other factors that are conceptually related to a person's willingness to take risk. While it is true that objective choice evaluations are an integral part of decision processes leading to the engagement in risky behavior, psychologists and those working in the emerging field of behavioral financial planning typically argue that subjective characteristics and environmental factors also play an important role in shaping decisions. Although not specifically a *financial* risk-tolerance framework, Iwrin's (1993) work presented a model of risk-taking attitudes and behaviors that has been used widely in a variety of behavioral studies. Irwin surmised that many different predisposing factors affect an individual's risk-tolerance attitude. Biopsychosocial and

environmental were the two concepts Irwin used as classifying factors that influence risk-tolerance attitudes. Biopsychosocial factors include specifics such as age or gender while environmental factors include income, net worth, education, and marital status, among other factors. Taken together, the combination of these factors and traits are expected to have a meaningful influence on an individual's risk-tolerance attitude.

Imbedded within Irwin's (1993) model are factors related to cultural experiences and socialization. The Cushion Hypothesis argues that these factors differ widely across countries and that it is important to account for national characteristics that can shape risk attitudes. It is this way that Irwin's risk-taking model blends with the Cushion Hypothesis. Specifically, personal circumstances are reliant on one's social and psychological environment. Social learning theory, or social cognitive theory, suggests peer pressure, exposure to media, social norms, and trusted advisors all may greatly influence the way individuals make financial decisions or their willingness to take risk. Sociocultural theory can also be used to explain the way members of a society are influenced by their developmental environment. These theories stress how the relationships and interactions people have with and within the culture where they live influence life choices (Vygotsky, 1980). While rooted in psychology, the relationship between environment, culture, and relationships all point to associations with the way consumers utilize money and make financial decisions involving risk.

As noted above, the Cushion Hypothesis is a theoretical framework that describes differences in risk seeking activities by individual's living in diverse environmental situations or countries with divergent levels of social support (Hsee & Weber, 1998). While often associated with cultural collectivism, the Cushion Hypothesis can be extended to reflect the social predilections reflected by policy that provide a public safety net for societal members. It could

therefore be theorized that a country's social safety net should translate into an effective cushion for individuals making risky decisions (Rieger et al., 2014). By comparing the perception of the riskiness in financial gambles, national background and country of origin have been linked to risk perceptions (Bontempo et al., 1997). Bontempo and associates (1997) indicated there may be a relationship between country of origin and the assessment of cross-cultural risk tolerance. Although risk tolerance currently does not have a generally agreed upon conceptual framework, by combing aspects of multiple frameworks, a cohesive set of relationships regarding the factors that influence and predict risk tolerance can be examined. The operationalization of such a model, from Chapter One, will be described in the next chapter.

Variables that are Thought to be Associated with Financial Risk Tolerance

"Despite its importance in the financial services industry, there remain some unresolved questions with respect to the "determinants of risk tolerance" (Hallahan, Faff, & McKenzie, 2004 p. 58). By determinants, Hallahan et al. meant the identification of factors (i.e., variables) that reveal a systematic association with risk tolerance. Over the years, many different factors have been proposed and tested but the results have been inconsistent. For example, gender is often thought to be a demographic characteristic that influences risk tolerance. Numerous studies have shown that females tend to be less risk tolerant than males (Bajtelsmit & Bernask, 1996; Gibson, Michayluk, & Venter, 2013; Powell & Ansic, 1997); however, other studies have also shown that gender is either not significant in predicting financial risk tolerance or being female is associated with risk-taking attitudes (Grable & Joo, 1999; Hanna et al., 1998).

Age, income, education, and wealth have all been shown to have a significant influence on an individual's risk tolerance (Bajtelsmit, Bernasek & Jianakoplos, 1999; Grable & Lytton, 1999; Palsson, 1996), but the explanatory power and magnitude of their effects have been

disputed (Gollier & Zachauser, 2002; Hairharan, Chapman, & Domain, 2000). These variables will be discussed in greater detail later in this chapter.

Trends in the broader economy often influence financial markets. Theoretically, these variables ought to also have the potential to influence individual investor attitudes; however, the relationship between the macro economy and an individual's willingness to take risk have only been studied over the last few years (see West & Worthington, 2014). At this time, it is difficult to discern a generally accepted relationship hypothesis. As additional studies continue to be conducted, the overall body of literature will continue to fill in gaps to present a clear picture of the exact variables that have an association with someone's risk tolerance. Cross-cultural risk tolerance, and datasets to support its study, are becoming more available as small and large firms across the world work with clients of multicultural backgrounds. The relationship between an individual's country of origin and social support within the country offer a new frontier of risk-tolerance research (Goetz, 2006; Rieger et al., 2014; Tan, 2011). Even so, it is reasonable to expect the following macroeconomic variables to be positively associated with financial risk tolerance: low unemployment, high GDP growth, and positive stock market appreciation. The following discussion provides greater context for these associations.

Macroeconomic Variables

Macroeconomics is a specific subfield of economics that observes the performance, behavior, collective decision making, and the structure of any whole economy (Blaug, 1997). By contrast, microeconomics typically looks at the behavior of individuals and firms in a specific economy (Blaug, 1997). Macroeconomics is often used to study broad trends in regional, national, and global economies or economic trends. Many individuals who were economically active or invested in markets during the Great Recession intuitively know that the overall

economy likely has some effect on how individuals make decisions. The extent to which economic forces impact individuals and investment markets has been studied by Chen, Roll, and Ross (1986). The results of the research suggested that from the perspective of Efficient Market Theory, asset prices are influenced, to some degree, by macroeconomic factors. In addition, Chen et al. concluded that stock returns are exposed to systematic economic news and assets are priced in relationship to this exposure. Their examination documented an important link in the relationship between the macro economy and the way individuals make investing decisions involving risk.

Borensztein and Reinhart (1994) took a unique approach to measuring the macroeconomic determinants of commodity prices. In their research they focused on determining real commodity prices beyond that of looking exclusively at demand factors. Their research examined international developments across Eastern Europe and the Soviet Union to help understand the connection between the macro economy and commodity prices. Their results however, were unable to explain the marked and sustained historical commodity price trends throughout the 1980s and 1990s. Popular press articles often discuss the relationships between well-known commodities, such as oil and gold, and the relationship they have with markets or overall economic conditions (Wall Street Journal, 2015). While it is possible to see commodity prices as drivers of the economy, nearly all market pundits address commodity issues by looking at the effect market conditions have on investable commodity markets (Motley Fool, 2016). In addition to commodity investment markets, countries around the world have varying levels of structural macroeconomic exposure to commodity prices. For several Middle Eastern economies, commodity prices (including oil) make up disproportionally large components of total revenue and output (World Bank, 2015). Understanding the relationship commodity prices have on

domestic and international markets may give additional clues to help understand the way individual investors make decisions. The exact relationship that global commodities' prices have on individual investors making decisions involving risk is an area of study that requires additional research and clarification.

West and Worthington (2014) examined the relationship between macroeconomic conditions and financial risk attitudes. Based in Australia, the study relied on surveys of approximately 6,800 households. The findings noted, consistent with past literature, that demographic characteristics—especially age—had a strong relationship with changes in risk tolerance over time. They also noted that macroeconomic conditions were jointly significant in determining risk attitudes. Several of the variables studied produced a significant influence on the risk attitudes of individuals.

Unemployment rates and domestic stock market returns were discussed by Yao, Hanna, and Lindamood (2004). In their work, Yao et al. looked at changes in financial risk tolerance over the period between 1983-2001. Based on the Survey of Consumer Finances,[2] all three levels of risk tolerance exhibited significant increases from 1995 to 1998 during a period of strong stock growth and large drops in unemployment. Yao and her associates also noted that poor global economic conditions in Asia and Russia had seemingly little effect on domestic risk tolerance.

Market conditions have been hypothesized to influence risk tolerence (Rabbani et al. 2015); however, there is a paucity of research beyond a handful of papers that deal with this topic, and as such, the relationship is still to be determined. Santacruz (2009) briefly looked at

[2] The Survey of Consumer Finance is often used due to its consistency, generalizability, and the fact that it is one of the few nationally representative surveys that includes information on household finances and risk tolerance.

general economic mood and its influence on risk-tolerance scores, but came to the conclusion that there is limited need to make major adjustments to current models. It was noted, however, that financial planners should recognize the herding behavior that can result in investor's perceptions of recent salient macroeconomic events. To address this apparent gap in the literature, the relationship between global macroeconomic variables and an individual's risk tolerance was examined in this study using macroeconomic variables, including unemployment rates, national production (GDP), commodity prices, and market pricing. One of the most difficult aspects of examining macroeconomic variables is the interdependent relationship between economic indicators. Therefore, one important step to evaluating the usefulness of economic variables in furture studies will be determining which variables are independently related to financial risk tolerance.

Biopsychosocial and Environmental Factors

Baker and Haslem (1974) noted the following: "The findings of this study suggest that some socioeconomic characteristics have a greater impact on investor common stock risk and return preferences than do others. When viewed in terms of the number of significant relationships found, the most important socioeconomic characteristic investigated was age, followed by sex, decision orientation, marital status, education, and income" (Baker & Haslem, 1974, p. 471). The implications of their findings were simply that demographics have a very strong influence on risk and perceived risk tolerance.

In 1997, Wang and Hanna studied the association between age and financial risk tolerance. Based on data from the Survey of Consumer Finances, the life-cycle investment theory was tested. The researchers measured risk tolerance as the amount of risky assets held as a percentage of total wealth. They concluded that risk tolerance increases with age, controlling for

other important variables. Dahlback (1991) also found that the propensity to take risks is influenced by saving decisions. Individuals who are willing to save more may have the ability to invest more aggressively in equity markets. This implies that older investors—typically those with more wealth—will be willing to take more risk. This assentation, however, is out of step with what financial planners typically assume. Many financial planners, and some individual investors, simply use heuristics or rules such "Age/100" bonds to stock holding to estimate the risk of a given portfolio allocation (Benartzi & Thaler, 2007). However, the effect may not always be related to biological age but instead age acting as a proxy for an investor's time horizon. By default, as someone ages they lose time to recoup potential losses. As such, there may be no real age effect. Age may simply be an indicator of someone's time horizon.

A 1996 study by Sung and Hanna investigated many factors that have a positive effect on a household's level of willingness to take a financial risk. Based on data from the 1992 Survey of Consumer Finances, they concluded that education, age, and net worth (including liquidity) are positively correlated with a household's willingness to take some level of risk. It was also shown that female headed households were less likely to be risk tolerant than similar male headed or married households.

Grable (2000) measured risk taking in everyday money matters and the relationships among demographic, socioeconomic, and attitude characteristics both in individuals and groups. His results showed that a higher risk tolerance was associated with being male, older, married, professionally employed with higher income, more education, more financial knowledge, and increased economic expectations. Defining risk tolerance as the maximum amount of uncertainty that someone is willing to accept when making financial decisions, Grable used discriminant analysis and univariate test statistics to measure the significance of the findings.

Morin and Suarez (1983) examined the empirical evidence of the effects of wealth on relative risk aversion. Their studies investigated a household's demand for risky investments using a dataset of asset holdings based in Canada. The results of their study suggest a diverging relative risk aversion when housing is excluded from the definition of wealth (or investments) or treated as a riskless asset. In addition, they noted that an investor's stage in the life cycle and age were uniformly increasing over time with tolerance for risk. Using regression analysis, they split their sample into three separate groups and examined the results to find differences between individuals with differing levels of wealth.

Bakshi and Chen (1994) tested how changes in demographic variables influence investments in capital markets. The life-cycle investment hypothesis suggests that at an early stage an investor will allocate more wealth in housing and then allocate a higher proportion of resources to financial assets at later life stages. Using the Euler Equation, Bakshi and Chen provided baseline estimates for determining how risk aversion and investor "consumption-portfolios" could be measured for individuals of all ages and across different cultural environments. They noted that when the population ages, aggregate demand for financial investments rise and demand for housing declines. The overall conclusion of their work was that demographic movements can bring about fluctuations in asset demand on capital markets.

Social Support and Country of Origin Variables

Cross-cultural risk tolerance has emerged over the last 20 years as a niche area of interest among those who study risk tolerance. Bontombo, Bottom, and Weber (1997) observed patterns across four different counties. They concluded that uncertainty avoidance in a country may influence risk perceptions. Many other studies using international comparisons have observed differences between the United State (or Western Europe) and Asian countries, notably China

(Fan & Xiao, 2006; Hsee & Weber, 1999; Tan, 2011; Wang & Fischbeck, 2004; 2008). Findings from these studies generally suggest that the Chinese are more risk seeking in financial arenas but not necessarily across other domains of risk. Kim, Chatterjee, and Cho (2012) looked at the differences in asset ownership of Asian immigrants from many different countries including China. They found a strong relationship between the country of origin and the holdings of different asset classes including homeownership, equities, and business ownership.

Reiger et al. (2014) presented the most comprehensive and complete evaluation of international risk assessment in their paper. They documented the risk preferences of individuals in 53 different countries. Their findings suggested that individuals across cultures are, on average, risk averse regarding gains and risk seeking with losses. This finding was in line with Prospect Theory. They also found that risk preferences are dependent on economic conditions and cultural factors. It was also suggested that their results may serve "as an interesting starting point for further research on cultural differences in behavioral economics" (p. 637).

Two other large scale international assessments of risk tolerance were conducted by Statman (2008) and Vieider, Chumura, and Martinsson (2012). Studying 22 and 30 different countries, respectively, the findings suggest that wealthy countries tend to be more risk averse in financial domains. Statman explained that, "People in low income countries have high aspiration relative to their current income" and they "pay with risk for a chance to move up in life" (p. 44). The findings of Vieider et al. showed a unique relationship between international macroeconomic variables and risk-seeking behavior. They found a strong negative correlation between risk tolerance and personal income. They explained the phenomenon by suggesting that risk attitudes act as a transmission mechanism for growth by encouraging entrepreneurial activities throughout the world.

Stability of Risk Attitudes

One of the least discussed notions within the financial risk-tolerance literature is the likeliness and degree to which risk attitudes change over time. Roszkowski, Delaney, and Cordell's 2009 article about the intrapersonal consistency in financial risk-tolerance assessment concluded that intrapersonal consistency was stable over time but greater variably was associated with higher risk-tolerance scores. What is left to be discovered are the unique aspects that influence individuals who show inconsistency in their risk-tolerance scores across multiple assessments.

The first barrier to assessing the stability of risk tolerance is understanding the consistency of the risk measurement. Although previously addressed by Cronbach (1951), Slovic's 1964 work suggested that inconsistent answers to questions measuring the same construct on a non-validated assessment may result in apparent instability. Bouchey (2004) even exposed the complexities involved in risk-tolerance assessment by noting that an individual may have a complex, seemingly paradoxical view of risky financial situations. For example, an individual may be willing to accept volatility for a high return but may also prefer undervalued stocks to high growth stocks.

The consistency of individual risk tolerance over time has been assessed and split into four distinct categories: (a) stability over time, (b) reactions to market conditions, (c) consistency across different dimensions of risk tolerance, and (d) consistency across different types of questionnaires (Roszkowski et al, 2009). When looking at risk tolerance change over time, Yao et al. (2004) surmised that if significant time trends are evident after controlling for biopsychosocial and environmental factors, the changes over time can be interpreted to be related to changes in attitudes toward risk, not changes because of other factors. Yook and Evertt (2003),

Grable and Lytton (2001), and Yang (2004), all looked at the consistency of different risk questionnaires over time finding supportive relationships between many different assessment tools. The general theme of research regarding the intrapersonal consistency of risk tolerance over time is that it is relatively stable but does show slight fluctuations based on environmental factors.

Chapter Summary

Although relatively new, compared to classical economics, research relating specifically to financial risk tolerance has developed into an important area of study over the last fifty years. Due to its importance in shaping portfolio allocation decisions and investor satisfaction, financial planners and individual investors utilize risk-tolerance assessments to gain a better understanding of how they are likely to act or respond in situations involving financial risk. Historically, nearly all of the risk-tolerance literature has focused on identifying the relationships between and among variables that influence risk tolerance, the relationship between risk tolerance and investment allocation, or developing accurate risk-tolerance assessment tools. To summarize the findings from past risk-tolerance research, in relation to this study, the following associations are most common: (a) men tend to be more risk tolerance than women; (b) older individuals tend to be less risk tolerant than younger individuals; (c) single individuals accept more risk than their married counterparts; (d) higher income is associated with a greater willingness to accept risk; (e) higher education is associated with enhanced risk tolerance; and (f) cultural factors appear to be associated with risk tolerance, with those from countries with great social support exhibiting elevated risk tolerance. In addition, macroeconomic variables and market driven forces have been shown to have a small, but observable, influence on individual risk tolerance. In times of economic growth, individuals tend to exhibit a greater willingness to accept risks. Although still

in its infancy and non-conclusive, reports from some studies suggest that risk tolerance does vary across cultures and social support or social collectivism may be a factor in how individuals perceive the riskiness of financial situations. Lastly, risk tolerance has been shown to be generally stable over time; however, some individuals who initially score highly on risk assessments have been shown to be more likely to exhibit inconsistency in risk assessment at later points in time.

As noted above, the study of financial risk tolerance is still emerging. Research implications will continue to grow as the construct is better understood over time. Even after successfully measuring basic risk tolerance, further refinement of an application or assessment tool could provide insight for both financial planners and individuals. The remainder of this dissertation is focused on (a) describing the methodology used to test the research questions, (b) reporting results from the tests, and (c) discussing the results with implications for financial planning practice.

CHAPTER III

METHODOLOGY

The primary goal of this study was to expand the body of knowledge regarding financial risk-tolerance assessment by examining the influence of macroeconomic, biopsychosocial and environmental, and social support on the financial risk tolerance of individuals and to document changes in risk tolerance over time. This study, by combining multinational perspectives with macroeconomic influences, allows researchers to see if, and what, economic changes influence individuals' risk tolerance over time. Examining the biopsychosocial and environmental factors that influence risk tolerance adds to the existing body of literature by presenting an updated data source with distinctive attributes known to influence risk tolerance. By looking at the multinational distinctiveness between and among three countries (United States, Australia, and the United Kingdom), this study furthers the understanding of how global similarities and differences, through social structure support networks, influence someone's willingness to take financial risk. Finally, examining the differences among individuals who have variability in risk tolerance over time and individuals with stable risk attitudes can be used to identify patterns regarding the overall stability of risk tolerance and the variables that influence instability.

A few recent studies (e.g., Rieger et al., 2014; Vieider et al., 2012; West & Worthington, 2014) have been conducted to test the cultural differences between and among countries and the influences such differences have on financial decision making. Risk tolerance is one of the largest components shaping personal financial decision making and investment choices; as such,

obtaining a clear understanding of how different cultures assess, interpret, and behave in relation to risk tolerance is valuable. The increasingly global financial system, technological advancements, and international accessibility to securities markets make understanding the global dynamics of risk attitudes and risk taking even more important as society moves into the future. Examining the presence, or lack therefore, of cultural differences in risk tolerance has the potential to impact the way domestic financial planners interact with individuals who identify with differing cultural norms shaped by their country of origin. Almost every large firm, and even many small or boutique firms, will likely build relationships with clients having a diverse set of multicultural experiences.

It has been determined empirically that many different variables influence risk tolerance (Grable, 2000). Adding additional insight into the role country of origin plays in shaping risk attitudes can make assessment even more accurate than it is at present. In addition, understanding differences among cultures that may impact the way risk tolerance is interpreted, and the extent to which local perceptions of risk influence someone's willingness to take risk, can help refine the way financial planning practitioners integrate financial risk tolerance into planning recommendations. Since the academic study of financial risk tolerance is still relatively new, most studies have focused on describing the risk attitudes of US investors and consumers (Fan & Xiao, 2005), but international perspectives are becoming increasingly common (Rieger, Wang & Hens, 2014). By examining the differences and similarities among first world countries, the results from this study aid in understanding the generalizability of studies based in the United States to other nations, including Australia and the United Kingdom.

Methodologically, this chapter explains the survey instrument, sample, research questions, variables, and data analysis used to address the dissertation's research objectives. As

described below, the survey instrument collected six demographic characteristics of respondents. These included age, income, net worth, gender, education level, and marital status. All individuals were surveyed twice throughout the study with an average of almost two years between assessments. This unique aspect of the data collection process allowed for observations to be made across different time frames and to examine the economic conditions before, after, and in-between assessment dates. For the purposes of this study, the survey was supplemented by combining the date of each response with different macroeconomic indicators. These variables included country specific GDP, country unemployment rates, and market conditions, as well as data from global commodities indices. While some researchers believe that risk tolerance is a mostly fixed trait (Baumeister, 1991; Satterwhite, Fogle, & Williams 1998), many recognize that outside variables may have some level of influence on how an individual perceives the riskiness of the market, employment, or overall economic conditions (Grable, Lytton, & O'Neill, 2004; Niendorf & Ottaway, 2002). The degree to which global economic conditions affect an individual's risk tolerance is an area with very little precedent for research. Although many economists, and some individual investors and financial planners, follow activities in international markets, the exact influence that international markets have on domestic investors and markets is still a topic of debate, although economic contagion has been shown to influence domestic markets (Aloui, BenAissa, & Nquyen, 2011). Some have noted that this trend may increase as international investment opportunities and globalization expand.

Operationalization of the Conceptual Model

The conceptual framework of this dissertation relates the idea of financial risk tolerance and risk-taking behavior to three primary factors: macroeconomic indicators, biopsychosocial and environmental variables, and social support. The selection of these elements was based on previous studies showing that elements from traditional economics, risk-taking studies, and the Cushion Hypothesis can be combined to provide a better description of factors shaping risk attitudes. For example, the Cushion Hypotheses suggests that societies that have high social safety nets provide individuals the opportunity to be more aggressive in their financial decision making. In an effort to accurately measure the global safety support systems of Australia (AUS), the United Kingdom (UK), and the United States (US), the US OECD relative rankings of these countries, in terms of the social support each country provides, was used in the models. Although some researchers use the notion of collectivism as a proxy for social support (e.g., Cheng, 2010), the cross cultural consistency of that measure is still in its infancy. In addition to measuring social support in AUS, UK, and US, the social support index can be used as a framework for expansion and future research to include other countries or make comparative analysis of first world English speaking countries to less homogenous global populations.

Figure 3.1 shows the conceptual model tested in this study. Each of the variables shown in the figure were introduced previously, both in the review of literature and earlier in this chapter. By incorporating all the different variables into a comprehensive model, the independent and interdependent relationships influencing risk tolerance could be evaluated. A description of each variable is provided below.

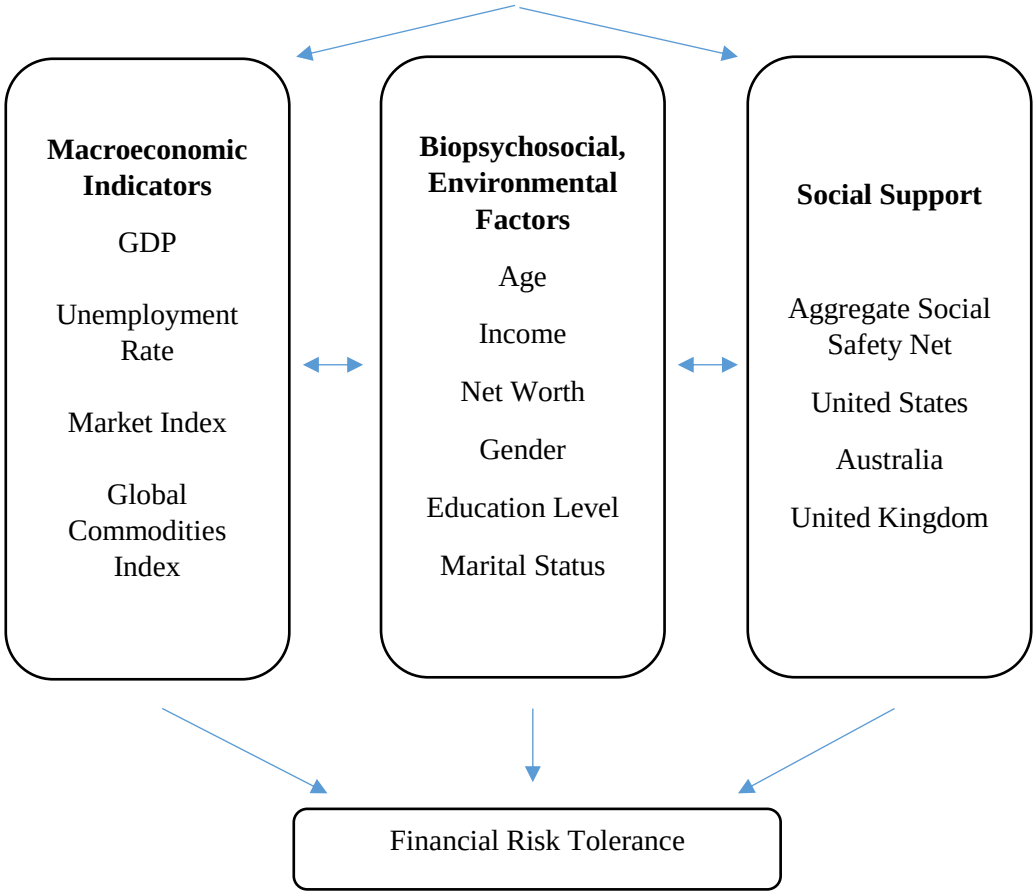

Figure 3.1 Full Risk-Tolerance Model

Sample

This study used a secondary dataset made available by FinaMetrica, Ltd. The risk profiling database included information collected in the United States (US), United Kingdom (UK), and Australia (AUS). The choice of these countries was dictated by the nature of the dataset. The data contained biopsychosocial and environmental information, as well as composite risk-tolerance scores for individuals who completed multiple risk-assessments. Data collection began in January of 2010 and ended in December of 2014. The time span provided a unique perspective on the global trends and distinctive macroeconomic environments that existed

in the post global recession that began in 2008. Due to the secondary nature of the dataset, some cleaning was required of the data because a substantial number of the respondents had missing or partially missing data within the assessment. Table 3.1 shows the demographic profile of the sample based on age, education, income, household size, net worth, and gender. The final sample size used in the multivariate analyses was 4,983. This represented the full sample, after delimitations and controlling for missing data.

Table 3.1
Demographic Profile of Sample

Variables	N	Mean	SD	Min	Max
Age	7722	57.8	11.30	18	93
Education	6113	3.1	1.09	1	4
Income	6143	3.2	1.26	1	6
Household Size	6023	1.2	1.28	1	9
Net worth	6083	7.2	1.49	1	10
Gender	9677	1.45	0.50	1	2

Again, Table 3.1 shows the basic demographic characteristics of the sample. With an average age of 57, the sample population was older than the global population, but this was not surprising based on the fact the sample was drawn from individuals seeking financial or investment guidance. The average income fell into the $50,000 - $100,000 range, and the mean education level was the Some College or Trade School category. The sample was skewed slightly toward males who made up almost 53% of the sample. A country comparison of demographic characteristics is provided in Chapter Four.

A unique feature of the dataset was that all of the respondents took multiple assessments over the course of several months or years. This unique aspect of the dataset allowed for a comparison of individuals at different points in time, which allowed for the identification of unique attributes of individuals who exhibited a significant change in their risk score. The

sample was delimited to include only those respondents who completed multiple assessments. Table 3.2 shows the distribution of risk scores (RTS_1) based on initial and follow up (RTS_2) test dates. The variables were also coded by country (AUS, UK, US).

Table 3.2
Demographic Profile of Risk Tolerance Score Sample

Risk Tolerance Scores	N	%	Mean	*SD*	Min	Max
RTS_1	9692	100.0%	47.40	9.51	14	93
RTS_2	9692	100.0%	48.00	9.61	15	95
AUS_RTS_1	1762	18.1%	48.72	9.63	18	86
AUS_RTS_2	1763	18.1%	48.92	9.49	16	87
UK_RTS_1	6269	64.3%	46.61	9.56	14	93
UK_RTS_2	6270	64.3%	47.38	9.69	15	95
US_RTS_1	1661	17.0%	49.18	8.81	18	83
US_RTS_2	1662	17.0%	49.73	9.15	21	84

Figure 3.2 provides a visual representation of the median risk-tolerance score for the sample. The box plots display the range of deviation for each individual country. As shown in Figure 3.2, the Risk Tolerance Scores (RTS) were separated into the first assessment (RTS_1) and the second assessment (RTS_2). The majority of the test takers (64.3%) were from the United Kingdom (UK). The remaining respondents were from Australia (AUS) and the United States (US).

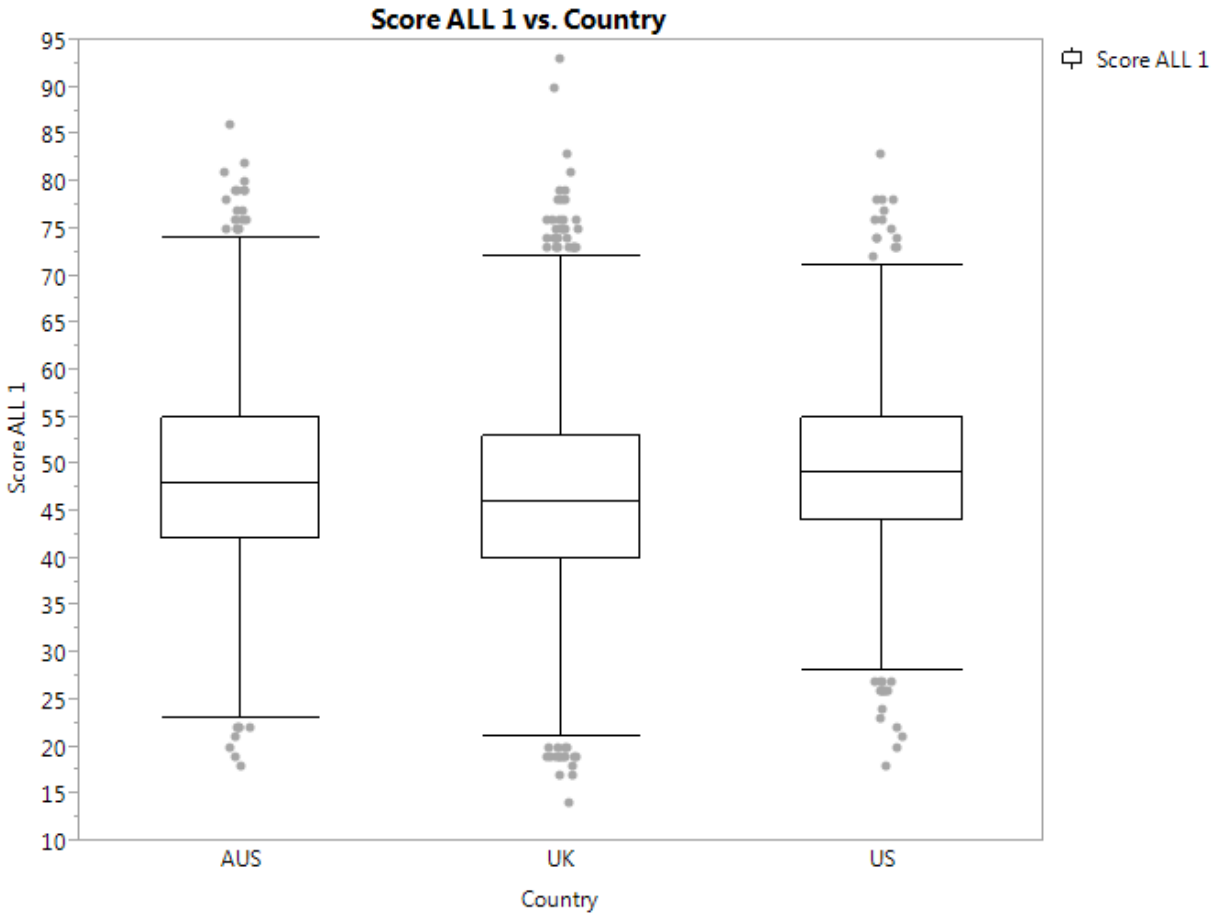

Figure 3.2 Median and Deviation of Risk Score by Country

Survey Instrument

The survey instrument was developed and administered by FinaMetrica, Ltd (FinaMetrica). Based in Australia, the company uses a psychometrically validated approached to reliably assess the risk tolerance of individuals. Financial planners in Europe, North America, Asia, and Australia use the scale extensively. FinaMetrica provided the dataset for this dissertation. FinaMetrica combined responses from 25 questions to create a summed Risk Tolerance Score (RTS) for respondents. The company obtained item responses from clients of financial planners in Australia (AUS), the United Kingdom (UK), and the United States (US). The original dataset included a small number of individuals from some other countries, but due

to sample size restrictions these were not included in the analysis. In order to make scale scores comparable, FinaMetrica used proprietary weights to the norm results. These weights were not available for this dissertation. Instead, the normed scores for each respondent were provided with matching biopsychosocial and environmental information. In this study, an RTS could range from 1 to 100, with higher scores representing an elevated level of risk tolerance.

The FinaMetrica scale was utilized across each of the three countries in the sample to create consistency and comparability across borders. Due to a common language, translation and semantic issues represented less of a methodological issue in this study compared with other studies measuring global risk attitudes where survey tools have been translated into multiple different languages. Minor adjustments to reflect regional dialects may have been used, but inconsistency across differing country boundaries was expected to be minor.

Dr. Michael Roszkowski originally developed aspects of the FinaMetrica assessment tool while working at The American College. The assessment tool continues to be refined and has evolved to become one of the most psychometrically valid and globally utilized tools to measure individual financial risk tolerance. Launched in 1998, FinaMetrica's risk profiling system was developed and trialed in Australia by researchers working at the University of New South Wales' Applied Psychology unit. Two assessments, one of 12 questions and another compromised of approximately 25 questions were used to assess risk tolerance within a 15 minute window. Previous studies have used similar datasets provided by FinaMetrica. When testing the validity of RTS, Gilliam et al. (2010) reported a Cronbach's alpha of 0.89, suggesting a high degree of reliability for the assessment tool. An example of two of the questions used in the assessment include:

Compared to others, how do you rate your willingness to take financial risk?

1. Extremely low risk taker
2. Very low risk taker
3. Low risk taker
4. Average risk taker
5. High risk taker
6. Very high risk taker
7. Extremely high risk taker

How easily do you adapt when things go wrong financially?

1. Very uneasily
2. Somewhat uneasily
3. Somewhat easily
4. Very easily

Some of the advantages associated with the use of the FinaMetrica system include the academic and theoretical manner in which the scale was conceptualized, wide professional and individual use, and simple to understand interpretations that help financial planners know where to allocate their client's investments (FinaMetrica, 2016).

Dependent Variables

Risk Tolerance Score (RTS): Risk tolerance, as defined by each respondent's RTS, was the primary dependent variable of interest. The assessment score was based on a 25-item scale that was aggregated to compute a composite risk score. Ranging from 1 to 100, scores were interpreted to mean those with higher scores exhibited greater levels of financial risk tolerance.

The mean and standard deviation of the initial test RTS for the sample was 47.50 and 9.51, respectively.

Change in Risk Tolerance Score: In additional to measuring overall composite risk tolerance scores, another aspect of the sample were data pertaining to changes in risk-tolerance scores over time by individual respondent. The dataset contained multiple scores for each individual over different time periods.

With such a large sample, it would be expected to see a selection of individuals who exhibit both extreme consistency in risk tolerance and others who have major fluctuations in their risk scores. To determine what constitutes large fluctuations, a technique suggested in the book *Financial Planning and Counseling Scales* (Grable, Archuleta & Nazarinia, 2011) was used to measure change. The following procedure was used to gauge large changes in risk tolerance:

1. Subtract the reliability coefficient from 1.0
    a. 1.0 – 0.89 = 0.11
2. Calculate the square root of the estimate
    a. SQRT(0.11) = 0.33
3. Multiply the square root outcome by the test's standard deviation to estimate the standard error of measurement (SE_M)
    a. 0.33 * 9.51 = 3.14
4. Estimate the 95% confidence interval by multiplying the SE_M by 1.96 (this is the approximate z score associated with 95% coverage within a normal distribution)
    a. 3.14 * 1.96 = 6.15

5. Based on the test mean of 47.40, any client with a score between 41.25 to 53.55 (41 to 54 rounded) would be considered *RTS_Stable*

This methodological approach, based on the standard error of the mean, provides an estimate of how much variation is needed to confidently conclude that a significant change in a risk score has occurred. If the difference in test scores between *RTS_1* and *RTS_2* dropped below the defined confidence interval the individual was placed into the *RTS_Drop* category. If the difference in test scores between *RTS_1* and *RTS_2* rose above the defined confidence interval the individual was placed into the *RTS_Increase* category. Again, by measuring individuals at two separate times, with months and/or years in between, and by combing information about time periods, biopsychosocial and environmental variables, and macroeconomic factors, it was possible to draw conclusions about the unique properties of individuals who exhibit variability in their risk attitude. Findings from this study should help financial planning professionals gain a better understanding of what to look for when working with specific types of clients.

Independent Variables

Obtaining a better understanding of the factors that influence an individual's willingness to take risk is one of the underlying objectives of this dissertation. Multiple assessments were given to the same individuals over differing time periods. Six biopsychosocial and environmental variables were also recorded along with each initial test. The following variables were included in the dataset: age, income, net worth, gender, education level, and marital status. Country of origin, time and date of initial response, and the date of the follow up survey were also included in the dataset. In addition to the data and sampling collected by FinaMetrica, macroeconomic indicator variables were combined with each sampling unit based on the date of the initial survey collection and the follow up survey. In an effort to understand what, if any, macroeconomic

variables influence an individual's willingness to take risk, the combined dataset allowed for tests of the significance of global macroeconomic factors. Three primary macroeconomic variables were included for each country: unemployment rate, quarterly GDP, and stock market performance. A fourth macroeconomic variable was included to account for global commodity prices. In addition to country specific macroeconomic variables, all countries were also combined to examine the broad global trends. A set of global variables were then used to measure overall and interaction effects on financial risk tolerance. Although survey responses were collected daily, some of the global macroeconomic variables were released monthly or quarterly; therefore, the tests focused on these broader macroeconomic trends.

Macroeconomic Indicators

Each of the macroeconomic variables was operationalized as follows:

- *United States Gross Domestic Product* (GDP): GDP is the value of all goods and services produced by the nation's economy less the value of the goods and services used in production (US Bureau of Economic Analysis, 2016). Reported quarterly, the range of US GDP was measured using data from the Bureau of Economic Analysis. The range of GDP from 2010 to 2015 was $14.7 trillion to $18.1 trillion, with a mean of $16.4 trillion.
- *Australia GDP*: The Australian Bureau of Statistics releases quarterly estimates for Gross Domestic Product. Measured in millions of US Dollars, the total annual GDP ranged from $1.34 trillion ($1.43 trillion AUD) to $1.55 trillion ($1.65 trillion AUD) with a mean of $1.45 trillion ($1.54 trillion AUD).
- *United Kingdom GDP*: The United Kingdom Office for National Statistics estimates quarterly GDP. Measured in US Dollars, the chained volume measures are reported in

trillions. The annual range of GDP from 2010 to 2015 was $2.53 trillion (£1.60 trillion) to $2.83 trillion (£1.79 trillion), with a mean of $2.67 trillion (£1.69 trillion).

- *United States Unemployment Rate*: The US Bureau of Labor statistics produces a monthly account of individuals defined as the percentage of the labor force that is unemployed but actively seeking and willing to work. The estimate was used in the this study.
- *Australia Unemployment Rate*: Data from the Australian Bureau of Statistics evaluating the monthly unemployment rate was used. The Australian unemployment rate measures the number of people actively looking for a job as a percent of the labor force.
- *United Kingdom Unemployment Rate*: Data from the United Kingdom Office for National Statistics were used based on the monthly unemployment rate (seasonally adjusted for all). The United Kingdom unemployment rate is defined as individuals currently unemployed, but have actively been seeking work in the past four weeks and are available to begin a job within the next two weeks.
- *US Stock Market Index*. To obtain an idea of general equity market conditions the composite Standard & Poor's (S&P) 500 was used in this study. The S&P 500 is a market capitalization based index of the 500 largest companies listed on the New York Stock Exchange (NYSE) or NSADAQ.
- *Australia Stock Market Index*: In April of 2000, the ASX 200 became the primary investment benchmark for the Australian market. The ASX accounts for 70% of the equity market. The index contains the top 200 listed companies by way of float-adjusted market capitalism. The ASX 200 index was used to measure the Australia equity market (denominated in Australian dollars).

- *United Kingdom Stock Market Index*: The FTSE 350 index is a market capitalization weighted stock market index composed of the largest 350 companies whose primary listing is based on the London Stock Exchange. The FTSE 350 index was used to measure the UK equity market (denominated in British pounds).
- *Global Commodities Index*: Although given less attention than equity markets, commodity markets are aggressively traded internationally and many countries (e.g., Australia, Saudi Arabia, Russia, Brazil) have commodity intensive domestic markets. The Green Haven Continuous Commodity Index (CCI) fund provides a broad based, diversified commodity basket that can be used as a proxy for commodity performance. The CCI uses an index of 17 commodity groups including grains, energy, precious metals, cash, and government treasury securities. The trajectory of the global index was used as an indicator for the general supply, demand, and pricing of global commodity markets. Although traded daily, a month average was calculated and matched with test score dates to provide a measure of commodity market activity.
- *Composite Gross Domestic Product:* In order to obtain a global perspective on domestic productions' relationship to risk tolerance, a weighted composite model was developed. Using weighted averages from the three countries represented in the sample, a Global GDP variable was created. The formula below was used for the calculation:

$$\text{GDP} = \frac{US\_GDP}{US\_GDP * UK\_GDP * AU\_GDP} * US_{GDP} + \frac{UK_{GDP}}{US_{GDP} * UK_{GDP} * AU_{GDP}} * UK_{GDP} + \frac{AU\_GDP}{US\_GDP * UK\_GDP * AU\_GDP} * AUS\_GDP$$

- *Composite Stock Market Index:* In addition to a composite GDP measure, a global stock market index variable was created using combined market information from Australia, United Kingdom, and the United States.

- *Initial High/Low Score:* In order to test the effects of initial outliers, a variable was created that separated individuals into categories based on their first risk-assessment score. If someone scored extremely low they were coded as Low Initial score and if they score extremely high they were given a High Initial score notation.

Biopsychosocial and Environmental Factors

Although some research has been conducted to uncover the relationships between risk tolerance and international cultural attributes, there are still many areas that need further clarification. This study fills the need using a unique sample and consistent questionnaire. It is well known that many professional financial planners use biopsychosocial and environmental variables to predict and assess the risk tolerance of their clients (Spitzer & Singh, 2008). Previous research has done a relatively thorough job examining the most popular biopsychosocial and environmental variables used by financial planners (Grable, 1997; Grable & Joo, 1998; Sung & Hanna, 1996) that appear to be associated with financial risk tolerance. An important consideration when examining academic risk-tolerance research is to look at the sample. Many widely distributed academic risk-tolerance papers were based on data obtained from convenience samples of college students or college faculty and staff as survey participants (e.g., Corter & Chen, 2006, Grable & Lytton, 1999; Grable & Joo, 2004). While insightful, measuring more diverse groups of individuals, especially those that are active participants in the securities markets, across cultures, is needed to obtain a better understanding of how risk attitudes shape behavior. The use of more diverse samples provides needed evidence to the generalizability of research findings. This study helps fill this gap in the literature by comparing similarities and differences between and among investors living in first world economies.

The following discussion provides operationalized definitions for each of the biopsychosocial and environmental variables used in this study.

- *Age*: Age was calculated using year of birth at the initial survey date.
- *Income*: Income was measured using five categories: (1) Under $30,000; (2) $30,000-$50,000; (3) $50,000-$100,000; (4) $100,000-$200,000; and (5) Over $200,000.
- *Net Worth*: The data for net worth were broken down into 10 different categories as follows: (1) Under $10,000; (2) $10,000-$25,000; (3) $25,000-$50,000; (4) $50,000-$100,000; (5) $100,000-$150,000; (6) $150,000-$250,000; (7) $250,000-$500,000; (8) $500,000-$1,000,000; (9) $1,000,000-$2,500,000; and (10) Over $2,500,000
- *Gender*: Males were coded 1; Females were coded 2.
- *Education Level*: Four levels of education were used to measure attained academic achievement: (1) Less than High School; (2) Completed High School; (3) Trade School or Some College; and (4) University Degree or Higher.
- *Household Size*: Household size was the count of all members (including children) in the household.
- *Marital Status*: Marital status was coded dichotomously. Those who were married were coded 1, otherwise 0.

Social Support. Social support is a broad term that indicates the aggregate level of transfer from government to individuals. Social support can be measured many ways with differing levels of comparability. Simply equating absolute numbers does not make sense globally when production, income, and consumption differ widely across regions. Social support may comprise many different concepts or programs, including, but not limited to, socialized healthcare, secondary and/or university education, unemployment insurance, and supplemental

retirement income. Government transfers, as a percent of GDP, produces a percentage statistic that allows for comparison across any set of countries worldwide. Adding a social support variable in this study was done to provide a test of the Cushion Hypothesis. For the scope of this dissertation, social support was measured by percent of GDP based on the US OECD's index, as shown in Table 3.3

Table 3.3
Social Support by Country

Country	Social Support (% GDP)
United Kingdom	21.7% GDP
United States	19.2% GDP
Australia	19.0% GDP

The percentage of GDP spent by a country to provide social support varies widely worldwide, but looking at the data from above, the levels were relatively similar among the three countries in the sample.

Table 3.4 provides a descriptive summary of the dependent and independent variables used in this study. A mean value is shown when the data were recorded at the interval level. A median score is shown for categorical variables. A country-by-country comparison will be provided in Chapter Four.

Table 3.4
Summary of All Independent Variables

Variable	N	Mean	Median	SD	Min	Max
RTS_1	9692	47.4	-	9.51	14	93
RTS_2	9692	48.0	-	9.61	15	95
Days Between	9692	805.0	-	388.70	0	1985
Education	6113	3.1	4	1.09	1	4
Income	6143	3.2	3	1.26	1	6
Household Size	6023	1.2	-	1.28	1	9
Net worth	6083	7.2	7	1.49	1	10
Age	7722	57.8	-	11.30	18	93
Score Change	9692	-0.6	-	6.13	-48	36
US GDP	9692	$15741.6	-	657.23	$14681	$17914
AUS GDP	9692	$1392.1	-	44.96	$1326	$1522
UK GDP	9692	$2611.8	-	53.11	$2528	$2823
US Commodity	9692	29.9	-	3.37	21	36
US Market	9692	$1339.8	-	203.99	$1031	$2107
UK Market	9692	£3079.3	-	258.18	£2598	£3862
AUS Market	9692	AUS$4596.8	-	355.29	AUS$4009	AUS$5929
US Unemployment	9692	8.6%	-	0.89	5%	10%
UK Unemployment	9692	7.9%	-	0.40	6%	9%
AUS Unemployment	9692	5.2%	-	0.27	5%	6%

Research Objectives and Models

Initial Test Scores

The following objectives were used to guide the study. In addition to the objectives, the comprehensive model used to address each research objective is shown below. Note that the variable definitions shown here will be described in greater detail later in the chapter:

1. *Identify the level of influence macroeconomic variables and market conditions have on an individual's risk tolerance.*
2. *Further clarify the relationship biopsychosocial and environmental factors have on an individual's willingness to take risk.*

3. *Examine the relationship between country specific social support and an individual's risk tolerance.*

The three objectives were addressed using the following model:

$$\textit{Model (i): } RTS = \alpha_0 + \alpha_1 Age + \alpha_2 Gender + \alpha_3 Education\_Level + \alpha_4 Income + \alpha_5 Married + \alpha_6 Household\_Size + \alpha_7 Net\_Worth + \alpha_8 Social\ Support + \alpha_9 Commodity\_Market + \alpha_{10} GDP + \alpha_{11} Market + \alpha_{12} Age\ x\ GDP + \alpha_{13} Gender\ x\ GDP + \alpha_{14} Education\_Level\ x\ GDP + \alpha_{15} Income\ x\ GDP + \alpha_{16} Married\ x\ GDP + \alpha_{17} Household\_Size\ x\ GDP + \alpha_{18} Net\_Worth\ x\ GDP + \alpha_{19} Social\ Support\ x\ GDP + \alpha_{20} Age\ x\ Market + \alpha_{21} Gender\ x\ Market + \alpha_{22} Education\_Level\ x\ Market + \alpha_{23} Income\ x\ Market + \alpha_{24} Married\ x\ Market + \alpha_{25} Household\_Size\ x\ Market + \alpha_{26} Net\_Worth\ x\ Market + \alpha_{27} Social\ Support\ x\ Market + \alpha_{28} Age\ x\ Commodity + \alpha_{29} Gender\ x\ Commodity + \alpha_{30} Education\_Level\ x\ Commodity + \alpha_{31} Income\ x\ Commodity + \alpha_{32} Married\ x\ Commodity + \alpha_{33} Household\_Size\ x\ Commodity + \alpha_{34} Net\_Worth\ x\ Commodity + \alpha_{35} Social\ Support\ x\ Commodity + \varepsilon_1$$

Very little research has been conducted to test the impact of macroeconomic factors on individuals' risk tolerance. As described in the review of literature, there is a logical connection between aggregate economic conditions and the willingness of individuals to take financial risks. Even so, there is a paucity of research on this potentiality. More empirical research needs to be conducted on the subject; this dissertation provides some information to help fill this gap in the literature. Unemployment, GDP, market indices, and commodity prices are all important variables that provide indications about the economic conditions of a country or global economy. As shown in the model above, it is possible to determine how each country's population is affected by domestic and international macroeconomic variables. Comparing the influences of

macroeconomic factors on each country, and individuals residing within a country, provides unique insights to help understand if, and to what extent, macroeconomic variables have an impact in shaping an individual's willingness to take risks.

Although studied extensively over the last 20 years, understanding the relationship between biopsychosocial and environmental variables and financial risk tolerance adds to the broader literature by providing additional evidence of the power these types of variables have in shaping risk attitudes. Note that in the models tested in this study, the possibility of an age curvilinear effect was estimated. Overall, if the data are indeed consistent with past literature, the generalizability increases. If there are differences, the context can be further explored in future studies to identify and additional insight.

The Cushion Hypothesis suggests that individuals with access to systemic and robust social safety nets have a greater ability—and thus willingness—to engage in risk taking behavior. Due to the 'cushion' available, the downside associated with a risky decision is thought to be mitigated by available social and government supports. In addition to observing the policy differences among the countries of interest in this study, additional value can be garnered from the framework developed in this dissertation to measure the association between risk tolerance and social support of other countries. As in this study, data from the United States Organization for Economic Co-operation and Development (OECD) Index can be used for this purpose in future studies.

Changes in Risk-Tolerance Scores

Another goal of this dissertation was to identify individuals who had significant changes in the risk tolerance scores over time. By isolating the variables that directly affect change,

financial planners may be better equipped to identify patterns of change for clients who have the potential for major swings in risk tolerance. Although it is still believed that risk tolerance is inherently stable, with any large population, a small group will still be likely to change over time. Modeling change can be done using logistic regression.

Logistic regression is a form of liner regression that is used when the dependent variable is dichotomous. While typical linear regression assumes the dependent variable is continuous, logistic regression interprets the dependent variable as a stochastic event. The output of logistic regression represents a density function with calculated probabilities from 0 to 1. Multinomial logistical regression adds additional functionally by allowing for dependent variables of more than two levels. In the following model, individuals with stable risk scores were compared to individuals who had large drops or large increases in their risk scores across two different measurement periods. Again, the goal of the model was to determine if there were significant differences in individuals who had large changes in their risk tolerance over time. The research question follows below:

4. *Identify the unique characteristics of individuals that exhibit fluctuations in risk tolerance over time.*

The objective of the research question was addressed using the following model:

$$\textit{Model (ii): } logit(y=-1) = log(p(y=-1)/1-(p=-1)) = \alpha_0 + \alpha_1 Age + \alpha_2 Gender + \alpha_3 Education\_Level + \alpha_4 Income + \alpha_5 Married + \alpha_6 Household\_Size + \alpha_7 Net\_Worth + \alpha_8 Social\ Support + \alpha_9 Commodity\_Market + \alpha_{10} GDP + \alpha_{11} Market + \alpha_{12} Age \times GDP + \alpha_{13} Gender \times GDP + \alpha_{14} Education\_Level \times GDP + \alpha_{15} Income \times GDP + \alpha_{16} Married \times GDP + \alpha_{17} Household\_Size \times GDP + \alpha_{18} Net\_Worth \times GDP + \alpha_{19} Social\ Support \times GDP$$

$+ \alpha_{20}Age\ x\ Market + \alpha_{21}Gender\ x\ Market + \alpha_{22}Education\_Level\ x\ Market + \alpha_{23}Income\ x\ Market + \alpha_{24}Married\ x\ Market + \alpha_{25}Household\_Size\ x\ Market + \alpha_{26}Net\_Worth\ x\ Market + \alpha_{27}Social\ Support\ x\ Market + \alpha_{28}Age\ x\ Commodity + \alpha_{29}Gender\ x\ Commodity + \alpha_{30}Education\_Level\ x\ Commodity + \alpha_{31}Income\ x\ Commodity + \alpha_{32}Married\ x\ Commodity + \alpha_{33}Household\_Size\ x\ Commodity + \alpha_{34}Net\_Worth\ x\ Commodity + \alpha_{35}Social\ Support\ x\ Commodity + \varepsilon_1$

$logit(y=1) = log(p(y=1)/1-(p=1)) = \alpha_0 + \alpha_1 Age + \alpha_2 Gender + \alpha_3 Education\_Level + \alpha_4 Income + \alpha_5 Married + \alpha_6 Household\_Size + \alpha_7 Net\_Worth + \alpha_8 Social\ Support + \alpha_9 Commodity\_Market + \alpha_{10} GDP + \alpha_{11} Market + \alpha_{12} Age\ x\ GDP + \alpha_{13} Gender\ x\ GDP + \alpha_{14} Education\_Level\ x\ GDP + \alpha_{15} Income\ x\ GDP + \alpha_{16} Married\ x\ GDP + \alpha_{17} Household\_Size\ x\ GDP + \alpha_{18} Net\_Worth\ x\ GDP + \alpha_{19} Social\ Support\ x\ GDP + \alpha_{20} Age\ x\ Market + \alpha_{21} Gender\ x\ Market + \alpha_{22} Education\_Level\ x\ Market + \alpha_{23} Income\ x\ Market + \alpha_{24} Married\ x\ Market + \alpha_{25} Household\_Size\ x\ Market + \alpha_{26} Net\_Worth\ x\ Market + \alpha_{27} Social\ Support\ x\ Market + \alpha_{28} Age\ x\ Commodity + \alpha_{29} Gender\ x\ Commodity + \alpha_{30} Education\_Level\ x\ Commodity + \alpha_{31} Income\ x\ Commodity + \alpha_{32} Married\ x\ Commodity + \alpha_{33} Household\_Size\ x\ Commodity + \alpha_{34} Net\_Worth\ x\ Commodity + \alpha_{35} Social\ Support\ x\ Commodity + \varepsilon_1$

Y=-1 -> Drop; Y=1 -> Increase

Multiple models were used to address this aspect of the dissertation. The purpose behind this research question was to test whether risk tolerance varies across time, and in cases where this occurs, to identify the variables associated with change. Potential effect was evaluated directly with a number of independent variables and with moderation variables. Specifically, social support, GDP, market prices, and commodity prices were hypothesized to moderate the

relationship of age, net worth, income, and marital status on changes in risk tolerance. Due to the unique multi-year assessment nature of the dataset, observations were made about the consistency of risk tolerance over time. Through comparisons of risk-tolerance scale scores between the initial test and the follow up test, it was possible to determine the extent of risk-tolerance variability. By separating individuals into different levels of risk tolerance variability, conclusions were drawn about the traitedness of risk-tolerance. In addition, it was hypothesized that the length of time between tests, changes in economic condition, and personal characteristics may all influence the change in an individual's risk tolerance over time.

Data Analysis Methodology

In McLagen's 1973 article in *Business Economics*, a basic description of regression analysis was adapted for econometric modeling. McLagen described the concept of Least Squares as a "method of developing an equation which relates one variable (such as a company's sales) to one or more variables which should explain the first (such as price, economic demands, competition, etc.). This method is mathematically contrived so that the resulting combination of explanatory variables produces the smallest error between the historical actual values and those estimated in the regression" (McLagen, 1973, p. 132). Theoretically, regression looks at a specific variable (the dependent variable) and uses other factors (the independent variables) to see how they affect that variable. In developing ordinary least squares (OLS) models, an equation for the dependent variable that is being explained is provided. In the equation, the dependent variable equals the sum of the explanatory variables where each is multiplied by a regression estimated coefficient. The idea of OLS is to determine, based on a set of rules, the most logical estimators that are represented by coefficients to explain the behavior or observed value of the dependent variable. There are many important measurement tools that are used to

validate how useful the regression model is as an estimator of the dependent variable. The coefficient of determination (R-Squared) is the best known indicator of the success of the least squares fit. Basically, the R-Squared statistic measures the percentage change in the dependent variable that is explained by the series of independent variables. The standard error gives a measure of how close the fitted values are to the actual values. The smaller the standard error, the more representative the equation becomes. Finally, the *t* statistic shows the significance each explanatory variable has in predicting the dependent variable.

The simple goal of statistical modeling is to determine the relationship between two or more variables of interest. The research questions were examined using the following statistical techniques: correlation, probability distribution, regression analysis, and logistic regression analysis. After testing the individual variables for normality and multicollinearity, regression analysis was used to examine the relationship many different independent variables had on an individual's risk-tolerance score.

Model *(i)* was tested using OLS regression with RTS as the outcome variable and sixteen different independent variables with interaction terms to account for interdependent relationships between variables. The process of regression analysis began by examining how the independent variables were related by using correlation tables. If variables used in the models were extremely similar and had high correlations, then the coefficient estimators would be difficult to interpret individually, but should not affect the predictive value of the overall model. Next, one must consider the normality and consistency of the independent variables when interpreting the P-values of the test coefficients. If variables are extremely skewed, it may be more difficult to assess precision of the calculated probability. After the initial examination and observing the correlation tables, several variables were condensed for clarity. The model was then computed

using JMP and SPSS statistical analysis software and the results were compared with previous literature and the proposed research questions. The results of the models will be discussed at length in the following chapter.

Model *(ii)* was tested using multinomial logistic linear regression with the dependent variable separated into three different binary categories: Drop in Risk Score, Stable Risk Score, Increase in Risk Score. The model then evaluated the change of those whose risk score dropped and those whose risk score increased over time relative to individuals with stable scores. The results provided clarity to which, if any, variables uniquely influenced an individual's change in risk score over time.

Summary of Methodology

The anticipated outcome of this study was to expand the body of knowledge on financial risk tolerance by examining the influence of macroeconomic, biopsychosocial and environmental factors, and social support on individuals' risk tolerance. Examining the relationship between macroeconomic variables and risk tolerance was achieved by isolating independent macroeconomic variables and examining the way each influences someone's risk tolerance. Next, biopsychosocial and environmental factors were examined to see what, if any, variables influence an individual's willingness to take risk. Then, by investigating multinational distinctiveness between the AUS, the UK, and the US, social support was linked to the level of risk tolerance reported by respondents. Finally, this study was designed to test changes in risk tolerance over time. Obtaining a better understanding of those who exhibit inconsistency in risk tolerance over time may clarify how stable risk tolerance as a financial planning data analysis input.

In addition to describing the purpose of this study, this chapter provided a review of the way in which each variable was operationalized within the conceptual framework. A description of the statistical methods used to test the research questions was also provided. The remainder of this dissertation is focused on reporting the results from these tests and providing implications for financial planning practice.

CHAPTER IV

RESULTS

Introduction

The primary goal of this dissertation was to expand the body of knowledge regarding financial risk-tolerance assessment by examining the influence of macroeconomic, biopsychosocial and environmental, and social support variables on the financial risk tolerance of individuals, and to document changes in risk tolerance over time. By examining multiple risk-tolerance scores from the United States, United Kingdom, and Australia, it was determined that many of the independent variables selected exhibit significant relationships with individual financial risk-tolerance scores. Macroeconomic, biopsychosocial and environmental, and social support indicators were all related to financial risk tolerance with differing levels of influence on an individual's measured risk-tolerance score. The results provided are an expansion of previous works combined with a new framework designed to further explore how macroeconomic variables and social support influence risk-tolerance scores.

The initial results examined in this chapter are based on a linear regression model specifically examining the relationship between the dependent variable, risk-tolerance score, and a set of independent variables (i.e., macroeconomic, biopsychosocial and environmental, and social support) for individuals currently engaged or seeking financial advising services. Although previous literature has examined each of the independent variables in isolation, the model developed uniquely combined global macroeconomic and demographic variables to provide

insight to the overall relationship to risk tolerance, as well as the interaction effects of the independent variables. Next, the data were examined to determine the differences between individuals with stable risk tolerance over time and those who exhibit significant increases or decreases in risk scores across multiple assessments using multinomial logistic regression analysis. The results suggest that specific independent variables can be isolated to show how each influences the stability of an individual's risk-tolerance score.

Sample Characteristics

The original sample contained approximately 20,000 respondents, but the overall sample was initially reduced to 9,692 by eliminating any individual who did not complete at least two financial risk-tolerance assessments. Although every respondent may not have completed the entire demographic portion of the survey, each analysis utilized the largest possible number possible of respondents given the independent variables needed to complete the model. When looking at the multinomial regression model, the independent variables with the lowest response rates were educational status and household size, resulting in a complete sample size of 4,983. Since one of the primary goals of the study was to investigate the influences of risk tolerance and changes to it over time, the dataset chosen included one of the largest academically available sources of individuals taking multiple assessments across varying time periods. The sample is described below in Table 4.1.

Table 4.1

Summary of Full Sample by Biopsychosocial and Environmental Factors

	Observations	Percent of Sample
Gender		
Males	5285	54.6%
Females	4392	45.4%
Age		
18 – 34	1930	25.0%
35 – 54	1930	25.0%
55 – 65	1930	25.0%
65+	1930	25.0%
Education		
Did not complete high school	832	13.7%
Completed high school	707	11.6%
Trade or diploma	1246	20.5%
University degree or higher	3298	54.2%
Marital status		
Married (or in a de facto relationship)	5174	83.2%
Unmarried	1046	16.8%
Income (Income for all sources)		
Under $30,000	625	10.2%
$30,000-50,000	1177	19.2%
$50,000-$100,000	2133	34.7%
$100,000-$200,000	1295	21.1%
$200,000-$300,000	672	10.9%
Over $300,000	241	3.9%
Household Size (Children)		
0	2180	36.2%
1	1957	32.5%
2	859	14.3%
3	661	11.0%
4+	366	6.1%

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	Observations	Percent of Sample
Net assets		
Under $10,000	46	0.8%
$10,000-$25,000	31	0.5%
$25,000-$50,000	55	0.9%
$50,000-$100,000	116	1.9%
$100,000-$150,000	297	4.9%
$150,000-$250,000	966	15.9%
$250,000-$500,000	2055	33.8%
$500,000-$1,000,000	1460	24.0%
$1,000,000-$2,500,000	735	12.1%
Over $2,500,000	322	5.3%
Country		
Australia	1762	18.2%
United States	6269	64.7%
United Kingdom	4564	17.1%

Variables related to GDP, Unemployment Rates, Market Data, Commodities Index, and the Social Support Index were added directly from source data and included with every sample. Data were combined in Excel using index matching based on time and date of initial assessment.

Data Analysis Results

The first three research questions of interest were used to examine the influence of macroeconomic, biopsychosocial and environmental, and social support variables on an individual's willingness to take financial risk. The following research questions and model were developed:

1. *Identify the level of influence macroeconomic variables and market conditions have on an individual's risk tolerance.*
2. *Further clarify the relationship biopsychosocial and environmental factors have on an individual's willingness to take risk.*

3. *Examine the relationship between country specific social support and an individual's risk tolerance.*

Before the regression analysis could be fully examined, it was important to look at the characteristics of the data before evaluating the results. The nature, relationship, and consistency of the independent variables may have an impact on the regression model, particularly if someone is looking to determine the value in coefficient estimates. One specific difficulty of comparing domestic macroeconomic data across differing world regions is that global economies are becoming very interdependent. For example, what began as a European and domestic recession in 2008, spread to almost every developed market by the end of that year. Large domestic companies often do immense international trade and a simple walk down a local grocery aisle will confirm the capacity to which international trade markets function.

Due to the possibility that international markets have a relationship among themselves, the first step involved is checking the data for multicollinearity. Multicollinearity is a phenomenon where two or more of the predictor variables are highly correlated (Farrar & Glauber, 1967). When multicollinearity exists, the individual coefficient estimators may be erratic but the overall validity of the model is not reduced. Therefore, it is important to understand both the value of the entire model and also the relationship of the independent variables within the model itself. The first step is to look at the relationship between the predictor variables. This is accomplished by observing a correlation table between the independent variables. Below is the correlation table for the macroeconomic independent variables.

Table 4.2
Macroeconomic Variables Correlation Table

	US GDP	UK GDP	AUS GDP	US Market	UK Market
US GDP	1.00	0.98	1.00	0.91	0.75
UK GDP		1.00	0.97	0.93	0.80
AUS GDP			1.00	0.89	0.72
US Market				1.00	0.93
UK Market					1.00
AUS Market					
Commodity Index					
US Unemployment					
AUS Unemployment					
UK Unemployment					

	AUS Market	Commodity Index	US Unemploy-ment	AUS Unemploy-ment	UK Unemploy-ment
US GDP	0.35	-0.12	-0.98	0.65	-0.45
UK GDP	0.44	-0.1	-0.97	0.70	-0.53
AUS GDP	0.31	-0.14	-0.98	0.65	-0.41
US Market	0.66	-0.07	-0.93	0.71	-0.66
UK Market	0.81	0.04	-0.77	0.60	-0.65
AUS Market	1.00	-0.17	-0.41	0.60	-0.80
Commodity Index		1.00	0.16	-0.60	0.33
US Unemployment			1.00	-0.69	0.54
AUS Unemployment				1.00	-0.65
UK Unemployment					1.00

As shown in Table 4.2, worldwide GSP and investment markets are highly correlated. Incredibly, the correlation between GDP among the United States, compared with the United Kingdom and Australia was 0.98 and 1.00. This means that the measurements were almost equal, and this shows that domestic production is highly globalized. Interestingly, some variables related to Australia seem to be slightly less correlated than both the US and UK. The initial analysis suggested that there are some significant correlation issues with macroeconomic variables. In order to determine which needed to be in the model, each country specific macroeconomic variable was combined into a single variable, as show below.

Table 4.3
Simplified Macroeconomic Variables Correlation Table

	AVG GDP	AVG MKT	AVG COMMODITY	AVG UNEMP
AVG GDP	1.00	0.66	-0.12	-0.97
AVG MKT		1.00	-0.09	-0.73
AVG COMMODITY			1.00	0.17
AVG UNEMP				1.00

Table 4.3 shows the correlation table of the macroeconomic variables. Unemployment and gross domestic product were correlated at almost –1.00. This finding suggests that the two points move in opposite directions and needed to be combined or removed before developing the final regression model. Overall, the high degree of correlation, as defined as anything over 0.70 by Tabachnick, Fidell, and Osterlind (2007), may impact the interpretation of the individual coefficient estimates. When high multicollinearity exists, it can be helpful to combine or remove like variables to obtain accurate estimates for the model. In addition, if variables are extremely similar, then their combined values will produce a better regression model than the multiple highly correlated models. Because GDP is the primary indicator of economic activity, this variable was chosen to be included in the model. It is valuable to note that there is a high level of

negative correlation between a rise in GDP and a drop in unemployment. Although other macroeconomic variables such as inflation, interest rates, and unemployment were also initially tested, the final combined indicator variables included in the model were: GDP, Markets, and Commodity Index due to their interdependence.

After identifying unique non-highly correlated indicators, the following model was developed to answer the research questions introduced at the beginning of the chapter. The regression model measured the effects of many different independent variables and their interactions on the dependent variable Risk Tolerance Score (RTS).

$$\textit{Model (i): } RTS = \alpha_0 + \alpha_1 Age + \alpha_2 Gender + \alpha_3 Education\_Level + \alpha_4 Income + \alpha_5 Married + \alpha_6 Household\_Size + \alpha_7 Net\_Worth + \alpha_8 Social\ Support + \alpha_9 Commodity\_Market + \alpha_{10} GDP + \alpha_{11} Market + \alpha_{12} Age \times GDP + \alpha_{13} Gender \times GDP + \alpha_{14} Education\_Level \times GDP + \alpha_{15} Income \times GDP + \alpha_{16} Married \times GDP + \alpha_{17} Household\_Size \times GDP + \alpha_{18} Net\_Worth \times GDP + \alpha_{19} Social\ Support \times GDP + \alpha_{20} Age \times Market + \alpha_{21} Gender \times Market + \alpha_{22} Education\_Level \times Market + \alpha_{23} Income \times Market + \alpha_{24} Married \times Market + \alpha_{25} Household\_Size \times Market + \alpha_{26} Net\_Worth \times Market + \alpha_{27} Social\ Support \times Market + \alpha_{28} Age \times Commodity + \alpha_{29} Gender \times Commodity + \alpha_{30} Education\_Level \times Commodity + \alpha_{31} Income \times Commodity + \alpha_{32} Married \times Commodity + \alpha_{33} Household\_Size \times Commodity + \alpha_{34} Net\_Worth \times Commodity + \alpha_{35} Social\ Support \times Commodity + \varepsilon_1$$

The results of *Model (i)* are shown in Table 4.4 below.

Table 4.4
Summary of Regression Analysis for all Variables used to Predict Risk Tolerance, Including Interactions

Variable	B	SE B	t	P-Value
Intercept	82.213	3.792	21.680	0.000
Age	-0.207	0.012	-17.570	0.000
Gender	-4.630	0.249	-18.580	0.000
Education Level	0.486	0.109	4.460	0.000
Income	0.948	0.113	8.370	0.000
Married	0.231	0.325	0.710	0.476
Household Size	0.086	0.102	0.850	0.397
Networth	0.312	0.089	3.520	0.000
Social Support	-0.909	0.091	-9.970	0.000
Commodity Index	0.121	0.034	3.570	0.000
GDP	-0.001	0.000	-3.820	0.000
Market	0.002	0.001	3.100	0.000
GDP x Age	0.000	0.000	0.620	0.538
GDP x Gender	0.000	0.001	0.440	0.658
GDP x Education	0.000	0.000	0.330	0.744
GDP x Income	0.000	0.000	0.080	0.933
GDP x Married	-0.001	0.001	-0.660	0.511
GDP x Household	0.000	0.000	0.040	0.970
GDP x Networth	0.000	0.000	0.230	0.818
GDP x Social Support	0.001	0.000	2.790	0.005
Market x Age	0.000	0.000	-0.680	0.494
Market x Gender	0.000	0.001	0.070	0.947
Market x Ed	-0.001	0.001	-1.430	0.152
Market x Income	0.000	0.001	0.140	0.892
Market x Married	0.002	0.002	1.030	0.304
Market x Household	0.000	0.001	0.800	0.425
Market x Networth	0.000	0.000	0.870	0.384
Market x Social Support	-0.001	0.000	-2.410	0.016
Commodity x Age	-0.003	0.003	-0.890	0.373
Commodity x Gender	0.085	0.074	1.140	0.254
Commodity x Education	0.001	0.032	0.040	0.965
Commodity x Income	0.010	0.033	0.310	0.755
Commodity x Married	0.001	0.101	0.010	0.992
Commodity x Household	0.041	0.030	1.360	0.174
Commodity x Networth	0.033	0.026	1.250	0.213
Commodity x Social Support	0.023	0.027	0.880	0.380

Note: N = 5,773, R^2 = 0.203, F=<.0001

The F-test suggests there was a very strong relationship between macroeconomic, biopsychosocial and environmental, and social support variables as predictors of individual risk tolerance. The *p*-value of the F-test was <.0001, which suggests there was a significant relationship between at least one of the independent variables and an individual's risk-tolerance score. In addition, the model produced an adjusted R^2 of .20, which suggests that the model has valuable predictive powers.

The first model contains a wealth of information about the nature of risk tolerance and its relationship to environmental factors. With an adjusted R^2 of 0.20 the model is in line with previous predicative models of risk-tolerance scores using FinaMetrica data. The results suggest that environmental factors account for approximately 20% of the variation in an individual's risk-tolerance score. Macroeconomic, demographic, and country of origin variables all show significant relationships to an individual's risk-tolerance score. A detailed discussion of the implications will be discussed in Chapter five.

Of all the different variables discussed in this study, demographic variables, and their relationship to individual risk tolerance, have the longest history of study and largest body of support in the academic literature. Including the relationship between biopsychosocial and environmental factors is important to both confirm previous research but also to ensure the sample being used is consistent with past studies. In addition, when predicting an individual's willingness to take financial risk, many demographic variables have shown a strong impact on financial risk-tolerance scores. The results of the regression analysis show strong similarities to previous studies examining the relationship between risk tolerance and biopsychosocial and environmental factors. Age, gender, education level, income, and net worth all showed significant relationships to financial risk-tolerance scores. Specifically, age was negatively

associated with risk scores. Older respondents exhibited lower scores and females reported a lower risk tolerance than men. Income, household size, and net worth were all positively associated with an increase in risk-tolerance scores.

Although, as measured by the size of the coefficient, the macroeconomic predictive values were small, it is still worthwhile to note that there was a significant relationship between overall economic production and individual risk tolerance. This is partially due to the size of the variables in the model (in the 000s). The most interesting aspect of the macroeconomic analysis was the negative relationship between GDP and risk-tolerance score. In all three countries, and the combined variable, GDP had a negative coefficient, indicating that a rise in GDP was associated with lower risk-tolerance scores. Although GDP is often used by economists as an overall indicator of the general state of the economy, and to measure economic expansions/recessions, GDP is a better measurement of total production and economic activity and is only a proxy for how well/poorly an economy is actually preforming. For example, a natural disaster often produces a large short-term boost to local area GDP due to the economic activity to repair a city, but it is not necessarily an indication of economic prosperity.

The construct of social support is really a theoretical extension of country of origin. Past literature (Statman, 2008) has shown that different countries have differing levels of overall risk tolerance. Trying to understand why individuals in one country would exhibit higher levels of willingness to accept risk has been hypothesized in this dissertation (Chapters 1 & 2) to be related to the level of social support a country provides for its citizens. Upon further analysis of the data available in this study, it was noted that the overall levels of risk tolerance in each of the three first world countries examined were quite similar and the overall level of spending on social support, as a percent of GDP, was also very similar for the United States, United

Kingdom, and Australia. This is not surprising given the cultural and economic similarities of large, English-speaking, first world countries. The results suggest that as spending on social support, as a percentage of a country's gross domestic product, goes up, country-wide risk tolerance decreases. There are many different hypotheses related to why this might be the case and each will be discussed in the final chapter. It is also worth noting that the three countries analyzed in the sample are relatively similar compared to many other countries worldwide. The model here is simply an introductory framework for examining broader concepts related to country of origin and social support and the results they have on an individual's willingness to take financial risks.

The interaction between the independent variables was also a unique theorization within this dissertation. The idea that men and women may react differently to economic conditions or that net worth would be related to market activity related to risk tolerance was explored using interaction terms. Somewhat surprisingly, there were very few significant interactions in the full regression model. The combination of Social Support with GDP and Social Support with market activity were the only two interactions with significance. However, the effect size of the associations was very small.

The final research question of interest involved looking at the combined influence of macroeconomic, biopsychosocial and environmental, and country specific social support on an individual's willingness to take financial risk tolerance over time. The results of the analysis related to this question are presented below.

Risk Score Change

One of the primary goals of this dissertation was to identify individuals who had significant changes in the risk-tolerance scores over time. The first step of identifying change in risk tolerance involved looking at the descriptive differences between multiple risk assessments taken by the same individual. The simple analysis helped identify patterns in the data and provided context to the deviation of risk scores over two different measurement periods. By isolating the variables that directly effect change, financial planners may be better equipped to identify patterns of change for clients who have the potential for major swings in risk tolerance. Although it is still believed that risk tolerance is inherently stable, with any large population, a small group will still be likely to change over time. One way this study adds to the literature is helping financial planners identify the characteristics of individuals who are likely to have a significant risk-score change over time. Next, it was possible to identify which factors contribute to that change over time by using a logistic regression. Multinomial logistic models uniquely allow the isolation of specific dependent variables when the variable outcomes are a stochastic event.

A competent financial planner is one who is always looking for ways to provide a better client experience. Because planners often work with clients for many years through different life stages and economic situations, it is important to understand client tendencies over time. Knowing which clients are most likely to exhibit change can be useful when planning and adapting in changing economic conditions or life stage. In addition, asset allocations are often based on risk assessments. If allocations recommended are based on a sound risk assessment then an individual should be comfortable during different market cycles. However, if a client is one of the few individuals whose risk has changed over time and their asset allocation has

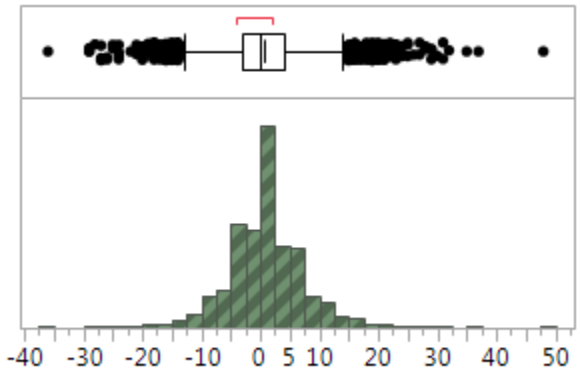
remained consistent, they may become misallocated over time and be poorly positioned for major changes in market conditions.

To build a multinomial logistic model, the survey participants were split into three different groups. The first were individuals that had a significant drop in score over time. After separating out the groups, specific factors were identified to examine the differences from the group of individuals who had stable risk tolerance over time. The second analysis identified individuals who had a large increase in risk tolerance over time. The groups were compared to the control group of stable scoring individuals. The combined results give insight into what to look for when assessing risk tolerance and managing its likely change over time.

The initial descriptive statistics provide content to the risk scores in the data set. Changes in risk scores were measured by the difference in value between Test 1 and Test 2. The overall distribution of changes in risk score appeared normal. Figure 4.1 shows the distribution of the changes in risk scores between Test 1 and Test 2 for the entire sample.

Figure 4.1

Distribution of Risk Score Change Between Test 1 and Test 2



Note: N = 9692, SD = 6.13, SE = 0.062

Table 4.5 compares the differences in scores between the respondents from Test 1 to Test 2. The initial scores appeared to be a strong indicator of the score on the second assessment, as individual's who initially scored on the extremely low end showed low risk-tolerance scores in Test 2. Likewise, individuals who scored high on Test 1 also exhibited higher scores on Test 2. It also appeared there may be slight movement toward the mean from outlining test scores, but the effects were moderate.

Table 4.5
Comparison of Initial and Follow Up Test Score of Outlying Respondents

Variable	Mean	St Dev	Std Err	Up 95%	Lw 95%	N
Initial Normal Score RTS1	47.01	6.29	0.07	47.15	46.87	7964
Initial Normal Score RTS2	47.61	7.59	0.09	47.77	47.44	7964
Initial Low Score RTS1	29.83	3.85	0.14	30.11	29.56	760
Initial Low Score RTS2	34.64	7.38	0.27	35.17	34.11	760
Initial High Score RTS1	64.82	4.72	0.15	65.11	64.52	968
Initial High Score RTS2	62.38	7.72	0.25	62.87	61.89	968

Note: N = 9692

Table 4.6 splits respondents out into multiple different categories based on a significant change between the original test and the follow-up test. Individuals that had a significant drop or rise in score over time, as measured by the standard error of mean technique, were separated from individuals who exhibited stable scores across multiple assessments. Almost 25% of respondents had a significant change in risk scores over the five year period of measurement. In addition, individuals who had significant drops consistently scored above the mean on the initial assessment and individuals who had significant increases in risk tolerance had initial lower than average scores.

Table 4.6
Description of Risk Tolerance Scores by Change Over Time

Variable	Mean	Std Dev	Std Err Mean	Upper 95%	Lower 95%	N	% of Sample
RTS Total: Test 1	47.44	9.51	0.10	47.63	47.25	9692	100.0%
RTS Total: Test 2	48.06	9.61	0.10	48.26	47.87	9692	100.0%
RTS Stable: Test 1	47.66	8.98	0.10	47.87	47.46	7399	76.3%
RTS Stable: Test 2	47.81	9.02	0.10	48.01	47.60	7399	76.3%
RTS Increase: Test 1	42.55	9.93	0.27	43.08	42.02	1355	14.0%
RTS Increase: Test 2	53.33	10.13	0.28	53.87	52.79	1355	14.0%
RTS Drop: Test 1	52.73	9.72	0.32	53.35	52.10	938	9.7%
RTS Drop: Test 2	42.50	9.63	0.31	43.11	41.88	938	9.7%

Note: N = 9692

The primary reason for splitting assessment takers into groups of stable, increasing, and decreasing scores was simply to isolate and identify any unique characters of individuals that exhibit changes in their scores over time. The final model used a multinomial logistic regression technique to examine the characteristics of individuals that exhibit fluctuations in their risk tolerance over time. The following research question and model were developed:

5. *Identify the unique characteristics of individuals that exhibit fluctuations in risk tolerance over time.*

   Model (ii): logit(y=-1) = log(p(y=-1)/1-(p=-1)) = α_0 + α_1Age + α_2Gender + α_3Education_Level + α_4Income + α_5Married + α_6Household_Size + α_7Net_Worth + α_8Social Support + α_9Commodity_Market + α_{10}GDP + α_{11}Market + α_{12}Age x GDP + α_{13}Gender x GDP + α_{14}Education_Level x GDP + α_{15}Income x GDP + α_{16}Married x GDP +

α_{17}*Household_Size x GDP* + α_{18}*Net_Worth x GDP* + α_{19}*Social Support x GDP* + α_{20}*Age x Market* + α_{21}*Gender x Market* + $_{\alpha 22}$*Education_Level x Market* + α_{23}*Income x Market* + α_{24}*Married x Market* + α_{25}*Household_Size x Market* + α_{26}*Net_Worth x Market* + α_{27}*Social Support x Market* + α_{28}*Age x Commodity* + α_{29}*Gender x Commodity* + $_{\alpha 30}$*Education_Level x Commodity* + α_{31}*Income x Commodity* + α_{32}*Married x Commodity* + α_{33}*Household_Size x Commodity* + α_{34}*Net_Worth x Commodity* + α_{35}*Social Support x Commodity* + ε_1

logit(y=1) = log(p(y=1)/1-(p=1)) = α_0 + α_1*Age* + α_2*Gender* + $_{\alpha 3}$*Education_Level* + α_4*Income* + α_5*Married* + α_6*Household_Size* + α_7*Net_Worth* + α_8*Social Support* + α_9*Commodity_Market* + α_{10}*GDP* + α_{11}*Market* + α_{12}*Age x GDP* + α_{13}*Gender x GDP* + $_{\alpha 14}$*Education_Level x GDP* + α_{15}*Income x GDP* + α_{16}*Married x GDP* + α_{17}*Household_Size x GDP* + α_{18}*Net_Worth x GDP* + α_{19}*Social Support x GDP* + α_{20}*Age x Market* + α_{21}*Gender x Market* + $_{\alpha 22}$*Education_Level x Market* + α_{23}*Income x Market* + α_{24}*Married x Market* + α_{25}*Household_Size x Market* + α_{26}*Net_Worth x Market* + α_{27}*Social Support x Market* + α_{28}*Age x Commodity* + α_{29}*Gender x Commodity* + $_{\alpha 30}$*Education_Level x Commodity* + α_{31}*Income x Commodity* + α_{32}*Married x Commodity* + α_{33}*Household_Size x Commodity* + α_{34}*Net_Worth x Commodity* + α_{35}*Social Support x Commodity* + ε_1

Y=-1 -> Drop; Y=1 -> Increase

The results of the multinomial logistical model are below in Table 4.7

Table 4.7
Multinomial Logistic Model Comparing Risk Decrease to Risk Stable

Variable	Increase *B*	P-Value
Intercept	6.189	0.000
Age	0.010	0.043***
Education Level	-0.090	0.046***
Income	-0.073	0.128
Household Size	-0.062	0.176
Networth	-0.057	0.117
Social Support	-0.105	0.005***
Commodity Index	-0.010	0.464
GDP	-0.001	0.000***
Market	0.001	0.014***
Gender	-0.110	0.292
Married	-0.103	0.423
Low Initial Score	0.719	0.009***
High Initial Score	-1.185	0.000***
GDP x Age	0.000	0.961
GDP x Gender	0.000	0.451
GDP x Education	0.000	0.541
GDP x Income	0.000	0.378
GDP x Married	0.000	0.920
GDP x Household	0.000	0.969
GDP x Networth	0.000	0.380
GDP x Social Support	0.000	0.039***
Market x Age	0.000	0.166
Market x Gender	0.001	0.106
Market x Ed	0.000	0.393
Market x Income	0.000	0.535
Market x Married	-0.001	0.338
Market x Household	0.000	0.572
Market x Networth	0.000	0.562
Market x Social Support	0.000	0.364
Commodity x Age	-0.002	0.229
Commodity x Gender	0.037	0.187
Commodity x Education	0.011	0.377
Commodity x Income	-0.007	0.598
Commodity x Married	-0.041	0.271
Commodity x Household	-0.003	0.772
Commodity x Networth	-0.004	0.654
Commodity x Social Support	0.002	0.837

Note: N=4,983, Cox & Snell: 0.07

Table 4.8
Multinomial Logistic Model Comparing Risk Increase to Risk Stable

Variable	Increase *B*	P-Value
Intercept	0.194	0.888
Age	-0.018	0.000***
Education Level	-0.048	0.204
Income	0.033	0.394
Household Size	0.035	0.300
Networth	-0.017	0.573
Social Support	-0.069	0.031***
Commodity Index	-0.014	0.249
GDP	0.000	0.061***
Market	0.000	0.143
Gender	0.082	0.348
Married	0.025	0.824
Low Initial Score	-1.344	0.000***
High Initial Score	0.898	0.000***
GDP x Age	0.000	0.993
GDP x Gender	-0.001	0.015***
GDP x Education	0.000	0.597
GDP x Income	0.000	0.783
GDP x Married	0.000	0.655
GDP x Household	0.000	0.906
GDP x Networth	0.000	0.429
GDP x Social Support	0.000	0.290
Market x Age	0.000	0.080***
Market x Gender	0.001	0.021***
Market x Ed	0.000	0.972
Market x Income	0.000	0.582
Market x Married	-0.001	0.366
Market x Household	0.000	0.460
Market x Networth	0.000	0.349
Market x Social Support	0.000	0.510
Commodity x Age	0.001	0.277
Commodity x Gender	0.044	0.101
Commodity x Education	0.006	0.617
Commodity x Income	0.010	0.411
Commodity x Married	0.013	0.713
Commodity x Household	0.006	0.587
Commodity x Networth	-0.011	0.258
Commodity x Social Support	0.006	0.516

Note: N=4,983, Cox & Snell: 0.07

The results of the model provide many different insights into the changes some individuals exhibit in their risk tolerance over time. Relative to those who did not change, individuals who showed a significant decrease in risk tolerance from Test 1 to Test 2 were likely to be older and less educated. In addition, lower domestic production and less economic social support decreased individuals' willingness to take risk relative to stable risk scorers. Positive stock market conditions was significantly associated with a decrease in their willingness to take risk relative to others with no change in risk attitudes.

Another significant factor determining the difference in risk scores over time was the score individuals received on their first assessment. As described earlier in the chapter, those with a low risk score tended to see an average increase in their risk score on the second assessment, but the average score was still much lower than the overall mean. For individuals who originally had an extremely low initial test score, they tended to decrease less relative to individuals who had stable scores on both tests. Likewise, for individuals who originally had an extremely individuals high initial test score, they tended to exhibit a decrease relative to individuals who had stable scores on both tests. This suggests that it may be important to carefully examine any individual who scores on the extreme ends of a risk assessment, especially if the relationship is maintained over a long period of time. Finally, the interaction between GDP and Social Support had a positive effect on the change in risk score between each of the test for individuals who had a decrease in scores. The significance of the interaction was not surprising given the impact both variables had individually on assessment takers.

By using multinomial logistic regression, a single model was used to compare both individuals who had a large decrease and a large increase in their risk tolerance over time relative to stable risk scorers. The results provide insights to the unique attributes of individuals who are

likely to have a change in their risk tolerance over time. Further analysis suggests there were several variables that were significant for individuals whose risk score increased significantly compared with those who decreased. Younger respondents were more likely to exhibit an increase in risk score. Education levels and market effects showed less influence on individuals whose risk scores increased over time, yet the interactions between GDP and Gender, Age and Market, and Gender and Market all showed significance. Somewhat expectedly, the direction of the effects for each of the independent variables between individuals who had a risk score decrease and risk score increase showed an almost complete inverse relationship. Relative to those who did not change, individuals who showed a significant increases in risk tolerance from Test 1 to Test 2 were likely to be younger. High domestic production and decreased social support were associated with an increase in risk score. For individuals who had an increase in risk score, a decrease in stock market conditions significantly increased their willingness to take risk relative other individuals. As noted above, increases in social support decreased an individual's willingness to take risk relative to stable risk scorers. When testing individuals who originally had an extremely low initial test score, they tended to increase more relative to individuals who had stable scores on both tests. Likewise, for individuals who originally had an extremely high initial test score, they tended to decrease more relative to individuals who had stable scores on both tests.

The results above are interesting; however, it is important to note that the overall amount of explained variation in the dependent variable was still quite small. Although a bit different than residuals in a traditional linear model, Cox and Snell (1989) developed a methodology for determining the amount of explanation in a given logistic model. For the model above, the Cox and Snell coefficient was 0.071, which suggests the model explains about 7% of the effect for

changes in risk scores over time. Although not extremely large, simply showing significant effects for different unique variables is a starting point to begin the discussion for future research about the exact reasons individuals change their willingness to take risk over time.

The results of the multinomial logistic model are quite insightful. Financial professionals and individual test takers tend to be looking for more information to help determine which individuals are likely to exhibit volatility in their risk tolerance over time. By identifying the variables that influence a change, it was shown that age, education level, GDP, market conditions, and initial test scores appear to be associated someone's willingness to take financial risk over time.

Summary of Findings

Overall, the findings from this study largely support previous literature and suggest that individual financial risk tolerance is generally stable over time but does show moderate movement due to environmental factors. Demographic factors had the largest impact on individual risk tolerance. The results were consistent with past studies. Males, those with high income and high net worth, and married individuals all exhibited higher risk-tolerance scores. In addition, minor, but significant effects of macroeconomic variables and social support were also shown to have an impact on individual risk tolerance. When examined from a global prospective, increases in macroeconomic production (GDP) were shown to reduce the willingness of individuals to take risk, but the effect size was small. Global macroeconomic variables proved to be difficult to separate as economic conditions, especially between the United States and the United Kingdom, partially because they trend in similar directions. Australia's economy was shown to operate more independently than the other two counties studied. Australians scored the lowest in terms of percentage of government revenue spent on social programs.

The majority (76.3%) of individuals studied exhibited consistent risk tolerance across multiple assessments. Approximately 9.7% had an increase in risk scores and 14.0% had a decrease in scores between the first and second assessment. Although the overall mean risk scores over time were relatively consistent, almost 25% of individuals showed a significant change over the multi-year period sampled.

The second model of the dissertation provided an interesting perspective on the variables that uniquely contribute to changes in risk tolerance over time. For individuals who had a decrease in risk scores over time, relative to those with stable scores, increases in age and market conditions had a positive impact on risk tolerance. Additionally, an increase in education level, social support, and GDP negatively affected an individual's willingness to take risk. For individuals who had an increase in risk score over time, relative to those with stable scores, increases in age and social support had a negative impact on risk tolerance. Additionally, increases in GDP positively affected an individual's wiliness to take risk. The results, implications, and limitations with be further examined in the final chapter.

The following chapter reviews the results reported here and provides a discussion of research implications. Variable coding for each model can be found in the appendix.

CHAPTER V

DISCUSSION

The academic study of financial risk tolerance and risk assessment has advanced significantly over the last three decades and will continue to evolve as investment options become more complex and individuals spend longer periods of time living off income invested during their working years. As markets continue to grow, change, and expand internationally, the need for financial planning will continue to grow along with it. In addition to changing societal conditions, over the last 75 years private companies and some government agencies have transitioned the risk of long-term cash flow planning and investing to individuals living in many first world countries through the reduction of employer sponsored pension plans and the partial privatizations of social savings programs. Due to the shift in structure of retirement income and greater accessibility of individual investing, larger numbers of individuals are investing in both domestic and international markets. Two of the biggest challenges to increased participation in markets is providing investors with information about both the riskiness of markets and measuring investors' comfort when investing money in stock or bond markets. The relationship between risk and return was well documented by Markotitz (1968), but understanding how individual investors evaluate and make investment decisions is predicated on the understanding and willingness to take financial risk for an expected return. Studies over the past 25 years have built a strong foundation regarding the factors that are associated with risk tolerance and psychometric tools to measure an individual's financial risk tolerance. However, changes that individuals exhibit in their own risk tolerance over time and across cultural and international

boundaries are still being explored in the academic literature. Despite the challenges, understanding an individual's financial risk tolerance is an essential aspect of developing comprehensive financial planning recommendations. Adequate measuring, recording, and blending of risk tolerance into investment allocation decisions for clients is required by most governing boards of financial planning to maintain a fiduciary standard (CFP Board, 2015). If a financial planner does well taking a client's financial risk tolerance into consideration, the professional may be in better positions to help clients by making choices consistent with their long-term goals.

If it is accepted that risk-tolerance assessment is a fundamental building block associated with personal financial decision-making, then an understanding of the subject can be helpful for both individual investors and financial planners. An additional important element of risk tolerance is understanding if, and how much, a person's risk tolerance changes over time. It has yet to be conclusively decided in the academic literature the true nature of risk tolerance change over time. Roszkowski and Davey (2010) suggested that risk tolerance is largely a fixed personality trait and stable, yet it is still marginally subject to environmental influences and may change due to life circumstances. They also noted that individuals with scores on the extremes tended to show greater propensity to move along the scale. Niendorf and Ottaway (2002) even suggested that individuals may be behooved to adjust their risk tolerance in relationship to factors occurring in the broader economy. The results and discussion from this study can be used to help address these issues.

The principal purposes of this study were to (a) identify the macroeconomic variables that influence individual risk tolerance, (b) clarify the relationship between biopsychosocial and environmental factors that influence risk tolerance, (c) determine whether country of residence

influences a person's risk attitude, and (d) examine changes in risk tolerance over time. The goal of the dissertation was to provide a substantial contribution to the risk-tolerance literature and offer insights into which, if any, macroeconomic and country of residence variables influence an individual's change in risk tolerance over time.

Before moving forward, it is important for readers to keep the following insights in mind. One important consideration when making comparisons throughout historical research involving risk tolerance is understanding the terminology used. Although academia is a bit more consistent than the popular media, literature may refer to the notion of risk tolerance using other terms such as "risk acceptance," "risk appetite," "risk attitude," "risk profile" and "risk propensity," which all deal with the same basic notion, namely, whether one is willing or unwilling to accept a nonguaranteed course of action (Roszkowski & Davey 2010).

Overall, this study can be broken down into five unique outcomes. The first was the relationship between macroeconomic variables and individual risk tolerance. Next, demographic factors were examined to ensure consistency across the dataset in relation to historical studies. The third outcome of the study looked at country of origin and social support, and the relationship international location and policy has on an individual's willingness to take risk. The fourth outcome of the study focused on overall changes in risk tolerance over time noting the differences between individuals with stable risk scores and those with fluctuations in their scores over time. A final outcome was the introduction of an exploratory model that was used to examine the interdependent relationship between variables known or theorized to affect risk tolerance. Overall, the results of this study were relatively consistent with past literature and provide a framework for future academic exploration.

The macroeconomic condition of any nation is a complex system of codependent activities that combine to produce and consume resources. There are many different statistical utilities and data points that can be used to gain understanding about the general level of economic activity in a country, state, or region. However, the complexities of a macroeconomic system are difficult to encapsulate into a few publicly available variables. For example, market activities can be measured in many different ways. Equities prices can be measured daily, weekly, monthly, or annually. In addition, changes in markets can be observed across multiple countries and are often related to broader economic conditions. Gross domestic product (GDP), while used as a baseline example of economic activity, can also be measured in multiple ways. When measured internationally, exchange rates and the size of an overall economy may have implications on the relative level of activity and the effects on global markets. In addition, depending on the goal of a particular study, one could measure GDP in a variety of ways. For instance, it can be measured at various time lengths (e.g., annually, quarterly, and monthly). It can be measured in a standardized base current or in individual country dominations. It is also possible to measure it per capita, per household, or in absolute terms. Despite the complexities of measuring overall economic health, broad economic statistics are useful for obtaining an idea of general economic activity and as indicators to the overall direction of an economy.

The cushion hypothesis suggests that individuals who live in collectivist cultures generally have a greater social support system that ‘cushions’ the downside risk when making risky decisions (Hsee & Weber, 1998). In theory, when personal risk is minimized, individuals are allowed to try new things, start small businesses, or invest in potentially riskier opportunities that promise a higher return. However, it can also be theorized that the opposite is true. It may be that risk is often assumed due to the necessity of making progress or achieving financial goals.

Statman (2008) even hypothesized that individuals often pay with risk for a chance to move up in life and that in many second/third world countries, individuals are willing to take greater risks for potentially higher rewards. Once an individual has enough money to sustain their lifestyle indefinitely, do they truly have an incentive to invest aggressively? Based on the theory of the cushion hypothesis, it would seem that countries with high levels of social support should allow individuals residing within their borders to take greater levels of individual risk. However, the finding in the study showed that as both Social Support and GDP increase, risk tolerance actually decreases. Although the effect sizes were small, and the predicative powers were weak, this certainly suggests a need for more detailed research into what social policies encourage (or discourage) individuals to be more aggressive with their personal investments. In addition, it may be useful in the future for policy makers to consider when making changes to large social support systems like Social Security or Medicare might have unintended consequences on risk attitudes.

Approximately 25% of the sample had a significant change in risk tolerance over time. By identifying the variables that influence the change, it was shown that age, education level, GDP, market conditions, and initial test scores all influenced someone's willingness to take financial risk over time. These insights provide a place to begin the conversation about what the exact variables are that determine one's likelihood to have a significant decrease or increase in risk tolerance over a short period of time. Overall, the study had many different findings that may be useful to individuals, academic professionals, and financial planners.

Table 5.1 provides a summary of the key results from this study. As discussed previously, nearly all of the biopsychosocial and environmental factors examined in this study were statistically significantly associated with respondent risk-tolerance scores. The direction of the regression coefficients were as expected. Only two exceptions were noted. No significant association was noted between risk-tolerance scores and marital status or household size.

Table 5.1
Summary of Key Findings

Variable	Cross Sectional Findings
Age	Older clients are less risk tolerant.
Gender	Women are less risk tolerant.
Education	Higher attained education is positively associated with increased risk tolerance.
Income	High income is positively associated with increased risk tolerance.
Marital Status	Marital status is not associated with risk tolerance.
Household Size	Household size is not associated with risk tolerance.
Net Worth	Higher net worth is positively associated with risk tolerance.
Social Support	Country level social support is negatively associated with risk tolerance.
Commodities	The commodity index is positively associated with risk tolerance.
Domestic Production	GDP is negatively associated with risk tolerance.
Market	Stock market indexes are positively associated with risk tolerance.
Interactions	GDP x Social Support is positively associated with risk tolerance. Market x Social Support is negatively associated with risk tolerance.
	Change Findings
Age	Older clients likely to decrease risk tolerance. Younger clients likely to increase risk tolerance.
Education	Those with less education likely to decrease risk tolerance.
Social Support	Lower country level social support associated with both a decrease and increase in risk tolerance.
Domestic Production	Lower GDP associated with a decrease in risk tolerance. Higher GDP associated with an increase in risk tolerance.
Market	Higher market index prices associated with a decrease in risk tolerance.
Initial Risk Score	A low initial risk-tolerance score associated with a decrease in risk tolerance. A high initial risk-tolerance score associated with an increase in risk tolerance.
Interactions	GDP x Gender negatively associated with increase in risk tolerance. GDP x Social Support positively associated with decrease in risk tolerance. Market x Age positively associated with increase in risk tolerance. Market x Gender positively associated with increase in risk tolerance.

Significant associations between risk-tolerance scores and the macroeconomic indicators and social support variables examined in this study were found. As noted previously, the associations, while significant, were not particularly large in terms of effect size. Nonetheless,

results indicate that financial planners may benefit from taking factors such as GDP, market indexes, and social support into account when evaluating a client's risk-tolerance attitudes.

Several noteworthy findings emerged from the risk-tolerance change analysis. As shown in Table 5.1, older respondents were more likely to decrease their tolerance for risk over time, as were those with less education. Interestingly, social support influenced those who exhibited a decrease and increase in financial risk tolerance. Lower domestic production, as proxied by GDP, was associated with a decrease in risk tolerance. Higher market index prices were found to be associated with a decrease in risk tolerance. The interaction between GDP and social support was positively associated with risk tolerance, while the interaction between GDP and gender was negatively associated with an increase in risk tolerance. The interactions between the Market and both Age and Gender were positively associated with increases in risk tolerance. It is important to note, however, that these macroeconomic indicators and social support variables had relatively small effects sizes.

The macroeconomic, stock market, and commodity index variables were all based on the moment in time when Test 1 was taken. Many studies use change in market conditions or domestic production variables, but this study used a baseline metric of the conditions present during the initial test. The period in which the study was performed was a relatively stable period with generally favorable market conditions occurring after the Great Recession. Comparing the results presented here with future studies in varied market conditions will provide even greater insight into the assessment of individual risk tolerance.

Implications

The initial goal of this dissertation was to expand the body of literature around the relationships that influence individual risk tolerance. If information can help individuals learn more about their own tendencies, greater satisfaction can be achieved by aligning personal decisions with ones that provide the most utility. In addition to understanding aspects of one's own personalities and behaviors around the idea of investing, professionals that engage with clients on a regular basis may also benefit by better understanding the true desires of their clientele and provide even more practical assessments and recommendations that increase customer satisfaction. Risk tolerance is an integral part of investment decision making; therefore, a deeper understanding can help create optimal utility for both individuals and society when making allocation decisions.

One of the challenges many financial professionals face is the need to gain an understanding of a client while potentially only meeting them for a few hours. Rapport is often built over time, but it can be difficult to have a full picture of an individual after a short introductory meeting or two. Trying to assess different personality traits or tendencies is often accomplished through various assessments and, for better or worse, financial planner intuition. Risk capacity is often examined once all relevant documents have been reviewed, but accurately assessing personality traits in a short period is necessary and, if accurate, helpful for both the individual and the financial planner. To help a client allocate their investments, some form of risk assessment is needed. In addition to a basic risk assessment, financial planners also need to know if the information gathered will be relevant both now and in the future as well. It is common practice to take a risk assessment during the intake process for new clients, but it is possible that the information is rarely reviewed to ensure it remains accurate over time. A debate

still exists to whether or not risk tolerance is fixed or flexible. Even if the academic consensus suggests that most individuals are relatively stable in their risk tolerance over time (Roszkowski & Davey, 2010), understanding the individuals who are likely to change can be extremely helpful for both financial planners and individuals assessing their own allocation decisions. Due to the nature of the profession, veteran financial planners often have client relationships lasting decades or even multi-generational. Findings from this study help financial planners determine exactly how 'traited' risk tolerance is and what the characteristics are of individuals who may change over time.

The sample studied consisted of individuals seeking financial planning or financial services. Although the full context of any meeting content is unknown, previous research has suggested that one way financial planners my offer value is by reducing wealth volatility (Grable and Chatterjee, 2015). Now known as Zeta, the measurement combines the commonly known financial constructs of alpha and gamma to objectively measure the value created by reduced wealth volatility. As many practicing planners know, individuals without a strategic financial plan may be misallocated and taking too little or too much risk to achieve their portfolio goals. Some of the change observed in the results may be attributed to the financial direction being suggested by financial planners over time. An interesting area for further research would be looking at the actual financial risk behavior of individuals after their initial meeting with a financial planner over a long-term planning horizon.

Financial planners could benefit from the results of this study by using the insights to gain a better understanding of their clientele. Individuals exhibit generally stable risk tolerance over time but as most planners know, demographic variables and life stage are important considerations for factors that affect the change as one ages and grows wealthier. Another

valuable insight is that initial test scores outside the typical range are an indication that the individuals may exhibit changes over time. If a client scores extremely high or extremely low, it may be useful to monitor that individual closely over time. In addition, any major changes to macroeconomic conditions may be an indicator that risk tolerance should be reassessed to ensure the individual investments are meeting the clients' need. It should also be noted that any major, or potentially major, changes in social policy around social security or Medicare may influence the way an individual perceives risk. As a matter of best practices, financial planners should reevaluate risk on a periodic basis. Based on the results of the logistic regression, individuals who score extremely low or high on risk assessments, older individuals, and those with lower education levels were most likely to exhibit change over at four-year window.

Changes in macroeconomic conditions may likely influence individuals who practice goal based retirement planning. There are many ways to conceptually develop a plan for successfully replacing income during retirement. Starting with pensions and social programs, individuals across the globe are often forced to supplement fixed income in retirement. Fixed and variable annuity products may help bridge the gap, but are diminished by inflation or expenses if riders for increased payouts are not added over time. Many retirees continue to work well past the traditional retirement age and often have additional tax-deferred retirement plans from previous employment. For a portion of many first world nations, one goal of financial planning is to maintain consistent consumption throughout the years of retirement (Modigliani, 1966). Typically, during retirement an individual's investment time horizon is shorter and the ability to withstand dramatic fluctuations in the market are reduced. In a time of economic prosperity or in a high interest rate environment, it may be possible to obtain a risk-free rate sufficient enough to provide an acceptable level of income based on the capital available at the date of retirement.

However, if risk free rates are extremely low (or negative), the sample individual may have a higher risk need to simply keep up with inflation and provide a stable level of retirement income. This change in risk need is an important concept to contrast with the desire to take the risk needed. This may explain the reason why some individuals are willing to take less risk when economic times are good. It may be possible they simply do not need to take additional risks to achieve their specific goals.

The results associated with the demographic variables related to risk tolerance are important for several different reasons. The first is simply to add additional support to the body of research about which and how different variables influence risk tolerance. Although many variables have been tested in the past, additional testing and re-testing only further confirms the validity and reliability of the specific variables that influence risk tolerance. Risk-tolerance studies over the last 30 years have used a wide range of samples from college students, general populations, wealthy individuals, or strictly financial planning clients. When examining the FinaMetrica data used for this study, it was helpful to compare the sample of individuals seeking financial services to other populations in historical risk tolerance assessment studies. In almost every case, the biopsychosocial and environmental variables known to influence risk tolerance were confirmed with the sample used for this study. Knowing this, it is helpful when extrapolating the results and comparing them to other studies utilizing differing samples both in the past and in the future. While nothing new was added by looking at the demographic variables, ensuring they met historical patterns makes the other additions to the study more generalizable.

Does risk tolerance change over time? That was, and still, remains one of the most important implications of any new study in the area of risk tolerance. Overall, risk tolerance, in

this study, was surprisingly stable. Risk tolerance did show some deviation over time, but for the clear majority of individuals it changed very little. However, even if only a small portion of clients exhibit inconsistent risk scores, there may very well be strong implications. In this study, approximatively 75% of individuals exhibited consistent scores across multiple assessments. So, hypothetically extrapolated, for a mid-sized firm with 200 clients over a five-year period, almost 50 clients could have significant changes in their risk scores. Although the average risk score showed much less deviation, individuals who started with low scores saw increases and those who started with high scores experienced declines, producing a minor regression toward the mean (29.83 -> 34.64; 64.82 -> 62.38). Macroeconomic variables, initial test scores, and social support all had a significant impact on individuals who exhibited significant increases or decreases in their risk tolerance across two assessments. The research presented here is another step to expand the possibilities of conditions that influence one's willingness to take financial risk.

Future Research

Understanding risk tolerance and accurate assessment of risk scores will become increasingly important in the near future. On the frontier of this work, internet based robo-advisors are bringing in billions of dollars in assets under management (Fein, 2015), and many of their portfolio allocations are derived explicitly from risk-tolerance assessment tools. Similar to the way many individual financial planners assess risk, a series of questions is asked to examine the anticipated responses to risky situations for individual investors. Once the assessments are complete and combined with demographic information, automated allocations are recommended. Although often theoretically sound, basing an entire portfolio on a five-minute assessment requires extreme trust in the psychometric scales. The implications for incorrect allocations can

be potentially dangerous for individuals who wind up investing in securities not suited for their needs. The self-assessment tools are useful but need to be utilized in context with a holistic assessment to truly understand a client and serve their true needs fully.

This study showed examples of how macroeconomic variables influence individual's risk tolerance. This study only represents the tip of the iceberg when looking at how global macroeconomic conditions influence individual's choice and investor behavior. Economic instability, especially international, is a fascinating area of potential future research. Although beyond the scope of this dissertation, understanding how individuals perceive local and global economic conditions, and the influence it has on their investing and consumption decisions, is an area for future exploration. In addition, two other interesting variables are worthy of further study. Interest rates and inflation are two macroeconomic variables that dramatically affect the value of money and contribute to the demand that money must grow if a client's goal is to maintain consistent buying power over time. Interest rates already dramatically affect valuations on portions of fixed income markets. In addition, interest rates influence the risk-free rate of return and often signal anticipated future growth in an economy. Inflation is also a major consideration. Since first world monetary inflation has been consistently rising over the last 60 years, investment decisions must consider the time value of money and its future value. Although addressed in a minor way in this dissertation, adding inflation and interest rates to macroeconomic models that do not include GDP could possibly add insight into the way individuals evaluate decisions involving financial risk.

Another area to explore in future research would be the perceptions of social programs, financial markets, and macroeconomic conditions. Instead of observing the statistics of actual conditions, measuring consumer sentiment may provide additional insight into the effects of

perception on financial risk taking. For example, one's perception of the long-term viability of Social Security in the United States may impact their risk perception and investing decision. In addition, changes in the political economy may bring uncertainty even if the actual changes are limited in scope. Finally, future studies could measure both financial education and finical knowledge to see how it impacts individual willingness to take risk.

Financial planning is a fascinating area of study that will continue to evolve and grow as people around the world learn, invest, and take careful consideration of how they want to save and spend their money over time. The pace of information dissemination continues to increase and, unsurprisingly, many of the seminal articles citied in this dissertation were written before the internet was publicly available or utilized daily. The way individuals gather information, make economic choices, and evaluate risk will certainly change over time as will the role of financial planning professionals. Risk tolerance will continue to be an important factor shaping consumer and household decision making. This study has added to the risk-tolerance literature by showing how, while generally stable, risk-tolerance can change over time.

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APPENDIX 1

SPSS Output Multinomial Logistic Regression Model II

```
NOMREG Change_Catagory101
(BASE=0 ORDER=ASCENDING) BY Gender Married LowOutlie
r HighOutlier WITH
Age Education_Level Income Household_Size Networth Social_Support_GDP Comm
odity_Index GDP_AVG_C
MARKET_AVG GDPxAge GDPxGender GDPxEd GDPxIncome GDPxMarried GDPxHousehold
GDPxNetworth
GDPxSocialSupport MarketxAge MarketxGender MarketxEd MarketxIncome Marketx
Married MarketxHousehold
MarketxNetworth MarketxSocialSupport CommodityxAge CommodityxGender Commod
ityxEd CommodityIncome
CommodityxMarried CommodityxHousehold CommodityxNetworth CommodityxSocialS
upport
/CRITERIA CIN(95) DELTA(0) MXITER(100) MXSTEP(5) CHKSEP(20) LCONVERGE(0)
PCO
NVERGE(0.000001)
SINGULAR(0.00000001)
/MODEL
/STEPWISE=PIN(.05) POUT(0.1) MINEFFECT(0) RULE(SINGLE) ENTRYMETHOD(LR)
REMOV
ALMETHOD(LR)
/INTERCEPT=INCLUDE
/PRINT=PARAMETER SUMMARY LRT CPS STEP MFI.
```

Nominal Regression

Page 1

Case Processing Summary

	N	Marginal Percentage
Change_Catagory -1,0,1		
-1	576	10.0%
0	4379	75.9%
1	817	14.2%
Gender 1	3288	57.0%
2	2484	43.0%
Married 1		
2		
Really Low Score .00		
1.00		
Really High Score .00		
1.00		
Valid		
Missing		
Total		
Subpopulation		

4829 83.7%
943 16.3%
5369 93.0%
403 7.0%
5148 89.2%
624 10.8%
5772 100.0%
3920
9692
5746[a]
The dependent variable has only one value observed in 5737 (99.8%) a. subpopulations.

Model Fitting Information

Model
Model
Fitting
Criteria Likelihood Ratio Tests
-2 Log
Likelihood Chi-Square df Sig.
Intercept Only
Final
8256.133
7831.130 425.003 74 .000

Pseudo R-Square

Cox and Snell
Nagelkerke
McFadden
.071
.093
.051

Page 2

Likelihood Ratio Tests

Effect
Model
Fitting
Criteria Likelihood Ratio Tests
-2 Log
Likelihood
of Reduced
Model Chi-Square df Sig.
Intercept
Age
Education_Level
Income
Household_Size
Networth
Social_Support_GD
P
Commodity_Index
GDP_AVG_C
MARKET_AVG
GDPxAge
GDPxGender
GDPxEd
GDPxIncome
GDPxMarried
GDPxHousehold
GDPxNetworth
GDPxSocialSupport
MarketxAge
MarketxGender
MarketxEd
MarketxIncome

MarketxMarried
MarketxHousehold
MarketxNetworth
MarketxSocialSupp
ort
CommodityxAge
CommodityxGender
7831.13a .000 0 .
7856.545 25.415 2 .000
7836.140 5.009 2 .082
7834.524 3.393 2 .183
7834.419 3.289 2 .193
7833.695 2.565 2 .277
7842.181 11.051 2 .004
7832.820 1.690 2 .430
7860.112 28.982 2 .000
7840.235 9.105 2 .011
7831.133 .002 2 .999
7837.294 6.164 2 .046
7831.712 .582 2 .748
7831.939 .809 2 .667
7831.331 .201 2 .905
7831.145 .015 2 .993
7832.732 1.602 2 .449
7837.152 6.022 2 .049
7835.592 4.462 2 .107
7838.316 7.186 2 .028
7831.877 .746 2 .688
7831.748 .618 2 .734
7832.677 1.547 2 .461
7831.912 .781 2 .677
7832.226 1.095 2 .578
7832.547 1.416 2 .493
7834.145 3.014 2 .222
7835.086 3.956 2 .138

Likelihood Ratio Tests

Effect
Model
Fitting
Criteria Likelihood Ratio Tests
-2 Log
Likelihood
of Reduced
Model Chi-Square df Sig.
CommodityxEd
CommodityIncome
CommodityxMarried
CommodityxHouseh
old
CommodityxNetwort
h
CommodityxSocialS
upport
Gender
Married
LowOutlier
HighOutlier
7832.064 .934 2 .627
7832.205 1.075 2 .584
7832.608 1.478 2 .478
7831.551 .421 2 .810

7832.501 1.371 2 .504
7831.568 .438 2 .803
7833.385 2.255 2 .324
7831.867 .737 2 .692
7964.301 133.171 2 .000
7964.391 133.260 2 .000
The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.
This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.
a.
Page 4
Parameter Estimates
Change_Catagory -1,0,1[a] B Std. Error Wald df Sig. Exp(B)
95%
Confidence ...
Lower
Bound
-1 Intercept
Age
Education_Level
Income
Household_Size
Networth
Social_Support_GD
P
Commodity_Index
GDP_AVG_C
MARKET_AVG
GDPxAge
GDPxGender
GDPxEd
GDPxIncome
GDPxMarried
GDPxHousehold
GDPxNetworth
GDPxSocialSupport
MarketxAge
MarketxGender
MarketxEd
MarketxIncome
MarketxMarried
MarketxHousehold
MarketxNetworth
MarketxSocialSupp
ort
CommodityxAge
CommodityxGender
CommodityxEd
CommodityIncome
CommodityxMarried
6.189 1.513 16.734 1 .000
.010 .005 4.098 1 .043 1.010 1.000
-.090 .045 3.989 1 .046 .914 .837
-.073 .048 2.320 1 .128 .930 .846
-.062 .046 1.827 1 .176 .940 .860
-.057 .036 2.452 1 .117 .945 .880
-.105 .038 7.727 1 .005 .901 .837
-.010 .013 .537 1 .464 .990 .965
-.001 .000 22.871 1 .000 .999 .999

.001 .000 6.022 1 .014 1.001 1.000
.000 .000 .002 1 .961 1.000 1.000
.000 .000 .567 1 .451 1.000 .999
.000 .000 .374 1 .541 1.000 1.000
.000 .000 .778 1 .378 1.000 1.000
.000 .000 .010 1 .920 1.000 .999
.000 .000 .002 1 .969 1.000 1.000
.000 .000 .771 1 .380 1.000 1.000
.000 .000 4.262 1 .039 1.000 1.000
.000 .000 1.923 1 .166 1.000 1.000
.001 .001 2.616 1 .106 1.001 1.000
.000 .000 .729 1 .393 1.000 1.000
.000 .000 .385 1 .535 1.000 1.000
-.001 .001 .917 1 .338 .999 .998
.000 .000 .320 1 .572 1.000 .999
.000 .000 .336 1 .562 1.000 1.000
.000 .000 .823 1 .364 1.000 .999
-.002 .001 1.448 1 .229 .998 .996
.037 .028 1.738 1 .187 1.038 .982
.011 .012 .780 1 .377 1.011 .987
-.007 .013 .277 1 .598 .993 .969
-.041 .037 1.213 1 .271 .960 .893

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Parameter Estimates

Change_Catagory -1,0,1[a]

95% Confidence ... Upper Bound

-1 Intercept
Age
Education_Level
Income
Household_Size
Networth
Social_Support_GDP
Commodity_Index
GDP_AVG_C
MARKET_AVG
GDPxAge
GDPxGender
GDPxEd
GDPxIncome
GDPxMarried
GDPxHousehold
GDPxNetworth
GDPxSocialSupport
MarketxAge
MarketxGender
MarketxEd
MarketxIncome
MarketxMarried
MarketxHousehold
MarketxNetworth
MarketxSocialSupport
CommodityxAge
CommodityxGender
CommodityxEd
CommodityIncome
CommodityxMarried

1.020
.998
1.021
1.028
1.014
.970
1.017
1.000
1.001
1.000
1.000
1.000
1.000
1.001
1.000
1.000
1.000
1.000
1.002
1.001
1.001
1.001
1.000
1.001
1.000
1.001
1.097
1.035
1.019
1.032

Parameter Estimates

Change_Catagory -1,0,1[a] B Std. Error Wald df Sig. Exp(B) 95% Confidence ... Lower Bound

CommodityxHousehold

CommodityxNetworth

CommodityxSocialSupport

[Gender=1]

[Gender=2]

[Married=1]

[Married=2]

[LowOutlier=.00]

[LowOutlier=1.00]

[HighOutlier=.00]

[HighOutlier=1.00]

1 Intercept

Age

Education_Level

Income

Household_Size

Networth

Social_Support_GDP

Commodity_Index

GDP_AVG_C

MARKET_AVG

GDPxAge
GDPxGender
GDPxEd
GDPxIncome
GDPxMarried
GDPxHousehold
GDPxNetworth
GDPxSocialSupport
MarketxAge
MarketxGender
MarketxEd
MarketxIncome
-.003 .012 .084 1 .772 .997 .973
-.004 .010 .201 1 .654 .996 .977
.002 .010 .042 1 .837 1.002 .983
-.110 .105 1.111 1 .292 .895 .729
0[b] . . 0 . . .
-.103 .128 .642 1 .423 .902 .702
0[b] . . 0 . . .
.719 .275 6.850 1 .009 2.053 1.198
0[b] . . 0 . . .
-1.185 .122 94.682 1 .000 .306 .241
0[b] . . 0 . . .
.194 1.374 .020 1 .888
-.018 .004 18.856 1 .000 .982 .974
-.048 .038 1.610 1 .204 .954 .886
.033 .039 .728 1 .394 1.034 .958
.035 .034 1.076 1 .300 1.036 .969
-.017 .030 .318 1 .573 .983 .927
-.069 .032 4.672 1 .031 .933 .877
-.014 .012 1.327 1 .249 .986 .962
.000 .000 3.503 1 .061 1.000 1.000
.000 .000 2.144 1 .143 1.000 .999
.000 .000 .000 1 .993 1.000 1.000
-.001 .000 5.952 1 .015 .999 .999
.000 .000 .279 1 .597 1.000 1.000
.000 .000 .076 1 .783 1.000 1.000
.000 .000 .199 1 .655 1.000 .999
.000 .000 .014 1 .906 1.000 1.000
.000 .000 .626 1 .429 1.000 1.000
.000 .000 1.122 1 .290 1.000 1.000
.000 .000 3.059 1 .080 1.000 1.000
.001 .000 5.324 1 .021 1.001 1.000
.000 .000 .001 1 .972 1.000 1.000
.000 .000 .304 1 .582 1.000 1.000

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Parameter Estimates

Change_Catagory -1,0,1[a]
95%
Confidence ...
Upper
Bound
CommodityxHouseh
old
CommodityxNetwort
h
CommodityxSocialS
upport
[Gender=1]
[Gender=2]
[Married=1]
[Married=2]

[LowOutlier=.00]
[LowOutlier=1.00]
[HighOutlier=.00]
[HighOutlier=1.00]
1 Intercept
Age
Education_Level
Income
Household_Size
Networth
Social_Support_GD
P
Commodity_Index
GDP_AVG_C
MARKET_AVG
GDPxAge
GDPxGender
GDPxEd
GDPxIncome
GDPxMarried
GDPxHousehold
GDPxNetworth
GDPxSocialSupport
MarketxAge
MarketxGender
MarketxEd
MarketxIncome
1.020
1.015
1.022
1.100
.
1.160
.
3.518
.
.388
.
.990
1.026
1.117
1.108
1.043
.994
1.010
1.000
1.000
1.000
1.000
1.000
1.000
1.000
1.000
1.000
1.000
1.000
1.000
1.002
1.000
1.001

Parameter Estimates

Change_Catagory -1,0,1[a] B Std. Error Wald df Sig. Exp(B)

95%
Confidence ...
Lower
Bound
MarketxMarried
MarketxHousehold
MarketxNetworth
MarketxSocialSupp
ort
CommodityxAge
CommodityxGender
CommodityxEd
CommodityIncome
CommodityxMarried
CommodityxHouseh
old
CommodityxNetwort
h
CommodityxSocialS
upport
[Gender=1]
[Gender=2]
[Married=1]
[Married=2]
[LowOutlier=.00]
[LowOutlier=1.00]
[HighOutlier=.00]
[HighOutlier=1.00]
-.001 .001 .817 1 .366 .999 .998
.000 .000 .546 1 .460 1.000 1.000
.000 .000 .876 1 .349 1.000 1.000
.000 .000 .434 1 .510 1.000 1.000
.001 .001 1.183 1 .277 1.001 .999
.044 .027 2.689 1 .101 1.044 .992
.006 .011 .249 1 .617 1.006 .984
.010 .012 .675 1 .411 1.010 .987
.013 .036 .135 1 .713 1.013 .945
.006 .010 .295 1 .587 1.006 .985
-.011 .009 1.277 1 .258 .989 .971
.006 .010 .422 1 .516 1.006 .987
.082 .087 .882 1 .348 1.086 .915
0[b] . . 0 . . .
.025 .113 .049 1 .824 1.025 .821
0[b] . . 0 . . .
-1.344 .120 124.656 1 .000 .261 .206
0[b] . . 0 . . .
.898 .179 25.062 1 .000 2.454 1.727
0[b] . . 0 . . .

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Parameter Estimates

Change_Catagory -1,0,1[a]
95%
Confidence ...
Upper
Bound
MarketxMarried
MarketxHousehold
MarketxNetworth
MarketxSocialSupp
ort
CommodityxAge
CommodityxGender

CommodityxEd
CommodityIncome
CommodityxMarried
CommodityxHouseh
old
CommodityxNetwort
h
CommodityxSocialS
upport
[Gender=1]
[Gender=2]
[Married=1]
[Married=2]
[LowOutlier=.00]
[LowOutlier=1.00]
[HighOutlier=.00]
[HighOutlier=1.00]
1.001
1.000
1.000
1.000
1.004
1.100
1.028
1.034
1.087
1.027
1.008
1.025
1.288
.
1.280
.
.330
.
3.488
.
The reference a. category is: 0.
b. This parameter is set to zero because it is redundant.
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