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Does financial risk tolerance change over time? A test of the role macroeconomic, biopsychosocial and environmental, and social support factors play in shaping changes in risk attitudes

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Abstract

Financial planners work in an environment that requires the documentation of a client's financial attitudes and preferences. Financial risk tolerance is one such attitudinal construct that is generally required by regulators to be evaluated. While there are numerous commercial and academic products used to assess client risk attitudes, questions have been raised over the past several decades regarding the stability of scores from risk-tolerance tools. Specifically, financial planners, as well as regulators, require evidence documenting to what extent risk tolerance changes over time, and if changes do occur, the variables associated with variability. The purpose of this study was to address these needs. Based on a model that included macroeconomic indicators, biopsychosocial and environmental factors, and measures of social support, it was determined that risk-tolerance attitudes remain generally stable over time. However, there are groups of test takers that exhibit significant shifts in risk tolerance. This article describes some of the variables associated with these score changes, as well as providing financial planning professionals with guidance on how to identify clients who may be prone to shifting their tolerance for financial risk.

Keywords: Financial risk tolerance; Macroeconomic indicators; Social support; Change in risk tolerance

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1. Introduction

Understanding appropriate investment options and recommending a suitable allocation of a client's assets is a key component of a well-drafted comprehensive financial plan. Accurate assessment of financial risk tolerance, as an element of the asset allocation process, is generally accepted as an essential condition to developing a suitable and quality financial plan for individuals (CFP Board, 2015). For those working as a financial planner, financial risk tolerance (FRT) can be defined parsimoniously as an individual's willingness to take risk (Dalton and Dalton, 2004). In the information and data gathering stage of client work, a suitable risk assessment is generally required to be used to meet regulatory requirements, as well as to formulate the best plan for an individual (Roszkowski and Davey, 2010). Understanding how a person's FRT 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 FRT is closely linked to better understanding the mechanics that combine to influence an individual's behavior (Xiao, 2008).

FRT assessment serves as a foundation for nearly all financial planning models, frameworks, and recommendations. A well-designed FRT assessment is a tool that can be used to anticipate an individual's decisions, determine optimal financial choices, and maximize utility under the constraint of imperfect knowledge. One question related to the study of FRT is of particular importance, specifically: Does FRT change over time? The concept of FRT "traitedness" is gaining traction as a way to answer the question of how much an individual's FRT deviates over time (Roszkowski, Delaney, and Cordell, 2009). The extent to which people will exhibit a personality trait in behaviors across different situations and contexts defines traitedness (Baumeister and Tice, 1988). For financial planners, policy makers, and researchers, answering the question of how much an individual's FRT changes (if at all) across time is needed to fully understand how clients will react in a variety of situations and within the context of changing macroeconomic environments.

The purpose of this study was to document changes in FRT across time. An important aspect of the study was to test whether macroeconomic variables and social support, as indicated by country of residence, were associated with changes in FRT at the individual/household level. Results from this study help expand the existing literature on the degree to which FRT changes over time. Furthermore, results provide an insight into the role macroeconomic and household level variables play in shaping changes in FRT.

2. Research framework

If the assumption that FRT is an essential element in the development of an accurate and acceptable comprehensive financial plan is true, it then follows that 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 global financial crisis, can affect an individual's measured FRT. They noted that some view FRT as a completely stable characteristic (trait), while others view FRT as something that varies

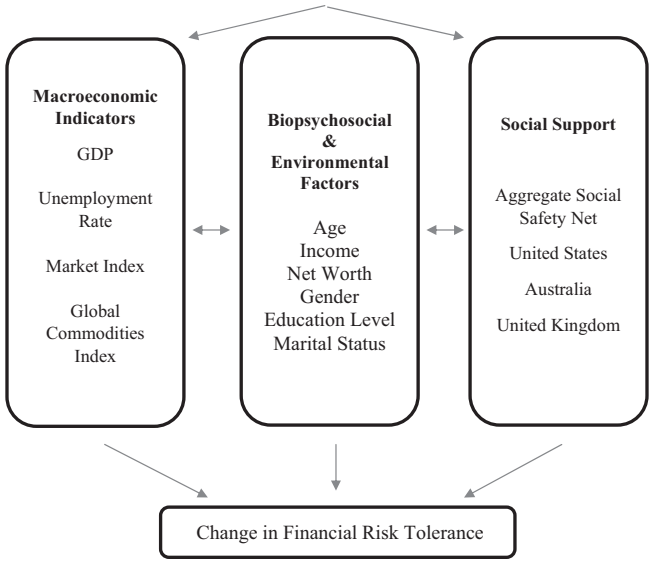

Fig. 1. The financial risk tolerance (FRT) model based on changes in FRT.

depending on the mood or environment of the test taker (state). However, they concluded, based on a review of the literature and their own experience, that FRT 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 multidecade relationships are common.

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 the associations between and among macroeconomic variables, demographic factors, and social support and FRT. The model is shown in Fig. 1.

The model was developed using concepts from three frameworks of risk taking: macroeconomic theory, the cushion hypothesis, and a model of the determinants of risk taking developed by Irwin (1993). It was hypothesized in this study that the macroeconomic condition of any nation may be associated with changes in FRT. Macroeconomic conditions are complex, with codependent activities that combine to produce and consume resources. Macroeconomic factors may influence the willingness of individuals to take risk in two ways. First, negative events may reduce financial capacity, leading to a negative shift in FRT. Second, perceptions of conditions, rather than the actual impact of macroeconomic events, could shape someone's willingness to take financial risk. Four variables were used in this study to test the impact of macroeconomic conditions on changes in FRT: country level gross domestic product (GDP), national unemployment rates, stock market conditions, and global commodity prices.

The second element of the framework was based on Irwin's (1993) model of risk taking. Irwin surmised that different predisposing factors affect an individual's risk-tolerance attitude. Biopsychosocial and environmental were two concepts Irwin used as classifying factors

that influence FRT. Biopsychosocial factors include variables such as age and gender while environmental factors include income, net worth, education, and marital status, among other factors. Taken together, the combination of these factors and characteristics are expected to have a meaningful influence on an individual's risk-tolerance attitude. Imbedded within Irwin's (1993) model are variables related to cultural experiences and socialization.

As shown in Fig. 1, social support was also included in the model. The choice of this variable was based on the cushion hypothesis. This hypothesis states that individuals who live in collectivist cultures generally have a greater social support system that "cushions" downside risks when making risky decisions (Hsee and Weber, 1999; Weber and Hsee, 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. In other words, the hypothesis posits that as social support increases, so does the willingness to take financial risk at the household level. It is important to note, however, that it can also be hypothesized that the opposite may be true. It may be that risk is often taken because of the necessity of making progress or achieving financial goals. Statman (2008) noted that individuals often pay with risk for a chance to move up in life and that in many countries, individuals are willing to take greater risks for potentially higher rewards, even when familial and national support is low.

3. Literature review

Hallahan, Faff, and McKenzie (2004) noted the following: "Despite its importance in the financial services industry, there remain some unresolved questions with respect to the 'determinants of financial risk tolerance'" (p. 58). By determinants, Hallahan et al. meant the identification of factors or variables that reveal a systematic association with FRT. Over the years, varied factors have been proposed and tested but the results have been inconsistent. This review highlights literature that has tested some of these factors.

3.1. Macroeconomic factors

Many individuals who were economically active or invested in the markets during the global financial crisis 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 their 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 relation to this exposure. Their study documented an important link in the relationship between the macro economy and the way individuals make investing decisions involving risk.

Reinhart and Borensztein (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 association they have with markets and overall economic conditions. 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, n.d.). 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, for example, commodity prices (including oil) make up disproportionally large components of total revenue and output (World Bank, n.d.).

West and Worthington (2014) examined the relationship between macroeconomic conditions and financial risk attitudes. Based in Australia, their study relied on surveys of approximately 6,800 households. They noted, consistent with past literature, that demographic characteristics—especially age—had a strong relationship with changes in FRT over time. They also noted that macroeconomic conditions were jointly significant in shaping risk attitudes. Several of the variables studied were found to be significantly associated with 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 FRT during the period 1983–2001. Based on the Survey of Consumer Finances, FRT 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 a seemingly negligible effect on domestic FRT.

Market conditions have been hypothesized to influence FRT. Rabbani, Grable, Heo, Nobre, and Kuzniak (2017), for example, noted that daily market volatility exhibited a positive association with FRT scores in their study, although the relationship was not strong enough to generally warrant a change in portfolio holdings. A similar finding was reported by Zeisberger, Vrecko, and Langer (2010). Santacruz (2009) looked at general economic mood and its influence on FRT scores. He concluded 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 investors' perceptions of recent salient macroeconomic events. In general, however, there continues to be a paucity of research that deals with this topic, and as such, the relationship is still subject to debate.

To address this apparent gap in the literature, the relationship between global macroeconomic variables and an individual's FRT 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 among economic indicators. Therefore, one essential step to evaluating the usefulness of economic variables in future studies will be determining which variables are independently related to FRT.

3.2. Biopsychosocial and environmental factors

Age, income, education, and wealth have all been shown to be significantly associated with an individual's FRT (Bajtelsmit, Bernasek, and Jianakoplos, 1999; Grable and Lytton, 1999; Pålsson, 1996), but the explanatory power and magnitude of their effects have been disputed (Gollier and Zeckhauser, 2002; Hariharan, Chapman, and Domian, 2000). In general, young men and those with more income and wealth are thought to be more risk tolerant compared with older individuals and those with fewer resources. The role of household size in shaping risk attitudes has also been explored. Most often, large households tend to exhibit relative risk aversion. This may result from a lack of risk capacity or a preference to be conservative with household resources. Similarly, variables associated with human capital have been found to be positively associated with FRT. Higher attained education, for example, is generally thought to be associated with elevated levels of FRT.

Baker and Haslem (1974) showed that some socioeconomic characteristics have a more profound influence in shaping the risk and return preferences of individual investors. Among the most important factors are age, gender, marital status, education, and income. The implications of their findings were that a person's demographic profile can have a strong influence on perceptions of risk and ultimately FRT.

In 1997, Wang and Hanna (1997) studied the association between age and FRT. Based on data from the Survey of Consumer Finances, they tested the life-cycle investment theory. Wang and Hanna measured FRT as the amount of risky assets held as a percentage of total wealth. They concluded that FRT increased with age, controlling for other important variables. Dahlbäck (1991) found that the propensity to take risks was influenced by saving decisions. Individuals who are willing to save more may have the ability to invest more aggressively. This implies that older investors—typically those with more wealth—may be more willing to take more risk. This relationship, however, is out of step with what financial planners typically assume. Nearly all financial planners, and some individual investors, simply use heuristics or rules such "Age = Percent Allocated to Bonds" to estimate the appropriate risk level within a given portfolio allocation (Benartzi and 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 or risk capacity. By default, as someone ages they lose time to recoup potential losses. As such, there may be no real age effect.

A 1996 study by Sung and Hanna (1996) investigated several factors that are generally thought to have a positive association with a household's 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) were 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 compared with 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 FRT was associated with being male, older, married, professionally employed with higher income, and more education, among other factors. Morin and Suarez (1983) examined the empirical evidence of the effects of wealth on relative risk aversion. Their work investigated a household's demand for risky investments using a

dataset of asset holdings based in Canada. The results of their study showed a diverging relative risk aversion when housing was 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.

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 to 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" can be measured for individuals of all ages and across diverse cultural environments. They noted that when the population ages, aggregate demand for financial investments rise and demand for housing declines. One conclusion from their work was that changes in someone's demographic profile can bring about fluctuations in asset demand.

3.3. Social support and country of origin factors

Cross-cultural FRT has emerged over the last 20 years as a niche area of interest among those who study FRT. Bontempo, Bottom, and Weber (1997) observed patterns across four different countries. They concluded that uncertainty avoidance in a country may influence risk perceptions. Many other studies using international comparisons have observed differences between the United States (or Western Europe) and Asian countries, notably China (Fan and Xiao, 2005; Hsee and Weber, 1999; Tan, 2011; Wang and Fischbeck, 2004). Findings from these studies have generally indicated 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 country of origin and the holdings of different asset classes, including homeownership, equities, and business ownership.

Rieger, Wang, and Hens (2014) presented a comprehensive evaluation of international risk taking in their article. Rieger et al. documented the risk preferences of individuals in 53 countries. They reported that individuals across cultures are, on average, risk averse regarding gains and risk seeking with losses. This finding was in line with the propositions found in prospect theory (Kahneman and Tversky, 1979). Rieger et al. also noted that risk preferences appear to be dependent on economic conditions and cultural factors. It was 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 FRT were conducted by Statman (2008) and Vieider, Chmura, and Martinsson (2012). Studying 22 and 30 countries, respectively, the findings from these studies showed that those from 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 socioeconomic variables and risk-seeking behavior. They reported a strong negative correlation between FRT 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.

When viewed from the perspective of the cushion hypothesis, country of origin variables become important because each country has a unique social support policy. It is possible that countries with generous social support systems create a 'cushion' for risk takers who fail in the markets. If true, this ought to increase the willingness of those in these countries to take risk. On the other hand, a robust social support system may dampen FRT based on signals that country residents need not take risk to gain financial stability. At this point, neither hypothesis has been fully explored in the literature.

3.4. Stability of FRT

One of the least discussed notions within the FRT literature is the likeliness and degree to which risk attitudes change over time (Zeisberger et al., 2010). In this regard, Roszkowski and his associates (Roszkowski et al., 2009) concluded that intrapersonal consistency was stable over time but greater variability was associated with higher risk-tolerance scores. What remains to be discovered are the unique characteristics of individuals who show inconsistency in their FRT scores across multiple assessments.

The consistency of individual FRT over time can be assessed and split into four distinct categories: (1) stability over time, (2) reactions to market conditions, (3) consistency across different dimensions of FRT, and (4) consistency across different types of questionnaires (Roszkowski et al., 2009). When looking at FRT 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 Everett (2003), Grable and Lytton (2001), and Yang (2004) each looked at the consistency of different risk questionnaires across time. In generally, they found that psychometrically valid assessment tools with published reliability estimates tend to, on average, generate repeatable scores, but that even with the most reliable instrument, changes in FRT scores do occur among some test takers. The general theme of research regarding the intrapersonal consistency of FRT across time is that the construct of FRT is relatively stable but does show some fluctuation based on environmental factors. For example, Zeisberger et al. (2010) noted that risk parameters appear quite stable for the majority of investors, but that it is possible for one-third of investors to exhibit significant instability over time.

4. Methodology

In an attempt to test the FRT model (Fig. 1), this study used a secondary dataset made available by FinaMetrica Pty Ltd. The risk profiling database included information collected in the United States (US), United Kingdom (UK), and Australia (AUS). The choice to retain data from each country was based on two factors. First, it was thought that the risk tolerance exhibited by citizens of each country might differ based on the macroeconomic conditions present in each locale. Second, the use of multicountry data allowed for a test of the cushion

hypothesis. The data contained biopsychosocial and environmental information, as well as composite FRT scores for individuals who completed multiple risk assessments. Data collection began in January of 2010 and ended in December of 2014. The mean and median time period between tests was 805 and 763 days, respectively ($SD = 388.74$) or slightly more than two years. The time span provided a unique perspective on the global trends and distinctive macroeconomic environments that existed in the post global financial crisis period. Table 1 shows the demographic profile of the sample based on age, education, income, household size, net worth, and gender. Keep in mind that education, income, and net worth were measured using ordinal variables (variable coding is discussed later in this section). The sample size used in the regression ($n = 4{,}983$) was reduced because of missing data and modeling delimitations.

With an average age of 57, the sample population was older than the mean global population, but this was not surprising based on the fact the sample was drawn from individuals seeking financial or investment guidance. Average income fell into the $50,000 to $100,000 range, whereas the average net worth for respondents fell into the $250,000 to $500,000 range. The mean education level was the Some College or Trade School category. The sample was skewed slightly toward males who made up almost 55% of the sample.

A unique feature of the dataset was that all respondents took multiple assessments over the course of several months or years. This unique aspect of the dataset allowed for a comparison of respondents at different points in time, which made possible the identification of unique attributes of respondents who exhibited a notable change in their risk-tolerance score (RTS). The sample was delimited to include only those respondents who completed multiple assessments. Table 2 shows the distribution of risk scores based on the initial risk-tolerance score (RTS_1) and the follow up risk-tolerance score (RTS_2) test dates. The variables were also coded by country (AUS, UK, US).

The FinaMetrica scale was utilized across each of the three countries in the sample to create consistency and comparability across countries. Because of a common language, translation and semantic issues represented less of a methodological issue in this study compared with other research projects measuring global risk attitudes where survey tools have been translated into multiple languages. Minor adjustments to reflect regional dialects may have been used, but inconsistency across differing country boundaries was expected to be minor. The validity and reliability of the assessment tool has been verified in previous studies that have used the FinaMetrica dataset. For example, when testing the validity of the measure, Gilliam, Chatterjee, and Zhu (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 includes:

Compared with 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

Table 1 Demographic profile of sample

Variable	*N*	Percent of sample
Gender		
Males	5,285	54.6%
Females	4,392	45.4%
Age		
18–34	1,930	25.0%
35–54	1,930	25.0%
55–65	1,930	25.0%
65+	1,930	25.0%
Education		
Did not complete high school	832	13.7%
Completed high school	707	11.6%
Trade or diploma	1,246	20.5%
University degree or higher	3,298	54.2%
Marital status		
Married (or in a de facto relationship)	5,174	83.2%
Unmarried	1,046	16.8%
Income (income from all sources)		
Under $30,000	625	10.2%
$30,000-$50,000	1,177	19.2%
$50,000-$100,000	2,133	34.7%
$100,000-$200,000	1,295	21.1%
$200,000-$300,000	672	10.9%
Over $300,000	241	3.9%
Household size		
0	2,180	36.2%
1	1,957	32.5%
2	859	14.3%
3	661	11.0%
4+	366	6.1%
Net worth		
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	2,055	33.8%
$500,000-$1,000,000	1,460	24.0%
$1,000,000-$2,500,000	735	12.1%
Over $2,500,000	322	5.3%
Country		
Australia	1,762	18.2%
United States	6,269	64.7%
United Kingdom	4,564	17.1%

7. Extremely high risk taker

How easily do you adapt when things go wrong financially?

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

Table 2 Demographic profile of the sample based on financial risk tolerance (FRT) scores

FRT scores	*N*	%	Mean	Standard deviation	Min	Max
RTS_1	9,692	100.0%	47.40	9.51	14	93
RTS_2	9,692	100.0%	48.00	9.61	15	95
AUS_RTS_1	1,762	18.1%	48.72	9.63	18	86
AUS_RTS_2	1,763	18.1%	48.92	9.49	16	87
UK_RTS_1	6,269	64.3%	46.61	9.56	14	93
UK_RTS_2	6,270	64.3%	47.38	9.69	15	95
US_RTS_1	1,661	17.0%	49.18	8.81	18	83
US_RTS_2	1,662	17.0%	49.73	9.15	21	84

RTS = risk-tolerance score; AUS = Australia; UK = United Kingdom; US = United States.

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 how to allocate their client's investments (FinaMetrica, n.d.).

4.1. Dependent variable

4.1.1. Change in FRT score

FRT, as defined by each respondent's RTS, was the primary outcome 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, higher scores were indicative of having a higher FRT. The mean and standard deviation of the initial test (RTS_1) for the sample was 47.40 and 9.51, respectively. In addition to measuring overall composite FRT scores, another aspect of the sample were matching data pertaining to changes in FRT scores across time by individual respondent. The dataset contained an additional score for each respondent (RTS_2). The mean and standard deviation for the RTS_2 score was 48.10 and 9.61, respectively. Overall, FRT scores increased less than one point (0.63; $SD = 6.13$) from the initial test.

With such a large sample, one would expect to see a selection of individuals who exhibited both extreme consistency in FRT and others who had major fluctuations in their FRT scores. The following mean deviation technique, as outlined by Roszkowski and Spreat (2010), was used to estimate large fluctuations as a way to isolate those with significant changes in FRT:

1. Subtract the reliability coefficient from 1.0.
   a. $1.0 - 0.89 = 0.11$
2. Calculate the square root of the estimate.
   a. $\text{SQRT}(0.11) = 0.33$
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 test taker with a RTS_2 score between 41.25 to 53.55 (41 to 54 rounded) was considered *RTS_Stable*.

This methodological approach, based on the standard error of the mean, provided an estimate of how much variation was needed to confidently conclude that a significant change in a RTS had occurred. If the difference in test scores between *RTS_1* and *RTS_2* dropped below the defined confidence interval, the respondent was placed into the *RTS_Decrease* category. If the difference in test scores between *RTS_1* and *RTS_2* rose above the defined confidence interval, the respondent was placed into the *RTS_Increase* category. Again, by measuring respondents at two separate times, with months and/or years in between, and by combing information about time periods, biopsychosocial and environmental variables, macroeconomic factors, and social support, it was possible to draw conclusions about the unique properties of respondents who exhibited variability in their risk attitude.

4.2. Independent variables

Six biopsychosocial and environmental variables were also recorded at the time of each initial test: 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 measured. In addition to the information in the dataset, macroeconomic indicator variables were combined with each sampling unit based on the date of the initial survey. In an effort to understand what, if any, macroeconomic variables might influence an individual's willingness to take risk, the combined dataset allowed for tests of the significance of global macroeconomic factors. Three 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 FRT. 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 data points by matching data based on the date of the initial assessment.

The macroeconomic variables were operationalized as follows:

- *United States Gross Domestic Product (GDP)*: 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*: 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*: Measured in US dollars, the chained volume measures were 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 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 percentage 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 NASDAQ.
- *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, and 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:* To obtain a global perspective on domestic productions' relationship to FRT, 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:

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

- *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.

These data were matched, by date of the initial test, to each respondent's data profile. These data, rather than a change variable, were used in subsequent analyses.

Other variables were also included in the analysis. To test the effects of initial outliers, a variable was created that separated individuals into categories based on their RTS_1. If someone scored extremely low they were coded as Low Initial score, and if they scored extremely high they were given a High Initial score notation.

Biopsychosocial and environmental factors were also included in the analysis. It is well known that many professional financial planners use biopsychosocial and environmental variables to predict and assess the FRT of their clients (Spitzer and Singh, 2008). Previous research has done a relatively thorough job describing the most popular biopsychosocial and environmental variables used by financial planners (Grable, 1997; Grable and Joo, 1998; Sung and Hanna, 1996) that appear to be associated with financial risk tolerance. Some of the most important of these factors were included in this study. Each was measured as follows:

- *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 coded using 10 distinct 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.

Table 3 Social support by country

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

GDP = gross domestic product.

A measure of social support was included in the study. Social support is a broad term that describes the aggregate level of transfers 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 can 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 percentage of GDP, produces a percentage statistic that allows for comparison across any set of countries worldwide. Adding the social support variable in this study was done to provide a test of the cushion hypothesis. For the scope of this study, social support was measured by percentage of GDP based on the US OECDs index, as shown in Table 3.

Table 4 provides a descriptive summary of the dependent and independent variables used in this study (data for social support are shown in Table 3). A mean value is shown when the data were recorded at the interval level. A median score is shown for categorical variables.

4.3. Data analysis methodology

The following statistical techniques were used in this study: correlation, probability distribution, and logistic regression analyses. After testing the individual variables for normality and potential multicollinearity, a multinomial logistic regression analysis was used to examine the relationships among the independent variables and changes in FRT. Specifically, the conceptual model was tested using a multinomial logistic linear regression with the dependent variable separated into three different binary categories: Decrease in Risk Score, Stable Risk Score, and Increase in Risk Score. The model was used to evaluate the change of those whose RTS decreased and those whose RTS increased across time relative to respondents with stable scores. The results provided clarity to which, if any, variables uniquely influenced a respondent's change in FRT across time.

5. Results

The first step in the analysis involved testing for possible multicollinearity among the independent variables. This test was conducted using a correlation analysis. The associations between and among the biopsychosocial and environmental factors were not particularly

Table 4 Descriptive summary of the independent variables

Variable	*N*	Mean/median	Standard deviation	Min	Max
RTS_1	9,692	47.4	9.51	14	93
RTS_2	9,692	48.1	9.61	15	95
Δ in RTS	9,692	.63	6.13	−36	48
Days between tests	9,692	805.0	388.70	0	1985
Education	6,113	3.1	1.09	1	4
Income	6,143	3.2	1.26	1	6
Household size	6,023	1.2	1.28	1	9
Net worth	6,083	7.2	1.49	1	10
Age	7,722	57.8	11.30	18	93
Gender	9,692				
Male	5,285	54.6	n.a.	0	1
Female	4,407	45.4	n.a.	0	2
Marital status	9,692				
Married	5,174	83.2	n.a.	0	1
US GDP	9,692	$15,741.6	657.23	$14,681	$17,914
AUS GDP	9,692	$ 1,392.1	44.96	$ 1,326	$ 1,522
UK GDP	9,692	$ 2,611.8	53.11	$ 2,528	$ 2,823
US commodity	9,692	29.9	3.37	21	36
US market	9,692	$ 1,339.8	203.99	$ 1,031	$ 2,107
UK market	9,692	£3,079.3	258.18	£2,598	£3,862
AUS market	9,692	AUS$4,596.8	355.29	AUS$4,009	AUS$5,929
US unemployment	9,692	8.6%	0.89	5%	10%
UK unemployment	9,692	7.9%	0.40	6%	9%
AUS unemployment	9,692	5.2%	0.27	5%	6%

RTS = risk-tolerance score; GDP = gross domestic product; US = United States; AUS = Australia; UK = United Kingdom.

high. On the other hand, the correlations among some of the macroeconomic variables were quite high, as shown in Table 5.

As shown in Table 5, worldwide GDP and investment markets were highly correlated during the period of analysis. The correlation between US GDP and UK and AU GDP was 0.98 and 1.00, respectively. Given the high correlations among these variables, composite variables based on each country's data were created. The correlations among these new variables are show in Table 6.

Unemployment and gross domestic product were correlated at almost –1.00. Overall, the high degree of correlation, as defined as a coefficient over 0.70 (Tabachnick, Fidell, and Osterlind, 2007) indicated a potential multicollinearity issue. Because GDP tends to be the primary indicator of economic activity, this variable was chosen to be included in the model.

To build the multinomial logistic model, study participants were split into three unique groups. The first split included respondents who exhibited a significant decrease in their RTS ($N = 938$). The second split was based on respondents who exhibited a significant increase in their RTS ($N = 1{,}355$). The third group included those with a nonsignificant change in their RTS ($N = 7{,}399$). After separating out the groups, specific factors were identified to examine the differences associated with changes in FRT, using the stable group as the reference category.

Table 5 Macroeconomic variables correlation table

	US GDP	UK GDP	AUS GDP	US market	UK market	AUS market	Commodity index	US unemployment	AUS unemployment	UK unemployment
US GDP	1.00	0.98	1.00	0.91	0.75	0.35	−0.12	−0.98	0.65	−0.45
UK GDP		1.00	0.97	0.93	0.80	0.44	−0.1	−0.97	0.70	−0.53
AUS GDP			1.00	0.89	0.72	0.31	−0.14	−0.98	0.65	−0.41
US market				1.00	0.93	0.66	−0.07	−0.93	0.71	−0.66
UK market					1.00	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	−.060	0.33
US unemployment								1.00	−0.69	0.54
AUS unemployment									1.00	−0.65
UK unemployment										1.00

US = United States; UK = United Kingdom; AUS = Australia; GDP = gross domestic product.

Table 6 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

GDP = gross domestic product; MKT = market; COMMODITY = commodity index; UNEMP = unemployment.

Table 7 compares the differences in scores between the respondents from RTS_1 to RTS_2. The overall distribution of changes in risk scores appeared normal.

A correlation estimation was made between change in RTS and days between tests. The test was conducted to evaluate if a longer (or shorter) time horizon between tests might have explained the likelihood of a shifting RTS. The mean score change was 0.63, whereas the mean period between tests was 805 days. A small positive association was noted between the two variables ($r = 0.02$); however, the effect size was very small, with much of the association resulting from the large sample size. The result of the test confirmed that test scores generally increased over the period of analysis, but that the time gap between tests was not a particularly important variable in explaining this shift.

Table 8 show the results of splitting respondents into distinct categories based on a meaningful change between RTS_1 and RTS_2. Respondents that had a significant decrease or increase in score over time, as measured by the standard error of mean technique, were separated from respondents who exhibited stable scores across assessments. Almost 25% of respondents had a significant change in their RTS. In addition, respondents who exhibited significant decreases consistently scored above the mean on the initial assessment, whereas respondents who had significant increases in FRT had initial lower than average scores.

The results of the multinomial logistical model are shown in Table 9. The second and third columns of Table 9 show the model comparing those with a decrease in FRT to those whose score was stable. The last two columns in Table 9 show the model comparing those with an increase in FRT to those whose score remained stable.

The results from the test provide insights into the change some individuals exhibited in their FRT over time. Relative to those whose RTS did not change:

Table 7 Comparison of initial and follow-up scores

Variable	Mean	Standard deviation	Standard error mean	Upper 95%	Lower 95%
Initial average score RTS1	47.01	6.29	0.07	47.15	46.87
Initial average score RTS2	47.61	7.59	0.09	47.77	47.44
Initial low score RTS1	29.83	3.85	0.14	30.11	29.56
Initial low score RTS2	34.64	7.38	0.27	35.17	34.11
Initial high score RTS1	64.82	4.72	0.15	65.11	64.52
Initial high score RTS2	62.38	7.72	0.25	62.87	61.89

RTS = risk-tolerance score.

Table 8 Description of RTS by change across time (N = 9,692)

Variable	Mean	Standard deviation	Standard error mean	Upper 95%	Lower 95%	% of sample
RTS total						
Test 1	47.44	9.51	0.10	47.63	47.25	100.0%
Test 2	48.06	9.61	0.10	48.26	47.87	100.0%
RTS stable						
Test 1	47.66	8.98	0.10	47.87	47.46	76.3%
Test 2	47.81	9.02	0.10	48.01	47.60	76.3%
RTS increase						
Test 1	42.55	9.93	0.27	43.08	42.02	14.0%
Test 2	53.33	10.13	0.28	53.87	52.79	14.0%
RTS decrease						
Test 1	52.73	9.72	0.32	53.35	52.10	9.7%
Test 2	42.50	9.63	0.31	43.11	41.88	9.7%

RTS = risk-tolerance score.

- Older respondents were more likely to be in the decrease category.
- Older respondents were less likely to be in the increase category.
- Those with more education were less likely to be in the decrease category.
- Those who lived in a country with high social support were less likely to be in the decrease category.
- Those who lived in a country with high social support were less likely to be in the increase category.
- Those who lived in a country with a high GDP were less likely to be in the decrease category.
- Those who lived in a country with a high GDP were more likely to be in the increase category.
- When the market was initially high, respondents were more likely to be in the decrease category.
- Those with a low RTS_1 score were more likely to be in the decrease category.
- Those with a low RTS_1 score were less likely to be in the increase category.
- Those with a high RTS_1 score were less likely to be in the decrease category.
- Those with a high RTS_1 score were more likely to be in the increase category.
- An interaction between GDP and social support was noted for those in the decrease category.
- An interaction between GDP and gender was present for those not in the increase category.
- An interaction between market and age was noted for those in the increase category.
- An interaction between market and gender was present for those in the increase category.

To summarize, the regression results provide insights into the unique attributes of individuals who exhibited a change in their FRT across time. The following individuals were more likely to show a decrease in their FRT: older respondents with less education, who lived in a country with lower social support and GDP with initially high market values. They were also more likely to have a lower initial RTS_1 score. Among those showing an increase in FRT were younger respondents who lived in a country with lower social support and a higher GDP. They also had a higher initial RTS_1 score. Although not unexpected, it is noteworthy

Table 9 Multinomial logistic model comparing RTS decrease/increase to RTS stable

Variable	Decrease in score		Increase in score	
	Increase *B*	*p*-value	Increase *B*	*p*-value
Intercept	6.189	0.000	0.194	0.888
Age	0.010	0.043***	−0.018	0.000***
Education level	−0.090	0.046***	−0.048	0.204
Income	−0.073	0.128	0.033	0.394
Household size	−0.062	0.176	0.035	0.300
Net worth	−0.057	0.117	−0.017	0.573
Social support	−0.105	0.005***	−0.069	0.031***
Commodity index	−0.010	0.464	−0.014	0.249
GDP	−0.001	0.000***	0.000	0.061***
Market	0.001	0.014***	0.000	0.143
Gender	−0.110	0.292	0.082	0.348
Married	−0.103	0.423	0.025	0.824
Low initial score	0.719	0.009***	−1.344	0.000***
High initial score	−1.185	0.000***	0.898	0.000***
GDP × Age	0.000	0.961	0.000	0.993
GDP × Gender	0.000	0.451	−0.001	0.015***
GDP × Education	0.000	0.541	0.000	0.597
GDP × Income	0.000	0.378	0.000	0.783
GDP × Married	0.000	0.920	0.000	0.655
GDP × Household size	0.000	0.969	0.000	0.906
GDP × Net worth	0.000	0.380	0.000	0.429
GDP × Social support	0.000	0.039***	0.000	0.290
Market × Age	0.000	0.166	0.000	0.080***
Market × Gender	0.001	0.106	0.001	0.021***
Market × Ed	0.000	0.393	0.000	0.972
Market × Income	0.000	0.535	0.000	0.582
Market × Married	−0.001	0.338	−0.001	0.366
Market × Household size	0.000	0.572	0.000	0.460
Market × Net worth	0.000	0.562	0.000	0.349
Market × Social support	0.000	0.364	0.000	0.510
Commodity × Age	−0.002	0.229	0.001	0.277
Commodity × Gender	0.037	0.187	0.044	0.101
Commodity × Education	0.011	0.377	0.006	0.617
Commodity × Income	−0.007	0.598	0.010	0.411
Commodity × Married	−0.041	0.271	0.013	0.713
Commodity × Household size	−0.003	0.772	0.006	0.587
Commodity × Net worth	−0.004	0.654	−0.011	0.258
Commodity × Social support	0.002	0.837	0.006	0.516

GDP = gross domestic product. N = 4,983: Cox and Snell (1989) for first model: 0.07; Cox and Snell (1989) for second model: 0.07.

that the direction of the effects for each of the independent variables (excluding social support) between respondents who exhibited a RTS decrease and a RTS increase showed an almost complete inverse relationship. It is worth noting that tests of those respondents who originally had an extremely low RTS_1 score tended to report a higher RTS_2 score relative to respondents who had stable scores on both tests. Likewise, respondents who originally had an extremely high RTS_1 score tended to exhibit a decrease in their RTS_2 score relative to respondents who had a stable score on both tests.

6. Discussion

The principal purpose of this study was to identify biopsychosocial, environmental, macroeconomic, and social support variables associated with changes in FRT across time. Several noteworthy findings emerged from the analysis. In general, those who were older at the initial test date were more likely to exhibit a significant decline in their risk score. A similar result was noted for those with less formal education. An interesting find was that living in a country with high social support tended to reduce the migration towards either a decrease or increase on FRT scores. Living in a country with a high GDP was indicative of exhibiting an increase in FRT scores. High market values at the initial assessment was predictive of a decrease in FRT.

The findings from this study can be incorporated into the practice of financial planning. One of the challenges many financial professionals face is the need to gain an understanding of a client's feelings and attitudes validly and quickly during the data gathering phase of the financial planning process. Rapport is often built over time, which makes it difficult to gain 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 (e.g., cash flow, net worth, and insurance forms) have been reviewed, but accurately assessing personality attitudes and traits in a brief period of time is also necessary and, if accurate, helpful for both the client and the financial planner. To help a client allocate their investments, some form of FRT assessment is needed. In addition to a basic risk assessment, financial planners also need to know if the information gathered will be relevant now and in the future. It is customary to have a client complete a FRT assessment during the data intake process. Other than an initial assessment, there are no rules that require any follow-up evaluations. Being able to identify clients who are likely to show a FRT change can be helpful for both financial planners and individuals assessing their own allocation decisions. Findings from this study help financial planners determine approximately how "traited" FRT is and what the characteristics are of individuals who may change over time.

As shown here, individuals tend to exhibit generally stable FRT scores, but as most financial planners know, household dynamics do change over time, which may cause this financial planning data input to change. In general, FRT scores increased across the sample, but not enough to warrant a change in portfolio or other financial recommendations. Among some respondents, a marked decrease or increase in FRT scores was noted. The age of the test taker was an important predictor of change. Older respondents were more likely to exhibit a decrease in their RTS, whereas younger respondents were more likely to report a higher RTS at a later date.

Another insight is that initial test scores were predictive of future scores. A RTS outside the typical range provides an indication that a client may exhibit a meaningful change in his or her FRT at some point in the future. If a client initially scores extremely high or extremely low, it may be useful to monitor that individual closely across time. In addition, any major changes to macroeconomic conditions may be an indicator that FRT should be reassessed to ensure that portfolio recommendations still match a client's needs and willingness to take risk. It should also be noted that any major, or potentially major, changes in social policy

around social retirement plans or national health insurance may influence the way an individual perceives risk.

Does FRT change over time? That was, and still, remains one of the most important questions asked by financial planners, researchers, and policy makers. Overall, FRT, in this study, was relatively stable. FRT did show some deviation across time, but for the majority of respondents, the initial RTS changed very little. However, even if only a small portion of clients exhibit inconsistent FRT scores, this can cause a problem in practice. In this study, approximatively 75% of individuals exhibited consistent scores across two assessments. So, hypothetically extrapolated, for a midsized firm with 200 clients over a five-year period, almost 50 clients could have significant changes in their FRT scores. Macroeconomic variables at the time of initial assessment, initial test scores, and social support all had a significant role to play in describing who was likely to exhibit significant a decrease or increase in their FRT across two assessments.

When interpreting the results from this study it is important to keep in mind that the macroeconomic, stock market, and commodity index variables were based on values when the first test was taken. A few studies have used change in market conditions or domestic production variables to forecast variations in FRT scores, but this study used a baseline metric of the conditions present during the initial test. This methodological approach was applied for two reasons. First, the period in which the study was performed was a relatively stable period with generally favorable market conditions occurring after the global financial crisis. Second, the applied nature of the study drove the decision. Financial planners, when working with clients in developing investment recommendations within a financial plan, must use data at hand. They do not have access to pre- and postperiod macroeconomic data. The ability to describe potential variations in client FRT requires the use of baseline inputs. Even so, comparing the results presented here with future studies that use macroeconomic, biopsychosocial, and social support change data would be useful.

It is also worth noting that while the results from this study are valuable in establishing baseline metrics for predicting changes in FRT, the overall amount of explained variation in the dependent variable was relatively small. Although 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 tested in this study, the Cox and Snell coefficient was 0.071. This means the model explained about 7% of the effect for changes in FRT scores over time. Although not extremely large, the ability to show 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 across time.

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