



A test of the relationship between self-classified financial risk-tolerance and investment risk-taking behaviour

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Abstract: The purpose of this study was to determine how accurately individuals judge their own level of financial risk-tolerance and whether self-assessed financial risk-tolerance is associated with investment risk-taking behaviours. Using a sample of internet risk-assessment survey respondents

($n = 1,740$), it was concluded that individuals do a fair job of assessing their own level of financial risk-tolerance using self-classifications into one of four levels of risk-tolerance ($r = 0.50$ with risk-tolerance test score). Moreover, this self-classification was associated with actual risk-taking investing behaviours. Individuals who saw themselves as real risk avoiders or cautious when making investments tended to hold more cash than riskier assets like equities. Conversely, individuals who viewed themselves as gamblers or being willing to take risks after completing adequate research had larger holdings in equities.

Keywords: financial risks; investing; investment suitability; risk-assessment; risk-tolerance.

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1 Introduction

Financial risk-tolerance plays an important role in the financial decision-making process. Although there are a number of possible definitions of risk-tolerance, the concept can be broadly defined as the willingness to engage in "behaviors in which the outcomes remain uncertain with the possibility of an identifiable negative outcome" (Irwin, 1993, p.11). Generally, an individual's risk-tolerance is quite situation-specific, differing from one context to another (Weber, Blais and Betz, 2002). There is some disagreement about the exact number of contexts, but most researchers agree that monetary or financial risk constitutes one such domain over which there is some regularity in behaviour, even though there may be differences in risk preferences in aspects such as gambling and investing.

The ramifications associated with failing to accurately evaluate risk-tolerance are quite serious for financial advisers, consumers and marketers. For advisers, there is a career damaging threat of professional and legal censure, not to mention potential lawsuits, for a failure to document the risk attitudes of clients or to verify investment suitability. For consumers seeking advice or for individual investors managing their own money, the threat is potentially more serious, namely, allocating assets in a way that either over- or under-exposes the person to investment volatility. Either outcome can lead to losses in principal and/or purchasing power. For marketers, there is the danger of a lost sale because of the wrong message.

It has been shown that the results of a risk-tolerance assessment are very method specific (Yook and Everett, 2003; Fellner and Maciejovsky, 2007; Nasic and Weber, 2007). A variety of single item self-classification questions have been developed, but the validity of such global evaluations remains an issue yet to be adequately addressed in the literature. Further study is needed on how accurately individuals assess their own level of risk-tolerance relative to what a psychometrically designed test indicates. Furthermore, there is only limited research showing a link between self-estimated financial risk-tolerance and actual risk-taking behaviour in monetary matters.

This gap in the literature is unfortunate in two respects. First, global self-classification is used quite often as an input into financial planning and marketing models, but without evidence of the method's validity, it is hard to say if the approach is justifiable. Second, consumers who do not work with financial professionals need to know if the self-classification approach truly offers an accurate gauge of risk-taking propensities that can help shape consumer and financial decisions involving risk.

The purpose of the research reported here was, thus, two-fold. The first aim was to test how accurately individuals judge their own level of financial risk-tolerance relative to a multi-item test. The second goal was to determine if self-classified financial risk-tolerance was associated with actual risk-taking investment behaviour.

2 Literature review

Over the past decade, researchers, financial services professionals and policy makers have taken a renewed interest in better understanding the factors associated with an individual's financial risk-tolerance and how to best measure it. In part, this interest stems from a desire to help people make more effective decisions, given that risk-tolerance may affect so many important consumer issues and financial decisions (Wong and Carducci, 1991; Campbell, 2006; Faro and Rottenstreich, 2006).

The critical role of risk attitudes is most commonly evident in investment decisions (Jacobs-Lawson and Hershey, 2005). But risk-tolerance also plays a significant part in explaining how much debt a person is willing to assume, preferred types of consumer product financing, and the allocation of household income between fixed and variable expenditures (Campbell, 2006). Risk-tolerance is also positively related to consumers' use of information intermediaries when searching for information in the financial markets (Lin and Lee, 2004; Lee and Cho, 2005).

Financial risk-tolerance plays an especially important role in the financial services marketplace. Financial advisers must consider monetary risk-tolerance for a number of reasons (McGinnis, 2004; Moreschi, 2004). Failing to accurately measure a client's risk-tolerance prior to engaging in financial planning services not only can create problems in the client-planner relationship, but also place an adviser in legal jeopardy, potentially leading to litigation and arbitration. Today, nearly all international professional financial planning organisations (e.g. Financial Planning Association, National Association of Personal Financial Advisers), certification bodies (e.g. Certified Financial Planner Board of Standards, Inc., International Association of Registered Financial Consultants) and regulatory agencies (e.g. US Securities and Exchange Commission, Financial Industry Regulatory Authority, the European Parliament and the European Council) require financial services professionals to assess and document a client's risk preferences prior to making investment and financial planning recommendations.

Generally, acceptable means for acquiring information on risk-tolerance are not explicitly defined by regulators or practice standards (Roszkowski, Davey and Grable, 2005). According to Nairn (2005, p.388), "despite the apparent importance of the risk tolerance variable the construct is ill-defined. There is little agreement across the industry as to either the number of risk-tolerance categories or how to capture the information". The ways in which financial risk-tolerance is actually measured in practice are quite diverse (van de Venter, 2006). Some financial advisers use psychometrically designed risk-tolerance scales, whereas others rely on qualitative heuristics or proxies based on a client's demographic characteristics.

2.1 *Global self-classification as a means for gauging risk-tolerance*

When conducting qualitative risk-tolerance assessments, many financial advisers trust simple client provided 'global' self-classifications (van de Venter, 2006). However, there is ample evidence to indicate that single items of any sort tend to be unreliable, and financial advisers have been warned about the potential mishaps in relying on them (Callan and Johnson, 2002). Therefore, whenever possible, it is better to assess financial risk-tolerance by means of a multi-item, psychometrically designed scale with an appropriate level of reliability and validity (Callan and Johnson, 2002; Weber, Blais and Betz, 2002; Corter and Chen, 2005; Roszkowski, Davey and Grable, 2005).

2.2 *Accuracy of perceptions of the risk-tolerance of others*

Knowledge about how individuals arrive at an assessment of their own willingness to engage in a risky behaviour is rather limited. There is, however, a somewhat larger literature addressing how accurately one person predicts another's risk-tolerance. Since this research has some bearing on the issues addressed in this study, it is worth reviewing this topic briefly.

According to Funder (1995), the extent to which a judgment about any personality trait is accurate is a function of four moderator variables:

- 1 characteristics of the judge
- 2 features of the target
- 3 the trait that is being judged
- 4 the quality and quantity of the information that is the basis for the judgment.

Borkenau and Liebler (1992, 1993) proposed two other important moderating variables, namely,

- 1 meaning systems shared by observers
- 2 the consistency of the target behaviour.

One person's impression of another's risk-tolerance is formed on the basis of these moderators. Random error acts to diminish the degree of accuracy in estimating another's risk-tolerance, but evidence suggests that systematic error operates as well. Two heuristics that can lead to problems in estimating the risk-tolerance of others are:

- 1 stereotyping based on features of the target
- 2 using oneself as the anchor for the judgment.

Stereotyping is most likely to occur if the target is a stranger. Hsee and Weber (1997) hypothesised that when one is forming an impression of another person, two sources of information are used, which they called personal and distributional. Personal information deals with the particular individual, while distributional information concerns the class to which that person belongs. If the target is an unknown person or an abstraction, the impression is made mainly on the basis of distributional information.

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In the Hsee and Weber (1997) study, students made a choice between a sure bet and a 50/50 lottery. Also, they had to predict the choice that would be made by another person. The other person was either

- 1 an average American
- 2 an average student on campus
- 3 the person sitting next to them.

The risk preferences of the average American and the average student on campus were overestimated, but the error disappeared when the target was the person in the next seat. In other words, people were more accurate when the 'other' person to be estimated was a concrete individual rather than an ambiguous, abstract entity.

Stereotyping was shown to be a factor in several other investigations. In a study by Eckel and Grossman (2002), participants selected for play one of five gambles varying in risk and return characteristics. Besides making a choice themselves, participants were asked to guess which of the five gambles every other participant would pick, having only visual information about those they were judging (e.g. gender, age, etc.). Stereotyping on the basis of sex was part of the estimation process, such that men tended to under predict the risk preferences of women. Siegrist, Cvetkovich and Gutscher (2002) also found that among undergraduates, predictions of others' risk-tolerance were influenced by sex stereotypes. In their study, judges were more accurate in estimating the risk-tolerance of females because they systematically overestimated the risk preferences of males. Stereotyping of risk-tolerance on the basis of sex was also reported by Martin (1987).

In the study by Eckel and Grossman (2002), guesses by all the participants were averaged for each participant and the mean guess was correlated to each person's actual gamble. The correlation between actual choice and average estimate was 0.42. Since this study involved undergraduates who were relative strangers, the modest size of the correlation may not be surprising. However, research by Roszkowski and Grable (2005a) illustrated that even more detailed knowledge of a target and professional training did not seem to assure better accuracy, as has been the finding with other types of tasks (see Camerer and Johnson, 1997). In Roszkowski and Grable's study, the correlation between financial planners' estimates of their clients' risk-tolerance and the scores that these clients obtained on an extensive (51 question) test of risk-tolerance was 0.41. A similar analysis in Australia (Elsayed and Martin, 1998), correlating scores from a 25-item test with planners' estimates, resulted in a coefficient of 0.38. Roszkowski and Grable (2005a,b) attributed some of the error in advisers' estimates to assigning too much diagnostic value to certain demographic variables like sex, when estimating client risk-tolerance (i.e. stereotyping).

Recent research suggests that the person making the judgment tends to be the anchor for judging the risk-tolerance of others. As illustrated in a recent study by Borgsen and Weber (2007), the greater the ambiguity in the situation and the less information there is about the target, the more likely people are to think that the choice by others will be similar to their own risk preference. When Faro and Rottenstreich (2006) asked undergraduates to predict the risk preferences of another individual (i.e. a randomly selected University of Chicago MBA student), they too tended to predict the other's choices based on their own level of risk-tolerance. However, these estimates were 'closer to risk neutrality than those choices actually are' (p.530). In other words, 'predictions of other's choices are too regressive' (p.530).

Self-anchoring may also be a factor in how people judge the risk-tolerance of intimate others, not just strangers, as shown in a study by Bateman and Munro (2005). Married couples were able to predict their spouse's risk choices on lotteries involving risk at an accuracy rate of 65%. This appears to be quite respectable until, as Bateman and Munro pointed out, one considers that if the spouse used himself or herself as the basis for the judgment, and the preferences within couples were not correlated, then the expected chance of success was 64.7%.

2.3 Accuracy of self-classifications of risk-tolerance

The results of studies devoted to how a judge forms an estimate of the risk-tolerance of a target generally suggest that inaccuracy is to be expected (Siegrist, Cvetkovich and Gutscher, 2002; Furnham and Chamorro-Premuzic, 2004). Whether or not misprediction is also the norm when risk-tolerance is self-assessed is a question that has not been widely studied. Generally, it is harder to assess another person's personality than one's own (Furnham, 1990), so one would expect less error in self-judgments.

Although Chamorro-Premuzic, Furnham and Moutafi (2004) did not specifically measure risk-tolerance attitudes, their work is of relevance. They determined that people are fairly good at estimating their own degree of depression, anxiety, hostility and assertiveness, but are less effective in estimating characteristics closely linked with risk-taking. For example, respondents to their questionnaire were not very good at estimating their level of impulsivity ($r = 0.06$) or tendency to exhibit excitement-seeking attitudes ($r = 0.26$).

Probably, the most widely used risk-tolerance self-classification item can be found in the Federal Reserve's Survey of Consumer Finances (SCF). This question measures level of risk-tolerance with a four-point scale.

"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."

Hundreds, if not thousands, of published studies have used this single-item risk measure as either an outcome or independent variable.

Researchers who use the SCF item believe that it is an effective proxy for the measurement of actual risk-tolerance (Hanna and Lindamood, 2004; Yao, Hanna and Lindamood, 2005). Despite the vagueness of terms such as 'substantial' and 'above average', there is some evidence to support this contention. Grable and Lytton (2001) found that answers to the question correlated with a 13-item, psychometrically developed risk-attitude scale at a level ranging from 0.41 to 0.54, depending on the sample. Moreover, Gutter, Fox and Montalto (1999) reported that a self-classification of risk-tolerance using this item was positively associated with the ownership of risky assets in almost 70% of cases.

Roszkowski and Grable (2005a) reported even stronger correlations between self-estimates based on a seven-point scale and a 50-item measure of financial risk-tolerance. They also compared financial advisers and clients on the ability to estimate their own risk-tolerance relative to a psychometrically designed risk-tolerance test. Surprisingly, clients were better at the self-assessment task than were the advisers. That

is, the correlation between the test score and the self-classification was 0.77 for clients and 0.63 for the advisers, a statistically significant difference. The reason for the discrepancy may have been due to the subjective standard used for the estimate. That is, financial planners may have been using other planners as the benchmark, and as a class, financial planners in the sample (working primarily on commission) were more risk-tolerant than average.

Studying a primarily Australian sample, Hallahan, Faff and McKenzie (2004) compared the relationship between client self-estimated financial risk and a 25-item psychometrically developed scale. After completing the scale, the test takers were told that on this measure, scores could theoretically fall between 0 and 100, but that, in practice, scores ranged from 20 to 80 and followed a normal distribution (a diagram was provided) that had a mean of 50. They were further instructed that about two-thirds of the scores fell within 10 points of this average. Study participants were then asked to indicate what they thought their own score was. In terms of a Pearson correlation coefficient, the relationship was 0.79. While 4% were exactly on the mark, 73% underestimated their actual score and 23% overestimated it. The average discrepancy was about five points.

As this review of the literature on perceptions of risk-tolerance suggests, the preponderance of research shows that people are better at estimating their own risk-tolerance than judging it in another person. However, people do a less than stellar job of self-assessment for themselves or others.

2.4 Other factors to consider when analysing self-classified risk-tolerance and risk-taking behaviour

Given previous research documenting connections between certain demographic factors and risk-tolerance, it is reasonable to assume that age, gender, household income, attained educational status and marital status might be related to an individual's self-classified risk-tolerance. Further, these same factors most likely also influence the types and degrees of financial risk behaviour in which a person routinely engages on a daily basis. Incorporating these personal characteristics into tests as possible confounding factors can therefore help clarify the relationship between self-classified risk-tolerance and investing behaviour.

The current state of knowledge about the factors associated with financial risk-tolerance is based on research conducted within the psychological, behavioural decision-making, human services and consumer behaviour disciplines. Researchers have shown that variables predictive of both risk-tolerance and risk-taking behaviour can be classified into two broad categories: biopsychosocial and environmental (see Irwin, 1993; Grable and Joo, 2004). Biopsychosocial factors are immutable personal characteristics, such as age and gender. Environmental factors reflect more modifiable individual and family differences. Examples include income, education and marital status. These types of factors are similar to what Weber and her associates (2002) called person-centred characteristics.

The two most frequently examined biopsychosocial variables are age and gender. In general, older individuals are found to be less risk-tolerant than their younger counterparts (e.g. Yao, Gutter and Hanna, 2005). However, it is necessary to note that there is some inconsistency within the literature regarding the nature of the relationship between age, risk-tolerance and actual risk-taking behaviour in investments (Wang and Hanna, 1997; Callan and Johnson, 2002). For example, Chang, DeVaney and

Chiremba (2004) found that, while those with the least risk-tolerance tended to be the oldest, older individuals invested more aggressively. Finke and Huston (2003) observed a similar age-risk-tolerance pattern in their study; the youngest workers in their sample were more willing to take risk than those nearing retirement, but younger respondents did not invest more aggressively. Some researchers have proposed curvilinear relationships between age and risk-tolerance. Chang, DeVaney and Chiremba (2004) observed a hump-shaped relationship between age and risk-tolerance, with the youngest and oldest respondents indicating the highest levels of risk aversion. Hallahan, Faff and McKenzie (2004) reported a different curvilinear effect where 'risk-tolerance declines at an increasing rate as age increases' (p.66).

Issues surrounding the gender-risk-tolerance association are also somewhat complex. Normally, women tend to be less risk-tolerant than men across different domains (Weber, Blais and Betz, 2002). This is especially true when it comes to taking financial risks (Chang, DeVaney and Chiremba, 2004; Slovic, 2004). It is a point of contention whether gender differences are a result of purely biological or purely social factors or a combination of the two (Bartlett, 1997). Weber, Siebenmorgen and Weber (2005) argued that gender differences are probably not biologically based but rather are an artefact of risk perceptions. They noted that women report feeling less competent when making asset return predictions, which implies that gender differences when making uncertain decisions may be mediated by knowledge and experience (Weber and Milliman, 1997).

In other words, gender differences may be due to how women and men perceive the extent of a risk in a given situation rather than their willingness to accept a risk of a known magnitude. This notion is consistent with the Risk-as-Feelings hypothesis proposed by Hsee and Weber (1997) and Loewenstein et al. (2001), which advances the possibility that an individual's emotional judgments and reactions to a situation play as strong a role as cognitive evaluations.

Environmental factors such as education, income and marital status have also been shown to be linked with financial risk-tolerance attitudes and risk-taking behaviours. Higher levels of attained education (Barsky et al., 1997; Gilliam, Goetz and Hampton, 2008) and higher household incomes (Chang, DeVaney and Chiremba, 2004; Deaves et al., 2007) are generally associated with increased levels of financial risk-tolerance and risk-taking. These relationships may be explained by what Krueger and Dickson (1994) called the self-efficacy effect or a person's self-perceived ability to make an optimal decision. Education increases a person's perception of self-efficacy so that he or she is less likely to be hampered by self-doubt when making a decision.

The relationship between marital status and risk-tolerance, as reported by Hallahan, Faff and McKenzie (2004), suggests that married persons are normally less risk-tolerant than singles. However, it is also possible that since married individuals have a greater sense of financial security due to dual incomes, it might lead to an increased willingness to take risks. Deaves et al. (2007) examined this hypothesis but found no significant differences on a psychometrically measured risk-tolerance scale between those who were married and those who were single. But the relationship may be more complex than is generally thought, involving a number of interactions with other variables (Chaulk, Johnson and Bulcroft, 2003).

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2.5 Risk-tolerance assessment and actual behaviour under risk

As MacCrimmon and Wehrung (1986) pointed out, “we can expect risk takers and risk averters to act differently with regard to the components of risk” (p.34). According to traditional economic models, risk-takers should accept greater variability in returns in pursuit of higher profits. On the other hand, those who are risk averters ought to tolerate less variability and engage in more conservative investment behaviour. Therefore, risk averters ought to prefer cash equivalents whereas risk-takers should prefer equities. Researchers such as Barsky et al. (1997) and Hanna, Gutter and Fan (2001) have documented how, in general, risk-tolerance tends to be positively associated with real-life risk-taking behaviour in investments. Even researchers who contend that neoclassical economic models fail to reach acceptable levels of ‘descriptive adequacy’, as described by Slovic et al. (1977, p.239), have to concede that consumers do, in the main, act in line with risk-value tradeoffs (Butler, Dyer and Jia, 2005). However, investors may not be responding to the signals of expected value and variance. People have distinct perceptions and notions about the riskiness of investment decisions (Keller, Sarin and Weber, 1986), but they may not be based on risk defined strictly by variance in returns (Luce and Weber, 1986; Weber, Shafir and Blais, 2004).

3 Methodology

3.1 Sample

Data were collected using an internet-based risk-tolerance survey conducted between September 2002 and September 2003. The sample time frame was chosen to represent an equity investment market cycle that included a market decline, bottom and gain, so that average risk scores would not be duly influenced by market conditions. The survey was designed to capture participant answers to a risk-tolerance assessment scale and a series of basic demographic and socioeconomic assessments. The survey, hosted by a university sponsored online survey system, was open to anyone with internet access. It was widely advertised by state and county Cooperative Extension personnel throughout the United States. Other forms of publicity for the online survey included textbook references, referrals by financial planning firms and online key word searches through internet search engines.

Table 1 provides a demographic profile of the participants. Respondents ($n = 1,740$) were, on average, 33.7 years of age ($SD = 15.6$). Close to half (46.8%) were college graduates (Bachelor’s or higher). Approximately 43% were female. Slightly more than 50% of those responding to the survey indicated being single or never married and approximately 36% reported being married at the time the survey was completed. The median household income, computed on the basis of brackets, was \$50,475.

Compared to the national US average, the sample was slightly younger, better educated and more likely to be single than the average American (Census Bureau, 2005). The sample represents what is known as ‘Internet savvy’ respondents (Smith, 2003) – an income, education and socioeconomic profile that represents younger technologically knowledgeable persons.

Table 1 Descriptive statistics

<i>Variable</i>	<i>Descriptive statistics %</i>
<i>Self-assessment</i>	
A real risk avoider	7.0
Cautious	32.6
Willing to take risks after completing adequate research	52.6
Real gambler	7.8
<i>Household income</i>	
Income < \$24,999	27.7
\$25,000 < income < \$49,999	20.4
\$50,000 < income < \$74,999	19.9
\$75,000 < income < \$99,999	13.5
Income > \$100,000	18.4
<i>Gender</i>	
Female	43.2
Male	56.8
<i>Age</i>	<i>M: 33.7, SD: 15.6</i>
<i>Marital status (1 = married)</i>	
Never married	50.3
Not married but living with significant other	5.2
Married	35.5
Separated or divorced	5.9
Widowed	1.8
Shared living arrangement	1.3
<i>Attained educational level</i>	
High school and some college	44.6
Associate's degree	8.6
Bachelor's degree	27.6
Graduate/professional degree	19.2

3.2 Measures

Self-classification. Respondents first answered the following question as a measure of their own self-assessed financial risk-tolerance:

In general, how would your best friend describe you as a risk-taker?

- 1 a real gambler
- 2 willing to take risks after completing adequate research
- 3 cautious
- 4 a real risk avoider.

Responses were coded (a) = 4, (b) = 3, (c) = 2 and (d) = 1. The majority of respondents considered themselves as either cautious (32.6%) or willing to take risks after completing research (52.6%). Fewer respondents reported that they were risk avoiders (7.0%) or real

gamblers (7.8%). This item was originally part of a 13-question risk-tolerance assessment instrument (see Grable and Lytton, 1999). Although this item is a self-rating, it is phrased in terms of how one believes others perceive him or her. Research on meta-accuracy indicates that people generally think that others see them in the same way as they see themselves (Kenny and DePaulo, 1993; Leary, 1996).

Multi-item measure of risk-tolerance. A 12-item scale was used to measure financial risk-tolerance. The scale was developed using psychometric principles (see Grable and Lytton, 1999). Examples of items in the scale included the following.

- 1 Suppose a relative left you an inheritance of \$100,000, stipulating in the will that you invest all the money in one of the following choices. Which one would you select?
 - a savings account or money market mutual fund
 - a mutual fund that owns stocks and bonds
 - a portfolio of 15 common stocks
 - commodities such as gold, silver and oil.
- 2 If you had to invest \$20,000, which of the following investment choices would you find most appealing?
 - 60% in low-risk investments 30% in medium-risk investments 10% in high-risk investments
 - 30% in low-risk investments 40% in medium-risk investments 30% in high-risk investments
 - 10% in low-risk investments 40% in medium-risk investments 50% in high-risk investments.
- 3 Your trusted friend and neighbour, an experienced geologist, is putting together a group of investors to fund an exploratory gold mining venture. The venture could pay back 50–100 times the investment if successful. If the mine is a bust, the entire investment is worthless. Your friend estimates the chance of success is only 20%. If you had the money, how much would you invest?
 - nothing
 - one month's salary
 - three month's salary
 - six month's salary.

Scores on the 12-item measure ranged from 12 to 43, with a mean score, median score and SD of 24.8, 25.0 and 5.2, respectively. The instrument had a Cronbach's alpha of 0.77, indicating an adequate level of scale reliability for exploratory research purposes (Pedhazur, 1982). This alpha compares favourably to reliability estimates ranging from 0.75 to 0.85 for the full scale as reported in the literature (e.g. Grable and Lytton, 1999; Grable, Lytton and O'Neill, 2004; Yang, 2004).

Measures of actual risk-taking behaviour. Respondents were asked to provide an estimate of the percentage of their personal and retirement savings and investments allocated to different asset categories, including

- 1 cash such as savings accounts, CDs or money market funds
- 2 equities such as stocks, stock mutual funds, direct business ownership or investment real estate.

They were specifically instructed not to include the value of their personal residence when assigning a percentage allocation for equity ownership. On average, respondents held 29.7 and 44.6% of assets in cash and equities, respectively. Two outcome measures were thus available, indicating the extent of

- 1 conservative investing
- 2 aggressive investing (the remainder of respondents' assets were distributed between fixed-income securities and other assets, such as real estate, gold and collectibles; these were not considered in the analysis).

Environmental and biopsychosocial variables. The following environmental and biopsychosocial variables were included in this study: age, gender, household income, marital status and attained educational level. Age was measured at the interval level. Gender was measured dichotomously with women coded 1 and men coded 0. Each one of the five categories of household income, as collected on the survey (see Table 1), was coded dichotomously. Marital status was recoded to be a dichotomous variable: currently married = 1, otherwise = 0. Attained educational level was measured using six categories (see Table 1), but the first three categories

- 1 some high school or less
- 2 high school graduate
- 3 some college/trade/vocational training]

were collapsed into a new variable called, 'some college or less'.

3.3 Data analysis

A combination of univariate and multi-variate statistics were used to analyse the relationship between self-classified financial risk-tolerance, the financial risk-tolerance scale score and financial risk-taking in investing. First, responses to the self-classification question were correlated with both the 12-item risk-tolerance scale and actual investing behaviour. The correlation analyses were followed by an analysis of variance (ANOVA) with *post hoc* tests to determine if there were differences in assessed risk-tolerance between all four self-classifications.

The next stage of the analysis employed ordinary least-squares regressions to assess the relationship between self-classified risk-tolerance and actual financial risk-taking as measured by how respondents allocated their investment portfolios. Two separate regressions were performed. In the first model, the outcome variable was the percent of assets allocated to cash (i.e. conservative investing). In the second model, the criterion was percentage of assets held in equities (i.e. aggressive investing). The holdout categories for the predictors were:

- 1 the real gambler category for self-classified risk-tolerance
- 2 'some college or less' for education
- 3 'less than \$25,000' for income.

To account for possible curvilinear effects related to age, a polynomial variable was created (i.e. age^2).

4 Results

4.1 Pearson correlations between self-classification and risk-tolerance score

The self-classification was correlated with scores from the summated 12-item risk-tolerance scale. The correlation between the self-rating and the summated scale score was 0.50 ($p < 0.001$).

4.2 Pearson correlations between self-classification and investing

Self-classified risk-tolerance was negatively associated with conservative risk-taking and positively related to aggressive risk-taking: -0.10 ($p < 0.001$) with cash holdings, and 0.17 ($p < 0.001$) with equity holdings, respectively.

4.3 Analysis of variance test of risk-tolerance scores by self-classifications

While correlations are useful for judging the overall magnitude of a relationship, it is also instructive to examine the average risk-tolerance scores from the summated 12-item scale at each of the four levels of self-classified risk-tolerance. An ANOVA test showed that differences in risk-tolerance by self-classified category were significant, $F(3,1705) = 206.01$, $p < 0.001$. The real gamblers scored the highest on the 12-item scale ($M = 28.94$, $SD = 6.32$), followed by those willing to invest after conducting adequate research ($M = 26.23$, $SD = 4.15$) and those that were cautious ($M = 23.14$, $SD = 3.97$). The risk avoiders ($M = 17.48$, $SD = 5.64$) had the lowest risk-tolerance scores and these scores were most distant from the scores of the other three categories. Tukey *post hoc* tests confirmed that the four levels of self-classified risk-tolerance were distinct from each other at the $p < 0.001$ level.

4.4 Multiple regression with conservative investing as the criterion

Ordinary least-squares regression methods were used to determine if a respondent's self-classification matched actual risk-taking behaviour in investing when controlling for biopsychosocial and environmental factors. For the first test, the outcome variable was conservative risk-taking behaviour, measured using the percent of respondents' personal and retirement savings and investments allocated to cash assets. In addition to the self-classification, all of the biosocial-environmental variables were included as predictors in the model.

As would be expected, differences in cash holdings differed by self-classification. Respondents who considered themselves to be either 'cautious' or 'risk avoiders' differed significantly from 'real gamblers'. Specifically, those who claimed to be cautious or risk avoiders held a significantly greater percentage in cash assets relative to the 'real gamblers'. The difference in cash holdings between 'real gamblers' and respondents that were 'willing to take risks after completing adequate research', while in the right direction, failed to achieve statistical significance.

Holding self-classified risk-tolerance constant, three control variables were related to conservative investing: household income, age and education. Household finance and neoclassical economic theory suggests that income and risk aversion should be inversely related. Findings from this study support this hypothesis. As income increased, compared

to those with household incomes less than \$25,000, the percent of assets allocated to cash decreased significantly. Respondents with the highest incomes held the least cash.

Age was found to be negatively related to conservative risk-taking; however, the age² term was not significant. In other words, the relationship was linear: the older the respondent, the less of the investor's assets were allocated to low-risk investments. This finding may be surprising to some because the relationship between age and risk-tolerance in this sample was negative ($r = -0.13$), as is usually the case in a majority of studies, which would lead one to expect that older respondents would have a larger (rather than smaller) percentage of their portfolio in cash equivalents. In this sample, older respondents held less in cash equivalents relative to younger respondents, after adjusting for age-related differences in risk-tolerance. That is, there was an age-related preference that was independent of risk-tolerance. It was also found that having an Associate's degree level of education was positively associated with conservative risk-taking (Table 2).

Table 2 Summary of regression analysis for factors associated with financial risk-taking in investment behaviour

Variable	Conservative investing			Aggressive investing		
	B	SE B	β	B	SE B	β
<i>Self-assessment</i>						
A real risk avoider	15.2**	4.5	0.10	-18.8**	3.5	-0.15
Cautious	11.8**	3.4	0.15	-7.9**	2.7	-0.11
Willing to take risks after completing adequate research	4.5	3.2	0.06	1.1	2.6	0.02
<i>Household income</i>						
\$25,000 < income < \$49,999	-6.1*	2.5	-0.07	7.3**	2.0	0.09
\$50,000 < income < \$74,999	-10.3**	2.6	-0.11	13.6**	2.1	0.17
\$75,000 < income < \$99,999	-13.4**	3.0	-0.12	15.2**	2.3	0.16
Income > \$100,000	-15.8**	2.8	-0.16	19.3**	2.2	0.23
Gender (1 = female, male = 0)	1.2	1.7	0.02	-3.9**	1.4	-0.06
Age	-0.65**	0.06	-0.27	0.51**	0.05	0.25
Marital status (1 = married, other = 0)	-2.1	2.2	-0.03	5.3**	1.7	0.08
<i>Attained educational level</i>						
Associate's degree	6.9*	3.1	0.05	3.7	2.5	0.03
Bachelor's degree	-0.12	2.2	-0.00	9.2**	1.7	0.13
Graduate/professional degree	-3.0	2.6	-0.03	8.5**	2.1	0.10
Age ²	-2.3E-006	0.00	-0.02	5.1E-007	0.00	0.01
Constant	67.4**	3.5		1.2	2.8	

Note: R^2 for the conservative investing model was 0.16; $F(14, 1727) = 23.9^{**}$; R^2 for the aggressive investing model was 0.31; $F(14, 1727) = 54.6^{**}$; * $p < 0.05$. ** $p < 0.01$.

4.5 Multiple regression with aggressive investing as the criterion

Aggressive risk-taking was measured using the percent of respondents' personal and retirement savings/investments allocated to equities. It was anticipated that opposite effects would be noted in the aggressive model compared to the conservative model. This expectation was confirmed. Persons who classified themselves as 'cautious' or 'risk avoiders' had a smaller percent of their assets in equities compared to those who assessed themselves as 'real gamblers'. Again, no significant difference was noted between gamblers and those that were willing to take risks after conducting adequate research.

Household income differences were evident in aggressive risk-taking. Each increasing level of household income was found to be more positively associated with financial risk-taking through equity investing. Compared to those with household incomes of less than \$25,000 per year, the more affluent were more likely to allocate additional assets to equities, with those at the highest income levels devoting the largest percent of savings and investments to equities. Age, too, was found to be positively associated with equity investing, which indicated that older respondents were more likely to allocate assets aggressively compared to younger respondents, holding self-classified risk-tolerance constant. The results related to income and age were consistent with findings noted in the conservative model.

Several predictors not significant in the conservative model were statistically significant in the aggressive model. To begin with, there was a gender effect. Women were found to be less likely to allocate assets to equities, even when self-classified risk-tolerance was held constant. A positive association between aggressive risk-taking and marital status was also observed. Respondents who were currently married were significantly more likely to allocate assets in a risk-taking manner compared to those that were single, never married, divorced, widowed or living in another arrangement. Finally, a more extensive education effect was evident. Whereas in the conservative model, only the Associates degree category was significant, in the aggressive model Bachelor's and graduate degrees reached statistical significance. Holders of Bachelor's and graduate degrees exhibited more aggressive investment behaviour than those without a college degree.

A comparison of the conservative and aggressive models shows that, using the same predictors from the equivalent sample, more of the variance is explained in the aggressive investing model than in the conservative investing model (31 vs. 16%). It is also notable that in both models, age had the greatest independent contribution to explaining investment preferences, followed by income greater than \$100,000. Surprisingly, self-classification of risk-tolerance played a relatively lesser role in explaining investment behaviour.

5 Discussion

Considerable effort has been devoted over the past decade to create valid and reliable risk-tolerance assessment scales (Barsky et al., 1997; Grable and Lytton, 1999; Weber, Blais and Betz, 2002; Hanna and Lindamood, 2004; Corter and Chen, 2005; Roszkowski, Davey and Grable, 2005), but less work, either theoretical or empirical, has addressed how well individuals are able to assess their own level of financial risk-tolerance.

The present study sought to provide some additional insight on this issue. It was determined that the proportion of variance in self-classifications that can be explained by the 12-item risk preference test was about 25% (square of the correlation).

This degree of overlap was lower than the associations reported by Hallahan, Faff and McKenzie his colleagues (2004) and Roszkowski and Grable (2005a), who on the basis of different tests and means of self-classification, found the overlap between self-classification and psychometric test scores to be 63 and 59%, respectively. It is notable that the degree of redundancy in these studies fell within the range of the extent of agreement between a number of commonly used questionnaires/tests of risk-tolerance (Yook and Everett, 2003), although the construct validity and reliability of some of these scales ought to be questioned (Roszkowski, Davey and Grable, 2005).

The size of the simple correlation between self-classified risk-tolerance and allocation of investments was statistically discernable, but low in magnitude (accounting for 1–2% of the variance). This was not entirely unexpected. Nasic and Weber (2007), citing Kapteyn and Teppa (2002) and Fellner and Maciejovsky (2007) as examples, contended that generally studies attempting to link risk attitudes to investing either find no relationship or a very weak one. Indeed, Kapteyn and Teppa (2002) concluded that in portfolio choice, “the variable risk tolerance, which has the firmest grounding in economic theory, appears to have very little explanatory power” (p.32).

To some extent, a low level of explanatory power exists because investment decisions are not solely governed by risk-tolerance. A number of other factors operate in determining whether a particular investment is held (Baker and Nofsinger, 2002; Jacobs-Lawson and Hershey, 2005). As Yao, Gutter and Hanna (2005) observed, portfolio allocation is subject to factors unrelated to risk-tolerance, such as investor inertia and investments that were gifts and inheritances. To this list, one may add subjective perception of the risk, level of confidence and degree of optimism–pessimism (Weber and Milliman, 1997; Coval and Thakor, 2005; Nasic and Weber, 2007). Hong, Kubik and Stein (2004) reported that sociability is also a determinant; socially active households were found to be 4% more likely to invest in the stock market than non-social households, holding other relevant variables constant.

Furthermore, as Cohen (1988) observed, “many effects sought in personality, social, and clinical-psychology research are likely to be small effects ... both because of the attenuation in validity of the measures employed and the subtlety of the issues frequently involved” (p.13). The criterion (i.e. risk-taking in investing) was a self-report in summary form of portfolio holdings, which is subject to demand effects and memory errors. Measurement error in the criterion likely acts to depress the size of the validity coefficient.

Although this study demonstrates that people can do a reasonable job of estimating their own financial risk-tolerance, it is far from perfect in terms of both its overlap with a multi-item scale of risk-tolerance and the criterion of real-life investing behaviour. Clearly, these results should not be construed to mean that financial services professionals and researchers can eschew the use of psychometrically designed risk questionnaires and tests and just assess global self-opinion. Under ordinary circumstances, it is nearly always more prudent (and often legally required) to measure a client’s risk attitude with a valid and reliable scale rather than with an opinion. The potential errors surrounding the measurement of risk attitudes are significantly reduced when a scientifically designed risk-assessment scale, with high levels of validity and

reliability, is used (Callan and Johnson, 2002; Weber, Blais and Betz, 2002; Corter and Chen, 2005; Roszkowski, Davey and Grable, 2005).

Rather, the results of this study merely suggest that, if there is any doubt about the validity of a risk-tolerance test score, it makes sense to verify the results by asking clients to globally measure their own risk-tolerance. Verification of the outcome of the risk-tolerance 'tests' available on the internet is particularly warranted since many of these instruments are of dubious quality (Brown, 2003; Yook and Everett, 2003; Bouchey, 2004; Roszkowski, Davey and Grable, 2005; Kitces, 2006). Most consumers do not have the psychometric training to differentiate between good and bad risk-tolerance tests. Persons intending to use these tests would do well to heed the advice of Brown (2003), a personal finance columnist for the *Philadelphia Inquirer*, who warned his readers about this matter: "Measurements of risk-tolerance can also be very misleading. Lots of computer programs and Web sites use questionnaires to assess how much risk the investor is willing to take. But the results can vary widely". It is therefore prudent to take several online risk-tolerance assessments and compare the results. If the results of a risk-tolerance assessment do not feel right (i.e. go against personal intuition), the consumer should question the results. Just because something is available on the internet, does not mean that it can correctly assesses an individual's risk-tolerance.

Using a global self-classification to confirm other indicators of risk-tolerance (e.g. risk scales, investment knowledge, expectations, etc.) is a way to triangulate assessments and produce a more confident determination of a person's actual level of risk-tolerance. A question, similar to the one used in this study, can be easily incorporated into a formal multi-item questionnaire. A self-classification question has the potential to capture aspects of risk-tolerance that are known only by the individual making the judgment.

Prior research by Roszkowski and Grable (2005a) also shows that a client's self-estimate is better than a financial planner's estimate of the client's risk-tolerance. Consequently, if there is a discrepancy between a client's own estimate of his or her own risk-tolerance and an adviser's global estimate of it, in most situations the adviser would do well to place greater faith in the client's estimate. As with other personality characteristics, it is easier to estimate one's own risk-tolerance than that of another person.

For some purposes, however, when a less precise level of measurement may suffice, self-classification may be appropriate. For instance, single-item measures of risk-tolerance may be adequate for market segmentation, where only broad ('ballpark') levels of differentiation of risk-tolerance levels are required to divide the market into a few macro-segments. Also, providers of investment education programmes may be able to benefit from self-classifications to inform class content (so that educational programmes better target learner needs). For example, if a majority of learners indicate that they are willing to take risks after completing adequate research, an emphasis on 'how to' topics (e.g. how to read a mutual fund prospectus) and the historical performance of asset classes could be helpful. Conversely, risk averse participants might benefit from learning more about the role of prudent investment risks in meeting long-term goals. Financial educators will be most successful if they know their audience and create programmes to suit their needs (National Endowment for Financial Education, 2004).

Although not the primary focus of this research, the relationship detected between some control variables and investing behaviour merit attention. Typically, these variables

(e.g. sex, age, education) are used as proxies for risk-tolerance by many financial advisers. Nairn (2005) suggested their use for the same purpose to marketers when segmenting for risk-tolerance. The results of this study indicate that such biopsychosocial and environmental characteristics can be related to investment preferences independent of risk-tolerance. With the exception of age, the proxies used to estimate risk-tolerance were congruent with self-described risk-tolerance and with the risk inherent in the respondents' portfolios (actual behaviour). Thus, using the proxies would not lead to inappropriate recommendations.

The finding on sex differences conforms with the general consensus among researchers that, regardless of the reasons, men tend to make more risky investments than women (e.g. Chang, DeVaney and Chiremba, 2004; Slovic, 2004). It is noteworthy that this difference between males and females cannot be attributed solely to risk-tolerance. Similar results were observed in a study by van Rooij, Kool and Prast (2007) in the Netherlands, who reported that even after controlling for risk-tolerance, women showed a lower preference for stocks. These results lend some support to the Weber, Siebenmorgen and Weber (2005) hypothesis that to some extent gender differences are due to experience and familiarity with investing, which shape the perception of the extent of risk, rather than risk-tolerance *per se*.

According to Weber and Millman (1997), traditional financial models need to incorporate 'perceptions' as input variables in order to detect true 'attitude' towards risk. The normative risk-return model in finance, which assumes that investors want to minimise the risk for a given level of expected return, is represented by the following equation:

$$\text{WTP}(X) = V(X) - bR(X).$$

In this formula, willingness to pay (WTP) for a risky option is the compromise between return on value (V) and the risk (R), where coefficient b equals the risk-return tradeoff premium charged by the investor for each additional unit of risk that he or she assumes. Generally, $V(X)$ is measured by the expected value of option X (its mean return) and $R(X)$ is its variance. According to Weber and Millman (1997), if 'perceived return' and 'perceived risk' are used in place of 'expected value' and 'variance', respectively, then tradeoff coefficient b can be interpreted as an index of 'true' attitude towards risk.

The finding on the role of age was even more perplexing, but the relationship also has been observed previously (Finke and Huston, 2003; Chang, DeVaney and Chiremba, 2004). Holding risk-tolerance constant, age was positively related to aggressive investing and negatively related to conservative investing. Perhaps as investors' age, they become more familiar with increasingly sophisticated investment products and no longer have a 'fear of the unknown'. In other words, it may be possible that age works as a proxy for competence. As a person ages, her/his level of knowledge and experience increases, which may alter the way risky situations are perceived. Another possibility is that respondents' portfolios were not periodically rebalanced as investment experts suggest and, *de facto*, came to include more equity investments without a conscious decision to invest more aggressively. It could also be that the older individuals in this sample were non-representative of their age cohorts in that they were internet users. The literature on computer usage shows that older people are generally less comfortable with computers (as well as other new technologies). Perhaps technological sophistication and investing in equities are related.

6 Conclusions

Findings from this research provide guidance regarding the circumstances under which self-classification of financial risk-tolerance can be an effective tool. The global self-assessment was correlated with a risk-tolerance scale as well as actual choices reflecting risk preferences in real-life. However, the overlap between self-classified financial risk-tolerance and a longer 12-item measure was on the order of about 25%, so differences in conclusions reached on the basis of a scale and self-classifications are to be expected. The self-classification procedure is best used for screening purposes or to check on the validity of questionable scale assessment results. Also, this research suggests that preferences for cash and equities investments appear to be a function of demographic characteristics that are independent of self-classified risk-tolerance.

6.1 *Suggestions for future research*

It would be worthwhile to study the relationship between self-ratings and risk-tolerance test scores on a nationally representative sample. An added benefit of a national sample is that it would permit the development of some normative data to benchmark individual responses, as in the case of the SCF item. With the studies conducted to date, there is considerable variability in reported correlations between self-classification and scores based on more formal measurements of financial risk-tolerance. Since the studies are few in number, and those that are published differ in composition of samples, types of self-classification and the nature of the more extensive risk preference measures, it is no wonder the findings are not the same. An ideal study would be one where different formats of self-classification could be compared, controlling for sample and method of risk-tolerance determination. Also, studies comparing different versions of a single self-classification question (i.e. number of categories and verbal descriptions) may produce guidance on which type of item format works best.

Finally, the fairly high level of risk-tolerance in the current sample is an issue that needs to be acknowledged. A comparison of the distribution of the four-category classification used here to data from the SCF reported in Yao, Gutter and Hanna (2005), also on a four-point scale, suggests that a greater degree of risk-tolerance characterises the sample used in the present study, even taking into consideration differences in the verbal anchors associated with the four-levels in the two instruments. It is easy to attribute the greater risk-tolerance to the fact that this was an internet sample, but, without further analysis, sample differences in age and gender composition also may be important. Researchers may want to explore whether internet users are more risk-tolerant than non-users, given that risk-tolerance has been identified as a factor in the adoption of internet banking (Kolodinsky, Hogarth and Hilgert, 2004).

6.2 *Summary*

As highlighted at the outset of this article, there has been a renewed interest over the past decade in the role financial risk-tolerance plays in the financial decision-making process. While risk-tolerance has an obvious role in the investment management process, the function of financial risk-tolerance as a factor shaping other consumer decisions (e.g. how much debt a person is willing to assume, preferred types of consumer product financing, use of information intermediaries, etc.) is a topic that is gaining wider

recognition (Lin and Lee, 2004; Jacobs-Lawson and Hershey, 2005; Lee and Cho, 2005; Campbell, 2006). This article adds to the existing body of knowledge by showing that individuals can do a tolerable job of self-assessment, but that the use of psychometrically designed risk-tolerance scales will almost always provide a better picture of true risk-tolerance.

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