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A Comparison of Financial Risk-Tolerance Assessment Methods in Predicting Subsequent Risk Tolerance and Future Portfolio Choices

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Abstract: This study explores the effectiveness of various methods for measuring risk tolerance, with the aim to better understand the risk-taking attitudes and behaviors of financial decision-makers. Using data collected between October 2020 and March 2021, the research investigates three key areas: (a) the stability of risk tolerance over a six-month period, (b) the individual and household characteristics that predict future risk tolerance, and (c) the predictive accuracy of various risk-tolerance assessment methods in relation to portfolio choices made by financial decision-makers. The results show that risk-tolerance scores derived from a psychometrically developed scale provide the most accurate insights into future risk-taking attitudes and portfolio decisions. For those looking for a simple way to assess both current and future risk tolerance and portfolio choices, a stated-preference item can be effective. Although less consistent, a revealed-preference test can also be used to predict risk tolerance and risk-taking behavior. Findings provide guidance for financial decision-makers and financial advisors by comparing the key features of the three primary risk-tolerance assessment methods evaluated in this study. The study also establishes a foundational basis for selecting the most appropriate evaluation approach, based on the variables identified in the findings.

Keywords: financial risk tolerance; propensity measures; stated preferences; revealed preferences

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1. Introduction

Financial risk tolerance refers to a financial decision-maker's willingness to engage in a financial behavior in which the outcome is uncertain and potentially negative (Hermansson and Johnsson 2021; Rabbani and Nobre 2022). Regulatory bodies such as the European Securities and Market Authority (ESMA) and the U.S. Securities and Exchange Commission (SEC), along with certification boards like the Institute of Chartered Financial Analysts, and self-regulatory organizations (e.g., Financial Industry Regulatory Authority) require financial advisors to assess a client's risk tolerance before providing investment advice. The ESMA standard is representative of know-your-client (KYC) rules and guidelines in mandating that investment firms gather comprehensive information on a client's financial knowledge, ability to bear losses, and risk tolerance to ensure that investment recommendations align with a client's capacity to take risk in the pursuit of achieving investment objectives (ESMA 2018).

While regulators from North America, Europe, Australia/New Zealand, and across Asia obligate financial advisors to assess their clients' risk tolerance, regulators have been reluctant to prescribe how a financial advisor should actually go about measuring a client's or prospective client's willingness to take financial risk. This lack of prescription has led to a proliferation of financial risk-tolerance assessment tools, techniques, tests, quizzes, and scales being introduced into the marketplace. Although somewhat simplified, as shown

in Figure 1, three assessment procedures have come to dominate the marketplace (Hemrajani et al. 2023): propensity measures, stated-preference items, and revealed-preference tests. Numerous papers have been published over the past two decades describing the methodological issues associated with the development of reliable and valid measurement tools and the best types of questions to use when assessing risk tolerance (e.g., Guillemette et al. 2012; Hemrajani et al. 2023). Much of the existing literature suggests that few commercial products are fit-for-purpose in the sense of providing an accurate insight into someone's current and future willingness to take a risk (Brayman et al. 2017; Kitces 2016). The literature is also clear in showing that professional judgment is a weak substitute for a well-designed assessment tool (Roszkowski et al. 2005) and that hybrid methods that combine risk-assessment questions with measures of risk capacity, time horizon, and financial decision-maker's age, while useful in developing a broader risk profile, can lead to inaccurate estimates of someone's willingness to engage in risk-taking behaviors (Hubble et al. 2020).

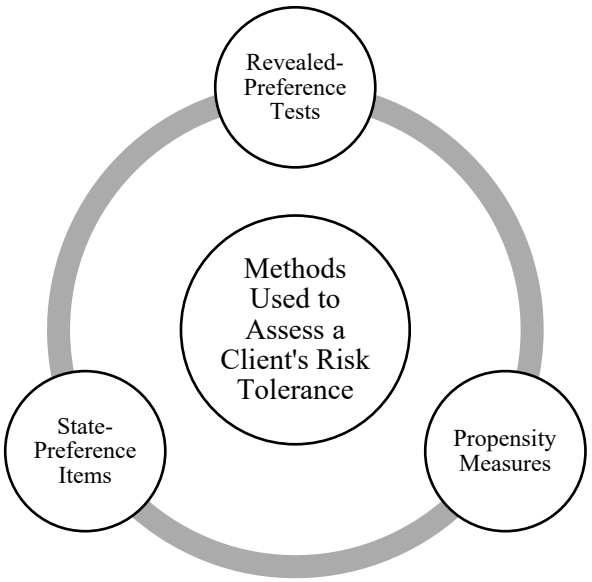

Figure 1. Three primary risk-tolerance assessment methods used by financial advisors.

This study is motivated by the proposition that it is important for financial advisors to understand the stability, reliability, and validity of the primary assessment methods used to determine a financial decision-maker's willingness to take risks. Gaining such an understanding can help financial advisors give qualified evidence-based investment advice. Additionally, identifying factors that can be used to predict a client's willingness to take risks can be helpful in acquiring a comprehensive understanding of each client's financial situation, allowing a financial advisor to create personally tailored portfolio recommendations (Ameriks et al. 2020; Froot and O'Connell 2003). Ultimately, understanding the association between outcomes associated with different risk-tolerance measurement techniques (e.g., portfolio selection decisions) ensures that clients are matched with investment choices based on their risk preferences, which is vital for achieving long-term client financial stability and success.

Given the study's motivation, the purpose of this study is to provide researchers, regulators, and financial advisors with information that can be used to better understand how a financial decision-maker's willingness to take financial risk can be reliably and validly measured. Specifically, this study is intended to address three issues. The first is to compare the stability of the three primary risk-tolerance assessment methodologies (i.e., propensity, stated-preference, and revealed-preference) across two periods. The second is to identify the factors that can be used to predict changes in risk tolerance across time. The third is to determine which risk-tolerance assessment method offers the best prediction

power when describing portfolio choices. The following assumptions were made at the outset of this study: (a) each risk-tolerance method would exhibit some degree of stability across periods; (b) unique factors and characteristics describe the subsequent risk tolerance of financial decision-makers; and (c) risk-tolerance evaluation methods, although positively correlated, exhibit a different degree of prediction power in explaining portfolio choices.

Rather than compare and contrast specific products available in the marketplace, we utilized test scores from widely used research instruments representing each assessment approach. A key assumption underlying this approach is that scores obtained from the tested instruments are indicative of scoring approaches used by the leading marketplace providers of risk-tolerance assessments, as well as being representative of research tests used by those in academia. The following research questions were tested in this study:

RQ_1. How stable is risk tolerance across periods?
RQ_2. What factors can be used to predict the subsequent risk tolerance of a financial decision-maker?
RQ_3. What type of risk-tolerance assessment method offers the best (i.e., most reliable and valid) prediction power when explaining subsequent portfolio choices?

2. Literature Review

The theoretical foundation of this study is based on Behavioral Portfolio Theory (BPT; Shefrin and Statman 2000) and Socioeconomic Status Theory (SES; Coleman 1988). When used jointly, these theories provide a comprehensive framework for understanding the relationship between risk tolerance and portfolio choices. BPT suggests that individuals apply multiple perspectives (e.g., goals, expected outcomes, etc.) and psychological factors (e.g., risk preference, mental accounting, etc.) in a layered fashion when making portfolio decisions under uncertainty. Additionally, by integrating SES theory into a model of portfolio choice, this study provides insight into the ways various socioeconomic factors and risk tolerance impact investment choices. According to Abriyanto and Barusman (2024), socioeconomic factors (e.g., income, education level, etc.) should play an important role in shaping individuals' financial attitudes, preferences, and behaviors. The combination of these theories allows for a more nuanced perspective when examining the relationships among personal characteristics, willingness to take risks, and portfolio decisions through the identification of important socioeconomic factors across the three primary risk-tolerance assessment methods evaluated in this study.

Building on this theoretical foundation, the following discussion provides a background review of the three types of financial risk-tolerance assessment methods that were evaluated in this study. The review also introduces variables commonly referenced in the literature whenever financial risk tolerance is evaluated empirically.

2.1. Propensity Measures

Propensity measures—sometimes referred to as psychometric tests (Frey et al. 2017)—comprise the largest number of commercial risk-tolerance assessment products in the marketplace. When building a propensity measure, psychometricians assume that decision-makers rely on subjective gain and loss probability estimates when choosing between and among alternatives. Classical test theory is most often used to frame how questions are asked in a propensity measure.[1] Classical test theory is premised on building scales that are reliable and valid (Faff et al. 2009). Reliability refers to the "consistency of individuals' responses to an instrument across measurement occasions and is a descriptive statistic designed to capture how much measurement error is in a variable" (Beauchamp et al. 2017, p. 205). Validity refers to how well scale scores describe and/or predict behavior (Babbie 2020). Propensity measures are designed to assess underlying attitudes that prompt behavioral intention and action, and as such, psychometric tests are considered the 'gold standard' among those who measure personality, intelligence, and other psychological constructs.

2.2. Stated-Preference Measures

Sometimes researchers need a straightforward and quick way to assess a decision-maker's willingness to take financial risks. Similarly, from time to time, financial advisors prefer to discuss a client's risk tolerance through a simple question-and-answer format. A stated-preference assessment approach is often used in these situations (Adamowicz et al. 1994). Single-question risk-tolerance assessments are, as a result, widely used and trusted by researchers and financial advisors alike. A stated-preference question can be asked this way: "If the markets were to fall by 10%, what would you do?" A stated-preference assessment can also be framed similarly to how risk attitudes are assessed in the Survey of Consumer Finances (SCF): "Which of the following statements comes closest to the amount of financial risk that you are willing to take when you save or make investments?" Two drawbacks associated with single-item stated-preference measures are that reliability tends to fall below statistical standards and the validity of scores tends to be low compared to other measurement methods (Gibson et al. 2013; Mata et al. 2018).

2.3. Revealed-Preference Measures

The primary alternative to propensity and stated-preference measurement techniques is a revealed-preference test. Revealed-preference methodologies are closely aligned with concepts embedded in economic theory. Hanna and Lindamood (2004) argued that "the only rigorous theoretical analyses relating risk tolerance to optimal portfolios are based on the economic concept of risk aversion" (p. 27). To fully understand the difference between a revealed-preference test and a propensity or stated-preference measure, risk and uncertainty must first be differentiated. Weber and Johnson (2009) clarified the difference between these two constructs as follows: "*Risk* refers to situations where the decision-maker knows with certainty the mathematical probabilities of possible outcomes of choice alternatives. *Uncertainty* refers to situations where the likelihood of different outcomes cannot be expressed with any mathematical precision" (p. 132). Those who prefer revealed-preference tests argue that "uncertain situations can be reduced to risky situations" (Weber and Johnson 2009, p. 132). According to Frey and associates (2017), revealed-preference measures are designed to "capture specific cognitive processes, such as the integration of gains and losses or the role of learning and experience" (p. 1). This assessment approach involves having a test taker choose between two outcomes in which the probability of potential gains and losses is known a priori. Many revealed-preference assessments have been gamified so that a test taker is presented with numerous choice scenarios. Based on their response, a risk-preference score can be estimated (Hanna et al. 2013).

2.4. Approaches Compared

There is little consensus concerning which measurement approach is the best in practice. Test developers and psychometricians continue to debate the merits and shortcomings associated with each technique. The principal argument against the use of a propensity scale is that a psychometric test may be little more than an extended stated-preference assessment. Propensity scores are also difficult to map to a portfolio in the context of the efficient frontier as described in modern portfolio theory. Fischhoff et al. (1978) noted that these limitations do not necessarily diminish the advantages associated with assessing attitudes with propensity measures. Fischhoff et al. argued that "Attitudes elicited in surveys often correlate highly with behavior . . . Furthermore, they elicit present values rather than historical preferences" (p. 130). There is some evidence to suggest that propensity measures—at least those developed using psychometric test standards—do a relatively good job of describing and predicting behavior (Dohmen et al. 2011; Lönnqvist et al. 2015).

The obvious weakness associated with the use of stated-preference items is that what a person says they will do does not necessarily correspond to what they do (or will do) in practice. Additionally, the use of a stated-preference test is almost always premised on the need for a quick response. This approach can result in greater systematic measurement errors and problematic estimates of validity, although it is important to acknowledge that

someone's stated preference may do just as well, or possibly better, in accurately describing the person's willingness to take a risk. This possibility has not been fully explored in the literature.

The revealed-preference measurement technique is generally considered to be the preferred assessment approach among those trained in economics because it provides the clearest path to descriptions of constant relative risk aversion. This assessment technique, however, is not without its critics. Mata et al. (2018) pointed out that revealed-preference tests often fail to provide enough context to lead to a useful response. These researchers also noted that the use of risk, rather than uncertainty, in choice scenarios may not capture the reality of situations faced by financial decision-makers. Additionally, as reported by Barsky et al. (1997) and Charness et al. (2013), asking the average person to make probability choices may be too complex of a task, which can lead to guessing (see also Dave et al. 2010). Lurtz et al. (2021) also suggested that people interpret their own risk tolerance through subjective factors such as thoughts, feelings, values, and life experiences, rather than relying on a mathematical calculation when making financial decisions that involve taking risks. In a summary review, Frey et al. (2017) argued that revealed-preference tests may be portraying situational characteristics (i.e., states) that help a person adapt to a particular situation rather than trait factors, which are preferences that display consistency across time (Reynaud and Couture 2012).

One point does tend to generate consensus among researchers: While scores from propensity, stated-preference, and revealed-preference measures tend to correlate positively, the statistical association among these measures tends to be weak (i.e., the effect size of the relationship is generally low). As noted by Frey et al. (2017): "... measures from the propensity and behavioral measurement traditions cannot be used interchangeably to capture risk preference" (p. 8). Results from this study provide evidence to support this assertion.

2.5. Other Considerations

Given the complexities associated with measuring financial risk-tolerance attitudes and the possibility that confounding variables may simultaneously influence someone's willingness to take a risk and their engagement in financial behaviors, it is important to account for variables that are known to be associated with risk tolerance and risk-taking behavior whenever descriptive and predictive tests are undertaken (Grable et al. 2024; Kaustia and Torstila 2011). The literature is replete with studies showing the variables most commonly associated with financial risk tolerance. The following discussion highlights some of the most important of these variables (all of which were accounted for in this study).

Gender. Gender, when measured as self-identifying as a male or female, is known to be related to risk tolerance, with males generally reporting a greater tolerance for risk (Anbar and Eker 2010; Chavali and Mohanraj 2016; Fisher and Yao 2017; Hallahan et al. 2004; Larkin et al. 2013).

Age. Age has also been shown to be related to risk tolerance, with older decision-makers generally exhibiting less risk tolerance (Brooks et al. 2018; Gibson et al. 2013; Hallahan et al. 2004; Yao et al. 2011).

Race/Ethnicity. Racial and ethnic background is also thought to be associated with a financial decision-maker's willingness to take financial risks, with those who self-identify as White/Caucasian being more risk tolerant compared to those who self-identify as Black or African American or Hispanic/Latinx (Dickason and Swanepoel 2018; Fisher 2019).

Financial knowledge. A financial decision-maker's knowledge of personal finance concepts has been shown to be positively associated with financial risk tolerance (Gibson et al. 2013; Noman et al. 2023; Wang 2009). It is thought that financial knowledge adds to a financial decision-maker's capacity to evaluate risk and endure possible losses associated with investment decisions.

Other factors. Other variables known to be positively associated with financial risk tolerance include household income, education, and wealth status (Hallahan et al. 2004;

Khalil-Oliwa and Jonek-Kowalska 2024; Pinjisakikool 2017; Wang et al. 2021; Wong 2011). Similar to financial knowledge, income, education, and wealth are thought to add to a household's (or financial decision-maker's) risk capacity or its ability to withstand losses associated with financial uncertainty. More inconsistency is related to associations between homeownership and risk tolerance and marital status and risk tolerance (Hallahan et al. 2004; Jianakoplos and Bernasek 2006; Koekemoer 2018; Tharp et al. 2020; Wong 2011). The inconsistency arises because it is unclear if financial decision-makers scale back on risk-taking when the outcomes associated with a risky decision can negatively impact other household members or whether the presence of others in the household enhances risk capacity.

3. Materials and Methods

3.1. Data and Risk-Tolerance Measures

Data for this study were obtained from a panel study of 365 individual financial decision-makers. Data were gathered using the online survey panel managed by Dynata.[2] Dynata recruited the sample and distributed Qualtrics questionnaires that included questions used in this study. The delivery of the first and second questionnaires fell approximately six months apart. Study participants completed the first survey in October 2020. The same individuals completed the second survey in March 2021. Each questionnaire took about 15 min to complete, with a standard deviation of five minutes. Those participating in the study received a modest financial incentive after completing each survey. Sample descriptive statistics are shown in Table 1.

Table 1. Sample and variable descriptive statistics (N = 365).

Variable	*M*	*SD*	Percentage
1st Survey Propensity Risk Score	24.132	5.41	
2nd Survey Propensity Risk Score	24.021	5.191	
1st Survey Stated-Preference Risk Score			
None			23.00%
Below Average			44.20%
Above Average			28.00%
High			4.80%
2nd Survey Stated-Preference Risk Score			
None			22.30%
Below Average			45.50%
Above Average			27.00%
High			5.20%
1st Survey Revealed-Preference Risk Score			
Low			40.20%
Below Average			32.10%
Above Average			16.60%
High			11.10%
2nd Survey Revealed-Preference Risk Score			
Low			44.10%
Below Average			34.60%
Above Average			9.20%
High			12.10%
Portfolio Equity Holdings	35.361	27.312	

Table 1. *Cont.*

Variable	*M*	*SD*	Percentage
Gender			
Male			49.00%
Female			51.00%
Subjective Financial Knowledge	3.18	1.041	
Financial Satisfaction	6.782	2.474	
Household Income	7.791	3.55	
Education	4.452	1.393	
Wealth Status	3.981	1.074	
Homeowner			73.20%
Race/Ethnicity			
White/Caucasian			68.60%
Black/African American			13.30%
Hispanic/Latinx			9.00%
Other Race/Ethnicity			9.10%
Age			
18–24			7.00%
25–34			12.10%
35–44			15.00%
45–54			22.30%
55–64			19.20%
65–74			18.50%
75 or Older			5.90%
Marital Status			
Single			33.20%
Married			54.40%
Other			13.40%

Three widely used research assessments were used as proxies for propensity, stated-preference, and revealed-preference measures, respectively. Study participants were asked to answer the assessment questions in both surveys. The Grable and Lytton (1999) risk-tolerance scale was used as an indicator of what is generally considered to be a propensity measure. The Grable and Lytton financial risk-tolerance scale, which was developed using concepts from classical test theory, has been widely used as a research instrument in studies designed to evaluate risk-taking attitudes and behaviors (Lobão 2022; Lucarelli et al. 2011). The scale consists of 13 multiple-choice questions that are summed to create a score ranging from 13 to 47, with higher scores representing an increased willingness to take financial risk. Across studies and over time, the scale has exhibited acceptable levels of validity (e.g., scores are known to be positively associated with more aggressive investment choices) and reliability (e.g., reported Cronbach's alpha scores have ranged from 0.70 to over 0.80, with higher reliability estimates reported for older financial decision-makers). Propensity scores ranged from 13 to 37 in the first survey (M = 24.00, SD = 5.19) and 13 to 39 in the follow-up survey (M = 24.17, SD = 5.40). Cronbach's alpha was 0.73 in the first survey and 0.76 in the second survey.

A study participant's stated preference for risk-taking was assessed using the single-item risk-assessment question from the SCF. Participants in the study were asked to respond to the following query:

> "Which of the following statements comes closest to the amount of financial risk that you are willing to take when you save or make investments?"

Four answer options were provided: (1) Not willing to take any financial risks; (2) Take average financial risks expecting to earn average returns; (3) Take above-average financial

risks expecting to earn above-average returns; (4) Take substantial risk expecting to earn substantial returns.

The SCF item is one of the most popular ways to assess a financial decision-maker's risk-tolerance (aversion) primarily because it is included in the Survey of Consumer Finances and many other national and international surveys. Although the reliability falls below evaluation standards, the estimated reliability of the item is relatively robust for a single-item measure. Across both surveys, as shown in Table 1, the modal category was to 'Take average financial risks expecting to earn average returns.'

A version of the widely used Barsky et al. (1997) revealed-preference test was used as an indicator of standard revealed-preference assessments. The assessment process involved asking study participants to answer the following questions based on a skip pattern choice scenario. Once the questions were answered, a four-point ordinal revealed-preference score was calculated (i.e., high, above-average, below-average, and low-risk tolerance):

> *Question 1: Suppose that you are the only income earner in the family, and you have a good job guaranteed to give you your current (family) income every year for life. You are given the opportunity to take a new and equally good job, with a 50-50 chance it will double your (family) income and a 50-50 chance it will cut your (family) income by a third. Would you take the new job?*
>
> If the answer to this question was 'yes', the participant was then asked:
>
> *Question 2: Suppose the chances were 50-50 that it would double your (family) income, and 50-50 that it would cut it in half. Would you still take the new job?*
>
> If the answer to the first question was 'no', the participant was then asked:
>
> *Question 3: Suppose the chances were 50-50 that it would double your (family) income and 50-50 that it would cut it by 20 percent. Would you then take the new job?*

Study participants who answered 'no' to the first and third questions were classified as having a low-risk tolerance. A participant who answered 'no' to the first question and 'yes' to the third question was classified as having below-average risk tolerance. A participant who answered 'yes' to the first question and 'no' to the second question was classified as having above-average risk tolerance. Those who answered 'yes' to the first and third questions were classified as having high-risk tolerance. Beauchamp et al. (2017) estimated the reliability coefficient for a similarly worded test using polychoric correlations. They estimated reliability to be approximately 0.59, an estimate that falls below generally recommended scale design guidelines (Postmes et al. 2013) but one that aligns with the estimated reliability of the SCF stated-preference question. The modal category across surveys was 'below average' in the first survey and 'low' in the second survey.

3.2. Validity Check

The following question was presented in the second survey and used as a validity check for the risk-tolerance measures:

> *"Suppose that you were to take a snapshot of your current financial position. Approximately what percent of your total savings and investments are held in stocks or other risky assets (e.g., equity mutual funds)?"*

Study participants were asked to indicate their answer as a percentage ranging from zero to 100%, on a sliding scale. It was hypothesized that risk-tolerance scores reported in the first survey should, if valid, predict answers to this question in the second survey. On average, participants held approximately 35% of their portfolios in equities (*Mdn* = 36%, *SD* = 27.31).

3.3. Control Variables

As discussed earlier in the paper, nine variables were included in the multivariate analyses. The gender of study participants was assessed by asking each participant to self-identify as male, female, non-binary, or other. The sample included only males (coded

0) and females (coded 1). Self-assessed financial knowledge was determined by asking, "How knowledgeable are you about personal finance topics?" Participants were asked to indicate their knowledge from the following five categories: (1) not knowledgeable at all, (2) slightly knowledgeable, (3) moderately knowledgeable, (4) very knowledgeable, and (5) extremely knowledgeable. The modal category was 'moderately knowledgeable'. Household income was measured using a 12-point ordinal scale with 1 = *income less than $10,000* and 12 = *more than $150,000*. The modal category was '$70,000 to $79,999'. Education was assessed using an ordinal scale ranging from 1 = *some high school or less* to 6 = *graduate or professional degree*. The modal category was a 'Bachelor's degree'. Wealth status was measured with the following item: "Think about what you own (assets) and what you owe to others (debts and liabilities). If you sold everything you own and paid off all your debts, how much would you have left over?" Participants were asked to select from the following five options: (1) *it would be a large negative number*, (2) *it would be a negative number*, (3) *neither negative nor positive* ($0), (4) *it would be a positive number*, and (5) *it would be a large positive number*. The modal response was 'it would be a positive number' (4). Homeownership was coded dichotomously with 1 = *homeowner*, otherwise 0. Self-identified race/ethnicity was assessed by asking each participant to self-report whether they affiliated as *Caucasian/White*, *African American/Black*, *Hispanic/Latino/Latinx*, *Native American*, *Asian or Pacific Islander*, *or other*. Responses were recoded dichotomously as follows: (a) *Caucasian/White* = 1 (used as reference group), otherwise 0; (b) *African American/Black* = 1, otherwise 0; (c) *Hispanic/Latino/Latinx* = 1, otherwise 0; and (d) *Other*, including *Native American, Asian or Pacific Islander*, or other = 1, otherwise 0. Age was measured categorically beginning at age 18 years (those age 85 or older were used as the reference category). The modal age category was '45 to 54 years'. Marital status was assessed using nominal categories ranging from *never married* to *widowed/other*. Data were coded so that 1 = *married*, otherwise 0 and 1 = *single*, otherwise 0. The reference category was the other classification that included *separated*, *divorced*, *widowed*, and other study participants.

3.4. Data Analysis Methods

Three statistical approaches were used to summarize and analyze the survey data. First, sample descriptive statistics were calculated based on the first survey responses.[3] This was followed by a Spearman correlation analysis showing associations among the three risk-tolerance measures across the first and second surveys. Finally, a series of ordinary least squares and ordinal regression models were estimated to determine the strength of association between risk-tolerance scores from the first survey to scores on the second survey and to determine how well risk-tolerance scores from the first survey predicted portfolio equity holdings at the second survey. The regressions were operationalized as follows:

$$Y_{it+1} = a_0 + a_1 Risk\text{-}ToleranceScore_{it} + X_{it}'b + \varepsilon_{it+1}$$

where Y is the risk-tolerance score or portfolio equity holdings, X is a vector of control variables for individual i at time t, b is a vector of coefficients for the control variables, and ε is an error term.

4. Results

As shown in Table 1, the sample was diverse in terms of gender, age, marital status, homeownership, and race/ethnicity. In other respects, those in the sample exhibited relatively high financial knowledge, financial satisfaction, household income, education, and wealth status. The risk tolerance of study participants fell in the average to the slightly below-average range. Scores on the propensity measure were at the mid-point of the scale across both surveys. Stated-preference scores were relatively stable across the surveys, with the majority of participants indicating below-average or no risk tolerance. Greater variability in revealed-preference score distribution across surveys was observed,

with a shift occurring from above-average and high-risk tolerance to below-average and low-risk tolerance.

Data from Table 2 indicate that the associations among the risk-tolerance measurements, across periods, were positive. Each measure was also positively associated with reported portfolio equity holdings in the second survey. This suggests that the three measurement techniques appear to offer some degree of predictive validity in relation to financial decision-making, although it is worth noting that the effect size of the relationship between revealed-preference scores and equity holdings, while statistically significant, was not large (Kelley and Preacher 2012). The correlation coefficients from the table can also be used to gauge the effect size of score associations across the two periods (Cohen 1992). The relationship between the first and second survey propensity scores was quite large. The effect size of the association between the first and second survey stated-preference scores was also large. The effect size of the association between the first and second surveys revealed-preference scores were lower (i.e., a medium effect).

Table 2. Estimated associations between risk-tolerance measures across periods.

Variable	1	2	3	4	5	6	7
1. 1st Survey PS	1.000						
2. 1st Survey SPS	0.532 **	1.000					
3. 1st Survey RPS	0.361 **	0.234 **	1.000				
4. 2nd Survey PS	0.742 **	0.511 **	0.281 **	1.000			
5. 2nd Survey SPS	0.503 **	0.590 **	0.243 **	0.612 **	1.000		
6. 2nd Survey RPS	0.241 **	0.172 **	0.304 **	0.251 **	0.153 **	1.000	
7. Portfolio Equity Holdings	0.412 **	0.441 **	0.170 **	0.490 **	0.481 **	0.112 *	1.000

Note. PS = Propensity Score; RPS = Revealed-Preference Score; SPS = Stated-Preference Score. * $p < 0.05$. ** $p < 0.01$.

Results from Tables 3 and 4 provide insight into the question that asked how stable is risk tolerance across periods? Table 3 shows the relationship between the first-survey propensity scores and subsequent propensity risk-tolerance scores. The propensity model was statistically significant, $F_{20,362} = 27.96$, $p < 0.001$. The model explained more than 60% of the variance in propensity risk-tolerance scores in the second survey ($R^2 = 0.61$). Propensity scores were quite stable across the two periods. Other variables of significance in the model included subjective financial knowledge (+), education (+), other race/ethnicity (+), and age categories of 25 to 54 (+), and 75 to 84 (+).

Table 3. Regression showing the strength of propensity scores in predicting subsequent propensity scores.

Variable	*b*	*SE*	*t*
(Constant)	2.270	1.531	1.480
1st Survey Propensity Score	0.701 **	0.037	18.070
Gender (0 = Male; 1 = Female)	−0.022	0.402	−0.041
Subjective Financial Knowledge	0.425 *	0.204	2.133
Financial Satisfaction	−0.140	0.090	−1.632
Household Income	0.082	0.071	1.110
Education	0.423 **	0.158	2.709
Wealth Status	−0.046	0.223	−0.238
Homeowner	0.610	0.510	1.190
Black/African American	0.472	0.579	0.805
Hispanic/Latinx	−0.367	0.641	−0.582
Other Race/Ethnicity	2.151 **	0.643	3.354
Age			
18–24	1.610	1.052	1.543
25–34	2.522 **	0.943	2.687

Table 3. *Cont.*

Variable	*b*	*SE*	*t*
35–44	2.001 *	0.860	2.330
45–54	1.931 *	0.818	2.351
55–64	1.448	0.820	1.772
65–74	0.950	0.824	1.172
75–84	2.203 *	1.069	2.061
Single	−0.239	0.621	−0.380
Married	−0.056	0.584	−0.103

Note. * $p < 0.05$. ** $p < 0.01$.

Table 4. Stated- and revealed-preference regression estimates showing the strength of scores in predicting subsequent scores.

Variable	Stated-Preference Score			Revealed-Preference Score		
	b	*SE*	*t*	*b*	*SE*	*t*
(Constant)	17.206 **	6.446	2.540	11.162 *	4.981	1.056
1st Survey Score	1.584 **	0.160	103.081	0.604 **	0.103	34.381
Gender (0 = Male; 1 = Female)	−0.557 *	0.231	5.925	−0.069	0.210	0.121
Subjective Financial Knowledge	0.302 **	0.118	6.759	0.150	0.106	1.937
Financial Satisfaction	−0.028	0.054	0.441	−0.064	0.053	1.670
Household Income	0.001	0.042	0.012	0.039	0.041	0.866
Education	0.272 **	0.086	8.701	0.090	0.094	1.210
Wealth Status	0.107	0.132	0.767	−0.191	0.122	2.481
Homeowner	0.330	0.301	1.210	0.376	0.277	1.824
Black/African American	0.551	0.330	2.748	0.110	0.314	0.125
Hispanic/Latinx	0.268	0.355	0.550	−0.312	0.351	0.750
Other Race/Ethnicity	0.020	0.373	0.001	−0.204	0.348	0.311
Age						
18–24	0.201	0.602	0.112	−0.163	0.574	0.082
25–34	0.072	0.531	0.020	−0.112	0.509	0.037
35–44	−0.548	0.488	1.264	−0.210	0.462	0.201
45–54	−0.302	0.473	0.423	−0.166	0.440	0.143
55–64	−0.467	0.466	0.988	−0.012	0.436	0.001
65–74	−0.904	0.470	3.585	−0.124	0.443	0.080
75–84	−0.390	0.612	0.401	0.630	0.570	1.224
Single	−0.231	0.357	0.400	0.344	0.347	0.956
Married	0.132	0.341	0.163	0.125	0.332	0.190

Note. * $p < 0.05$. ** $p < 0.01$.

Ordinal regressions were estimated to determine the association between stated- and revealed-preferences and subsequent stated- and revealed-preference scores. The stated-preference model was statistically significant, $\chi^2 = 211.42$, $p < 0.001$. The model explained approximately 47% of the variance in subsequent stated-preference risk-tolerance scores (Negelkerke $R^2 = 0.47$). The revealed-preference model was also statistically significant, $\chi^2 = 54.11$, $p < 0.001$. However, the model explained only 15% of the variance in subsequent revealed-preference risk-tolerance scores (Negelkerke $R^2 = 0.15$).

Table 4 shows the results from the regression analyses. The first panel represents estimates for the stated-preference outcome, whereas the second panel represents coefficients for the revealed-preference outcome. Stated-preference scores were positively associated with subsequent risk-tolerance scores, which provides evidence that stated preferences were stable across periods. Other variables of importance in the model included being male (+), subjective financial knowledge (+), and education (+). Only one variable was statistically significant in the revealed-preference model: the first survey revealed-preference scores. The relationship was positive, indicating some degree of stability across periods.

Table 5 summarizes the findings from the three regression models. The propensity measurement model was the most robust, explaining the greatest amount of variance in subsequent risk-tolerance scores. The stated-preference model also offered a reasonably high degree of outcome explanation. The revealed-preference model was the weakest of the three estimations. A key takeaway from the analyses was that across the variables of

interest, first-survey risk-tolerance (preference) scores were the only common predictor of subsequent risk-tolerance (preference) scores. The table also provides an answer to the second research question, which asked what factors can be used to predict the subsequent risk tolerance of a financial decision-maker? Subjective financial knowledge and education level were found to be positively associated with subsequent risk-tolerance scores in the propensity and stated-preference models. Compared to Whites/Caucasians and Blacks/African Americans, those from another racial or ethnic background exhibited greater risk tolerance in the propensity model. Age was also found to be positively associated with risk tolerance in the propensity model. Being male was observed to be positively associated with risk tolerance in the stated-preference model. None of the control variables in the revealed-preference model were statistically significant.

Table 5. Summary of explanatory variables across measures when predicting subsequent scores.

Variable	Propensity Measure	Stated-Preference Measure	Revealed-Preference Measure
1st Survey Risk Score	+	+	+
Gender (Males)		+	
Subjective Financial Knowledge	+	+	
Education	+	+	
Other Race/Ethnicity	+		
Age 25 to 34	+		
Age 35 to 44	+		
Age 45 to 54	+		
Age 75 to 84	+		
R^2	0.610	0.467	0.148

Note. Plus sign (+) = positively associated with the subsequent risk-tolerance score.

Data in Table 6 offer answers to the third research question that asked, which risk-tolerance assessment method offers the best prediction power when describing portfolio choices. Model A shows that first-survey financial risk-tolerance propensity scores positively predicted second-period equity portfolio holdings. Among the variables in the model, the propensity financial risk-tolerance score variable was the most important predictor. Household income and subjective net worth were also found to be positively associated with future equity holdings. Although the coefficients and effect sizes were different, the same pattern of prediction was noted in relation to the stated-preference model (Model B in Table 6). Both models explained more than 25% of the variance in second survey equity portfolio holdings. Model C shows the findings from the revealed-preference model. While the first survey revealed-preference scores did positively predict subsequent period equity portfolio holdings, revealed-preference scores were less important compared to household income, education, and wealth status. This means that the predictive validity of revealed-preference risk-tolerance scores was lower than that of propensity and stated-preference scores. Overall, the revealed-preference model explained approximately 20% of the variance in equity holdings.

To validate the predictive performance of the regression models, we conducted a *K*-fold cross-validation across all models. The use of five-fold cross-validation was chosen given the relatively small sample size (Abed et al. 2023; Lei 2020). The results from this process yielded an average Root Mean Squared Error of 4.85 and R^2 of 0.71, indicating that the models explained a substantial portion of the variance in risk tolerance and portfolio choices. These findings suggest that the models performed reliably in predicting future outcomes.

Table 6. Relationship of propensity, stated-preference, and revealed-preference scores to portfolio equity holdings.

Variable	A. Propensity Measure			B. Stated-Preference Measure			C. Revealed-Preference Measure		
	b	***SE***	***t***	***b***	***SE***	***t***	***b***	***SE***	***t***
(Constant)	−45.631 **	10.451	0.488	−27.332 **	9.437	0.214	−18.361 *	9.981	0.300
1st Survey Risk Score	1.772 **	0.270	0.343	11.286 **	1.581	0.353	2.952 *	1.321	0.114
Gender (0 = Male; 1 = Female)	0.180	2.704	0.001	−0.743	2.660	−.012	−1.576	2.824	−0.027
Sub. Financial Knowledge	0.201	1.383	0.013	1.101	1.341	0.035	2.443	1.402	0.091
Financial Satisfaction	0.257	0.580	0.020	0.667	0.576	0.062	0.160	0.607	0.020
Household Income	1.060 *	0.480	0.137	0.930	0.482	0.120	1.357 **	0.512	0.176
Education	1.791	1.061	0.085	1.731	1.061	0.087	2.531 *	1.109	0.131
Wealth Status	3.438 *	1.482	0.142	3.656 *	1.456	0.143	3.920 *	1.554	0.150
Homeowner	−0.591	3.513	−0.011	−1.387	3.487	−0.020	0.488	3.686	0.012
Black/African American	1.531	3.938	0.020	1.560	3.911	0.021	1.071	4.153	0.010
Hispanic/Latinx	5.202	4.304	0.057	2.464	4.269	0.034	3.950	4.520	0.038
Other Race/Ethnicity	1.749	4.38	0.021	0.521	4.350	0.010	0.449	4.621	0.011
Age									
18–24	−6.850	7.162	−0.063	−6.159	7.088	−0.058	−6.570	7.531	−0.064
25–34	1.211	6.380	0.011	−1.442	6.312	−0.019	−1.013	6.712	−0.011
35–44	−2.600	5.864	−0.031	−2.940	5.801	−0.037	−6.284	6.142	−0.082
45–54	3.862	5.619	0.062	2.044	5.557	0.032	0.206	5.904	0.001
55–64	6.856	5.624	0.103	5.168	5.559	0.080	2.958	5.887	0.040
65–74	1.524	5.580	0.018	0.985	5.523	0.011	−2.640	5.836	−0.041
75–84	6.741	7.317	0.056	2.689	7.202	0.023	0.031	7.641	0.000
Single	5.743	4.234	0.102	2.164	4.220	0.038	5.341	4.452	0.086
Married	3.410	3.980	0.061	0.902	3.947	0.021	2.214	4.188	0.037
	$F_{20,364}$ = 7.011 **, R^2 = 0.283			$F_{20,364}$ = 7.440 **, R^2 = 0.287			$F_{20,364}$ = 4.571 **, R^2 = 0.202		

Note. * $p < 0.05$. ** $p < 0.01$.

5. Discussion

This study aimed to compare three commonly used risk-tolerance assessment methodologies: propensity measures, stated-preference items, and revealed-preference tests. The following three questions were asked: (a) How stable is risk tolerance across periods; (b) What factors can be used to predict the subsequent risk tolerance of a financial decision-maker; and (c) Which type of risk-tolerance assessment method offers the best prediction power when describing portfolio choices? The goal of the study was to provide researchers, regulators, and financial advisors with a clear understanding of each approach's strengths and weaknesses. This purpose was accomplished by using the three research tools, each representing a specific measurement approach, to describe and predict subsequent risk-tolerance scores and portfolio holdings.

Each of the measurement approaches exhibited consistency and stability across periods. However, the propensity measurement technique offered the greatest degree of inter-period stability, followed by scores from the stated-preference measure. While the revealed-preference measure exhibited relative stability, revealed-preference scores were the weakest in terms of prediction. In this regard, findings from this study support an assertion made by Frey et al. (2017) who argued that "... measures from the propensity and behavioral measurement traditions cannot be used interchangeably to capture risk preference" (p. 8). Correlations among the three measurement approaches were positive, but the effect sizes of the associations varied from relatively low to high.

As noted above, scores from each measurement approach were found to be predictive of subsequent risk-tolerance scores. However, propensity and stated-preference scores were observed to provide a more robust estimate of subsequent risk-tolerance scores compared to revealed-preference scores. Nonetheless, the tests did show relative stability across periods for the three approaches in predicting future risk attitudes. Similarly, propensity, stated-preference, and revealed-preference scores were found to be predictive of future period equity portfolio holdings. Again, propensity and stated-preference scores provided

a more complete picture when making predictions. Household income, education, and wealth status were more important when predicting future equity holdings compared to revealed-preference scores. In other words, gauging a financial decision-maker's income level, educational level, and/or wealth status appears to provide a more robust indication of future equity holdings than a revealed-preference test score. It may be that as measures of risk capacity, these socioeconomic characteristics give more insight into future behavior than scores based on transient feelings.

Of the other variables included in the models, financial knowledge and educational status were important descriptors and predictors of subsequent risk-tolerance. Age, gender (i.e., being male), and other race/ethnicity were also important in some of the prediction models. When predicting future portfolio holdings, in addition to risk-tolerance scores, household income and wealth status were important predictors. Education was significant in the revealed-preference model only. When viewed holistically, these variables represent factors that lead to and support a financial decision-maker's degree of risk capacity (Hubble et al. 2020). As such, it is reasonable to assume that the presence of risk capacity in one period, together with a willingness to take financial risk, can be used to accurately predict future period portfolio choices.

Findings from this study can be used by researchers, financial advisors, and regulators when thinking about the optimal way to evaluate a financial decision-maker's willingness to take risks. The three measures used in this study are representative of what is currently offered by vendors. Scores from the propensity measure were the most reliable, stable, and valid followed by stated-preference and revealed-preference scores, respectively. When predicting future portfolio holdings, propensity, and stated-preference scores outperformed revealed-preference scores. In this regard, revealed-preference scores, while useful in predicting future investment behavior, were of less importance compared to household income, wealth status, and education. These findings suggest that if the intention underlying the use of a risk-tolerance assessment is to gain insight into subsequent risk attitudes and investing behavior, a propensity or stated-preference methodology should be given high priority.

The results from this study have practical implications for financial advisors. First, the results highlight the various impacts of socioeconomic factors in predicting subsequent risk tolerance across the three assessment methods. Each assessment method demonstrated a significant relationship with different socioeconomic factors when predicting a financial decision-maker's willingness to take risks. For instance, when using the propensity measurement approach, a broader range of factors were observed to have a relationship with subsequent risk tolerance (compared to the methods). This implies that financial advisors utilizing the propensity measurement method should be aware that other client factors are likely at play when a client makes investment selections. Second, each assessment method was significantly related to different portfolio choice factors. Household income and wealth status were particularly important descriptors of someone's risk capacity. For financial advisors who rely on the stated-preference measurement method, a thorough examination of a client's wealth status can help them provide better investment advice. Financial advisors using the revealed-preference measurement method should additionally consider education alongside income and wealth status when advising on portfolio decisions. Overall, each assessment method has unique characteristics that may yield similar outcomes; however, to provide optimal advice, these methods should be integrated with an understanding of each client's socioeconomic situation. Different factors will play varying roles in describing portfolio choices made by a client after accounting for the client's willingness to take risks. Taking a comprehensive approach (i.e., one that accounts for a client's attitude and capacity) can enable financial advisors to offer more tailored and effective advice, aligning with their ultimate goal of serving their clients' best interests.

As noted at the outset of this paper, regulators from North America, Europe, Australia/New Zealand, and across Asia generally mandate that financial advisors assess the risk tolerance of current and prospective clients. Regulators, however, do not prescribe

how a financial advisor ought to go about the measurement of someone's risk attitude. This explains the proliferation of financial risk-tolerance assessment tools, techniques, tests, quizzes, and scales in the marketplace today. Findings from this study provide independent empirical evidence that can be used to gain a better understanding of the strengths and weaknesses associated with propensity measurements, stated-preference assessments, and revealed-preference tests. Results presented in this paper suggest that a propensity approach (i.e., a scale developed using psychometric principles) can be described as being fit-for-purpose if the purpose of the assessment is to provide an accurate insight into a financial decision-maker's current and future willingness to take a risk. Results also suggest that for those who need a quick and simple indication of subsequent risk tolerance and portfolio allocation behavior, an appropriately worded stated-preference item can be useful. Findings from this study also indicate that while still valid in predicting subsequent risk tolerance and future investing behavior, scores from revealed-preference tests are the least reliable and valid of the alternatives examined in this study.

While this study fills a gap in the existing literature by following the risk-taking propensity, stated-preference, and revealed-preference of the same financial decision-makers across periods, and shows that risk-tolerance scores from one period predict future risk tolerance and portfolio choices, results do need to be evaluated in the context of certain limitations. To begin with, the sample size was small and likely not generalizable to the U.S. population. Future studies, using larger and more diverse samples, are needed to replicate this study's results. Related to this is the possibility that the choice of proxy measures might have influenced results. Had another type of propensity, stated- and/or revealed-preference measure has been used, the results might have changed.

Another limitation of this study is that the data were collected during the COVID-19 pandemic, as declared by The World Health Organization (2023). While the study was not designed to examine the effects of the pandemic, it is important to acknowledge the unique circumstances of this period. Some researchers have noted that the pandemic had a substantial impact on household-level risk tolerance, with many individuals exhibiting heightened risk aversion due to the uncertain economic environment (Battaglia et al. 2024; Hochman et al. 2024; Mineyama and Tokuoka 2024). Although statistical tests (i.e., paired *t*-test for the propensity measurement method and Wilcoxon Signed-Rank test for the other two assessment methods) indicated no significant differences in risk-tolerance scores between the two survey periods ($p > 0.05$) of this study, it is important to acknowledge that the exceptional conditions of this period could have affected the generalizability of the findings. In other words, the pandemic's influence on the results cannot be entirely ruled out. Whether this global health emergency altered the willingness of financial decision-makers to take financial risk is a topic that warrants further investigation. Similarly, it is worth acknowledging that the first survey was distributed before the contentious U.S. 2020 presidential election. Future studies could examine how unique events, such as pandemics or elections, impact changes in risk tolerance over time.

Additionally, the two surveys were conducted at a six-month interval. While the six-month interval may seem relatively short, the timing was chosen to capture a snapshot of financial attitudes during an unprecedented period, with the understanding that these events could uniquely impact risk assessment before extending the interval. Future research could employ longer intervals or periods to illustrate changes in values over time better. By incorporating these suggestions, future research can provide more comprehensive insights into understanding risk tolerance in a dynamic context. It is important to note that although a K-fold cross-validation test was conducted to validate the results, one of the model variables was time-variant, measured six months later. This poses a potential limitation, as the standard cross-validation approach may not fully account for temporal dependencies, which could lead to biased performance estimates. Nonetheless, findings from this study do provide baseline, if exploratory, insights into the stability of financial risk-tolerance across periods and the reliability and validity of commonly used assessment techniques.

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Notes

1 Other psychometric approaches can be used to guide questionnaire development, including item-response theory and Rasch modeling.

2 A power analysis showed that the sample size was adequate to detect a significant effect with a power level of 0.80, a significance level of 0.05, and an effect size of 0.80 (Aberson 2019; Cohen 2013).

3 Changes in participant demographic characteristics (e.g., marital status, income, etc.) were evaluated over the two periods. While some participants did exhibit a changed situation, no significant differences across the sample were noted.

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