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INVESTOR PROFILE ASSESSMENT TECHNICAL REPORT

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Introduction

The Investor Profile assessment is a psychometrically sound assessment of investor-related behaviors, experiences, attitudes, and preferences, designed to be used with a broad population of individuals who are making or are involved in financial and investment-related decision-making within their households. The assessment can be used in the context of a client-advisor relationship to assist in the creation of an appropriate investment portfolio, or by individuals who are creating a portfolio for themselves without the assistance of a financial advisor. The assessment provides several scores that can aid in decision-making related to investment allocation, coaching of financial and investment-related behaviors, and client relationship management.

The Investor Profile score is designed to serve as an indicator of an individual's psychological tolerance for investments that involve certain levels of risk. Likewise, the assessment includes a predictor of investor-related behavior in volatile markets, particularly in markets and corresponding investor portfolios that are experiencing a decline in value. Finally, the assessment provides factor-level scores and interpretation that provide a benchmark for maintaining or improving investor-related behaviors. The output of the assessment includes the following:

- Recommended portfolio allocations derived from Investor Profile Score
- Factor scores and corresponding feedback for the advisor and the client
- An overall predictor of investor sentiment and action during down markets
- A predictor of client retention

The Investor Profile assessment is unique in that it provides the necessary overall indicator of psychological-related risk tolerance while also providing information on the psychological constructs that impact that assessment. In other words, it provides advisors, clients, and individuals information on the components of risk-related behaviors, personality, and preferences that can be used for decision-making *and* for coaching/development of more successful investment-related behaviors.

An additional benefit of the Investor Profile is that it measures investor-related confidence and judgment, rather than requiring moderate or high levels of those constructs in order to complete the assessment without the assistance of a financial professional, as it does not require knowledge of investment-related concepts, numeracy, and the like. Likewise, it does not require past investing behaviors or experience, which is particularly important when considering individuals who have little to no experience with investing (and, particularly, experience with declines in the value of their investments). It does not include questions that ask about dollar-value losses or gains, which can be influenced by one's unique current financial position.

In other words, the factors measured by the assessment and their corresponding items do not rely on previous experience with or knowledge of investing, but instead are measured via a specific factor (i.e., Investor Judgment). Likewise, the assessment is designed to assess individual difference characteristics that should be relatively stable over time unless an effort to change behaviors is instituted (e.g., a coaching program), in addition to preferences, which may change over time.

In light of the importance of risk-appropriate portfolio allocation, using a properly constructed assessment of risk tolerance is a critical component of the advisor-client relationship. The assessment of risk tolerance is a specific requirement for financial advisors (under various regulatory regimes), but how

it is measured varies widely, and the multi-dimensionality leads to confusion and perhaps situationally inappropriate allocations. Indeed, most experts agree that *risk tolerance* includes a variety of components that span both demographic/financial characteristics as well as psychological characteristics of the investor. The Investor Profile assessment provides a scientifically sound measurement of *psychological risk tolerance.* The measurement of psychological risk tolerance is then used to map to portfolio allocations similar to those of investors working with advisors with similar psychological risk tolerance profiles (see Appendix).[1]

Few assessments of risk tolerance provide specific information on how the tests were developed and even fewer provide statistical data on the reliability and validity of their assessment.[2] To meet both professional guidelines in psychometric test design[3] and to provide the advisor, firm, and compliance departments with the statistical and research evidence supporting the test, a comprehensive technical manual is required. The remainder of this report outlines the rationale for the test and background on the competencies measured by the test, the methodology used to create the assessment, and studies related to the reliability and validity of the assessment for use by advisors with clients in the context of investment management and financial planning.

Background & Rationale

Investing is the act of committing money or capital to an endeavor (a business, project, real estate, etc.), with the expectation of obtaining an additional income or profit. Investing also can include the amount of time you put into the study of a prospective company or security.[4]

For an individual or household, investing involves the placement of financial resources into assets that have some level of risk and reward associated with them such that, if managed correctly and over the long-term, the financial resources can provide a return. However, each type of investment carries with it varying levels of risk and reward, and each type also has varying levels of success over the long-term (as well as intervening volatility).

To varying degrees, the values of assets and markets fluctuate over time, and consequently, so do individual portfolios. This fluctuation in markets can lead some investors to abandon long-term investment strategies at the worst possible time (i.e., when the value of their portfolios has suffered a significant decline) or make a variety of other ill-advised investing decisions.

Over time, and with some management, investing in the stock market or other investment markets can provide varying levels of return to the investor. This benefit is only achieved, however, if one remains in the market for a given amount of time. However, the volatility associated with certain types of investments may mean that investors who have *low* risk tolerance may not be willing to endure that volatility.

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[1] Financial Planning Performance Lab, 2018
[2] Finke, Brayman, Grable, & Griffin, 2017
[3] American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 2004
[4] Investopedia, 2018. Retrieved January 15th, 2018.

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A fundamental component of a long-term investment strategy is ensuring that once invested, money/resources are allowed to grow over time. This strategy involves managing investor behavior, including inaction in some cases. It requires, on the part of the individual investor, a variety of different levels of individual differences characteristics, including preference for risk, confidence in investing decisions, knowledge about the stock market and composure/psychological wherewithal for market declines.

Therefore, there are both practical and professional reasons to understanding one's propensity or ability to maintain a long-term position despite short-term (e.g., daily, weekly, monthly) declines in investment value. Specifically,

Whether measured for the purpose of self-assessment or for documentation of investment suitability, financial risk tolerance is assumed to be a fundamental issue underlying a number of financial decisions.[5]

To that end, individuals are encouraged to understand their *risk tolerance*, and advisors working with individuals are typically required to measure this characteristic. From a measurement/psychometric/psychological perspective, however, *risk tolerance* is an ill-defined construct that has, at its core, several components, several measurement strategies, and myriad ways in which it has been defined.

Many have described risk tolerance's relevance, importance, and helpfulness in the investment management process as less than ideal. Therefore, the purpose of the current assessment is to provide three useful components of both measuring psychological risk tolerance using a combination of biodata, preference, and proxy measures of knowledge/judgment:

1. A reliable and valid measure of psychological risk tolerance that is then mapped to portfolios
2. Scores on single, behavioral-based factors such that individuals and advisors can use factor-level information to help change/improve investor behavior, and
3. A predictor of future investor behavior during market declines.

The Investor Profile assessment provides advisors with three different types of information (see Table 1). The first includes the Investor Profile score, an overall score that can be used as an assessment of risk tolerance to provide a recommended portfolio allocation for clients. The intent of the Investor Profile was to create a way for advisors to assess a combination of experiences, behaviors, attitudes, and personality that could impact the way in which clients make decisions about their investments. This, in turn, provides the advisor and individual client or self-directed investor information that can be used to construct a risk-appropriate portfolio asset allocation. The Investor Profile score can be used along with time horizon, risk capacity, and other financial indicators to further refine portfolio allocation.

The second set of information provided by the Investor Profile assessment is scores on specific components of investor-related characteristics, or factors, that have been shown to impact investment-related decisions and attitudes. These factors are included on Table 1, and include Preferences, Confidence, Judgment, and Risk Personality.

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[5] Grable & Lytton, 1999.

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Finally, the Investor Profile assessment provides two scores designed to anticipate future investor behavior. The Action score is designed to predict investment-related behavior during downturns in the market. The Retention score is designed to predict the number of times an investor will break off a relationship with a professional advisor.

TABLE 1. SCORES INCLUDED IN THE INVESTOR PROFILE ASSESSMENT

Score	Type	Definition	Information/ Rationale
Investor Profile	Composite	The Investor Profile score is a composite score designed to assess psychological risk tolerance for the express purpose of providing guidance to the investor/financial advisor about the appropriateness of various portfolios given the score.	The Investor Profile score is a composite of five factors associated with patterns of experiences and behaviors that are designed to assessment psychological risk tolerance.
Preference	Biodata	This scale measures preference for risk in investments and level of risk preferred in the past.	This is a measure of both judgment and past financial-decision making related to investment/financial risk.
Confidence	Biodata	This scale measures patterns of behaviors related to confidence in and self-efficacy with investing.	This factor is a non-cognitive measure of experience with and interest in investing and investing-related concepts.
Judgment	Judgment/ Knowledge	This set of questions measures judgment and knowledge of sound investing behaviors and concepts.	This is an attitudinal based measure of investing-related concepts. It is measured on a 5-point scale (Strongly Disagree to Strongly Agree) and includes statements that are generally considered to be "rules of thumb" of sound investing.
Composure	Biodata	This scale measures patterns of behaviors related to changes in financial markets, the value of investments, and personal financial goals.	This is a measure of past experiences and behaviors related to financial loss. It is designed to predict investment-related behaviors when markets decline. The questions are designed to be appropriate regardless of one's experience with investing.
Risk Personality	Biodata	This scale measures personality related to taking risks and a propensity to try new or unknown methods or experiences.	This is a general measure of risk-taking behaviors and experiences, and is most like the personality concept of neuroticism, and specifically to impulsivity and sensation-seeking characteristics.

Action	Combination of Items	This is an overall predictor of investment-related decision making during volatile periods in the market.	This is an empirically-keyed measure that includes items across all factors measured within the test.
Retention	Combination of Items	This scale serves as a predictor of the likelihood that an individual will fire a professional advisor.	This is an empirically-keyed measure that includes items across all factors measured within the test.

Professional Requirements for Assessing Risk Tolerance

Financial service providers and researchers, in their respective roles as manager, consultants, and investors, share the common objective of quickly assessing financial risk tolerance and preferences (both their own and their clients). Instead of relying on a standardized measure of risk tolerance or empirically tested risk and investment rules, many individuals rely on one-dimensional assessments, objective measures, and other heuristics to gauge their own or someone else's risk-taking propensities.[6]

In the management of client portfolios, there are professional and regulatory guidelines that require financial advisors to assess what is broadly referred to as the *risk tolerance* of their clients.

The Finance Industry Regulatory Association (FINRA) requires advisors to assess the risk tolerance of their clients in order to allocate assets to different types of investments. This is done, in part, to ensure that their portfolio is suitable. In other words, to create a "suitable" portfolio of investments that may differ in terms of their risk, the advisor must understand the tolerance of the investor for potential changes in the value of those investments.

FINRA requires financial professionals to determine every client's level of risk tolerance. Specifically, they are required to ensure a recommended investment strategy is suitable for a client based on their profile. As described in the investor-focused content on the FINRA website, the practical implication is this:

When your broker recommends that you buy or sell a particular security, your broker must have a reasonable basis for believing that the recommendation is suitable for you. In making this assessment, your broker must consider your income and net worth, investment objectives, risk tolerance, and other security holdings.[7]

The Securities and Exchange Commission (SEC) also provides guidance to individuals seeking to understand risk tolerance. The SEC defines risk tolerance as: *"your ability and willingness to lose some or all of your original investment in exchange for greater potential returns. An aggressive investor, or one with a high-risk tolerance, is more likely to risk losing money in order to get better results. A conservative investor, or one with a low-risk tolerance, tends to favor investments that will preserve his or her original investment. In the words of the famous saying, conservative investors keep a "bird in the hand," while aggressive investors seek "two in the bush."*

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[6] Grable & Lytton, 1999, p. 179.
[7] U.S. Securities and Exchange Commission, 2018a

Despite the guidance and requirement that risk tolerance is assessed, the definition of risk tolerance is less than clear. Specifically, FINRA defines "risk tolerance" as: "*A customer's 'ability and willingness to lose some or all of [the] original investment in exchange for greater potential returns.' *" [8]

The SEC acknowledges that traditional measures of risk tolerance are unstable, noting that risk tolerance is fluid and tied to time horizon:

> *The most common reason for changing your asset allocation is a change in your time horizon. In other words, as you get closer to your investment goal, you'll likely need to change your asset allocation. For example, most people investing for retirement hold less stock and more bonds and cash equivalents as they get closer to retirement age. You may also need to change your asset allocation if there is a change in your risk tolerance, financial situation, or the financial goal itself.[9]*

Likewise, the SEC definition for investors also acknowledges the relative importance of (and behavioral differences in) financial savviness in holding assets regardless of performance:

> *But savvy investors typically do not change their asset allocation based on the relative performance of asset categories - for example, increasing the proportion of stocks in one's portfolio when the stock market is hot. Instead, that's when they "rebalance" their portfolios.*

Likewise, the SEC acknowledges that risk tolerance measures can be biased:

> *You can find out more about your risk tolerance by completing free online questionnaires available on numerous websites maintained by investment publications, mutual fund companies, and other financial professionals. Some of the websites will even estimate asset allocations based on responses to the questionnaires. … investors should keep in mind that the results may be biased towards financial products or services sold by companies or individuals maintaining the websites.*

The Complexities of Measuring Risk Tolerance

Despite the requirements that risk tolerance be understood and measured as part of the creation of an investment portfolio and strategy, its measurement is fraught with inaccuracies and an agreed upon method for measuring it is still being constructed via both academic, professional, and government circles. Risk profiling may include both demographic and psychological components, and these may all impact investor behavior. [10] Other distinctions have been made in academic and professional publications in the areas of risk-related definitions and individual differences characteristics.

There is some agreement, however, about the general concepts or components of risk tolerance (see Table 2). First, most experts separate financial-related risk tolerance from *psychological risk tolerance*. Risk need is typically defined as the level of risk required to meet an individual's financial goals.[11] Likewise, risk capacity is separate and distinct from one's psychological risk tolerance and is generally

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[8] Financial Industry Regulatory Authority, 2018; U.S. Securities and Exchange Commission, 2018b
[9] U.S. Securities and Exchange Commission, 2018b
[10] Nobre & Grable, 2015
[11] Brayman, Grable, Griffin, & Finke, 2017

considered a demographic/economic type variable that has little to do with psychological constructs.[12] Risk capacity is a financial measure that indicates the financial ability for an individual to withstand any financial loss. These types of questions are not related to psychological constructs, but rather specific financial demographics of the individual.

The third type of category is the assessment of risk preference, typically defined as one's inclination to prefer certain levels of risk in their investment portfolios. These are typically measured with situational judgement type questions asking scenarios related to potential loss, potential gain, or other types of scenarios. Some of the commercially available risk assessments are designed to assess risk preferences.

Risk perception refers to the way in which an individual investor perceives varying levels of risk associated with certain types of investments. This type of assessment is typically focused on attitudes about investments, which can fluctuate depending on financial or market factors.

Risk composure is typically thought of as a measure of an individual's ability to maintain composure during volatility. It can be measured using assessments of past behaviors and experiences, which can then help predict future behavior in relation to volatility in the market.[13]

Risk personality is typically considered to be the least "financially" related concept in risk tolerance assessment. Risk personality is generally considered to be a stable individual difference characteristic that is more general in nature (e.g., enjoying skydiving) versus a specific domain of investor risk.

TABLE 2. DEFINITIONS RELATED TO RISK TOLERANCE MEASUREMENT[14]

Label	Definition	Typical Measurement Strategy
Risk Tolerance	An attitude towards taking financial risk, particularly risk in one's investment portfolio.	Various, including combinations of demographic, financial, economic, and psychological measures.
Risk Capacity	Financial capacity to take on risk, i.e., to take on potential losses.	Financial
Risk Need	The amount of risk that must be included in one's investment portfolio in order to achieve a certain financial outcome.	Financial, economic
Risk Preference	Inclination/desire for certain levels of risk within one's portfolio	Psychological (attitudinal, judgment)
Risk Perception	Judgment regarding the potential volatility of different investment alternatives.	Psychological (attitudinal)

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[12] Ibid
[13] Brayman et al., 2017
[14] Ibid

Risk Composure	Behavioral assessment of past investment or financially-related decisions.	Psychological (biodata)
Risk Personality[15]	Tendency to take chances, be open to experience, and engaging in risk-related behaviors	Psychological (personality, biodata, situational judgment)

Psychological Risk Tolerance

Understanding a client's psychological willingness and comfort with financial risk is an important part of creating an investment strategy. While many other variables must be considered, the behavioral component is paramount to ensuring a plan that is created and agreed upon is maintained and not abandoned regardless of inevitable changes in the market and in the market value of one's investment portfolio throughout the timeline.

Among the first formal studies of investor risk tolerance that examined investor risk taking from an individual differences perspective was the landmark work of Professors John Grable and Ruth Lytton.[16] The authors created one of the first multi-dimensional, reliable, and valid measures of psychological risk tolerance. Their body of work and resulting 13-item measure of risk tolerance is one of the foundations of examining subsequent measures of risk tolerance. It has been widely used in research. The authors concluded that their assessment could be used as a "solid foundation in the development of a widely accepted instrument,"[17] and indeed the scale has been used and their work has been cited in over 280 academic publications related to investor-related risk tolerance.[18] The authors found support for a three-factor model of psychological risk tolerance, including investment risk, risk comfort and experience, and speculative risk.[19] The overall score (or risk tolerance score) combined items from across all three factors, as the individual factors did not have evidence of individual psychological constructs (or construct validation evidence). In other words, while the factor analysis demonstrated three components, subsequent reliability analysis did not.

In examining the validity of their assessment, the authors later found support for both the criterion-related and constructed-related validity of the measure[20], demonstrating that scores on their assessment of risk tolerance were associated with actual investing-related behaviors. In other words, those participants with high risk tolerance had higher percentages of their portfolios invested in equities (higher-risk investments). Likewise, those who had lower scores had a greater percentage of their portfolios invested in less risky investments (i.e., fixed income investments and cash).

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[15] Mayfield, Perdue, & Wooten, 2008
[16] Grable & Lytton, 1998, 1999, 2003
[17] Grable & Lytton, 1999, p. 179
[18] Google Scholar Results, retrieved January 15, 2018 from https://scholar.google.com
[19] Grable & Lytton, 1999
[20] Grable & Lytton, 2003

Proceeding and since the original Grable and Lytton (1999) study, a number of studies have examined other variables that are related to psychological risk tolerance. Specifically, the authors' 1998 study concluded that demographic variables were important in distinguishing individuals in terms of their risk tolerance levels. Education, gender, employment status (that is, self-employment), and income distinguished groups of high, average, and no/low risk-taking investors.[21]

Risk-taking behaviors are often associated with affluence, and studies have demonstrated that affluent households engage more often in and financial risk-taking behaviors then do lower net worth households. Affluent households tend to understand risk levels and understand the characteristics of certain Investments compared to their less affluent peers.[22], [23] One study found that aversion to risk taking decreased as income and wealth increased.[24]

There are gender differences in terms of risk-related assessments. Specifically, some authors[25] have found that women's risk tolerance scores are not influenced by method of administration of the assessment. On the other hand, men scored significantly higher on risk tolerance when the assessment was delivered electronically versus via paper and pencil. Gender was one of the most important factors in differentiating risk-taking in the study.[26]

Investor education level[27],[28] and financial knowledge[29],[30] is related to assessments of risk tolerance. As an example, in a study of individual differences in investing and risk tolerance,[31] 460 faculty and staff from two large universities were asked to complete different assessments of financial risk tolerance as well as other biodata-type items and demographic questions. Financial risk tolerance, financial knowledge, self-esteem, personality type, and sensation-seeking assessments were included. The authors found that financial knowledge, self-esteem, and sensation-seeking related to risk tolerance, but factors such as age, gender, ethnicity, personality type, and birth order were insignificant. The authors conclude that there may be a circular causation effect in risk tolerance. Higher emotional stability, sensation-seeking, knowledge, and net worth may lead to greater risk and reward capacity, and that this cycle continues and builds upon itself. The authors found that environmental factors were more important than biodata or biophysical-type factors.

Lower risk tolerance scores have also been linked to lower scores on financial numeracy[32]. In one such study, those who were less inclined to take risks displayed lower levels of self-assessed net worth. Those who avoided risk tended to have the lowest satisfaction with their own management skills related to

[21] Grable & Lytton, 1998
[22] Kruger, Grable, & Fallaw, 2017
[23] Finke & Huston, 2003
[24] Hartog, Ferrer-I-Carbonell, & Jonker, 2002
[25] Grable & Britt, 2011
[26] Wang, 2009
[27] Grable & Lytton, 1999
[28] Wang, 2009
[29] Grable, 2000
[30] Wang, 2009
[31] Grable & Joo, 2004
[32] Sages & Grable, 2010

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finances. The authors found that financial risk tolerance was associated with self-reported financial numeracy wealth defined by net worth, and self-assessed financial management skills. In the study those with the low risk tolerance also reported low self-reported financial numeracy, net worth, and satisfaction with their own financial management skills. The authors conclude "enhanced financial numeracy and enhanced financial management skills can help consumers weight the benefits and drawbacks of myriad investment choices available in the marketplace" (p. 64). The authors go on to conclude that "financial advisors are better served, and practice, using a multi-dimensional risk measure" (p. 64).

Investors with more experience in investing and making investment-related decisions had a higher risk appetite and were more risk tolerant as measured by a measure of risk tolerance.[33] Likewise, when investors are confident, they tend to make more risk-focused decisions.[34]

In one study researchers found that individuals who were happy tended to have a higher level of risk tolerance holding other individual difference and environmental factors constant.[35] The authors found that "test takers who classified themselves as happy scored significantly higher relative to persons in a neutral state, even when holding all other known relevant factors constant." (p. 918). The study used the short form of the Grable & Lytton (2003) scale.

In one study using the 13-item investment risk tolerance questionnaire from Grable & Lytton (1999), investigators found that professionals have a higher risk tolerance than individuals and that the higher the investors' career profile the higher than the performance on stock trading.[36] High-profile investors to have higher risk tolerance and had higher levels of investment related experience checked stock prices daily transacted more frequently and used sophisticated methods of selecting stocks to buy and sell they also relied on more psychological or personal reasons than other investors for certain investment related decisions.

A small study examined the relationship between different personality traits (as measured by the big five factors of personality) and investment related decisions.[37] Investors with high negative emotions or high neuroticism, high risk-taking personality and higher openness to experience had higher portfolio risk. The authors found that negative emotions and extraversion specifically had significant relationships on investment related decisions.

One study found that there are different types of personality and types of economic risk-taking. Specifically, the author divided risk-taking into two types of risk taking: instrumental risk-taking, which is related to risk preference in investing, as well as stimulating risk-taking, which is generally thought of as preferences for specific types of risks like recreational, ethical, or health-type risks.[38]

[33] Corter & Chen, 2006
[34] Wang, 2009
[35] Grable & Roszkowski, 2008.
[36] Dimitrios, Zeljko, & Prodromos, 2011
[37] Durand, Newby, & Sanghani, 2008
[38] Zaleskiewicz, 2001

Criticisms of Measuring Psychological Risk Tolerance

Psychometrics can be used to assess investor-related characteristics and to predict future investor behavior, but to do so, and to provide an assessment that can allow for the improvement of investor-related behaviors in a focused and meaningful way, it is critical to understand the merits of certain types of psychometric approaches.

There are several different problems with risk tolerance questionnaires in general.[39] First, psychological risk tolerance may be a domain-specific trait that predicts investment-related behavior.[40] Part of its measurement or typical operationalization appears to be temporal. Risk tolerance as traditionally measured for example by the Grable & Lytton 1999 scale may be a changeable factor depending on the status of financial markets. Risk tolerance is associated with increased expectations about financial outcomes.[41] Individuals tend to project and extrapolate from recent events related to their attitudes and tolerance for risk. [42],[43]

Situational judgment type questions, asking individuals about what they *might do* or *would do* given a certain set of circumstances, can be used to measure certain types of individual difference characteristics. But this measurement approach suffers from two main problems: a) these types of questions require making judgments that could be influenced by a variety of environmental (market) factors, and b) socially desirable responding. While this measurement strategy is important for determining preference at some level, these types of items should be used with caution when attempting to understand how one might behave or perform in the future. Instead, they can be used in combination with other measures of past experience and behaviors to provide a valid predictor of future behavior.

Criticisms of Psychological Risk Tolerance Questionnaires

1. Lack of evidence of reliability and/or validity
2. Measuring risk tolerance for situational judgment questions, which are prone to socially desirable responding and conjecture
3. Measurement including monetary values, which may result in varying responses depending on one's financial position
4. Results are related to market conditions (a reliability issue)
5. May include concepts that require knowledge or numeracy
6. Little or no information to provide guidance to individual investor on how to improve behaviors

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[39] Brown, 2013
[40] Corter & Chen, 2006
[41] Grable, 2000
[42] Grable, Lytton, & O'Neill, 2004
[43] Grable, Lytton, O'Neill, Joo, & Klock, 2006

Guidelines for Measures of Psychological Risk Tolerance

There are several best practices available to help guide how risk assessments should be constructed. In one review of risk tolerance assessments, the authors reported that commonly used questionnaires and the financial planning process do not often meet standards psychometric qualities. In many cases they are too short which often leads to an issue related to reliability, and they often include questions that would be considered double barreled which can lead to issues with construct validity (i.e., what the question is truly measuring). The authors cite the use of questions regarding risk capacity in conjunction with risk personality or risk composure type questions. Likewise, the authors cite the use of items that include financial terms that are overly complex as being questionable in terms of their usefulness for broad populations.[44]

Therefore, the original authors of one of the most widely tested assessment of psychological risk tolerance provided specific requirements for future risk tolerance assessments:[45]

- It should measure a central concept of risk tolerance
- It should allow for the creation or derivation of a specific risk measure
- It should be relevant to respondents
- It should be easy to administer
- It should have adequate validity and reliability
- It should also cover a variety of risky situations and be consistent, non-redundant, interesting to complete, and concise.

Rationale & Purpose of Assessment

The purpose of the Investor Profile assessment is to provide a reliable and valid assessment of psychological risk tolerance based on sound empirical research that could then be used as a component of providing portfolio recommendations to individuals or clients of financial advisors. The Investor Profile assessment was also designed to provide advisors with a tool to coach and develop their clients' critical competencies related to investing. Finally, the purpose of the test was to create an assessment of behaviors, experiences, and attitudes related to financial decision-making that could be used as a predictor of future investor behaviors and to gauge comfort with investing-related declines in market value of investments. The methodology employed in its creation met or exceeded recommendations for sound test construction.

An added rationale for the creation of the Investor Profile assessment was to address several key criticisms and disadvantages of commercially available risk tolerance assessments, particularly related to the validation of such assessments. The Investor Profile assessment differs from other commercially available assessments in that it:

- Measures patterns of behaviors and experiences, judgment/knowledge, and preferences;
- Is appropriate for a wide range of investors, including those with little to no experience in investing;

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[44] Roszkowski, Davey, & Grable, 2005
[45] Grable & Lytton, 1999, 2003

- Measures relevant constructs without the use of items that involve making numerical calculations and/or involve the gain or loss of specific dollar amounts;
- Has evidence of content, construct, and criterion-related validity; and
- Provides factor-level information to offer feedback to individuals and to advisors to help them improve investor behaviors.

The purpose and approach documented in this report demonstrates the use of psychometrics to assess patterns of behaviors, life experiences, judgment, and preferences that are associated with making investment- or financially-related decisions. This, in turn, provides the advisor and the client with information that can help the client improve behaviors that have been shown to relate to future investor behaviors and comfort with investing in general.

Some authors cite the use of psychological assessments as appropriate for research purposes but not necessarily appropriate for portfolio selection.[46] The Investor Profile addresses this concern through the mapping of its overall score to portfolios similar to those held by other investors ($n > 14,000$) who were working with advisors. A complete description of this methodology is contained in the Appendix.

Assessment Development

While the purpose of the current research was to create items that would ultimately predict specific behaviors and/or comfort with investment-related losses based on items that spanned the competencies listed above, a few items were included that were related to general risk preferences.

DataPoints maintains that a broad competency model can define the "job" of personal financial management,[47] and from this model, key factors that predict future success can be identified. Likewise, we argue that the measurement of behaviors and life experiences, or biodata, is a powerful means by which advisors and firms can assess patterns of financial behaviors that can also be used to anticipate future investor behavior.

Investment management is one of the myriad financial responsibilities that an individual has for his or her household. Research has demonstrated that the inclusion of risk-taking behaviors can differentiate affluent households from lower net worth households,[48] and that investing-related, and specifically risk-related tasks, are critical and important parts of financial management. Specifically, of the over 250 tasks that are associated with managing one's financial household, three of the most critical tasks of a household include the following investment-related tasks: [49]

- Understand the nature of investments and their likelihood of risk and return.
- Invest in employer-provided savings accounts (e.g., 401(k)s).
- Understand the appropriate level of risk to take in an investment portfolio.

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[46] Don, Eil, Pew, & Smith, 2015
[47] Fallaw, Kruger, & Grable, 2018
[48] Krueger et al. 2017
[49] Fallaw, Kruger, & Grable, 2018

If these tasks are critical to successfully performing the job of household financial manager, one could argue that measuring competencies/constructs that could predict success with those tasks could assist an individual or an advisor working with an individual in improving specific behaviors. Therefore, part of the work involved in the creation of the Investor Profile assessment was the inclusion of biodata items that were designed to measure specific competencies that might impact one's investment-related task performance (see below).

Item Sources & Development

The items and factors for the Investor Profile assessment were created over the series of studies beginning in 1981.

Items for the Investor Profile came from three different sources. The first source included items that came directly from the Affluent Market Institute and were used as part of the research that led to seven different publications, including *The Millionaire Next Door*[50] and *The Millionaire Mind*[51]. These items were developed originally to assess financial-related habits and behaviors of high- and ultra-high-net worth individuals.

The second source for item development was from the DataPoints team who wrote items specifically designed to measure components from the DataPoints model of household financial management, and specifically for competencies that were connected with investment management within one's household. Two types of items were written to assess the competencies listed above: biodata, or biographical data items, and items that assessed investing-related biases/attitudes. Specifically, items were written to assess the following competencies:

- Investing knowledge
- Financial acumen
- Risk-related personality
- Risk experiences
- Resiliency to change
- Confidence
- Volatility composure
- Investment-related attitudes & biases

Biodata (short for biographical data) is the systematic assessment of patterns of life experiences and behaviors. While other methods exist to gather biographical information about an individual, biodata has a long history and favor in industrial-organizational psychology,[52] and has consistently been found to predict future job performance[53] as well as other critical life outcomes such as career attainment.[54]

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[50] Stanley & Danko, 1996
[51] Stanley, 2000
[52] Stokes, Mumford, & Owens, 1994
[53] Schmidt & Hunter, 1998
[54] Snell, Stokes, Sands, & McBridge, 1994; Stokes, Mumford, & Owens, 1989

The benefit of a biodata-based approach to measuring aspects of psychological risk tolerance, and particularly in using certain item attributes, includes decreasing the opportunity for socially desirable responding[55], which may be of concern in the context of an advisor-client relationship. Likewise, by focusing on past behaviors and experiences, the opportunity for influence by current market conditions decreases, as the questions are asking about actual behavior in the past, versus asking for a judgment about certain types of investments or financial situations.

Biodata item writing followed generally accepted construction methodologies and covered a wide range of behaviors and experiences related to each of the competencies included in the research. Items were written to ensure they were objective and verifiable, and most items were historical, but a few (namely, what type of investment risk is desired) were written to be future-oriented.[52] Items were written with specific hypotheses in mind of how they would relate to the general concept of psychological risk tolerance. Biodata was used for many of the items in order to limit both socially desirable responding and responses based on market conditions or other financial conditions of the test taker. Risk preference, specifically, was measured using two items that include both a measure of life experiences with investing and situational judgment asking for a preference for risk within an investment portfolio. The items ask the respondent to (a) make a judgment about what he or she prefers, and (b) what he or she has done in the past or knowledge/beliefs about investing in general.

The team also created items designed to measure investor-related biases, judgment, and attitudes. These items asked respondents to choose their level of agreement with certain statements about investing, some of which were focused more on active management of investments, attending to market news and volatility, and passive management of investments. These items were designed to elicit knowledge about investing without subjecting the test taker to a traditional knowledge test, which was preferred given a critical purpose of the assessment was in the context of an advisor-client relationship.

Empirical Research

The process outlined above led to a set of 71 unique items, which were culled down to 50 items by the research team by removing items that were deemed by the research team to be (a) unclear and/or potentially low on readability, (b) measuring more than one construct, (c) an item that would require investing-related experience, or (d) not relevant to financial or investment related tasks/topics. Then, three studies served as the basis for the creation of the Investor Profile assessment factor, composite, and predictor scores. The studies were designed to gather data to examine the underlying factors related to investor-related behaviors and characteristics, to assess the construct and criterion-related validity of the factor scores, and to cross-validate the empirically-keyed scores and the factor structure of the remainder of the factors. Table 3 provides a description of the samples included in the studies.

Criteria (Outcomes) of Interest

Several outcome measures were embedded in the research version of the questionnaire used with Sample A. Instead of using these as *predictors,* as is the case in many commercially available measures of

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[55] Mael, 1991

risk tolerance, these types of variables were used as criteria to examine the *validity* of the items that did not require experience with investing as predictors of future investor behavior.

The criteria included the following:

- Comfort with decreases in the market value of investments (from not comfortable to very comfortable, on a 1 to 5 scale)
- Comfort investing in the stock market (from not comfortable to very comfortable, on a 1 to 5 scale)
- Action during last significant downturn in stock market (a decrease of 10% or more; with 1 = took money out of market, 2 = no action taken, and 3 = put money into market)
- Number of professional advisors fired in past

TABLE 3. DESCRIPTIONS OF SAMPLES INCLUDED IN INVESTOR PROFILE RESEARCH

Sample	Description	N	% Men	Average Age	Median Income	Median Net Worth	Average % of Inherited Wealth	Median Value of Investment Portfolio
Sample A	mTurk - Full Sample	390	38.5%	38.71 (10.44)	65,000 (47,084.73)	65,000 (333507.24)	5.36% (15.46)	37,000 (368,628.85)
Subsample A2	mTurk - Construct Validation Subsample	192	38.5%	38.87 (10.54)	70,000 (45,067.87)	80,000 (355685.09)	7.00% (16.23)	50,000 (258,645.00)
Sample B	mTurk - 2nd set	125	44.8%	40.34 (10.69)	70,000 (35,831.78)	140,000 (370300.73)	3.98% (11.07)	120,000.00 (322,333.82)
Sample C	Investor Sample	238	73.9%	44.42 (12.57)	132,500.00 (146,303.03)	600,000.00 (1906163.00).	6.24% (16.10)	350,000.00 (19,435,484.98)

Study 1

The purpose of Study 1 was to examine the factor structure of the investor-related items, to establish the empirical key for a predictor of investor-related outcomes, and to examine the criterion-related validity of the test. This study included Sample A. Participants were recruited from Amazon's Mechanical Turk (mTurk). First, a large sample of individuals (1,417) were recruited to participate through a screening process that asked a few questions in exchange for payment (between $0.05 and $0.10). Participants were asked three questions that served as screening questions:

- Total household income for previous year,
- Who was responsible for financial management within their households, and
- Age.

Only participants who had at least $25,000 in income the previous year, were responsible (or jointly responsible) for financial management, and who were over the age of 25 were included for the

DataPoints

remainder of the study. This process resulted in 791 participants being eligible for inclusion in the rest of the study or 55.8% of the screening sample.

Of those 791 participants who qualified, 481 responded to the HIT for the study, and 390 completed the questionnaire and were included in the final analyses, resulting in a 49.3% participation rate. Participants were paid $2.00 in exchange for participation, which took approximately 10-12 minutes. Participants completed a questionnaire containing the research items as well as demographic questions and the outcome-related questions.

Means, standard deviations, and frequencies of item-level responses were examined for each item included in the study. Likewise, skewness and kurtosis were examined to determine how the item responses were distributed. From these initial analyses, some items were removed from further examination. Specifically, items which had little variability (low standard deviations and high kurtosis) or were skewed on either side of the midpoint were removed. This resulted in the retention of 40 items for further examination.

Creation of Factor Scale Scores

The items were subjected to an exploratory factor analysis to reduce the items to a reasonable and conceptually sound set of factors for use in describing and providing developmental feedback to test takers. While the items were written and selected within certain categories of constructs as described on page 17, it was important to understand and ensure the underlying factor structure was sound before the creation and inclusion of scale-level scores in the assessment.

In some cases, items were reverse coded or recoded for purposes of the analyses of the factors. In the cases of some biodata items that were not Likert-type items, the authors used the original hypotheses about the item responses to code each of the items. By way of example, an item such as the following might be used to assess interest in finance/investing:

From which source do you get most of your knowledge about the financial markets?

    A. Social media feeds
    B. Friends and family
    C. Newspapers/magazines
    D. Financial newsletters
    E. Financial-related television shows
    F. I don't have knowledge about the financial markets and/or I don't seek out such knowledge

In the example above, if the desired outcome was to measure interest in financial and investing-related issues, the response options might be keyed this way from a rational perspective:

    -   Response options A-E might be coded 2
    -   Response option F might be coded 0

Factor Analysis

The factorability of the items was examined by using several criteria: 1) items correlated with at least one other item near a level of .30, and 2) the commonalities of the items were near 0.30. This resulted in removing nine items and retaining 32 items for inclusion in the factor analysis.

DataPoints

The Kaiser-Meyer-Olkin test of adequacy in the sample was .85, above the recommended 0.60 and Bartlett's test of sphericity was significant (χ^2 (496) = 3,928.29, p < .01). Maximum likelihood factoring with Promax with Kaiser normalization rotation was used because it was assumed that the underlying factors were related. The goodness of fit test was significant (χ^2 (293) = 447.87, p < .01). Factors were retained that included eigenvalues above 1.0, resulting in a seven-factor model that accounted for 42.95% of the variance.

In examining the factors resulting from the analysis above, two of the factors correlated with one another at r = .47, suggesting that the two factors were measuring a similar construct. Finally, the seventh factor resulted in no unique items.

Thus, a second factor analysis was conducted using a five-factor model. The goodness of fit test was significant (χ^2 (346) = 638.76, p < .01). Factors were retained that included eigenvalues above 1.0, resulting in a five-factor model that accounted for 40.39 % of the variance.

The analyses suggested a five-factor model that were underlying investor-related behaviors and judgment, and that the items in the factors were internally consistent.

TABLE 4. FACTORS INCLUDED IN THE INVESTOR PROFILE ASSESSMENT AND SAMPLE ITEMS

Factor Name	Example Item	Initial # of items	Number of Items
Risk Preference	*How would you describe most of the financial decisions you've made?*	2	2
Confidence	*I know more about the stock market than most people.*	10	6
Investor Judgment	*It is important to ignore news about the stock market when investing for the long-term.*	6	6
Investor Composure[56]	*When faced with challenges in life, my reaction is usually to remain calm.*	7*	7
Risk Personality	*I am comfortable taking risks when the chance for success is unknown.*	8	6

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[56] Note that one item from the initial Investor Confidence scale cross-loaded onto the Investor Composure scale. This item was retained and examined in both scales. It was removed from Investor Confidence and retained in Investor Composure. It was theoretically linked to the construct of Investor Composure and was found to be related internally as well.

DataPoints

Reliability of Scales

Next, internal consistency reliability was calculated for each of the factors. The goal was to create reliable measures with a minimum number of items in order to shorten the length of the test. Specifically, the authors were looking for internal consistency reliabilities above .70, which would indicate that the items within the factor were reasonably reliable measures of the factors without inducing test-taker fatigue. Depending on the factor, different numbers of analyses were conducted by examining the internal-consistency reliability and the item-level information (i.e., alpha when the item was deleted) to determine the shortest number of items that would still provide a reliable measure (see Table 4). Most of the factors met or exceeded the .70 threshold, while the Investor Composure scale approached this threshold (with α = .68). Results for the reliability analyses and intercorrelations among the scales are contained in Table 6. The factors and keyed scales were deemed to be internally consistent and thus reliable.

Creation of Empirically-Keyed Predictors (Action and Retention Scores)

As the Investor Profile is a commercially available assessment, the specific details regarding the creation of the overall Action and Retention scores will not be included in this technical report. Instead, we provide a brief overview of the creation of the predictor scores below.

Empirical keying is the process of identifying item-level responses that are statistically related to outcomes of interest, and then creating scoring mechanisms to maximize the prediction of the items and corresponding scales to certain outcomes of interest.[57] In the case of the Action and Retention scores, the methodology employed to create the empirical keys involved the following steps:

a. Identifying outcomes of interest, specifically investment-related behaviors, attitudes, and perceptions that would be important to predict in advance
b. Identifying items with response options that differentiated the sample on these outcomes
c. Scoring items such that item responses that were more closely related to the desired outcome would have higher scores
d. Creating a composite based on the empirically keyed scale
e. Examining the validity of the cross-validated scale in the prediction of the outcomes above, and to examine any decay in validity (described later in this document in Study 3)

Each item included in Study 1 was included as part of the development of the empirical key. A combination of both empirical and rational keying was used to create the overall predictor of investor behavior. Specifically, as each item was written with a specific hypothesis in mind regarding the relevancy of item-level responses for the prediction of investor-related behavior and attitudes during volatile markets, those hypotheses drove the initial weighting. One-tailed correlations between the items and the outcome measures were examined for initial confirmation that the items were related to the outcomes (note that one-tailed correlations were used because the direction of the relationship was already hypothesized). Next, items that were retained were submitted to further analyses to examine item response by assuming that they were independent variables and the outcomes were dependent variables. Using this approach, 10 items were identified as being appropriate for inclusion in the Action

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[57] Cucina, J. M., Caputo, P. M., Thibodeaux, H. F., & Maclane, 2012.

score and 9 items were included in the Retention score. Internal consistency reliabilities were conducted to estimate the reliability of the scales, and each approached the .70 threshold (see Table 5).

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TABLE 5. INTERNAL CONSISTENCY RELIABILITY COEFFICIENTS AND INTERCORRELATIONS OF FACTOR SCORES

	n	M	SD	1	2	3	4	5	6	7	8
Investor Profile Score	390	3.11	0.43	-							
Risk Preferences	390	2.58	0.74	.73**	*.85*						
Investor Confidence	390	3.17	0.70	.77**	.35**	*.83*					
Investor Judgment	390	3.29	0.63	.32**	.02	.04	*.73*				
Investor Composure	390	3.54	0.62	.68**	.28**	.51**	.08	*.68*			
Risk Personality	390	3.05	0.68	.50**	.43**	.33**	-.15**	.22**	*.78*		
Action Score	390	0.73	0.43	.79**	.35**	.77**	.37**	.59**	.24**	*.78*	
Retention Score	390	0.98	0.31	.72**	.36**	.83**	-.02	.48**	.55**	.67**	*.68*

Note. The Investor Profile, Action, and Retention scores are highly correlated with the other scales as those scores are comprised of items from the factor scores.

Criterion-Related Validation

Ensuring the validity of any psychological assessment is an essential component of sound test design.[58] Of critical importance to the purpose of the assessment was its ability to predict future investor behavior and comfort with decreases in the market value of investments. To that end, a concurrent validation strategy was employed to examine the relationship between the various scores and the criteria of interest. This strategy was used in order to examine the relationships between the factors and outcomes of interest in a population that has investor-related experiences in order to estimate the future predictive validity of the assessment in the prediction of investor-related behaviors in populations that may or may not already have investment experience. This type of strategy is often employed in personnel selection scenarios, whereby an assessment is validated with an employment population in order for it to be used in the selection of future employees who may or may not have

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[58] AERA et al., 2004

experience with the job in question. Likewise, this strategy was used by Grable and Lytton[59] in their creation of their risk tolerance assessment.

Included in these analyses were demographic characteristics commonly found to relate to risk-related variables (i.e., age, income, and net worth), along with the criteria mentioned previously (see Table 6).

As expected, the Investor Profile score correlated with outcomes including action and the comfort measures. The Action score correlated with the outcome measure, and particularly with the investor action during the last downturn in the market. The Retention measure related to the *breaking off relationships* criterion. The other factor scores were related to the outcomes of interest (other than the professionals' criterion) to a lesser extent than the overall Investor Profile score.

TABLE 6. INTERCORRELATIONS AMONG CRITERIA OF INTEREST

	N	m	SD	1	2	3	4	5	6
Age	390	38.71	10.43						
Income	390	75,681.62	47,084.73	-.02					
Net Worth	388	182,375.07	333,507.24	.34**	.30**				
Action During Last Downturn	275	2.09	0.56	-.06	-.03	.07			
Comfort with past decline in value of investments	365	2.90	0.91	-.11*	.14**	.01	.20**		
Comfort investing in Stocks	390	3.23	1.15	-.09	.16**	.25**	.23**	.29**	
Number of Times Fired Advisors	344	2.02	0.88	-.01	.12*	.08	-.07	-.08	.04

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[59] Grable & Lytton, 1999

DataPoints

TABLE 7. CORRELATIONS BETWEEN FACTOR SCORES AND CRITERIA OF INTEREST – STUDY 1

	Age	Income	Net Worth	Action During Last Downturn	Comfort with past decline in value of investments	Comfort investing in Stocks	Number of Time Fired Professional Advisor
Investor Profile Score	-.08	.25**	.29**	.29**	.33**	.67**	.15**
Risk Preferences	-0.04	0.18**	0.13*	0.13*	0.25**	0.48**	0.09
Investor Confidence	-0.12*	0.19**	0.26**	0.14*	0.17**	0.60**	0.19**
Investor Judgment	0.11*	0.08	0.20**	0.25**	0.13*	0.18**	-0.03
Investor Composure	-0.05	0.19**	0.26**	0.24**	0.23**	0.38**	0.03
Risk Personality	-0.17**	0.08	-0.04	0.04	0.23**	0.31**	0.17**
Action Score	-0.04	0.24*	0.37*	0.34**	0.28**	0.68**	0.14*
Retention Score	-0.18**	0.21**	0.20**	0.15*	0.17**	0.52**	0.33**

Examination of Predictor Scores

To determine the usefulness of the Action and Retention scores in the prediction of future behaviors, multiple correlation regression analyses were conducted. Specifically, it was important to understand the incremental variance of the Action and Retention scores in the prediction of behaviors above and beyond demographics and Risk Preferences (in the case of the Action score). The Risk Preference score was chosen because this particular score is highly related to one of the most widely used measures of risk tolerance, the Grable and Lytton (2003) 13-item measure of risk tolerance.

Hierarchical regression analyses were conducted to examine the usefulness of the predictor scores (Action and Retention) in the prediction of relevant outcomes. In the case of the Action Score, income and net worth were entered first (age was not included as it did not have a zero-order correlation with the outcome variables of interest), followed by Risk Preference, and finally the Action score. Results of these analyses are contained in Tables 8-11. In each case, the Action score added to the prediction of the outcome variables above and beyond income, net worth, and Risk Preference. Specifically, the Action score added significantly to the prediction of action during a downturn in the market (F (1,270) = 31.65, $p < .01$, $\Delta R^2 = .10$), comfort with a decrease in the value of one's investments (F (1,358) = 20.88, $p < .01$, $\Delta R^2 = .05$), and comfort with investing in stocks in general (F (1,383) = 212.68, $p < .01$, $\Delta R^2 = .26$).

DataPoints

Therefore, regression results indicate that the Investor Profile score is a significant predictor of investor behaviors and comfort, even after controlling for income, net worth, and Risk Preference.

For the Retention score, age, income, and net worth were entered into the equation first, followed by Risk Preference, and finally the Client Retention score. The results indicated that the inclusion of the Client Retention score in the equation led to a significant change in the overall variance explained (F $(1,338) = 36.82$, $p < .01$, $\Delta R^2 = .10$).

The results of these analyses demonstrated the overall usefulness of the Action score in the prediction of investor-related behaviors and composure during volatile markets. Specifically, we found that the incremental variance associated with the introduction of Action score was significant. Therefore, variance in an individual's investor-related behaviors and composure could be explained by the overall Investor Profile score, regardless of their income, net worth, or Risk Preference. Likewise, the Retention score added to the prediction of number of professional advisors fired, above and beyond demographic characteristics.

TABLE 8. REGRESSION OF INVESTOR ACTION DURING DOWNTURN IN MARKET AS A FUNCTION OF INCOME, NET WORTH, PREFERENCE, AND INVESTOR PROFILE SCORE

	Model 1			Model 2			Model 3		
Variable	B	SE B	β	B	SE B	β	B	SE B	B
Income	-63,809,186.96	.00	-.06	-83924171.98	.00	-.08	-1198776.23	.00	-.11
Net Worth	13,586,515.49	.00	.08	12942580.42	.00	.08	-296696419.33	.00	-.02
Risk Preference				.12	.05	.14	.05	.05	.06
Investor Profile Score							.47	.08	.35
R²		.01			.03			.13	
F for change in R²		1.01			5.20*			31.65**	

*p < .05   ** p < .01

TABLE 9. REGRESSION OF INVESTOR COMFORT WITH DOWNTURN IN MARKET VALUE OF PORTFOLIO AS A FUNCTION OF INCOME, NET WORTH, PREFERENCE, AND INVESTOR PROFILE SCORE

	Model 1			Model 2			Model 3		
Variable	B	SE B	B	B	SE B	β	B	SE B	B
Income	3,015,853.80	.00	.16	2452417.25	.00	.13	1950357.43	.00	.10
Net Worth	-11,105,614.29	.00	-.04	-15411894.14	.00	-.06	-35503449.87	.00	-.13
Risk Preference				.31	.07	.23	.22	.07	.17
Investor Profile Score							.55	.12	.25
R²		.02			.08			.13	
F for change in R²		4.81*			20.82**			20.88**	

*p < .05   ** p < .01

DataPoints

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TABLE 10. REGRESSION OF INVESTOR COMFORT WITH INVESTING IN STOCKS AS A FUNCTION OF INCOME, NET WORTH, PREFERENCE, AND INVESTOR PROFILE SCORE

	Model 1			Model 2			Model 3		
Variable	B	SE B	β	B	SE B	β	B	SE B	B
Income	2187666.41	.00	.09	53228245.40	.00	.02	-87027158.18	.00	-.04
Net Worth	78260483.56	.00	.23	64216722.81	.00	.19	-476336768.68	.00	.01
Risk Preference				.71	.07	.46	.44	.06	.28
Investor Profile Score							1.57	.11	.58
R²		.07			.27			.53	
F for change in R²		14.89**			105.04**			212.68**	

*p < .05   ** p < .01

TABLE 11. REGRESSION OF NUMBER OF TIMES FIRING A PROFESSIONAL ADVISOR AS A FUNCTION OF AGE, INCOME, NET WORTH, PREFERENCE, AND CLIENT RETENTION SCORE

	Model 1			Model 2		
Variable	B	SE B	B	B	SE B	B
Age	-.00	.01	-.03	.01	.01	.05
Income	1,928,278.78	.00	.10	1183884.83	.00	.06
Net Worth	18,237,008.40	.00	.07	-148018110.39	.00	-.01
Client Retention Score				.93	.15	.33
R²		.02			.12	
F for change in R²		2.12			36.82**	

** p < .01

DataPoints

Study 2 – Construct Validation of the Investor Profile Assessment

The purpose of Study 2 was to examine the construct validity of the individual factors and the Investor Profile score. Construct validation provides evidence that the factors and/or scores are measuring what they purport to measure by relating scores and factors to other similar measures.[60]

Participants who completed Study 1 were qualified to complete the questionnaires in Study 2 approximately two to three weeks after Study 1. Of those who completed Study 1 (n = 390), 192 completed the second study for a response rate of 49.2%. Participants in Study 2 completed a questionnaire that included several scales designed to examine the construct validity of the scales. These scales were chosen because they appeared to measure similar constructs to those measured by the composite and factor scores in the Investor Profile assessment. Each of the measures included in Study 2 are described in Table 12.

Results

The reliabilities and intercorrelations among the construct validity scales are contained in in Table 13. Table 14 provides the intercorrelations among the construct validity scales and the criteria of interest from Study 1. Finally, the zero-order correlations between the scores on the Investor profile assessment and the construct validation scales are contained in Table 15. The results of these analyses provided initial evidence of the construct validity of the scales. Specifically, the results supported the construct validation of the Investor Profile scores:

- The Investor Profile, Investor Confidence, and Action scores related to Risk Tolerance
- Investor Judgment was related to Education level and the Financial Knowledge measure
- Investor Composure was negatively related to Personalization of Loss
- Risk Personality was related to Risk Attitude and Sensation-Seeking measures

Unexpectedly, the following relationships were also found:

- Investor Judgment was negatively related to Risk Attitude, such that those with higher Judgment scores had a negative attitude towards extremely risky investments.
- Investor Judgment was also related to Investment Horizon. This finding made sense in that the judgment questions and factor have to do with long-term investing.

These findings generally support the construct validity of the Investor Profile composite and factor score. Future research should examine the relationships and validity using an approach to discern validity using multiple methods of measurement (e.g., multitrait – multimethod matrix, which can be used to establish both convergent and discriminant validation[61]).

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[60] AERA et al., 2004
[61] Campbell & Fiske, 1959

DataPoints

TABLE 12. SCALES INCLUDED IN CONSTRUCT VALIDATION OF THE INVESTOR PROFILE SCORES

Construct	Source	Description	Sample Item	Hypothesized Relationships
Risk Tolerance	Grable & Lytton, 2003	13-item scale measuring the multi-dimensional constructs of (1) investment risk, (2) risk comfort and experience, and (3) speculative risk with multiple-choice questions.	"When you think of the word risk, which of the following words come to mind first?" a) loss b) uncertainty c) opportunity d) thrill	Investor Profile Score Action Score Confidence
Education	-	Measure of education level	-	Investor Judgment
Financial Knowledge	Grable & Joo, 2004	10 item (true/false) scale assessing financial knowledge. A composite score is developed by adding the number of correct responses per participant.	"Interest paid on credit cards is tax deductible."	Investor Judgment
Sensation-Seeking	Grable & Joo, 2004	5 items that ask the participant to circle the option closest to their personality trait, adapted from Arnett (1994). Responses are summed, with a higher score indicating greater propensity for risk taking.	"I would prefer to ride the roller coaster or other fast rides at an amusement park."	Risk Personality
Investment Horizon	Wood & Zaichkowsky, 2004	4 items rated on a 7-point Likert scale (strongly disagree to strongly agree), with higher scores indicative of the length of time an investor expects to hold a portfolio.	"The constant media reporting of stock market fluctuations does NOT bother me."	Investor Judgment
Risk Attitude	Wood & Zaichkowsky, 2004	2 items rated on a 7-point Likert scale (strongly disagree to strongly agree), with higher scores indicative of more comfort in possible initial financial losses.	I am prepared to take greater risks (possibility of initial losses) in order to earn greater future returns.	Risk Personality Confidence
Personalization of Loss	Wood & Zaichkowsky, 2004	2 items rated on a 7-point Likert scale (strongly disagree to strongly agree), with higher scores indicative of greater self-doubt and internalization of loss when it does occur.	"When one of my investments performs poorly, I feel unlucky."	Composure

DataPoints

TABLE 13. INTERNAL CONSISTENCY RELIABILITY COEFFICIENTS AND INTERCORRELATIONS OF SCALES FOR CONSTRUCT VALIDATION

	n	M	SD	1	2	3	4	5	6	7
Risk Tolerance	182	23.98	5.43	.75						
Education Level	182	4.48	1.27	-.01	NA					
Financial Knowledge Measure	174	7.35	1.45	.11	.04	.54***				
Investment Horizon	184	3.18	0.65	.15*	.09	.13	.48			
Risk Attitude	184	3.35	0.88	.57**	-.09	-.07	-.02	.55		
Sensation-Seeking Measure	174	12.28	2.60	.32**	.01	-.00	.10	.28**	.32	
Personalization of Loss	184	3.20	1.00	-.20**	.02	-.01	-.42**	-.11	-.08	.69

*$p < .05$ ** $p < .01$ ***Split-half reliability estimate

DataPoints

TABLE 14. CORRELATIONS AMONG CONSTRUCTS OF INTEREST AND OUTCOMES/DEMOGRAPHICS

	Age	Income	Net Worth	Action During Last Downturn	Comfort with past decline in value of investments	Comfort investing in Stocks	Number of Time Fired Professional Advisor
Risk Tolerance	.01	.15*	.12	.01	.22**	.43**	.08
Education Level	-.04	.27**	.19*	.11	.09	.11	.10
Financial Knowledge Measure	.10	-.01	.09	.20*	.03	.08	-.02
Investment Horizon	-.01	.21**	.09	.21*	.29**	.21**	.01
Risk Attitude	-.07	.11	-.01	-.02	.08	.30**	.03
Sensation-Seeking Measure	-.12	.04	.04	-.03	-.02	.21**	-.08
Personalization of Loss	-.04	-.11	-.18**	-.15	-.31**	-.23**	.03

TABLE 15. CORRELATIONS BETWEEN THE INVESTOR PROFILE SCALE SCORES AND THEORETICALLY-RELATED SCALE SCORES

	Risk Tolerance	Education Level	Financial Knowledge Measure	Investment Horizon	Risk Attitude	Sensation-Seeking Measure	Personalization of Loss
Investor Profile Score	.43**	.13	.02	.24**	.40**	.21**	-.35**
Risk Preferences	.53**	.05	.07	.08	.48**	.18*	-.20**
Confidence	.24**	.06	.05	.08	.27**	.14	-.17*
Investor Judgment	-.00	.29**	.26**	.42**	-.19*	.03	-.16*
Investor Composure	.22**	.05	-.04	.17*	.20**	.12	-.44**
Risk Personality	.32**	-.09	-.15*	.06	.49**	.24**	-.17*
Action	.27**	.22**	.06	.26**	.18*	.13	-.27**
Retention	.23**	.04	-.07	.09	.35**	.17*	-.22**

*p <= .05 ** p <= .01

DataPoints

Study 3 – Cross-Validation of Investor Profile Assessment

The purpose of Study 3 was to examine the validity of the empirical key of the Investor Profile factor and the cross validation of the factor scores with outcome measures in a new sample. Specifically, a concurrent validation strategy was employed using the scale scores and empirically-keyed scales from Study 1. The importance of cross-validation is to ensure that:

    a. The empirical keys for the Investor Profile and Client Retention scores are similar across samples, and

    b. The correlations among the variables are similar across samples.

To that end, a broader sample of individuals was included in Study 3 (Samples B & C, see Table 1). Specifically, the authors set out to include in the sample a wider range of individuals, including those who would be more similar to the intended audience of the Investor Profile assessment. Two samples were included in Study 3:

- Sample B: mTurk Sample: Using the same screening technique from other studies, we screened 427 people. These respondents did not participate in Study 1. Of those, 223 qualified for participation in the survey, and 120 completed the study for a response rate of 53.8%. Participants were paid for their participation in the survey and did not receive feedback about their participation.
- Sample C: Investor Sample: The Sample C included a wider range of individuals who completed a beta version of the Investor Profile assessment. These included individuals interested in learning about their investor-related characteristics (n = 129), financial advisors and clients of advisors who trialed the assessment (n = 90), and owners of common stock recruited from a crowdsourcing site (n = 19).

The beta version of the Investor Profile assessment was used in this study. The beta version was available online on the DataPoints assessment platform. It differed from the research version in that it had fewer items (specifically, it did not include the judgment items), and two of the outcome measures including: comfort with decline in past investments and comfort investing in the stock market.

Results

For purposes of the analyses, the samples were combined, and analyses were conducted only with participants who were at least age 25 and had at least $25,000 in annual household income for the previous year, resulting in a final sample size of 125. The demographic characteristics of the combined sample included is included in Table 5, but for comparison purposes, this sample had an average age of 41.34 (SD = 10.69), a median income of $70,000 ($SD$ = $35,831.78), and a median net worth of $140,000 ($SD$ = $370,300.73). Likewise, the sample was comprised of 44.8% men. In general, this sample represented an older, male-centric, and more affluent sample than in Study 1.

Cross Validation of Scoring Keys

Correlational Analyses

Table 16 contains the reliability estimates and intercorrelations among the factors. Table 17 contains the intercorrelations among the demographic and outcome variables. Table 18 contains the correlations between the factors from the Investor Profile assessment and outcome measures. The reliability

estimates, intercorrelations among factors, and correlations between the factor scores and outcome measures are similar in nature to those found in Study 1, with some exceptions:

- Mean scores appear higher in the sample, most likely due to the inclusion of investors with more experience and knowledge in general (e.g., financial advisors)
- The Investor Judgment scale was not significantly related to Risk Personality in Study 3, while it was significantly and negatively related in Study 1.
- The Investor Judgement scale was significant related to Risk Personality in Sample 1 but not so in Sample 3.
- The Investor Judgment scores were significantly related to Net Worth and Comfort with Past declines in Study 1, but not so in Study 3. Age showed different relationships with the Investor Profile scores across the samples, most likely due to the difference in average ages in the samples, and in the skewness and kurtosis of the distribution of age. Likewise, the distribution of age in Sample 3 included what could be considered multiple modes.

TABLE 16. INTERNAL CONSISTENCY RELIABILITY COEFFICIENTS AND INTERCORRELATIONS – STUDY 3

	n	M	SD	1	2	3	4	5	6	7	8
Investor Profile Score	125	3.22	0.46	-							
Risk Preferences	125	2.76	0.69	.74**	.83						
Investor Confidence	125	3.23	0.70	.80**	.37**	.84					
Investor Judgment	125	3.46	0.61	.49**	.18**	.23*	.72				
Investor Composure	125	3.68	0.73	.73**	.36**	.56*	.23**	.70			
Risk Personality	125	2.97	0.73	.67**	.56**	.49**	.06	.40**	.85		
Action Score	125	0.81	0.45	.81**	.42**	.81**	.43**	.66**	.40**	.80	
Retention Score	125	0.96	0.34	.74**	.39**	.84**	.11	.55**	.68**	.69**	.76

$* \ p < .05 \quad **p < .01$

DataPoints

TABLE 17. INTERCORRELATIONS AMONG CRITERIA – STUDY 3

	N	M	SD	1	2	3	4
Age	125	41.34	10.69	-			
Income	125	80944.00	35831.78	.01	-		
Net Worth	125	255125.00	370300.73	.36**	.34**	-	
Comfort with past decline in value of investments	122	2.98	0.91	-.24	.38**	.01	
Comfort investing in Stocks	125	3.41	1.09	-.07	.30**	.21	.38**

* *p* < . 05 ***p* < .01

TABLE 18. CORRELATIONS BETWEEN FACTOR SCORES AND OUTCOMES OF INTEREST – STUDY 3

	Age	Income	Net Worth	Comfort with past decline in value of investments	Comfort investing in Stocks
Investor Profile Score	.07	.29**	.20*	.43**	.70**
Risk Preferences	-.10	.17	.07	.31**	.50**
Investing Confidence	-.13	.23*	.15	.32**	.64**
Investor Judgment	.04	.13	.11	.14	.29**
Investor Composure	.07	.28**	.27**	.32**	.48**
Risk Personality	-.08	.21*	.14	.71**	.47**
Action	-.05	.26**	.26**	.34**	.72**
Retention	-.07	.20*	.15	.30**	.57**

* *p* < . 05 ***p* < .01

DataPoints

Regression Analyses

To determine the usefulness of the overall Investor Profile score in the prediction of actions during the downturn in a market above and beyond income and net worth, a hierarchical multiple regression analysis was conducted. Specifically, it was important to understand the ability of the Action score to predict investor behavior and comfort above and beyond demographic characteristics and the Risk Preference score.

Hierarchical regression analyses were conducted to examine the usefulness of the Action score in the prediction of relevant outcomes. In the case of the Action score, income and net worth were entered first (age was not included as it did not have a zero-order correlation with the outcome variables of interest), followed by Risk Preference, and finally the Action score. Results of these analyses are contained in Tables 19-20. In most cases, the results were similar to those found in Study 1, with the exception being the beta weights for net worth and income in some of the steps. However, in each case, the Action score added to the prediction of the outcome variables above and beyond income, net worth, and Risk Preference. Specifically, the Action score added significantly to the prediction of comfort with a decrease in the value of one's investments ($F_{(1,117)} = 7.20$, $p < .05$, $\Delta R^2 = .05$) and comfort investing in stocks ($F_{(1,120)} = 74.13$, $p < .01$, $\Delta R^2 = .27$). Therefore, regression results indicate that Action score is a significant predictor of investor comfort, even after controlling for income, net worth, and Risk Preference.

The results of this validation study demonstrated the overall usefulness of the Action score in the prediction of investor-related behaviors and composure during volatile markets. Specifically, we found that the incremental variance associated with the introduction of Action score was significant, even though there were slight differences in the weights and intercorrelations in the overall models between Studies 1 and 3. Therefore, variance in an individual's comfort with investing and with declines in the market value of their investments could be explained by their overall Investor Profile score, regardless of their income, net worth, or preference.

TABLE 19. REGRESSION OF INVESTOR COMFORT WITH DOWNTURN IN MARKET VALUE OF PORTFOLIO AS A FUNCTION OF AGE, INCOME, NET WORTH, PREFERENCE, AND INVESTOR PROFILE SCORE

	Model 1			Model 2			Model 3		
Variable	B	SE B	β	B	SE B	β	B	SE B	B
Income	111793.44	.00	.44	102562.59	.00	.40	9477101.97	.00	.37
Net Worth	-37160540.49	.00	-.15	-38945642.32	.00	-.16	-50923178.66	.00	-.21
Risk Preference				.35	.11	.26	.24	.12	.18
Investor Profile Score							.50	.19	.24
R^2		.17			.23			.28	
F for change in R^2		11.88 **			9.91**			7.20**	

$*p < .05$ $** p < .01$

TABLE 20. REGRESSION OF INVESTOR COMFORT WITH INVESTING IN STOCKS AS A FUNCTION OF AGE, INCOME, NET WORTH, PREFERENCE, AND INVESTOR PROFILE SCORE

	Model 1			Model 2			Model 3		
Variable	B	SE B	β	B	SE B	β	B	SE B	B
Income	7738847.71	.00	.26	5516863.36	.00	.18	3194033.50	.00	.11
Net Worth	36315020.17	.00	.12	34447883.46	.00	.12	256919718.92	.00	.01
Risk Preference				.72	.12	.46	.36	.10	.23
Investor Profile Score							1.44	.17	.59
R^2		.10			.31			.57	
F for change in R^2		6.96 **			35.70**			74.13**	

$*p < .05$ $** p < .01$

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Application of the Investor Profile Assessment

The Investor Profile was created for different purposes. Individuals and advisors may use the assessment for assistance in constructing investment portfolios, in understanding one's patterns of behaviors and judgment related to investor-related characteristics for the purpose of development, and to anticipate future behavior including action during a downturn in the market, and remaining with a professional adviser. To that end, it is important to understand which score should be used for each purpose. Table 21 provides several applications related to the use of the Investor Profile assessment.

TABLE 21. APPLICATIONS OF THE INVESTOR PROFILE ASSESSMENT

Application	Information to Consider	Notes
Portfolio allocation	Investor Profile	The Investor Profile score is a composite measure of psychological risk tolerance comprised of five individual factors that measure behaviors and experiences that can impact investor-related decision-making. The Investor Profile score was used by the Financial Planning Performance Lab to map to portfolio allocation ranges held by investors working with advisors who had similar levels of psychological risk tolerance.[62]
Coaching & development	Factor scores	The individual factor scores from the Investor Profile assessment can be used to help individuals understand their patterns of behavior, and how to improve or maintain those behaviors in order to maintain a long-term investment position.
Anticipating future investor behavior	Action score	The action score can be used to anticipate investor behavior. A high score indicates that an investor may be inclined to put money into the market during a downturn in the market. Conversely, a low score indicates the likelihood that an individual investor will take money out of the market during a decline in the market.
Anticipating level of experience required for retention	Retention Score	The Retention score can be used by advisors to anticipate whether or not their client will be inclined to find a new financial advisor. As was demonstrated in the validation results, although this particular score predicts likelihood of firing an advisor, it also is related to positive investor behaviors, attitudes, and experiences. In other words, despite the fact that high scores indicate that there is a higher likelihood that these clients may fire advisors more frequently, it is also the case that these clients may in fact be more successful long-term investors.

[62] DataPoints

Administration Guidelines

Appropriate Audiences

The Investor Profile assessment is appropriate for adult populations who manage their household affairs. Specifically, the assessment is appropriate for individuals who are responsible for some aspect of leadership within their household.

It should be noted that this assessment is not designed to be a clinical measure of money-related disorders, such as hoarding behavior, compulsive gambling, or other similar types of psychological disorders.

Test Conditions & Retesting

Test takers (clients) should complete the Investor Profile on their own, preferably in a quiet location free from distractions. The test should be completed in one sitting, and each client should complete the assessment him or herself (versus having one household complete a single assessment).

The test is not appropriate or designed for retesting because the biodata items associated with the test measure past and current patterns of behaviors. If significant behavioral change occurs post-testing, the individual would continue to receive lower scores because the questions measure past behavioral patterns as well as current ones. Instead, it is recommended that advisors use a shortened version of the assessment, due out in late 2018, which includes current measures of investor-related behaviors and judgments.

Interpretation & Recommendations

Mapping to Portfolio Allocations

The overall Investor Profile score was mapped to portfolio allocations by the Financial Planning Performance Lab, LLC (FPPLab) using data from over 14,000 individuals working with professional financial advisors. Individuals are provided with a portfolio (ranging from 1 to 35) and a mapped allocation of stocks and bonds. Advisors are provided with allocation ranges, average returns, standard deviations, historical maximum losses, and historical maximum gains. The mapping indicates how an individual's score on the Investor Profile maps to portfolios held by investors with a similar score. For complete information on the risk mapping used to provide portfolio allocation mappings, please see the risk mapping technical report in the Appendix.

Normative Data and Percentiles

Normative data for the Investor Profile assessment includes the data points across all samples included in the studies outlined in this report. Percentile scores are reported to the individual and to the advisor, ranging from 5th to 99th percentiles for the factors.

Recommendations and Narratives

DataPoints assessments include developmental recommendations and narrative scoring text to aid users in understanding scores. Score descriptions and recommendations for each factor were written by the research team. Recommendations are provided based on the client's score on a given wealth factor in one of several score zones (for example, low (below the 33rd percentile), medium (33rd to 66th percentile), or high (67th percentile or higher)).

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Ongoing Research & Enhancements

DataPoints is committed to the ongoing enhancement of our products. To that end, we employ a process for evaluating and updating our assessments every twelve months. Specifically, this process includes the following:

1.   Analyses of aggregate data to produce updated norms (when sufficient data is available, i.e., more than 500 unique data points), ensuring continued accuracy in scoring for the relevant population (i.e., clients of financial advisors);

2.   Analyses of experimental items embedded within the tests; and

3.   Replacement of items with similarly performing yet updated items, particularly items that are powerful in terms of relationship to criteria of interest (namely, net worth).

Specifically, for cases 2 and 3 above, DataPoints assessments include the use of experimental content: items embedded in the test that are not scored or reported, but instead serve as a way for continuous improvement of the assessment. These experimental items allow for ongoing data collection and improvements to the predictive nature and client experience. Data from each assessment are used in aggregate form for analyses of item-level validities and factor characteristics (reliability and validity) with different combinations of items. DataPoints is focused on the technical aspects of the test, but also on the reactions of individuals to the test items and social desirability of the items. Future analyses will be conducted to ensure those components are accounted for and improved over time.

Conclusion

Limitations

As a self-report measure, the Investor Profile assessment suffers from what all self-report measures tend to have as their disadvantages, namely common-method variance, artefactual covariance, and consistency motif.[63] Future versions of the Investor Profile will attempt to examine the criterion-related validity of its scales via studies that separate the collection of the predictor and criterion. Likewise, future research will include client ratings by financial professionals on the factors included in the assessment as part of a construct validation strategy.

The Investor Profile assessment, in its current state, is neither appropriate nor designed for personnel selection or promotion. While certain factors may be related to job performance in different roles, or leadership ability, multiple studies confirming these relationships would need to be conducted in accordance with *The Standards*.[64]

Future Research

Test-retest reliabilities for the assessment will be conducted with future research to add to the evidence of reliability of the assessment. Future research will continue to examine the validity of the assessment in the prediction of investor behavior and comfort. Specifically, future research will look to examine the

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[63] Podsakoff & Organ, 1986
[64] AERA et al., 2004

usefulness of the assessment in the predictor of behavior during down markets using predictive validation studies. Likewise, future research will examine the usefulness of the assessment within non-US centric populations and with samples that represent a wider range of age groups. Future studies will also examine the Retention predictor in groups of high- and ultra-high net worth clients.

Likewise, future research will examine the usefulness of the assessment in a variety of market conditions. The conditions under which the data was collected for this creation of the assessment was positive. It is critical to examine the usefulness and consistency of the Investor Profile scores across different types of market conditions.

Summary

Psychological risk tolerance is a complex set of individual differences characteristics that can impact how an investor feels or behaves related to volatility in either his portfolio, financial markets in general, or some combination of the two. The Investor Profile assessment is a psychometrically sound assessment of constructs related to the behaviors that can be used by individuals and financial professionals as a measure of psychological risk tolerance. It improves upon past attempts at measuring risk tolerance by using a biodata-based approach to measurement, being applicable to investors with a wide range of investment or financial experience and providing factor-level information that can aid in coaching and development. The assessment can be used by individuals or by financial professionals providing investment advice to clients to help guide the creation of a portfolio that will be appropriate given their psychological risk tolerance and to provide recommendations for improving or maintaining certain financial behaviors that may improve the likelihood of sticking with a long-term investment strategy.

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Appendix

A Risk Mapping Technique: Linking Financial Risk Attitude Questionnaire Scores to a Portfolio Allocation

Financial Planning Performance Lab
(FP Performance Lab LLC)

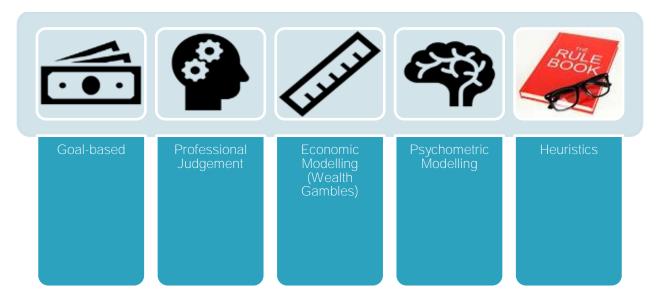### Technical Report: February 2018

Contents

Introduction

This report provides a conceptual overview and technical summary of the Financial Planning Performance Lab (FPP Lab) risk score mapping system.

The Measurement of Financial Risk Attitudes

Professional financial advisers are generally mandated by state, federal, and self-regulatory organizations to assess the risk tolerance of their clients prior to analyzing client data, developing financial and investment recommendations, and/or implementing recommendations. Numerous commercial firms have entered the risk assessment marketplace in an attempt to help investment advisers, financial planners, and financial planning firms evaluate the risk propensities of clients in a reliable and valid manner.

As shown in Figure 1, there are five general ways in which risk-assessment products are positioned in the marketplace.

- The first approach is based on initially establishing the rate of return a client needs to achieve to reach his or her financial goal(s). This is followed by a quantitative assessment of the probabilities associated with goal achievement and a discussion with the client regarding the client's comfort taking the amount of prescribed portfolio risk. With this approach, few direct measures are used to evaluate a client's willingness to take financial risk.
- The second approach relies on the professional expertise and judgement of the financial adviser to qualitatively evaluate a client's willingness and capacity to take financial risk. Professional judgement is most often documented through lengthy adviser-client discussions.
- A third approach relies on traditional economic modelling techniques, which are sometimes referred to as assessments of revealed preferences.
- The fourth technique involves the use of psychometrically designed and validated measures of a client's risk attitude. A well-designed tool should provide useful insights into a client's willingness to engage in financial behaviors in which the outcomes are both unknown and potentially negative. Sometimes psychometric tools are combined to estimate a client's risk profile. For example, some assessment techniques blend elements of a client's risk perceptions, preferences, capacities, and other characteristics into a generalized risk profile.
- The fifth attitudinal assessment procedure entails the use of heuristics or commonly applied financial and investment rules. One heuristic used to determine the appropriate asset allocation split between equities and fixed-income securities is the "100-age" rule. In this case, the client's age is subtracted from 100. The result is the proportion of a client's assets that should be allocated in equities and other risky assets. Other risk-tolerance heuristics include the use of demographic factors to predict who is more or less willing to take risk. For instance, women are generally thought to exhibit a lower tolerance for financial risk than men.

FIGURE 1. COMMON WAYS CLIENT RISK-TOLERANCE IS EVALUATED

While each of the assessment methods shown in Figure 1 have advocates within the investment and financial planning community, only goal-based, economic modelling, and psychometric modelling pass minimally accepted standards for use, based on evidenced-based assessment techniques. Professional judgement and heuristic approaches suffer from potential biases. There is little evidence to suggest that professional judgement works particularly well in predicting current or future risk-taking behavior on the part of clients. Additionally, heuristic approaches lack specificity to individuals, even when the rules appear to be true in the aggregate.

The Current State of the Assessment Marketplace

There is a growing preference among financial advisers to adopt one of three risk assessment methodologies as the preferred method for evaluating a client's willingness to take financial risk: (1) goal-based, (2) economic modelling, or (3) psychometric approach. These methods are discussed in more detail below.

Goal-Based Approach

Those who advocate a goal-based approach believe that the accomplishment of a goal supersedes a client's comfort level when investing to reach the goal. A goal-based model works very well when clients have the financial capacity (e.g., time, financial wherewithal, etc.) to deal with large and unexpected financial losses. This is the reason financial advisers who work with high net worth clientele or through family office arrangements often use this assessment approach. A goal-based model becomes more problematic when a client's financial capacity may not be strong enough to support a large financial loss, especially when the client's willingness to take risk is conceptually below the level of return required to achieve the goal.[65]

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[65] Lower net worth clients with a short time horizon, and those with fewer financial resources, may not have the time or financial ability to recoup losses that can occur when they are required to stretch for returns that exceed their attitudinal willingness to accept such risk.

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Economic Modelling Approach

Economic modelling techniques are increasingly used to assess client risk attitudes. More specifically, economic techniques are employed to evaluate a client's risk preference, through choice scenarios. Client answers provide an insight into risk taking proclivities through revealed preferences. If enough questions are asked, it is possible to derive a measure of a client's constant relative risk aversion (CRRA). The higher the CRRA score, the lower the appropriate risk in a portfolio.[66] Once a CRRA score has been estimated, it is then theoretically possible to place a client's preferences onto the efficient frontier.

There are two potential problems associated with economic modelling approaches. First, the questions used to derive a measure of CRRA are almost always based on 50/50 choice scenarios. While conceptually elegant and easy to administer, such scenarios are divorced from realities faced by investors on a day-to-day basis. While economic approaches are useful when risks are pre-defined, their use becomes more problematic when choice outcomes are uncertain. Second, few economic modelling tools that are available in the marketplace have been tested in a sustained negative-market environment. While some products have been back-tested, all existing products available were created after the global recession that started in 2007-2008.

Psychometric Approach

The assessment technique with the longest published history, and the approach with the highest level of academic validity, is the psychometric method. Nearly all the commercial products in the psychometric space have been designed using academically rigorous methods of scale development. While nearly all psychometric instruments can provide evidence regarding validity and reliability, each suffers from a major shortcoming (one that the economic modelling approach solves): a less than clear connection between a derived risk score and an asset allocation model.

It is very difficult to link financial risk tolerance (or risk profile) scores to a portfolio allocation or financial recommendation. In nearly all cases, test developers advocate using psychometric risk-tolerance scores as a "starting point" in client discussions. Some financial advisers use risk questionnaires only for regulatory purposes. They then shift to using professional judgement to evaluate client risk attitudes in the context of portfolio allocation decisions. Stated another way, the problem is that it is difficult to map risk-assessment scores to an empirically rigorous asset allocation strategy.

The Problem and Solution

The essential problem facing financial advisers who use a psychometric test is that it is very difficult to know what a score means. For example, what is an appropriate portfolio allocation, between equities (stocks) and fixed-income securities (bonds), for a client who is

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[66] More information on CRRA models can be found in the following journal article: Sherman D. Hanna, Michael S. Gutter, and Jessie X. Fan. 2001. A Measure of Risk Tolerance Based on Economic Theory. *Financial Counseling and Planning* 12 (2): 53-60.

classified holding a below- or above-average (or any other classification) willingness to take financial risk? Without a benchmark or guideline, the asset allocation decision tends to be based primarily on professional judgement.

Researchers working at the FPP Lab developed a model that can be used to help solve the mapping problem. Specifically, the FPP Lab mapping methodology links psychometric financial risk-assessment scores to benchmark allocations of equities and fixed-income assets. The allocations (a mix of stocks and bonds) represent what similar investors with a given risk tolerance or profile score, who work with financial advisers, hold in their investment portfolios.

How the Model Works

For illustration purposes, assume that the financial adviser's psychometric risk evaluation results in a client risk score of 3.50, on a scale of 1.00 to 8.00 (this example is for illustrative purposes only and does not represent the actual mapped score for a person with a 3.5 on the DataPoints risk profile measure). Traditionally, the financial adviser would be required to use his or her professional judgement to determine the level of portfolio risk that would be appropriate for the client. The FPP Lab mapping system simplifies the adviser's role by providing a baseline (benchmark) asset allocation that can serve as a starting point when making asset allocation recommendations. The FPP Lab benchmark allocations represent actual portfolios of investors who have worked with a financial adviser.

In this hypothetical case, a risk score of 3.50 maps to a portfolio evenly split between stocks and bonds. The mapping system uses historical market returns to then provide an historical expected rate of return for such a portfolio (7.22 percent over the period 1928 through 2017).

The mapping process was developed using a targeted sample of over 14,000 investors collected over multiple market cycles. Each investor's risk score was measured and evaluated against portfolios informed by professional financial advisers. In order for data to be included in the mapping process, the investor needed to be 35 years of age or older and working with a professional financial adviser.

Data, thus, represent approximations of client portfolio allocations as guided by financial advisers. This mapping approach provides information about the appropriateness of a suggested allocation, given a client's psychometrically defined risk score. This approach reduces the level of "guessing" currently used by some financial advisers when analyzing their client's risk score in relation to a risk need. The analysis provides a framework for a financial adviser to determine if the portfolio they are going to recommend is in-line with what other financial advisers, working with a client with a similar risk score, have recommended in practice.

Technical Features

The process begins by mapping the risk score from a financial adviser's psychometric risk-assessment questionnaire to a proprietary risk-scoring system developed by the FPP Lab.

- The mapping process includes performing a validity and reliability analysis of the financial adviser's current risk-assessment platform and then mapping scores to FPP Lab data. The mapping procedure is shown in Figure 3.

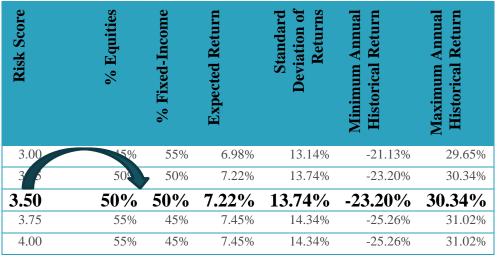| Risk Score	% Equities	% Fixed-Income	Expected Return	Standard Deviation of Returns	Minimum Annual Historical Return	Maximum Annual Historical Return
3.00	45%	55%	6.98%	13.14%	-21.13%	29.65%
3.25	50%	50%	7.22%	13.74%	-23.20%	30.34%
3.50	**50%**	**50%**	**7.22%**	**13.74%**	**-23.20%**	**30.34%**
3.75	55%	45%	7.45%	14.34%	-25.26%	31.02%
4.00	55%	45%	7.45%	14.34%	-25.26%	31.02%

FIGURE 3. THE MAPPING PROCESS

As illustrated in Figure 3, the client's risk score, in this case, 3.50, is mapped to a portfolio allocation that matches the portfolio profile of investors who have exhibited a similar risk attitude. In this case, a score of 3.50 is matched to a 50/50 portfolio mix between equities and fixed-income assets. Based on historical returns, such a portfolio would have generated an expected return of 7.22 percent, with a standard deviation of 13.74 percent. The worst and best returns for such an allocation, since 1928, are -23.20 percent and 30.34 percent, respectively.[67]

- Portfolio data:
    - Stock and bond data represent historical returns of the S&P 500 and 10-year Treasury bonds.
    - Data represent the period 1928 through 2017.[68]
        - For mapping that occurred in 2018, the model used the following data:
            - S&P 500 historical return: 9.65 percent.
            - 10-year Treasury bond return: 4.88 percent
            - S&P 500 historical standard deviation: 19.62 percent.

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[67] The mapping report also provides an allocation range for stocks and bonds. The range data represent observed variations among investors at each portfolio level. For example, the allocation stock range for the hypothetical client is 40 percent to 60 percent. These data provide a financial adviser with additional guidance on the upper limit of an allocation, measured by variations in investor portfolios among those with a similar risk score. Factors that might influence a shift from a target allocation include the investor's time horizon, risk capacity, risk need, and/or other adviser determined elements.
[68] Because new data will influence the mapping of risk scores to expected rates of return, the model should be updated at least annually. Data represent geometric means.

- o 10-year Treasury bond standard deviation: 7.72 percent.
        - o Maximum one-year S&P 500 loss: 43.84 percent
        - o Maximum one-year 10-year Treasury bond loss: 11.12 percent.
        - o Maximum one-year S&P 500 gain: 52.56 percent.
        - o Maximum one-year 10-year Treasury bond gain: 32.81 percent.
    - o Mapping data:
        - ▪ The proprietary mapping system is based on ongoing surveys of investors. Specifically, data represent:
            - • Investors 35 years or older.
            - • Investors who rely on the advice of a professional financial adviser.[69]
    - o Benchmarking sample characteristics:
        - ▪ Gender:
            - • 57 percent male.
            - • 43 percent female.
        - ▪ Marital Status:
            - • 20 percent never married.
            - • 8 percent not married but living with significant other.
            - • 59 percent married.
            - • 9 percent separated or divorced.
            - • 3 percent widowed.
            - • 1 percent other shared living arrangement.
        - ▪ Education: 70 percent Bachelor's or Graduate degree.
        - ▪ Household Income:
            - • 6 percent less than $25,000.
            - • 15 percent between $25,000 and $49,999.
            - • 18 percent between $50,000 and $74,999.
            - • 16 percent between $75,000 and $99,999.
            - • 45 percent above $100,000.

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[69] The system has also been validated with retiree samples.

DataPoints

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