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APPLIED PSYCHOLOGY | RESEARCH ARTICLE

RISk SCReening on the Financial Market (RISC-FM): A tool to assess investors' financial risk tolerance

Ingrid Wahl¹ and Erich Kirchler^{2*}

Abstract: To advise investors on the financial market according to their financial risk tolerance it is necessary to apply a valid and reliable instrument measuring financial risk tolerance. We develop a screening instrument which assesses different facets of financial risk tolerance, namely, risk propensity, risk attitude, risk capacity, and risk knowledge. First, an item pool was generated and discussed with lay people as well as financial advisors to assure the questions' understandability and answerability. Second, the most coherent and practice-oriented questions were tested empirically to determine four scales representing the four facets of risk tolerance. Third, resulting items were assessed using a representative sample of Austrian citizens interested in saving, stock trading, and investing, and psychometric quality of the instrument was determined.



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ABOUT THE AUTHORS

Ingrid Wahl is professor, researcher, and senior lecturer at the FernFH Distance-Learning University of Applied Sciences. Her research focusses on cooperation in social dilemmas, diversity in organizations as well as on working and learning in the virtual context. As economic psychologist, she also examines people's behavior in the economic context, such as tax evasion and financial behavior. Measuring financial risk tolerance complements her scientific work.

Erich Kirchler is professor of applied psychology (economic psychology) at the Faculty of Psychology, University of Vienna, Austria. Most of his 400 scientific publications are dedicated to research fields in the economic psychological context, such as financial decision making and tax compliance. Relevant books are „Conflict and Decision Making in Close Relationships“, published by Psychology Press, UK (2001), „The Economic Psychology of Tax Behaviour“, published by Cambridge University Press, UK (2007); “Economic Psychology: An Introduction”, published by Cambridge University Press, UK (2018, with Erik Hoelzl).

PUBLIC INTEREST STATEMENT

Financial advisors are requested by legal regulations to assess their clients' risk tolerance to advise them accordingly. Many financial advisors currently use short item-scales on financial risk tolerance, which suffer empirical support and obey the law only in the broadest sense. These scales do also often lack minimum standards in test-psychology, a sub-discipline specialized in the construction of questionnaires. We as economic psychologists try to overcome this shortcoming and created a time-saving and easy-to-apply questionnaire which is ideal for practical use. We called the questionnaire RISC-FM standing for RISk SCReening on the Financial Market. With the RISC-FM, advisors can quickly learn about a client's financial risk tolerance and whether it is below, within, or above the population's average. This information helps starting a dialogue with clients about their financial needs and aspiration and meets legal requirements.

Subjects: Psychological Science; Economics, Finance, Business & Industry; Economics; Business, Management and Accounting

Keywords: assessment; financial risk tolerance; scale construction; investment behavior

1. Introduction

Investment advisors need to know their clients' financial risk tolerance to be able to provide appropriate and well-tailored investment advice. To assure that financial advisors suggest suitable portfolios to their clients, legal regulations in many western countries (e.g., Australia: Corporations Act 2001 s912A(1)(h); European Union: Markets in Financial Instruments Directive 2014/65/EU Chapter 2 Section 2 Article 25(2); United Kingdom: Conduct of Business sourcebook 2007 9.2.2; United States: Pension Protection Act of 2006 Section 601, Financial Industry Regulatory Authority Rule 2111, all as amended) demand the assessment of clients' risk tolerance and for them to be advised based on this tolerance. However, legal regulations are silent on how to assess risk tolerance.

Assessing investors' risk tolerance is difficult to estimate, it can vary over time, and value and development of securities, bonds, and stocks are subject to change overtime and the time horizon of investments plays a crucial role. Moreover, investors' self-ascribed risk tolerance may be affected by decision anomalies, such as framing effects and heuristics, or the investors may get emotionally overwhelmed while taking financial risks.

Investment advisors—although retained to assess their clients' risk tolerance—frequently lack validated instruments to assess risk tolerance. Consequently, investors often end up holding too conservative or too risky portfolios relative to their preferences (Cutler, 1995; Hallahan, Faff, & McKenzie, 2004; Moreschi, 2005; Morse, 1998). In practice, financial advisors often provide their clients with information on investment options but do not incorporate their clients' needs and aspirations (Snelbecker, Roszkowski, & Cutler, 1990). Instead of judging their clients' risk tolerance, advisors often offer standardized rather than client-tailored solutions (Elsayed & Martin, 1998).

Investment institutions frequently use small sets of untested questions to assess risk tolerance with the aim to merely satisfy the legal requirements (Roszkowski, Davey, & Grable, 2005). Thus, instruments meeting psychometric standards, such as high reliability and validity, that can provide valid information on risk tolerance are long-needed (Dohmen et al., 2011; Grable, 2017). To the best of our knowledge, these criteria are so far met by Grable and Lytton's (1999) risk-tolerance scale (Kuzniak, Rabbani, Heo, Ruiz-Menjivar, & Grable, 2015). Furthermore, an instrument measuring financial risk tolerance should be easy to apply, economic and time costs involved in risk measurement should be low (Roszkowski et al., 2005). Previous instruments interpret clients' individual scores, however, for an adequate interpretation of single values a comparison to norm values would be useful as this gives advisors and clients a comprehensive information about being below, within, or above the population's average. Individual risk tolerance resulting from a validated scale and related to population norms should be taken by advisors as a starting point to discuss and evaluate their clients' needs in depth (Davey, 2012; Grable, 2017; LeBaron, Farrelly, & Gula, 1989).

Measuring risk tolerance is challenging as it is a psychological characteristic and as such not directly observable (Yao & Curl, 2011). Combining subjective data obtained from developed scales and objective risk measures based on previous behavior shall result in the most accurate assessment of clients' risk tolerance (Marinelli, Mazzoli, & Palmucci, 2017). However, gathering objective data is not always possible due to lack of data and privacy protection. Thus, accurate self-assessment measures are considered best practice to predict portfolio allocations (Guillemette, Finke, & Gilliam, 2012).

In the present paper, we develop a theoretically based and practically applicable screening instrument for the self-assessment of risk tolerance on the financial market. Psychometric standards are tested and norm values of the population's risk tolerance are developed. In the remainder of the paper we first define risk tolerance and describe a selection of biases in financial decision-making. Further, we describe the construction and selection of items for the risk tolerance scale and the final construction of the instrument on the basis of data from a representative sample of Austrian citizens interested in financial matters. Finally, we show how data collected regarding the risk assessment instrument can be interpreted in comparison with norm values.

2. Financial risk tolerance

Although people may be perceived generally as being either risk averse or risk seeking, predictions of risky decisions and behavior in a specific area cannot reliably be made by considering a person's general risk tolerance but must be based on risk tolerance in a specific field (Corter & Chen, 2006; Dohmen et al., 2011). As risk tolerance cannot be generalized to other behavioral fields, risk tolerant financial investors may take risky decisions in different financial areas but not in other areas such as extreme sports. Research distinguishes between risk taking in the financial, physical, social, and ethical areas (Jackson, Hourany, & Vidmar, 1972; MacCrimmon & Wehrung, 1990; Weber, Blais, & Betz, 2002).

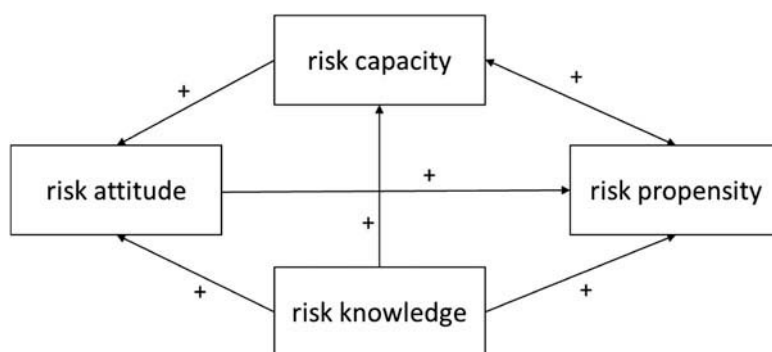
A widespread definition of financial risk tolerance is that it is the maximum amount of uncertainty a person is willing to bear when making financial decisions (Grable, 2000). A more specific definition describes financial risk tolerance as risk-taking attitude in monetary affairs (Callan & Johnson, 2002; Hallahan et al., 2004; Hanna, Gutter, & Fan, 2001). This attitude varies on a continuum with extremes ranging from "low risk tolerance" to "high risk tolerance" (Weber & Milliman, 1997). Although being quite constant over time (Nosić & Weber, 2009; Roszkowski, Delaney, & Cordell, 2009; Van de Venter, Michayluk, & Davey, 2012), critical life events such as getting married and having children can considerably affect people's financial situation and thus their financial risk tolerance (Davey, 2002).

Cordell (2001, 2002) suggests the evaluation of the following four factors of clients' risk tolerance: (a) clients' past behavior in financial decisions (i.e., risk propensity), (b) clients' attitudes toward financial risks (i.e., risk attitude), (c) clients' ability to bear financial risks (i.e., risk capacity), and (d) clients' knowledge about financial risks (i.e., risk knowledge). Risk propensity and risk attitude especially reflect clients' subjective perception and acceptance of risk. The four factors are positively related to each other as depicted in Figure 1 (Cordell, 2001). Risk propensity is affected by risk attitude and risk knowledge and is interrelated with risk capacity. Furthermore, risk attitude is influenced by risk capacity and risk knowledge. Contrary to the other factors, risk knowledge is related to the other factors; however, it is not influenced itself by any of the other factors.

The most relevant factors for the evaluation of risk tolerance are risk attitude and risk capacity (Cordell, 2001; Yook & Everett, 2003). Accordingly, risk seekers hold positive attitudes toward

Figure 1. Associations between the four factors of financial risk tolerance (Cordell, 2001, p. 39).

Notes: Adapted from the article "RiskPACK": How to Evaluate Risk Tolerance by D.M. Cordell. *Journal of Financial Planning*, June 2001; lines with two arrows indicate correlations and lines with one arrow one-directional influences.



financial risks combined with a high financial capacity; whereas, risk avoiders hold negative risk attitudes and are unable to bear financial losses.

We assume that people face emotional strains as well when taking financial risks and that some people are emotionally overwhelmed by imagining or facing the risk of losing money. An instrument assessing financial risk tolerance thus needs to consider risk capacity as well as emotional aspects and should therefore measure objective and subjective risk capacity. Moreover, financial literacy, such as knowledge about investments was found to influence financial risk tolerance (Croy, Gerrans, & Speelman, 2010; Grable, 2000; Grable & Joo, 1999, 2004) and should therefore also be part of an instrument addressing financial risk tolerance.

In our attempt to develop a valid financial risk tolerance assessment instrument, we consider the described four factors in the selection and construction of items. Moreover, in the following chapter we consider systematic biases occurring in financial decisions and explain how to formulate items accordingly. Furthermore, criterion-related validity (i.e., using situational and personal characteristics that are likely to influence a person's risk tolerance; cf. Roszkowski et al., 2009) is assessed.

3. Financial decisions and biases

Financial decisions are predominantly decisions involving uncertainty and therefore often deviate from the neoclassical model of utility maximization and rationality. Especially deviations from rationality which yield biases resulting in a contorted perception of risk might influence financial decisions crucially. Examples for such systematic biases are framing effects, heuristics, and that the perception of risk depends on the presentation of probabilities.

Framing effects show that decision makers' preferences may alter if objectively identical decision alternatives are presented as either gains or losses (Tversky & Kahneman, 1981). Often when deciding between an alternative with a sure, but relatively small, gain and the alternative with a higher, but risky, gain, or no gain at all, people tend to choose the sure gain alternative. Thus, they show a low risk tolerance. However, when participants decide between a sure loss alternative and a lottery alternative with either no loss or an even higher loss, the risky option is more likely to be chosen. Thus, they show a high risk tolerance, as if they would try to repair the imminent loss. This effect was not only shown in gambling situations but also in financial decisions (Diacon & Hasseldine, 2007; Schoemaker, 1990). Accordingly, Guillemette et al. (2012) point out that amongst questions on self-assessment also questions incorporating loss aversion should be used to predict people's portfolio compositions. Consequently, measurement of financial risk tolerance needs to incorporate gain and loss situations as well as risk and certainty.

Heuristics are rules of thumb regarding decisions whose uncertain conclusions can be evaluated to ascertain and select an alternative that is expedited with a low cognitive effort (Tversky & Kahneman, 1974). While the application of heuristics often leads to good choices, sometimes they mislead decision makers. For example, the affect heuristic, which was discovered by psychologists, states that feelings may influence the outcome of risky decisions (Finucane, Alhakami, Slovic, & Johnson, 2000; Slovic, Finucane, Peters, & MacGregor, 2004). It is assumed that decision alternatives are evaluated and afflicted by either positive or negative feelings. Positive feelings toward alternatives lead to an underestimation of the contained risk and to an overestimation of the positive outcome of alternatives. Negative feelings toward alternatives cause an overestimation of the related risk and an underestimation of the utility. Thus, decision makers are more likely to select positively evaluated alternatives and neglect negatively evaluated alternatives. This effect shows even, if—from an objective point of view—the positive evaluated alternative yields worse results or the negatively evaluated alternative leads to better results than the other alternatives at stake. Johnson and Tversky (1983) showed that risk evaluations can be changed through a selective communication of positive or negative feelings. In addition, investors in the financial

market showcase these biases. When estimating unknown stocks, positively evaluated stocks are perceived to have lower risks and higher chances of profits than the suggested objective criteria. In contrast, negatively evaluated stocks are perceived to include higher risks and lesser chances of profit than estimated objectively (Ganzach, 2000). Furthermore, investors report a biased tendency of investing in familiar instruments (Sahi, Arora, & Dhameja, 2013) and are more optimistic about the financial returns of companies with familiar product brands (Aspara, 2013). Accordingly, questions measuring financial risk tolerance should be formulated neutrally and should omit information that may trigger positive or negative feelings (e.g., trade names, company names).

In addition, the presentation of probabilities can influence decision makers' risk perception. Probabilities presented as frequencies (e.g., 20 out of 100) are perceived to be higher than the objectively similar probabilities presented as percentages (e.g., 20%; Slovic, Monahan, & MacGregor, 2000). Hence, when asking people about their financial risk tolerance, questions presenting probabilities both as frequencies and as percentages should be included.

4. Situational and personal characteristics and financial risk tolerance

Personal experiences and specific sociodemographic characteristics correlate with financial risk tolerance. For example, experiments on risky decision making show that prior positive experiences with risky decisions lead to even riskier behavior in the future (Bachmann, Hens, & Stössel, 2015; Barron & Erev, 2003; Hertwig, Barron, Weber, & Erev, 2004; Kaufmann, Weber, & Haisley, 2013). Men were found to be more risk tolerant in financial decisions than women (Dohmen et al., 2011; Fisher & Yao, 2017; Grable, 2000; Gürdal, Kuzubaş, & Saltoğlu, 2017; Hallahan, Faff, & McKenzie, 2003; Hallahan et al., 2004; Lemaster & Strough, 2014; Slovic, 1999). However, results on age and financial risk tolerance are inconsistent. Some studies found that older people are more risk tolerant (Grable, 2000; Wang & Hanna, 1997); whereas, other studies suggest that older people behave more risk conservative (Bonsang & Dohmen, 2015; Dohmen et al., 2011; Hallahan et al., 2003, 2004; van Rooij, Kool, & Prast, 2007). These contradictory results are explained through a non-linear correlation between age and risk tolerance (Hallahan et al., 2003, 2004). Moreover, higher-income earners (Grable, 2000; Grable & Lytton, 1999; Hallahan et al., 2003), as well as wealthier people (Cohn, Lewellen, Lease, & Schlarbaum, 1975; Hallahan et al., 2003, 2004), seem to be more risk tolerant than lower-income earners and less wealthy people.

5. Item selection and development of preliminary scales

5.1. Development of the item pool

Several steps were undertaken to develop items which suffice both the theoretical considerations on risk tolerance as well as the practical applicability in professional financial advising. First, to generate an extensive item pool on scientific and practically useful questions scientific as well as non-scientific literature was scanned for questions on financial risk taking (Appendix A shows the sources used). To identify questions suitable to measure financial risk tolerance we grouped the found questions according to Cordell's (2001) factors risk propensity,¹ risk attitude, risk capacity, and risk knowledge. Questions which did not reflect these factors were omitted. The so collected questions were translated into German and were reformulated for them to clearly refer to the used factors. For factors which were underrepresented, especially risk knowledge, additional items were composed. Second, the pool of 152 items so collected was discussed with two experienced financial advisors to see which items they consider as useful in the advisory practice. If an item was identified as not fulfilling the criteria of practical use, it was reformulated. Third, to learn whether the questions were comprehensible to laypeople, a focus group with laypeople was run. The group consisted of two women and two men aged between 31 and 65 years with an educational background ranging from school leaving examination to doctorate. All participants already invested on the financial market or were interested in investing in the near future. All items were thoroughly discussed and revised if necessary. Finally, to check which questions are relevant for the advisory routine, the item pool was discussed with two newly recruited financial advisors. The final item pool consisted of 60 coherent and practice-oriented questions.

5.2. Assessment of the item pool

An introduction letter with a link to the online questionnaire containing the selected 60 items, was distributed in the authors' professional and private networks. Participants were asked to forward the online questionnaire to friends and relatives (i.e., snowball sampling; Etter & Perneger, 2000). The online questionnaire was started by 124 participants. In total, 62 women and 41 men whose ages ranged between 23 and 76 years ($M = 37.36$; $SD = 11.24$; $Md = 34.00$) fully completed the online questionnaire. Of these participants, 4 had undergone apprenticeship training, 15 held a secondary education qualification, 82 held a university degree, and 2 did not indicate their education. Last year's gross income of participants amounted to less than 15,000 Euro for 14, between 15,001 and 30,000 Euro for 23, between 30,001 and 45,000 Euro for 21; between 45,001 and 60,000 Euro for 20; between 61,001 and 75,000 Euro for 6, and more than 75,000 Euro for 9; nine participants did not indicate their gross income. There were 67 participants who had prior experiences on the stock market; whereas, 36 participants indicated not having any prior experience whatsoever.

The set of 60 items included 19 items concerning the behavior in risky financial situations. These items referred either to previous gains or losses (answering format ranged from 1 = "very unlikely" to 7 = "very likely" and 1 = "very low-risk portfolio strategy" to 7 = "very high-risk portfolio strategy"). Additional 19 items assessed attitudes toward financial vulnerability and financial safety (the answering format ranged from complete disagreement (1) to full agreement (7); 15 items concerned financial and emotional risk capacity (answering format: 1 = "do not agree at all" to 7 = "fully agree"), and the remaining seven items examined participants' knowledge about financial risks (7-point answering format ranging from complete disagreement to full agreement). A final direct question about the general readiness to take risks was enclosed ("Please indicate how willing to take risks you estimate yourself"; answering format: 1 = "not willing to take risks at all" to 7 = "very willing to take risks"). Items with the same answering format were presented in randomized order. At the end, participants indicated their gender, age, last year's gross income, and prior experience in financial markets.

Table 1 shows the descriptive statistics and the discriminatory power of all 60 items, as well as inter-item correlations. To construct the scales on risk taking behavior, items that were not normally distributed (skewness < -0.95 or skewness > 0.95), and that showed floor or ceiling effects (median < 2.00 or median > 6.00) were excluded from further analyses. With the remaining 46 items, an exploratory principal component analysis with varimax rotation was conducted to test whether the resulting factor structure would represent the hypothesized factors risk propensity, risk attitude, risk capacity, and risk knowledge. Although, the sample size is small for running factor analyses, we used the procedure for a first test of the scales. Kaiser-Meyer-Olkin criterion for sampling adequacy (0.81) and Bartlett's test of Sphericity ($\chi^2 (1081) = 2801.09$; $p < .01$) indicate that the data is adequate for factor analysis. The extracted factors' eigenvalues above 1.00 were 13.84, 3.01, 2.62, and 2.41; further, nine factors had eigenvalues between 1.81 and 1.07 suggesting a four-factor solution when depicted in a scree plot. Additionally, Velicer's (1976) MAP test conducted with O'Connor's (2000) syntax for SPSS suggested a four-factor solution. The explained variances were 29.45%, 6.39%, 5.58%, and 5.12% for the first four factors and between 3.86% and 2.27% for the remaining nine factors.

The factor analysis was repeated with a restriction to four factors (explained variance = 46.55%). Items on propensity, attitudes, capacity, and knowledge loaded mainly on one of the factors. Items loading lower than .40 and items that could be assigned to more than one factor were disqualified from further analyses. In addition, to build reliable scales, the five items with the highest loadings on the respective factor were re-analyzed by a principal component analysis restricted to four factors. Explained variance amounted to 58.43%. Table 2 shows the descriptive statistics of the scales and the inter-scale correlations. Appendix B depicts all items of the questionnaire, labeling the selected items with an asterisk.

Table 1. Means, standard deviations, medians, skewness, discriminatory power, and inter-item correlations of the items on financial risk propensity, financial risk attitude, financial risk capacity, and financial risk knowledge in the preliminary scale development

Item	M	SD	Md	SK	DP	Inter-item correlations						
						PR01	PR02	PR03	PR04	PR05	PR06	PR07
<i>Financial risk propensity</i>												
#	2.37	1.79	2.00	1.46	.21	1.00						
+	3.35	2.03	3.00	0.33	.55	.15	1.00					
#	2.02	1.37	2.00	1.71	.34	.17	.24	1.00				
~	2.77	1.59	2.00	0.74	.33	.24	.27	.10	1.00			
*	4.50	2.31	5.00	-0.41	.21	.24	.08	.02	.20	1.00		
~	3.72	1.74	4.00	0.17	-0.09	-0.06	-0.21	-0.03	.03	.05	1.00	
*	5.26	1.24	5.00	-0.76	.47	.12	.36	.22	.39	.17	-0.02	1.00
*	4.99	1.55	5.00	-0.82	.47	.10	.40	.12	.15	.26	-0.07	.43
#	2.43	0.88	2.00	0.97	.59	.07	.62	.24	.16	.03	-0.12	.39
#	2.18	1.43	2.00	1.36	.46	.01	.39	.24	.21	-0.09	.00	.21
~	3.39	1.48	4.00	-0.03	.42	.10	.33	.25	.15	.02	.04	.32
+	3.42	1.61	3.00	0.16	.43	.18	.24	.32	.14	.09	-0.08	.23
*	4.31	2.27	5.00	-0.26	.37	.04	.31	.19	.05	.24	.00	.12
~	4.52	1.42	5.00	0.30	.26	-0.08	.12	.11	.03	.15	.03	.31
*	3.67	2.09	3.00	0.21	.56	.08	.39	.17	.24	.07	.05	.24
~	3.21	2.26	2.00	0.61	.23	-0.01	.15	.21	.13	.12	-0.09	.12
+	3.15	1.70	3.00	0.49	.49	.24	.39	.24	.14	-0.02	-0.12	.23
+	3.31	1.79	3.00	0.39	.24	.02	.16	.10	.06	.05	-0.02	.09
+	3.07	1.90	2.00	0.72	.16	.09	.19	-0.02	.02	-0.03	-0.15	.06

(Continued)

Table 1. (Continued)

Item	M	SD	Md	SK	DP	Inter-item correlations						
						AT01	AT02	AT03R	AT04	AT05	AT06	AT07
Financial risk attitude												
~	4.04	1.79	4.00	0.05	.61	1.00						
+	4.80	1.72	5.00	-0.52	.52	.48	1.00					
#	1.85	1.08	2.00	1.39	-.23	.06	.07	1.00				
*	3.11	1.71	3.00	0.53	.60	.28	.37	.14	1.00			
*	2.66	1.49	2.00	0.84	.75	.41	.39	.22	.70	1.00		
#	2.17	1.57	2.00	1.41	.67	.35	.29	.21	.51	.67	1.00	
#	1.85	1.24	1.00	1.54	.57	.29	.14	.28	.56	.61	.74	1.00
	3.20	1.75	3.00	0.29	.71	.56	.39	.10	.41	.54	.45	.35
	2.83	1.66	2.00	0.65	.80	.63	.54	.14	.50	.59	.54	.47
	3.65	1.69	4.00	-0.18	.71	.56	.46	.03	.42	.52	.49	.34
#	2.36	1.52	2.00	1.13	.57	.38	.35	.13	.36	.48	.42	.41
~	4.38	1.68	5.00	-0.39	.19	.10	.09	.10	.28	.32	.17	.08
	2.95	1.80	2.00	0.33	.83	.62	.50	.13	.45	.59	.58	.48
*	2.55	1.31	2.00	0.64	.58	.31	.13	.37	.38	.51	.57	.47
	3.14	1.63	3.00	0.50	.56	.35	.46	.17	.29	.36	.33	.23
	3.38	1.74	3.00	0.30	.70	.48	.27	.09	.37	.53	.47	.42
	3.18	1.81	3.00	0.46	.60	.45	.44	.26	.21	.34	.36	.30

(Continued)

Table 1. (Continued)

Item	M	SD	Md	SK	DP	Inter-item correlations						
						CA01	CA02	CA03	CA04	CA05R	CA06	CA07R
* AT18R	2.52	1.39	2.00	0.82	.74	.33	.35	.18	.54	.67	.55	.48
* AT19R	2.68	1.47	2.00	0.72	.63	.31	.22	.22	.50	.52	.41	.41
<i>Financial risk capacity</i>												
# CA01	3.52	1.77	3.00	0.34	.43	1.00						
CA02	2.02	1.64	1.00	1.70	.55	.37	1.00					
CA03	3.42	1.83	3.00	0.22	.65	.29	.51	1.00				
CA04	2.87	1.70	3.00	0.74	.46	.38	.36	.63	1.00			
* CA05R	4.18	2.05	4.00	-0.10	.52	.22	.35	.39	.38	1.00		
CA06	3.05	1.77	2.00	0.57	.62	.37	.40	.58	.53	.56	1.00	
* CA07R	3.70	1.91	3.00	0.15	.68	.36	.46	.51	.48	.63	.60	1.00
CA08	4.65	1.71	5.00	-0.44	.52	.25	.24	.42	.28	.20	.41	.34
~ CA09R	3.48	1.95	3.00	0.37	.33	.13	.27	.22	.01	.30	.19	.27
* CA10	4.02	1.95	4.00	-0.11	.53	.34	.34	.40	.21	.28	.23	.41
CA11	3.36	2.01	3.00	0.37	.52	.18	.32	.35	.18	.26	.26	.33
* CA12	4.07	1.94	5.00	-0.19	.58	.37	.29	.43	.34	.28	.43	.41
# CA13	5.40	1.89	6.00	-1.16	.49	.20	.31	.35	.12	.24	.29	.30
# CA14	5.92	1.76	7.00	-1.84	.11	-.04	.03	-.07	-.18	-.05	.03	.03
# CA15	5.88	1.57	6.00	-1.64	.48	.09	.23	.24	.03	.23	.14	.30
<i>Financial risk knowledge</i>												
* KL01	2.78	1.87	2.00	0.83	.43	1.00						
* KL02	4.14	2.22	5.00	-0.11	.61	.53	1.00					
# KL03	5.85	1.38	6.00	-1.35	.15	.16	.07	1.00				
* KL04	3.70	1.86	4.00	0.01	.78	.57	.73	.21	1.00			
* KL05R	4.32	1.85	4.00	0.02	.52	.34	.33	.06	.42	1.00		
# KL06R	5.20	1.70	6.00	0.97	.57	.46	.36	-.01	.46	.55	1.00	
* KL07	4.12	1.72	4.00	-0.27	.70	.50	.47	.19	.68	.49	.54	1.00

Inter-item correlations

	PR08	PR09	PR10	PR11	PR12	PR13	PR14	PR15	PR16	PR17R	PR18R	PR19R
	<i>Financial risk propensity</i>											
#												
+												
#												
~												
*												
~												
*												
*	1.00											
#	.35	1.00										
#	.20	.49	1.00									
~	.43	.33	.29	1.00								
+	.21	.44	.28	.27	1.00							
*	.29	.22	.27	.11	.04	1.00						
~	.33	.16	.03	.31	.11	.05	1.00					
*	.29	.36	.35	.32	.16	.49	.32	1.00				
~	.18	.06	.08	-.01	.20	.12	.28	.27	1.00			
+	.20	.53	.47	.32	.42	.21	.01	.37	-.04	1.00		
+	-.06	.24	.22	.05	.27	.08	-.05	.18	.05	.39	1.00	
+	.05	.25	.20	.02	.16	.08	-.07	.08	.03	.22	.18	1.00

(Continued)

Table 1. (Continued)

		Inter-item correlations												
	AT08	AT09	AT10	AT11	AT12	AT13R	AT14R	AT15R	AT16R	AT17R	AT18R	AT19R		
	Financial risk attitude													
~														
+														
#														
*														
*														
#														
#	1.00													
	.64	1.00												
	.65	.66	1.00											
#	.42	.60	.47	1.00										
~	.21	.10	.16	.10	1.00									
	.59	.71	.60	.44	.10	1.00								
*	.37	.45	.31	.33	.22	.54	1.00							
	.41	.45	.46	.35	-.10	.63	.38	1.00						
	.56	.59	.53	.46	.07	.74	.46	.47	1.00					
	.51	.58	.39	.38	.08	.63	.44	.51	.53	1.00				
*	.49	.52	.56	.43	.23	.61	.56	.50	.56	.44	1.00			
*	.47	.50	.47	.33	.13	.54	.52	.41	.53	.40	.71	1.00		

(Continued)

Table 1. (Continued)

		Inter-item correlations										
	CA08	CA09R	CA10	CA11	CA12	CA13	CA14	CA15				
	Financial risk capacity											
#												
*												
*												
*												
~	1.00											
*	.06	1.00										
	.19	.32	1.00									
	.21	.38	.47	1.00								
*	.66	.10	.37	.22	1.00							
#	.49	.17	.35	.20	.46	1.00						
#	.09	.05	.07	.38	.06	.15	1.00					
#	.42	.26	.31	.49	.27	.43	.43	1.00				
	Financial risk knowledge											
*												
*												
#												
*												
*												
#												

Note: SK = skewness; DP = discriminatory power; * Items included in the scales financial risk taking behavior, attitudes towards financial risks, financial capacity, and financial knowledge; # items which are not normally distributed (skewness < -0.95 or > 0.95 or Md < 2.00 or Md > 6.00); ~ items loading lower than .40; + items, which loaded on more than one factor; correlations above .19 are significant on a level of $p < .05$; items with concluding "r" are recoded; PR = financial risk propensity, AT = financial risk attitude, CA = financial risk capacity, KL = financial risk knowledge.

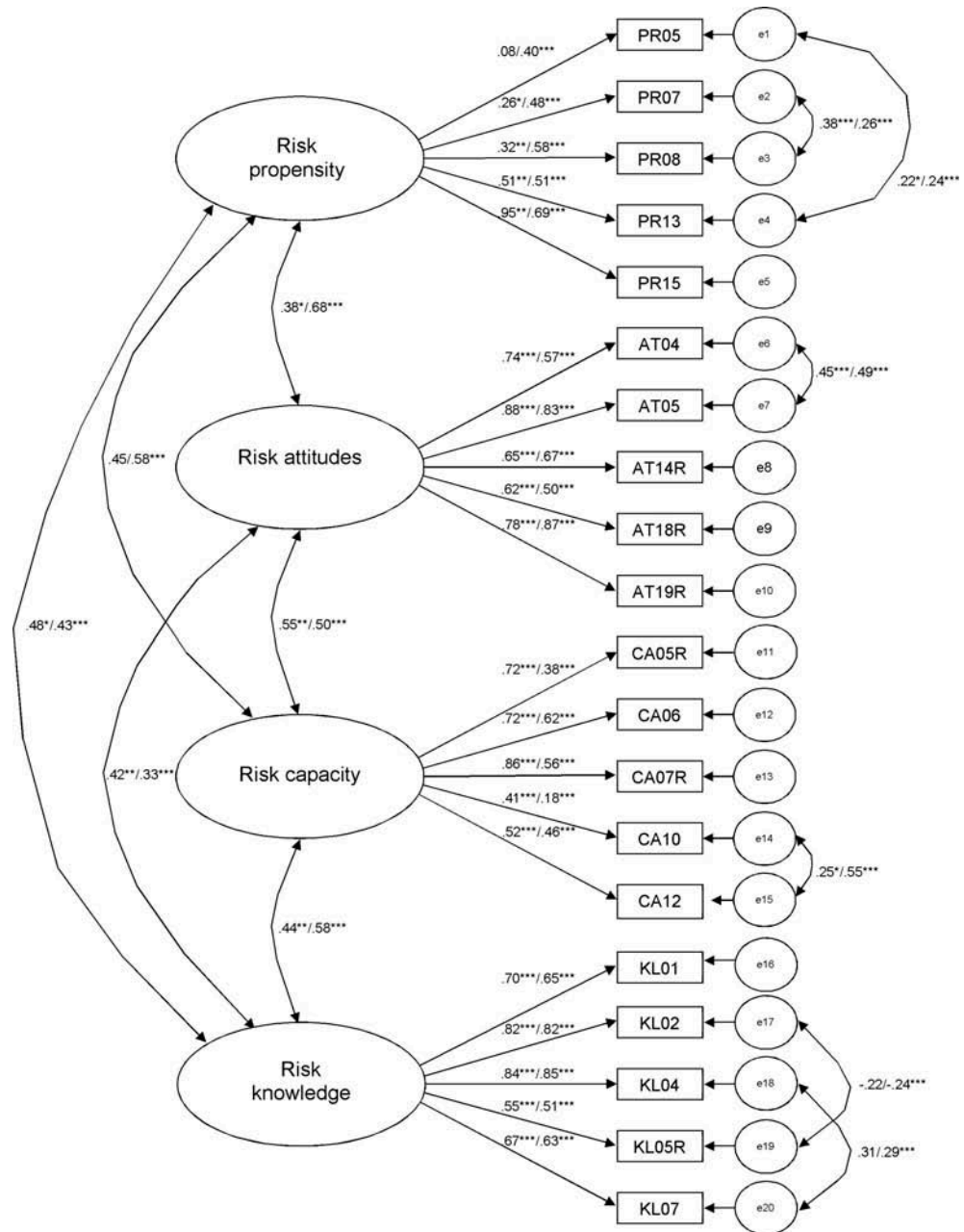
Table 2. Means, standard deviations, medians, skewness, Cronbach's Alpha, and scale-intercorrelations of the scales on financial risk propensity, financial risk attitude, financial risk capacity, and financial risk knowledge for the preliminary scale development and the representative study

	M	SD	Md	SK	Alpha	Propensity	Attitudes	Capacity	Knowledge
<i>Preliminary scale development</i>									
Financial risk propensity	4.55	1.22	4.60	-0.33	.61	1.00			
Financial risk attitude	2.70	1.19	2.40	0.53	.86	.37	1.00		
Financial risk capacity	3.80	1.41	3.60	0.24	.78	.25	.44	1.00	
Financial risk knowledge	3.68	.148	3.80	0.14	.83	.25	.38	.40	1.00
Please indicate how willing to take risks you perceive yourself.	3.00	1.37	3.00	0.43		.42	.68	.48	.46
<i>Representative study</i>									
Financial risk propensity	4.07	1.34	4.00	-0.03	.70	1.00			
Financial risk attitude	2.44	1.12	2.20	0.78	.82	.57	1.00		
Financial risk capacity	3.91	1.15	3.80	0.08	.59	.31	.34	1.00	
Financial risk knowledge	3.97	1.40	4.00	0.08	.82	.31	.36	.42	1.00
All in all, how risk averse or risk seeking do you evaluate yourself in financial matters?	3.04	1.43	3.00	0.29		.58	.72	.39	.44

Note: Correlations equal or higher .25 are significant on a level of $p < .01$

Figure 2. Factor structure of the four solution for the preliminary scale development and the representative study.

Note: ***p < .001, **p < .01, *p < .05; the numbers preceding the slash show the coefficients of the preliminary scale development and the numbers following the slash depict the coefficients of the representative study; items with a closing “R” are recoded.



Finally, fit indices of confirmatory factor analyses with a general factor solution and a four-factor solution were compared. Critical values which indicate a good fitting model are a non-significant χ^2 -test with $\chi^2/df < 2.00$, RmSEA < 0.06, CFI > 0.90, and AGFI > 0.90 (cf. Byrne, 2001; Kline, 2011). The general factor solution with all items loading on one factor did not indicate a satisfactory fit ($\chi^2(170) = 504.86$, $p < 0.01$, RmSEA = 0.14, CFI = 0.57, AGFI = 0.64). The four-factor solution with the items on propensity, attitudes, capacity, and knowledge loading on a single latent factor each, however, showed a better but not fully sufficient model fit ($\chi^2(164) = 259.09$, $p < 0.01$, RmSEA = 0.08, CFI = 0.88, AGFI = 0.75). Only when the four-factor solution allowed for the correlation of error terms of items with similar concepts the model fit was satisfactory (χ^2

(158) = 216.17, $p < 0.01$, RmSEA = 0.06, CFI = 0.93, AGFI = 0.78). Figure 2 shows the regression and correlation coefficients of the final model.

According to Cordell (2001) risk propensity, risk attitude, risk capacity, and risk knowledge are interrelated. Thus, a good construct validity of the scales goes along with positive inter-scale correlations. Furthermore, general risk tolerance is related to risk tolerance in more specific areas (Dohmen et al., 2011). Therefore, to test for construct validity, the correlations among the scales' propensity, attitude, capacity, and knowledge, as well as the general readiness to take risks were assessed (see Table 2). The scale on risk propensity and the scales on attitudes, capacity, and knowledge were positively related. In addition, attitudes toward financial risks and capacity and knowledge showed positive correlations. Furthermore, the scales on financial risk capacity and financial risk knowledge revealed a positive relation. As expected, the direct question on the readiness to take risks showed positive correlations with all constructed scales. Although the direct question on risk tolerance did not specifically ask about financial risk tolerance, participants were assumedly primed on financial risk tolerance.

The selection and first analyses of items yielded five useful items for each risk tolerance scale. In the next step of scale development, financial risk tolerance items were presented to a representative sample of investors.

6. Representative study

6.1. Method

6.1.1. Participants and procedure

An internationally operating market research institute was engaged for data collection. They sent an online questionnaire to a representative pool of Austrian residents interested in saving, stock trading, and investing. In total, data of 1,018 participants was obtained. However, some data had to be excluded due to odd response patterns ($N = 18$) and due to more than two missing responses ($N = 64$). Therefore, data of 936 participants (396 female; 540 male) was examined with an age range between 15 and 82 years ($M = 46.81$; $SD = 15.75$; $Md = 47.00$). As the highest educational level, 6.60% of the participants indicated to have completed compulsory education, 34.70% finished apprenticeship training, 30.40% indicated secondary education qualification, and 22.00% held a university degree. A non-specified other education was reported by 6.40% of the participants. The allocation of the personal monthly net income² was as follows: 16.8% earning less than 1,200 Euro; 14.50% between 1,201 and 1,650 Euro; 20.9% between 1,651 and 2,100 Euro, 12.20% between 2,101 and 2,700 Euro; 11.10% more than 2,701 Euro; 2.50% had no income of their own; 21.90% gave a blank response. One-fourth of the participants (25.70%) had no prior experience on the stock market, whereas, the majority of participants had already invested money at some point in time in the past. A small percentage (3.10%) did not respond to this question.

6.1.2. Material

The online questionnaire included the 4×5 questions on financial risk propensity, attitudes toward financial risks, financial risk capacity, and financial risk knowledge (answering formats: 1 = "very unlikely" to 7 = "very likely"; 1 = "do not agree at all" to 7 = "fully agree"; "I do not know"). In addition, a direct question on the general financial risk tolerance was included ("All in all, how risk averse or risk seeking do you evaluate yourself to be in financial matters?" answering format: 1 = "very risk averse" to 7 = "very risk seeking"). Finally, participants completed questions regarding their demographics and prior investment experiences.

6.2. Results

Table 2 shows the descriptive statistics and Cronbach's alphas of the scales propensity, attitude, capacity, and knowledge. To further examine the factor structure, confirmatory factor analyses with a general factor solution and a four-factor solution were conducted. Missing responses were

replaced by the respective scale means (propensity: 4.06; attitude: 2.44; capacity: 3.91; knowledge: 3.96). The general factor solution revealed unsatisfactory fit indices (χ^2 (165) = 1,625.91, $p < 0.01$, RmSEA = 0.10, CFI = 0.77, AGFI = 0.78) and the four-factor solution showed better but still unsatisfactory fits (χ^2 (164) = 1,305.59, $p < 0.01$, RmSEA = 0.09, CFI = 0.82, AGFI = 0.82). However, allowing for the same correlations between error terms, as in the assessment of the item pool, resulted in a satisfactory model fit (χ^2 (158) = 647.16, $p < 0.01$, RmSEA = 0.06, CFI = 0.92, AGFI = 0.91). Regression coefficients and correlations are shown in Figure 2.

To assess the scales' construct validity, the scale inter-correlations and the correlations between the scales and the direct question on financial risk tolerance were analyzed (see Table 2). Financial risk propensity was positively correlated with the attitude toward risk, capacity, and knowledge. Accordingly, positive relations were found between attitudes and capacity as well as between attitudes and knowledge. The relationship between capacity and knowledge was also positive. Finally, positive correlations were found between the direct question on general financial risk tolerance and the scales themselves. These results are a first indication of the existence of a good construct validity.

To examine the scales' criterion-related validity, MANOVAs and correlation analyses were conducted (cf. Table 3). Independent variables in the MANOVA included prior experience in the financial market (yes, no) and gender (female, male). Dependent variables included the scales on propensity, attitudes, capacity, and knowledge. Both multivariate analyses revealed significant results (experience: $F(4,902) = 58.76$, $p < .001$, $\eta^2 = .21$; gender: $F(4,931) = 32.55$, $p < .001$, $\eta^2 = .12$). As expected, participants with prior experiences on the financial market had a higher propensity to take risks ($F(1,905) = 27.57$, $p < .001$, $\eta^2 = .03$), more positive attitudes ($F(1,905) = 13.08$, $p < .001$, $\eta^2 = .01$), more capacity ($F(1,905) = 60.07$, $p < .001$, $\eta^2 = .06$), and indicated better knowledge ($F(1,905) = 219.76$, $p < .001$, $\eta^2 = .20$) than participants without experience. Male participants indicated higher financial risk propensity ($F(1,934) = 57.11$, $p < .001$, $\eta^2 = .06$), had more positive attitudes toward financial risks ($F(1,934) = 85.04$, $p < .001$, $\eta^2 = .08$), and reported a higher risk capacity ($F(1,934) = 47.26$, $p < .001$, $\eta^2 = .05$) as well as a higher risk knowledge ($F(1,934) = 70.64$, $p < .001$, $\eta^2 = .07$) than female participants.

The correlation analyses included age, monthly net income, and the four developed scales on risk tolerance. Results show that with increasing age the propensity to take risks and the attitudes toward taking financial risks decrease ($r = -.15$, $p < .001$ and $r = -.27$, $p < .001$, respectively). However, no relation between the participants' age and their capacity and knowledge was found ($r = -.05$, $p = .13$, $r = -.01$, $p = .68$, respectively). The monthly net income was positively related to financial risk propensity ($r = .16$, $p < .001$), attitudes toward financial risks ($r = .13$, $p < .001$), financial capacity ($r = .29$, $p < .001$), and financial knowledge ($r = .30$, $p < .001$). In sum, these results are a first indication of a good criterion-related validity.

7. Computation and interpretation of data obtained by the instrument

As individual scores cannot be interpreted easily, psychometric personality tests compare the results of single participants to norm values obtained from a representative sample. Through this comparison the actual value of the single participant can be interpreted accordingly. To acquire the norm values for the financial risk tolerance scales at hand, data obtained from a representative sample interested in saving, stock trading, and investing was used.³

To assess individuals' risk tolerance, data obtained by the questionnaire (see Appendix B for the items and scales) need to be processed using the following steps: (a) recoding the six questions which are formulated in the reversed direction (see Table 1); (b) calculating subscale means; (c) identifying the subscale means (i.e., raw scores) in the particular norm tables depicted in Appendix C and selecting the corresponding T-values.⁴ A general value of risk tolerance should incorporate that the subareas are differently important for financial risk tolerance. Therefore, further steps include: (d) multiplying subscale means with their respective weighting factor⁵ (propensity: 0.21;

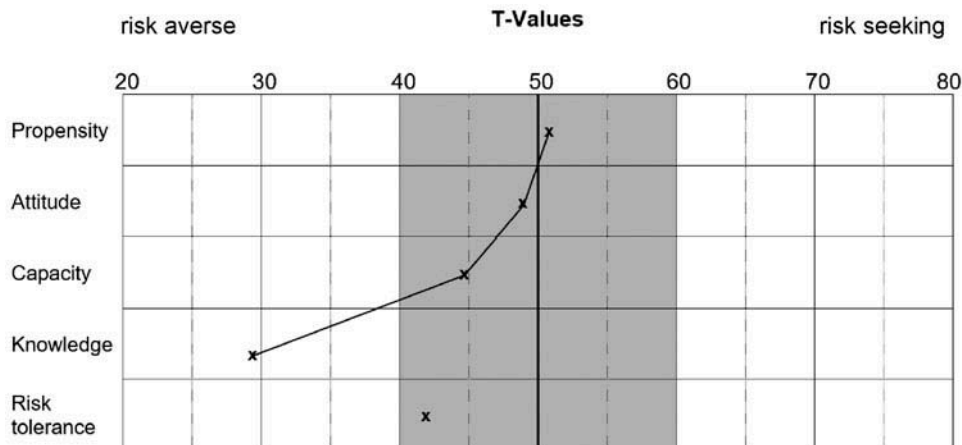
Table 3. Results of the criterion-related validity test of the scales financial risk propensity, financial risk attitude, financial risk capacity, and financial risk knowledge regarding prior experience, gender, age, and monthly net income

	N	Financial risk propensity		Financial risk attitude		Financial risk capacity		Financial risk knowledge	
		M	SD	M	SD	M	SD	M	SD
Prior experience on the financial market	yes	4.20 ^a	1.33	2.53 ^a	1.15	4.08 ^a	1.15	3.35 ^a	1.34
	no	3.67 ^b	1.29	2.22 ^b	1.02	3.43 ^b	1.01	2.93 ^b	1.05
Gender	female	3.69 ^a	1.26	2.07 ^a	0.89	3.62 ^a	1.05	3.53 ^a	1.35
	male	4.34 ^b	1.32	2.72 ^b	1.20	4.12 ^b	1.17	4.28 ^b	1.36
Age	N	r	r	r	r	r	r	r	r
	707	-.15***		-.27***		-.05		-.01	
Monthly net income	707	.16***		.13***		.29***		.30***	

Note: Differing superscripts in the column indicate significant differences for the attributes of the respective independent variable on a level of $p < .001$; *** indicates correlations significant on a level of $p < .001$.

Figure 3. Example profile sheet to assess single investors' financial risk tolerance.

Note: The gray area represents the mean 68 percent of the norm sample's answer.



attitude: 0.51; capacity: 0.09; knowledge: 0.15); (e) identifying the sum of the weighted values in the norm table and selecting the matching T-value; (g) transferring all T-values to a profile sheet as shown in Figure 3.

On basis of the profile sheet, financial counselors can now assess a single investor's risk tolerance compared to a representative sample of Austrian citizens interested in financial matters (i.e., norm group). If the marked T-value is located within the gray area, it signifies an average value compared to other Austrian citizens interested in saving, stock trading, and investing in this subcategory. If the mark is on the left side of the gray area, it implies a below average value. Accordingly, if the mark is on the right side of the gray area, it indicates an above average value. This information can be easily understood by advisors as well as clients and can be used by advisors to start a well-founded discussion about an individual's investment intentions.

8. Discussion

The aim of the present study was to develop a reliable and valid screening instrument for assessing investors' risk tolerance. The 20-item-instrument is suitable to assess risk propensity, risk attitude, risk capacity, and risk knowledge within a few minutes. Following a theoretical and practical approach for item construction overcomes the shortcomings of ad hoc measures. After further validation the instrument can be used in the daily advisory routine.

Questions were collected according to the theoretical definition of financial risk tolerance and the empirically derived factors of risk propensity, risk attitude, risk capacity, and risk knowledge. Furthermore, when (re-)formulating items, systematic decision biases based on psychology were taken into account and omitted in item formulations. In addition, to receive relevant questions for the counseling practice, all questions were discussed with investment advisors. A further discussion with present and future investors assisted in obtaining a set of comprehensible questions, as requested by Roszkowski et al. (2005). Finally, psychometric principles were applied for scale construction, revealing four scales which when proved gave a first indication of its reliability and validity. Thus, the presented instrument is both theoretically founded as well as eligible for practical use. However, further validation of the found scales is needed and incremental validity compared to other existing scales should be examined.

A word of caution is as follows: when used for counseling, the instrument should not be used to replace an informative and constructive discussion between the client and the financial advisor (Davey, 2012; LeBaron et al., 1989). Accordingly, the instrument at hand provides financial counselors with a first impression of a client's financial risk tolerance, which can function as the starting point of an informed dialog in which the client's needs and aspirations can also be identified.

Since not all factors are perceived as equally important (Cordell, 2001; Yook & Everett, 2003), risk attitude and risk capacity should have higher weights than risk propensity and risk knowledge. The instrument at hand takes this into account since it weighs the subscales differently before they are combined to obtain a general risk tolerance value. These calculations can easily be conducted either by manual calculation or via a computer program.

To check whether a client is more or less risk tolerant than others, the results of individuals can be compared with the results of a norm group of the population. However, for translated questionnaires and for the application in different countries, new norms are needed. Also, different norms for comparison should be computed for men and women and for different age groups separately because gender and age influence risk tolerance (Bonsang & Dohmen, 2015; Dohmen et al., 2011; Grable, 2000; Hallahan et al., 2003, 2004; Slovic, 1999; van Rooij et al., 2007; Wang & Hanna, 1997). Although, income and wealth also effect investors' risk tolerance (Cohn et al., 1975; Grable, 2000; Grable & Lytton, 1999; Hallahan et al., 2003, 2004) we do not recommend generating separate norm groups, as these are sensitive topics and thus obtaining valid data is difficult. Moreover, norm values need to be renewed after some years to assure that they are still valid. Although a person's risk tolerance is rather stable over years (Nosić & Weber, 2009; Roszkowski et al., 2009), after experiencing significant life events (e.g., marriage, childbirth, etc.), changes may occur (Davey, 2002). Hence, if financial advisors are counseling clients from whom they do not have much background information, the questionnaire could be re-administered after a period of time to take possible changes into account.

Objective as well as subjective measures of risk tolerance are needed to accurately assess financial risk tolerance (Marinelli et al., 2017). The presented scale can be combined with clients' objective data such as investors' real-life portfolios to further prove its criterion validity. This could countervail the problems of subjectivity and self-representation underlying all psychological assessments. Thus, future research on the instrument should include objective risk measures. It would be of great interest to compare actual investment behavior of a relevant sample of investors with the data obtained through the instrument. This would also serve as a further validation of the instrument.

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Correction

This article has been republished with minor changes. These changes do not impact the academic content of the article.

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Notes

1. Questions on risk propensity disregard clients' past behavior but rather use scenarios in which financial behavior should be shown. Through this special formulation we receive standardized and comparable measures of clients' behavior.
2. 1,200 Euro, 1,650 Euro, 2,100 Euro, and 2.700 Euro monthly net income are approximately equal to 20,750 Euro, 32,500 Euro, 44.300 Euro, and 62.000 Euro annual gross income, respectively.
3. Norm values originate from the representative study's data and are calculated through a non-linear (area) transformation of the whole sample's raw data.
4. T-values are linearly transformed norm values ($M = 50$, $SD = 10$). A T-value of 50 indicates that 50% of the population has a lower result and 50% has a higher result than the corresponding norm value. A T-value of 30 represents that 2% of the population has lower results and 98% has higher results and a T-value of 80 is interpreted to indicate that 98% of the population has lower results and 2% has higher results.
5. Weighting factors include the beta-weights of the respective subscale regressed on the direct question on general financial risk tolerance in the representative study. The factors indicate the explanatory value of each scale regarding financial risk tolerance and show that the subscale attitude should have the highest influence in the aggregated scale; however, propensity, capacity, and knowledge are also needed to be considered to develop

a complete understanding of an individual's financial risk tolerance.

6. Copies of no longer available online resources can be obtained from the authors.

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Appendix B Items used in the preliminary scale development

	ID	German	English
		<i>Finanzielles Risikoverhalten</i>	<i>Financial risk propensity</i>
	PR01	Stellen Sie sich vor, Sie könnten in eine von zwei Anlageformen 100,000 Euro investieren. Bei der ersten Anlageform würden Sie mit einer Wahrscheinlichkeit von 20 Prozent 200,000 Euro und mit einer Wahrscheinlichkeit von 80 Prozent 87,500 Euro erhalten. Bei der zweiten Anlageform würden Sie mit Sicherheit 110,000 Euro erhalten. Wie wahrscheinlich würden Sie in die erste Anlageform investieren?	Imagine you could invest 100,000 euros in one of the two types of investments. Investing in the first type would result in 200,000 euros with a chance of 20 percent and in 87,500 with a chance of 80 percent. Investing in the second type you would get 110,000 euros. How likely would you be to invest in the first type?
	PR02	Wie wahrscheinlich ist es, dass Sie 10 Prozent Ihres Vermögens sehr spekulativ, das heißt sehr riskant investieren?	How likely would you be to invest 10 percent of your wealth very speculative, that is to invest very risky?
	PR03	Stellen Sie sich vor, Sie könnten Geld in die Bohrung einer Goldmine investieren, bei der jedoch nur eine geringe Erfolgchance besteht. Wenn die Bohrung erfolgreich ist, erhalten Sie das 100fache Ihrer Investition zurück. Ist die Bohrung nicht erfolgreich, dann ist das investierte Geld verloren. Wie wahrscheinlich würden Sie in die Bohrung investieren?	Imagine you could invest money in drilling a gold mine which has only a very low chance of success. If the drilling is successful you receive your investment hundredfold. If the drilling is not successful the invested money is lost. How likely would you be to invest in the drilling?
	PR04	Stellen Sie sich vor, Sie könnten in eine von zwei Wertanlagen 10,000 Euro investieren. Sie wissen, dass die erste Anlage nach einem Jahr einen Wert zwischen 9,800 und 10,600 Euro haben wird. Bei der zweiten Wertanlage ist Ihnen bekannt, dass sie nach einem Jahr einen Wert zwischen 6,400 und 14,200 Euro haben wird. Wie wahrscheinlich würden Sie in die zweite Wertanlage investieren?	Imagine you could invest 10,000 euros in one of two types of investments. You know that the first type will be worth between 9,800 and 10,600 euros after one year. For the second type, you know that its value will be between 6,400 and 14,200 euros. How likely would you be to invest in the second type?
	* PR05	Stellen Sie sich vor, Sie sind in einer Quizshow und können entweder 50 Euro erhalten oder eine Wette eingehen. Bei der Wette wird eine Münze geworfen und wenn Sie die richtige Seite vorhersagen, erhalten Sie 100 Euro, wenn Sie die falsche Seite vorhersagen, dann erhalten Sie nichts. Wie wahrscheinlich würden Sie die Wette eingehen?	Imagine you attend a quiz show and get offered either 50 euros or a gamble. If you choose the gamble, a coin will be tossed. If you predict the side correctly, you will receive 100 euros, if you predict the side incorrectly, you will not receive anything. How likely would you be to accept the bet?
	PR06	Stellen Sie sich vor, Sie wollen eine Hypothek aufnehmen und Ihnen werden zwei Möglichkeiten vorgeschlagen, wie Ihr Zinssatz berechnet werden kann: Entweder Ihr Zinssatz wird regelmäßig angepasst, so dass Ihre Zinsen steigen und fallen können oder Ihr Zinssatz ist höher und unterliegt keinen Schwankungen. Wie wahrscheinlich würden Sie sich für Schwankungen des Zinssatzes entscheiden?	Imagine you want to borrow a mortgage and are provided with two options on how your interest rate could be calculated: Either your interest rate will be adjusted and can increase and decrease or your interest rate is higher without fluctuation. How likely would you be to decide for the fluctuating interest rate?
	* PR07	Stellen Sie sich vor, Sie könnten in ein renommiertes Unternehmen investieren, dessen Zukunft relativ sicher ist. Wie wahrscheinlich würden Sie in dieses Unternehmen investieren?	Imagine you could invest in a well-respected company whose future is relatively safe. How likely would you be to invest in this company?

(Continued)

	ID	German	English
*	PR08	Stellen Sie sich vor, Sie arbeiten in einem Unternehmen, das in drei Jahren an die Börse gehen wird. Ihnen werden jetzt Aktien angeboten, welche Sie für die nächsten drei Jahre nicht verkaufen können und keine Dividende erhalten. Es besteht jedoch die Möglichkeit, dass die Aktien nach dem Börsengang 10-mal mehr wert sind als jetzt. Wie wahrscheinlich würden Sie die Aktien kaufen?	Imagine you are working in a company that will go public in three years. You are now offered stocks which you cannot sell for the next three years and do not receive a dividend until then. There is, however, the possibility that the stocks are worth ten times more than what they are now after the initial public offering. How likely would you be to buy the stocks?
	PR09	Wenn Sie die Möglichkeit hätten, sich zwischen verschiedenen Zusammensetzungen von Wertanlagen zu entscheiden, welche Zusammensetzung würden Sie wählen? ^o	If you would have the possibility to decide between different compositions of your investments, which composition would you choose? ^o
	PR10	Wie wahrscheinlich ist es, dass Sie nach einem beträchtlichen Investitionsverlust weiter in risikoreiche Wertanlagen investieren?	How likely would you be to invest again in risky assets after a considerable loss?
	PR11	Stellen Sie sich vor, Sie haben vor einigen Jahren Aktien eines Unternehmens gekauft, welche Sie inzwischen mit Verlust wieder verkauft haben. Das Unternehmen hat sich nun unter einer neuen Unternehmensführung wieder saniert und Ihr Finanzberater erwartet, dass es in Zukunft überdurchschnittliche Gewinne erwirtschaften wird. Wie wahrscheinlich würden Sie wieder in dieses Unternehmen investieren?	Imagine some years ago you bought stocks of a company which you have already sold at a loss. With new management this company has now been restored and your financial counselor expects that it will achieve above-average gains. How likely would you be to reinvest in this company?
	PR12	Stellen Sie sich vor, Sie haben 10,000 Euro in eine Wertanlage investiert. Diese Anlage hatte zuerst einen guten Wertzuwachs, jedoch ist kürzlich ihr Wert um 10 Prozent gefallen, obwohl sich keine größeren Änderungen an der Börse abzeichnen. Sie könnten nun die Gelegenheit wahrnehmen und günstig weiter in diese Wertanlage investieren. Wie wahrscheinlich würden Sie weiter investieren, obwohl der Wert der Anlage gerade gesunken ist?	Imagine you have invested 10,000 euros in an asset. At first this asset had a good increase in value; however, recently its value dropped by 10 percent, although no major changes at the stock exchange are apparent. You could avail yourself of the opportunity of investing further in this asset cheaply. How likely are you to be investing in it further, although the value of the asset just dropped?
*	PR13	Stellen Sie sich vor, Sie haben gerade mit einem Bekannten gewettet und 20 Euro verloren. Nun bietet Ihnen der Bekannte eine weitere Wette an. Wenn Sie den Ausgang eines Münzwurfes richtig vorhersagen, dann erhalten Sie 60 Euro, sagen Sie jedoch die Seite der Münze falsch voraus, dann verlieren Sie weitere 10 Euro. Wie wahrscheinlich ist es, dass Sie die Wette annehmen?	Imagine you just bet with a friend and lost 20 euros. Now the friend offers you another gamble. If you predict the output of a coin toss correctly, you will receive 60 euros, but if you foretell the wrong side of the coin, you will lose another 10 euros. How likely would you be to accept the bet?
	PR14	Stellen Sie sich vor, Sie haben investiert und erhalten nun einen Gewinn. Wie wahrscheinlich würden Sie den Gewinn wieder investieren?	Imagine you have invested in something and are now ready to receive a profit. How likely would you be to invest the profit again?
*	PR15	Stellen Sie sich vor, Sie haben 10,000 Euro gewonnen und überlegen es zu investieren. Es besteht eine 50 zu 50 Chance, dass Sie nach einiger Zeit 50,000 Euro erhalten beziehungsweise, dass Sie nur noch 5,000 Euro erhalten. Wie wahrscheinlich ist es, dass Sie diese Investition tätigen?	Imagine you won 10,000 euros and consider investing this money. There is a fifty-fifty chance that after a while you receive 50,000 euros or that you only get 5,000 euros. How likely would you be to make this investment?

(Continued)

(Continued)			
	ID	German	English
	PR16	Stellen Sie sich vor, Sie haben in einer Quizshow 1,000 Euro gewonnen. Jetzt können Sie entweder Ihren Preis behalten oder folgende Wette mit der Moderatorin eingehen: Ziehen Sie aus einer Urne mit 100 Bällen einen der 5 roten Bälle, dann erhalten Sie 100,000 Euro, ziehen Sie jedoch einen Ball mit einer anderen Farbe, dann verlieren Sie die bereits erhaltenen 1,000 Euro. Wie wahrscheinlich würden Sie die Wette eingehen?	Imagine you won 1,000 euros at a quiz show. Now, you can either keep the money or bet as following with the moderator: if you draw from an urn of 100 balls, and pick one of the 5 red balls, you get 100,000 euros; however, if you draw a ball with a different color you lose the 1,000 euros already received. How likely would you be to make this bet?
	PR17R	Wie wahrscheinlich würden Sie <u>ausschließlich</u> in sichere Wertanlagen investieren? (R)	How likely would you be to <u>solely</u> invest in safe investments? (R)
	PR18R	Stellen Sie sich vor, Sie überlegen ein Viertel Ihres frei verfügbaren Einkommens zu investieren. Derzeit befindet sich das Geld auf einem Sparbuch und Sie erhalten 3 Prozent Zinsen. Bei der Investition haben Sie eine Gewinnchance von 6 Prozent, jedoch ist die Investition nicht gegen Verluste geschützt. Wie wahrscheinlich würden Sie Ihr Geld weiter auf Ihrem Sparbuch lassen? (R)	Imagine you consider investing a quarter of your disposable income. Currently the money is on a savings account and you receive an interest rate of 3 percent. If you invest, you have a chance of winning 6 percent; however, the investment is not secured against losses. How likely would you be to leave the money in your savings account? (R)
	PR19R	Stellen Sie sich vor, Sie sparen für Ihre Pension und könnten ihr Geld in zwei Investitionsformen anlegen. Bei der ersten Investitionsform bleibt der Wert Ihres Geldes erhalten, aber es bestehen keine großen Gewinnchancen. Die zweite Investitionsform bietet die Möglichkeit hoher Gewinne, jedoch kann der Wert der Anlage auch sinken. Wie wahrscheinlich würden Sie in die erste Anlageform investieren? (R)	Imagine you save for your retirement and you can invest in two types of investments. The first type retains the value of your money; however, there are no high chances of gains. The second type offers the opportunity of high gains; however, the value of the investment can also decrease. How likely are you to invest in the first type of investment? (R)
		<i>Einstellung zu finanziellem Risiko</i>	Financial risk attitude
	AT01	Ich bin bereit, Verluste in Kauf zu nehmen, um auf lange Sicht Gewinne zu erzielen.	I am ready to accept losses to achieve gains in the long run.
	AT02	Ich bin bereit, ein wenig Sicherheit aufzugeben, um höhere Gewinne erzielen zu können.	I am ready to reduce a little security to achieve higher gains.
	AT03R	Wenn ich an Risiko denke, dann denke ich auch an mögliche Verluste. (R)	When I am thinking about risk, then I also think about possible losses. (R)
	* AT04	Hohe Gewinne sind für mich reizvoll, obwohl das heißt, dass ich auch hohes Risiko eingehen muss.	High profits are attractive to me, although this means that I must also take a high risk.
	* AT05	Ich gehe gerne das Risiko ein, Geld zu verlieren, wenn die Chance besteht, Geld zu gewinnen.	I like to take the risk of losing money when there is the chance to win money.
	AT06	Ich bin bereit, mehr als ein Viertel meiner Finanzanlagen riskant zu investieren.	I am ready to invest more than a quarter of my financial assets in a risky investment.
	AT07	In der Hoffnung hohe Gewinne einzufahren, bin ich bereit, hohe finanzielle Risiken zu tragen.	Hoping to achieve high gains, I am ready to bear high financial risks.
	AT08	Um die Möglichkeit zu haben, hohe Gewinne einzufahren, würde ich Investitionen tätigen, deren Wert in den letzten Monaten gesunken ist und darauf spekulieren, dass ihr Wert wieder steigt.	To get the chance to achieve high gains I would invest in products which lost in value over the past months and speculate that their value will increase in the future.

(Continued)

	ID	German	English
	AT09	Um meinen Gewinn zu erhöhen, bin ich bereit, finanzielle Risiken auf mich zu nehmen.	To increase my gains, I am ready to accept financial risks.
	AT10	Ich bin bereit, Wertschwankungen bei meinen Investitionen in Kauf zu nehmen, um höhere Gewinne, als bei stabileren Investitionen, zu erzielen.	I am ready to accept value fluctuations in my investments to achieve higher gains than with more stable investments.
	AT11	Um bei einer Investition mein Geld zu verdreifachen, würde ich auch das Risiko in Kauf nehmen, die Hälfte des investierten Geldes zu verlieren.	To triple my money with an investment, I would take the risk of losing half of the invested money.
	AT12	Wenn ich investiere, dann denke ich vor allem an die möglichen Gewinne.	When I am investing, I mainly think about the possible gains.
	AT13R	Ich fühle mich wohler, wenn mein Geld auf meinem Sparbuch ist, als wenn ich es auf der Börse investiere. (R)	I feel more comfortable putting my money on a savings account, than investing it on the stock exchange. (R)
*	AT14R	Ich möchte die Gewissheit haben, dass meine Wertanlagen ihren Wert behalten. (R)	I would like to have the certainty that my investments retain their value. (R)
	AT15R	Mein primäres Ziel bei Wertanlagen ist es, dass der Wert der Anlage ständig zunimmt, auch wenn dies auf lange Sicht bedeutet, dass nur niedrige Gewinne erzielt werden können. (R)	My primary aim with investments is that they constantly increase their value, although in the long run this means that only low gains can be realized. (R)
	AT16R	Ich bevorzuge es meine Ersparnisse auf ein Sparbuch zu legen, weil ich dann genau weiß, wie viel ich in Zukunft zur Verfügung haben werde. (R)	I prefer to put my savings in a savings account, because in this case I know how much money I have at my disposal in the future. (R)
	AT17R	Ich finde es zu riskant, in Wertpapiere ohne gesicherte Erträge zu investieren. (R)	I think it is too risky to invest in stocks without secured earnings. (R)
*	AT18R	Stabilität und Kontinuität meiner Wertanlagen ist mir wichtiger als die Chance auf schnelle Gewinne. (R)	Stability and continuity of my investments are more important to me than the chance of quick profits. (R)
*	AT19R	Wenn ich investiere, ist mir die Sicherheit meiner Anlage wichtiger als hohe Gewinne. (R)	When I invest, the security of my investment is more important to me than high profits. (R)
		<i>Finanzielle Belastbarkeit durch Risiko</i>	<i>Financial risk capacity</i>
	CA01	Wenn finanziell etwas schief läuft, dann kann ich mich sehr leicht darauf einstellen.	If something goes wrong financially, I can adopt easily.
	CA02	Ich könnte ein Viertel meiner flüssigen Geldmittel in riskante Anlagen investieren, ohne mich dabei unwohl zu fühlen.	I could invest a quarter of my liquid funds in risky investments without feeling queasy.
	CA03	Von Zeit zu Zeit können meine Wertanlagen auch im Wert sinken, ohne dass ich nervös werde.	From time to time, the value of my investments can decrease without me getting nervous.
	CA04	Auch wenn meine Aktien nur mehr 80 Prozent ihres Kaufwertes wert sind, fühle ich mich dabei noch nicht unwohl.	Even if my stocks are only worth 80 percent of their purchase price, I do not feel queasy.
*	CA05R	Die Gefahr, einen Teil meiner Ersparnisse an der Börse zu verlieren, belastet mich stark. (R)	The risk of losing a part of my savings on the stock market gives me a great deal of stress. (R)
*	CA06	Auch bei stark fallenden Kursen meiner Investitionen bleibe ich ruhig.	Even with strongly falling stock prices of my investments, I remain calm.

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(Continued)			
	ID	German	English
*	CA07R	Wenn meine Investitionen an Wert verlieren, dann fühle ich mich schnell unwohl. (R)	If my investments lose value, I am quick to feel uncomfortable. (R)
	CA08	Wenn eine meiner Investitionen stark an Wert verliert, dann kann ich mit dem Verkauf warten und so den Verlust aussitzen.	If one of my investments loses strongly in value, I can hold it off selling and thus escape the loss.
	CA09R	Ich habe viele finanzielle Verpflichtungen, die mein monatliches Einkommen schmälern. (R)	I have a lot of financial obligations, which reduce my monthly income. (R)
*	CA10	Ich kann lange von meiner „eisernen Reserve“ leben, ohne auf meine Wertanlagen zurückgreifen zu müssen.	I can live for a long time off my assets as the last resort without having to access any of my investments.
	CA11	Nach Abzug aller Fixkosten, reicht mein monatliches Einkommen aus, um einen höheren Geldbetrag zu investieren.	After deducting all fixed costs, my monthly income suffices to invest a higher amount of money.
*	CA12	Ich kann mehrere Jahre darauf warten, dass sich meine Wertanlagen von den Auswirkungen einer schlechten Wirtschaftslage erholen.	I can wait several years for my investments to recover from the effects of a poor economic situation.
	CA13	Ich benötige keine regelmäßigen Ausschüttungen aus meinen Wertanlagen, um „über die Runden“ zu kommen.	I do not need periodic dividend payouts to make ends meet.
	CA14	Ich beziehe ein regelmäßiges monatliches Einkommen, das meinen Lebensstandard sichert.	I earn a regular monthly income which ensures my standard of living.
	CA15	Ich habe genug Geld, um meine finanziellen Verpflichtungen zu erfüllen.	I have enough money to fulfill my financial obligations.
		<i>Finanzielles Risikowissen</i>	<i>Financial risk knowledge</i>
*	KL01	Mir macht es Spaß, mich am Kapitalmarkt zu informieren und die erhaltenen Informationen in meinen eigenen Geldanlagen umzusetzen.	It is a delight for me to keep myself informed about the capital market and to apply the information obtained to my financial investments.
*	KL02	Ich habe schon Erfahrungen am Finanzmarkt gesammelt.	I have already gained experience on the financial market.
	KL03	Bevor ich investiere, versuche ich Informationen über verschiedene Anlagealternativen einzuholen.	Before investing, I try to gather information about different investment alternatives.
*	KL04	Ich kenne mich mit den meisten Finanzprodukten (z.B.: Anleihen, Aktien, Investmentfonds, etc.) aus.	I am familiar with most financial products (e.g., bonds, stocks, investment funds, etc.).
*	KL05R	Wie Finanzgeschäfte abgewickelt werden, ist schwer zu verstehen. (R)	How financial transactions are processed is difficult to understand. (R)
	KL06R	Ich benötige Beratung, um meine Anlagegeschäfte abzuwickeln. (R)	I need counseling to transact my investments. (R)
*	KL07	Ich weiß gut über Geldangelegenheiten Bescheid.	I am well aware regarding money matters.

*Note: * Items included in the scales financial risk propensity, financial risk attitude, financial risk capacity, and financial risk knowledge; items with concluding "R" are recoded; PR = financial risk propensity, AT = financial risk attitude, CA = financial risk capacity, KL = financial risk knowledge; *The answering format for this item was seven different investment allocations from only low-risk investments to only high-risk investments.*

Appendix C: Norm tables for financial risk propensity, financial risk attitude, financial risk capacity, financial risk knowledge, financial risk tolerance

Raw score financial risk propensity	T-Value	Raw score financial risk attitude	T-Value	Raw score financial risk capacity	T-Value	Raw score financial risk knowledge	T-Value	Raw score financial risk tolerance	T-Value
1.00	27.09	1.00	37.14	1.00	24.70	1.00	28.79	1.00	27.72
1.10	27.84	1.10	38.04	1.10	25.57	1.10	29.50	1.10	28.80
1.20	28.58	1.20	38.93	1.20	26.43	1.20	30.21	1.20	29.89
1.30	29.33	1.30	39.82	1.30	27.30	1.30	30.93	1.30	30.98
1.40	30.07	1.40	40.71	1.40	28.17	1.40	31.64	1.40	32.07
1.50	30.82	1.50	41.61	1.50	29.04	1.50	32.36	1.50	33.15
1.60	31.57	1.60	42.50	1.60	29.91	1.60	33.07	1.60	34.24
1.70	32.31	1.70	43.39	1.70	30.78	1.70	33.79	1.70	35.33
1.80	33.06	1.80	44.29	1.80	31.65	1.80	34.50	1.80	36.41
1.90	33.81	1.90	45.18	1.90	32.52	1.90	35.21	1.90	37.50
2.00	34.55	2.00	46.07	2.00	33.39	2.00	35.93	2.00	38.59
2.10	35.30	2.10	46.96	2.10	34.26	2.10	36.64	2.10	39.67
2.20	36.04	2.20	47.86	2.20	35.13	2.20	37.36	2.20	40.76
2.30	36.79	2.30	48.75	2.30	36.00	2.30	38.07	2.30	41.85
2.40	37.54	2.40	49.64	2.40	36.87	2.40	38.79	2.40	42.93
2.50	38.28	2.50	50.54	2.50	37.74	2.50	39.50	2.50	44.02
2.60	39.03	2.60	51.43	2.60	38.61	2.60	40.21	2.60	45.11
2.70	39.78	2.70	52.32	2.70	39.48	2.70	40.93	2.70	46.20

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Raw score financial risk propensity	T-Value	Raw score financial risk attitude	T-Value	Raw score financial risk capacity	T-Value	Raw score financial risk knowledge	T-Value	Raw score financial risk tolerance	T-Value
2.80	40.52	2.80	53.21	2.80	40.35	2.80	41.64	2.80	47.28
2.90	41.27	2.90	54.11	2.90	41.22	2.90	42.36	2.90	48.37
3.00	42.01	3.00	55.00	3.00	42.09	3.00	43.07	3.00	49.46
3.10	42.76	3.10	55.89	3.10	42.96	3.10	43.79	3.10	50.54
3.20	43.51	3.20	56.79	3.20	43.83	3.20	44.50	3.20	51.63
3.30	44.25	3.30	57.68	3.30	44.70	3.30	45.21	3.30	52.72
3.40	45.00	3.40	58.57	3.40	45.57	3.40	45.93	3.40	53.80
3.50	45.75	3.50	59.46	3.50	46.43	3.50	46.64	3.50	54.89
3.60	46.49	3.60	60.36	3.60	47.30	3.60	47.36	3.60	55.98
3.70	47.24	3.70	61.25	3.70	48.17	3.70	48.07	3.70	57.07
3.80	47.99	3.80	62.14	3.80	49.04	3.80	48.79	3.80	58.15
3.90	48.73	3.90	63.04	3.90	49.91	3.90	49.50	3.90	59.24
4.00	49.48	4.00	63.93	4.00	50.78	4.00	50.21	4.00	60.33
4.10	50.22	4.10	64.82	4.10	51.65	4.10	50.93	4.10	61.41
4.20	50.97	4.20	65.71	4.20	52.52	4.20	51.64	4.20	62.50
4.30	51.72	4.30	66.61	4.30	53.39	4.30	52.36	4.30	63.59
4.40	52.46	4.40	67.50	4.40	54.26	4.40	53.07	4.40	64.67
4.50	53.21	4.50	68.39	4.50	55.13	4.50	53.79	4.50	65.76
4.60	53.96	4.60	69.29	4.60	56.00	4.60	54.50	4.60	66.85
4.70	54.70	4.70	70.18	4.70	56.87	4.70	55.21	4.70	67.93

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Raw score financial risk propensity	T-Value	Raw score financial risk attitude	T-Value	Raw score financial risk capacity	T-Value	Raw score financial risk knowledge	T-Value	Raw score financial risk tolerance	T-Value
4.80	55.45	4.80	71.07	4.80	57.74	4.80	55.93	4.80	69.02
4.90	56.19	4.90	71.96	4.90	58.61	4.90	56.64	4.90	70.11
5.00	56.94	5.00	72.86	5.00	59.48	5.00	57.36	5.00	71.20
5.10	57.69	5.10	73.75	5.10	60.35	5.10	58.07	5.10	72.28
5.20	58.43	5.20	74.64	5.20	61.22	5.20	58.79	5.20	73.37
5.30	59.18	5.30	75.54	5.30	62.09	5.30	59.50	5.30	74.46
5.40	59.93	5.40	76.43	5.40	62.96	5.40	60.21	5.40	75.54
5.50	60.67	5.50	77.32	5.50	63.83	5.50	60.93	5.50	76.63
5.60	61.42	5.60	78.21	5.60	64.70	5.60	61.64	5.60	77.72
5.70	62.16	5.70	79.11	5.70	65.57	5.70	62.36	5.70	78.80
5.80	62.91	5.80	80.00	5.80	66.43	5.80	63.07	5.80	79.89
5.90	63.66	5.90	80.89	5.90	67.30	5.90	63.79	5.90	80.98
6.00	64.40	6.00	81.79	6.00	68.17	6.00	64.50	6.00	82.07
6.10	65.15	6.10	82.68	6.10	69.04	6.10	65.21	6.10	83.15
6.20	65.90	6.20	83.57	6.20	69.91	6.20	65.93	6.20	84.24
6.30	66.64	6.30	84.46	6.30	70.78	6.30	66.64	6.30	85.33
6.40	67.39	6.40	85.36	6.40	71.65	6.40	67.36	6.40	86.41
6.50	68.13	6.50	86.25	6.50	72.52	6.50	68.07	6.50	87.50
6.60	68.88	6.60	87.14	6.60	73.39	6.60	68.79	6.60	88.59
6.70	69.63	6.70	88.04	6.70	74.26	6.70	69.50	6.70	89.67

(Continued)

(Continued)

Raw score financial risk propensity	T-Value	Raw score financial risk attitude	T-Value	Raw score financial risk capacity	T-Value	Raw score financial risk knowledge	T-Value	Raw score financial risk tolerance	T-Value
6.80	70.37	6.80	88.93	6.80	75.13	6.80	70.21	6.80	90.76
6.90	71.12	6.90	89.82	6.90	76.00	6.90	70.93	6.90	91.85
7.00	71.87	7.00	90.71	7.00	76.87	7.00	71.64	7.00	92.93



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