Measuring Risk Tolerance in Finance: Does the Decision Frame Matter?

Serkan ŞAHİN

Dr., Kahramanmaraş Sütçü İmam Üniversitesi

İİBF, İşletme Bölümü

Özlem YILMAZ

Prof. Dr., Orta Doğu Teknik Üniversitesi

İİBF, İşletme Bölümü

Abstract: Risk taking behavior has great influence on the decision making process of individuals. In this respect, the methodology used in assessing individuals' risk tolerance becomes an important issue. However, there is lack of unique and commonly used risk tolerance measure in literature. There are mainly two different approaches in measuring risk tolerance in literature; lottery versus financial risk assessment technique (FRT). The purpose of this study is to investigate whether measurement techniques differ with different decision frames (choosing lotteries as gambling decision frame and choosing portfolio etc. as investment decision). The results show that these two different risk assessment instruments differ when measured through using lottery versus investment questions (individuals tend to be more risk tolerant when they make investment decisions). However, two different financial risk assessment instruments fall into the same line.

Keywords: Risk Tolerance, Risk Measurement and Risk Attitudes.

Finansal Risk Kabullenme Düzeylerinin Ölçümü: Karar Süreçlerinin Etkisi?

Öz: Bireylerin risk kabullenme düzeylerinin karar verme süreçleri üzerinde oldukça etkili olduğu kabul edilmektedir. Bu bağlamda bireylerin risk kabullanme düzeylerinin belirlenmesi önemli olduğu düşünülmektedir. Ancak literature bakıldığında ortak bir risk ölçümünün var olmadığı görülmektedir. Mevcut ölçüm tekniklerinin ise iki ana kategoride gruplandırılabileceği görülmektedir. Bunlar finansal risk ölçüm ve şansa dayalı ölçümleme teknikleridir. Bu çalışmanın amacı bu iki farklı ölçümleme tekniğinin aynı sonucu sağlayıp sağlamadığının araştırılmasıdır. Elde edilen bulgular, risk kabullenme düzeylerinin bu iki farklı ölçümleme tekniğinde farklı sonuçlar verdiğini ortaya koymaktadır (Finansal risk ölçümlerine göre yapılan analizlerde bireylerin risk

kabullenme düzeylerinin daha yüksek ölçüldüğü sonucuna ulaşılmıştır.) Ancak farklı iki finansal risk ölçümle anketinin birbirinden farklı sonuçlar vermediği sonucuna ulaşılmıştır.

Anahtar Kelimeler: Risk Kabullenme Düzeyi, Risk Düzeyinin Ölçümü ve Riske Bakış Açısı.

INTRODUCTION

It is shown in literature that decision making process is affected by risk tolerance (Grable and Lytton, 1998). It is also shown that risk tolerance is domain specific. In particular, individuals might be both risk seeker and risk averse in different domain (MacCrimon and Wehrung, 1990; Schomaker, 1990). It is also argued that domain difference is not only context specific but also measurement specific. In particular it is argued that different measurements may yield different results (Pennings and Smidts, 2000). It is well known in risk measurement literature that there is need for a common risk measurement scale. It is highly crucial to determine how individuals differ in terms of their risk taking behavior. Both investment advisors and financial intermediaries are interested in risk tolerance of individuals (Weber et al., 2002).

This paper considers only the financial decision context and measurement issues together. For financial decision making, all factors except risk tolerance can be objectively determined. However, how to measure risk tolerance is not clear in literature (Grable and Lytton, 1999: 164). The earliest and pioneering method in explaining the risk attitude difference is related to the functional form of the risk. In other words risk is accepted to be related to the utility function (Pratt, 1964; Arrow, 1971). However, these models are not successful in explaining the risk tolerance of individuals (Eisenhauer, 2003). In this regard, different approaches to measure risk tolerance have been developed in recent years in literature. Risk attitude has been mostly measured using two different approaches namely lotteries and investment scenarios. In lottery assessment approach, risk attitude is measured using gambling scenarios (Wang and Hanna, 2007; Hallahan et al., 2004).

Many of the studies using this approach apply either hypothetical questions related to lottery or experimental gambling scenarios. The alternative approach in measuring risk attitude, financial risk attitude/financial risk tolerance approach, is offered by Holt and Laury (2002). In this approach, risk attitude is measured using financial investment scenarios. Conceptually, these two approaches should yield in same results. However we think that these two measures may yield different results when applied to same population. The purpose of this paper is to explore whether there is a difference between the risk

tolerance levels of individuals when they are measured in two different decision frames. More specifically, does an individual risk tolerance level change when he/she makes a gambling and investment decision? The remainder of this article proceeds as follows. Section 2 reviews literature about risk attitude/tolerance. Section 3 explains the data and sampling and describes the methodology. Section 4 presents the results of the analysis. Finally, section 5 concludes.

LITERATURE REVIEW

Kahneman and Tversky (1979: 266) argued that utility theory cannot fully identify the risk taking behaviors of individuals since any amount of any probable gain or loss and uncertainty contribute to the behavior of individuals. In this respect, many psychological measures arise in literature. It is possible to identify these measures into two main groups, gambling and investment scenarios assessment instruments. Most of the gambling scenarios use BDM procedure developed by Becker et al. (1963). The alternative approach in measuring risk tolerance, financial risk tolerance approach is developed by Holt and Laury (2002). In this approach, risk tolerance is measured using financial investment scenarios.

Financial risk tolerance (FRT hereafter) is the individuals' risk attitude. It is defined as the level of risk that the individual is ready to take (Brooks, 2008; Grable, 2000). Also, it can be considered as the opposite of risk aversion. Hence, the more the risk averse a person, the less risk tolerant he/she is. Assessing the risk tolerance accurately is crucial not only for investors or managers but also for researchers that are interested in exploring the factors that affect financial decision making. There are many studies examining the relation between risk tolerance and demographic, socio-economic and psychological factors. Indeed, these analyses form the common point of these two approaches. It is seen in literature that gambling and investment scenarios instruments most of the time yield similar results. Studies using gambling and FRT approaches generally showed that women are more risk averse (Donkers et al., 2001; Dohmen et al., 2005; Daghofer, 2007). Studies using FRT instruments also found the same result though they are using different instruments (Yao and Hanna, 2005; Powell and Ansic, 1997). However, some studies could not find any relation between gender and level of risk tolerance (Keller and Siegrist, 2006; Harrison et al., 2007).

Moreover, studies using gambling instruments (Donkers et al, 2001; Dohmen et al., 2005; Harrison et al., 2007; Booij and Praag, 2009) and FRT instruments (Grable, 2000; Hallahan et al., 2004) both found that there is negative relation between age and level of risk tolerance. It is also found that

there is a positive relation between level of risk tolerance and level of education using gambling scenarios. However contradictory results are also found by Daghofer (2007). In this manner, it seems that using different methodologies in assessing risk attitudes some of them are able to find the same relationships between level of risk tolerance and demographic, socio-economics and psychological factors whereas some of them cannot. Intuitively, there might be two reasons for these differences. First, some of the previous studies showed that cultural factors may have an effect on risk taking behaviors (McDaniels and Gregory, 1991). According to cultural theory, fear is a significant cultural factor affecting the risk taking behaviors of individuals (Douglas and Wildavsky, 1982; Thompson et al., 1990). The most influential paper on the cultural theory is of Douglas and Wildavsky (1982). In this paper it is argued that hierarchy, egalitarianism, individualism, and fatalism are the main factors affecting the risk attitudes. In particular, they argue that when a society shows hierarchical behavior it is more possible that those individuals in that society are more risk averse.

Weber and Hsee (1998) compared risk taking behaviors of subjects from the People's Republic of China (P.R.C.), U.S.A., Germany, and Poland. They found that American subjects were more risk-averse than Chinese and argued that the cultural difference is the main factor in explaining the observed differences. Bontempo et al. (1997) compared the cultural differences of risk taking behaviors of individuals in Hong Kong, Taiwan, Netherlands, and U.S. They found that individuals in Netherlands and US differ from their peers in Hong Kong and Taiwan. Rohrmann and Chen (1999) compared risk taking behaviors of Chinese and Australians and found that Chinese subjects are more risk averse than Australian ones. Though there many studies examining the relation between demographic factors, cultural factors and level of risk tolerance, up to our knowledge this study is the first one searching for the framework effect in financial risk taking behavior.

DATA AND METHODOLOGY

Existing measures of individual differences in risk attitude have proven unsatisfactory in concluding a single measure of risk attitude. We compare and contrast two major measurement approaches using three different commonly used questionnaires. Two of the questionnaires account for the investment

decision making (FRT) whereas the other one is measuring risk tolerance using gambling scenarios.**

The first two financial risk tolerance questionnaires provide a scientific assessment of an individual's personal investment risk tolerance, and use psychometrics to ensure validity and reliability. Between these two questionnaires, the first questionnaire consists of ten, whereas the second one has seven psychological questions which measure risk attitude using the questions with financial scenarios. Each of the questions in the first questionnaire contributes the overall risk tolerance score either with 1, 2, 3 or 4 points which creates a scale of minimum 7 (relatively less risk tolerant) to maximum 28. The second financial risk tolerance questionnaire has ten financial scenarios and each of which contributes the overall risk tolerance score with 1, 2, 3 or 4 points yielding to a scale of 10 (minimum score for risk tolerance) to 40 (maximum risk tolerance).

Finally, the questionnaire measuring the risk tolerance using five gambling scenarios is obtained from the study of Donkers et al. (2001). Each answer for each scenario/question contributes the overall risk tolerance score with 2 points for the risky gambling/more risky choice, 1 point for the safe choice. Hence, a respondent can have a minimum score of 5 indicating relatively the lowest risk tolerant level (i.e. the highest risk aversion level) and a maximum score of 10 indicating the highest risk tolerant level. The data are gathered through asking investment and gambling questions to 140 respondents, 112 of which are undergraduate students and the remaining are graduate students in Middle East Technical University, Turkey.

RESULTS

Our research objective in analyzing the data is to explore any differences between these three questionnaires in assessing the risk tolerance. Presenting the percentages for each of these questionnaires is useful in both understanding the risk characteristics of the respondents and contributing the related literature. Table 1 shows the risk tolerance levels assessed by the first financial risk tolerance questionnaire (FRT-1) in investment decision frame.

** The first FRT questionnaire is obtained from Reilly and Brown (2004) adapted from "Feathering Your Nest: The Retirement Planner. Copy" Right @1993 by Lisa Berger. The second FRT questionnaire is obtained from Security Industry Association obtained from partners.financenter.com/businessweek/learn/guides/investbasic/invprofile.fcs. The last one is the questionnaire previously used by Donkers et al. (2001).

Table 1. Risk Tolerance Levels (FRT-1)

FRT-1	N	%
1	3	2.14
2	57	40.71
3	70	50.00
4	10	7.14

Individuals with the lowest risk tolerance are grouped under the "1" interval whereas the individuals with the highest risk tolerance are grouped under the "4" interval.

Table 2. Risk Tolerance Levels (FRT-2)

FRT-2	N	%
1	0	0
2	3	2.14
3	76	54.29
4	53	37.86
5	2	1.43

As it can be seen from the results of the FRT-1 questionnaire, the percentage of the investors outside the highest risk tolerance level accounts for the 92.86%. If we define the individuals grouped under any of first three groups as relatively more risk averse (less risk tolerant) investors, we see that the number of these individuals reaches to 130 out of 140 respondents. Table 2 presents the FRT scores of the respondents for the second financial risk tolerance questionnaire (FRT-2). The results of the FRT-2 questionnaire show that the percentage of the total number of individuals who have a risk tolerance level below the highest group which is shown as "5" comes out to be 98.57% of all respondents.

The results of the gambling decision frame questionnaire (G-1) shows that the percentage of the total number of individuals who have a risk tolerance level below the highest group which is shown as "6" comes out to be 95.71% of all respondents. At first glance, it seems that there are more individuals grouped under the higher levels of risk tolerance levels.

Table 3. Risk Tolerance Levels (G-1)

G-1	N	%
1	1	0,71
2	25	17,86
3	34	24,29
4	46	32,86
5	28	20,00
6	6	4,29

However, the clear results require statistical analyses. Table 4 shows the descriptive statistics of the FRT scores calculated using the answers of all three questionnaires. One should easily notice the higher mean for results of gambling questionnaire (G-1).

Table 4. Descriptive Statistics

	Tests	Mean	N	Std. Dev.	Mean Std.Err.
Pair 1	FRT-1	26.23	134	3.96	0.341
	FRT-2	26.80	134	3.67	0.317
Pair 2	FRT-1	26.22	140	3.96	0.335
	G-1	30.65	140	4.54	0.383

		26.8	1	3.67	0.317
	FRT-2	0	40		
Pair 3					
		30.6	1	4.63	0.400
	G-1	5	34		

Table 5 shows the correlations between each pair of questionnaires. The correlation is statistically significant between the questionnaires of financial risk assessment techniques in investment decision frame where financial scenarios are used (at 99% confidence level since p-value is smaller than 0.001).

Table 5: Correlation Coefficients

	Tests	**N**	**Correlation**	**P-values**
Pair 1	FRT-1 & FRT-2	134	0.421	0.000
Pair 2	FRT-1 & G-1	140	0.030	0.725
Pair 3	FRT-2 & G-1	134	0.112	0.198

However, there is no statistically significant correlation between any of the financial risk tolerance questionnaire in investment frame (FRT-1 or FRT-2) and the questionnaire that measures risk tolerance using gambling scenarios (G-1). Table 6 shows paired-sample t-statistics results to compare the scores of all three risk tolerance questionnaires. The results indicate that statistically there is no difference between these two financial risk tolerance questionnaires based on investment frame (FRT-1, FRT-2). However, t-statistics indicate that gambling questionnaire scores are significantly different than scores of both of these two different financial risk assessment questionnaires.

Table 6. Paired Samples Test

Tests	Paired Differences				Signif.
	Mean	M.S.E	Conf. Int. of Diff. (95%)		
			Lower	Upper	
FRT-1 & FRT-2	-0.57	0.355	-1.273	0.132	0.111
FRT-1 & G-1	-4.43	0.502	-5.422	-3.44	0.000
FRT-2 & G-1	-3.86	0.482	-4.807	-2.90	0.000

Using the information in Table 4 and Table 6, we can conclude that risk tolerance measurement using gambling questionnaire tend to result in more risk aversion. In other words, the level of risk tolerance decreases when risk tolerance is measured through asking gambling questions rather than asking investment questions.

CONCLUSION

The current study examines whether individuals do have different risk tolerance levels when they make gambling decisions versus when they make investment or in other words contextual financial decisions. Results showed that there is a significant difference between the FRT scores of the respondents in gambling and the FRT scores of the respondents in investment decision making frames. Furthermore, we can conclude that measuring risk tolerance using gambling questionnaire tend to result in more risk aversion. In other words, the level of risk tolerance decreases when risk tolerance is measured through asking gambling questions rather than asking investment questions.

Results indicate that different methodologies may yield different risk tolerance levels of individuals. This conclusion is extremely crucial especially for portfolio managers and financial institutions. Lack of a common and unique measure may mislead them in measuring risk tolerance levels of their customers. Hence, a robust measure of risk tolerance should be developed to achieve a true level of risk tolerance.

The results of this study cannot be fully generalizable for many reasons. However, it is an initiation of further investigations of FRT measurements. It is obvious that many different measurement techniques of risk tolerance are not yet sufficiently clarified; this applies to both to the roots and the impacts of risk propensity/aversion. However, this study showed that these two type of questionnaires result in different risk tolerance levels for the same individuals. Thus, further research is needed for the conceptualization, measurement effects of risk tolerance, since this will provide several benefits.

One of the limitations of the study and also a suggestion for the future research is that asking the questionnaires to students disabled us to explore the effects of most demographic characteristics on the FRT measures. It would be more comprehensive if we also had tested FRT level of the individuals in an insurance context. That would give us a chance to compare the individual risk tolerance level in gambling, investment (in a gain domain), insurance (in a loss domain). Moreover, cross-cultural studies may show the cultural differences for future studies.

REFERENCES

Arrow, Keneth (1971), **Essays in the Theory of Risk-Bearing**, North-Holland Publishing Co., Amsterdam.

Becker, Gordon – Degroot - Moris - Marschak, Jacob (1963), "Probabilities of Choices among very Similar Objects: An Experiment to Decide Between Two Models", **Behavioral Science**, Vol. 8, No 4, pp.306–311.

Bontempo, Robert - Bottom, William - Weber Elke (1997), "Cross-Cultural Differences in Risk Perception: A Model Based Approach", **Risk Analysis**, Vol. 17, No: 4, pp.479–488.

Booij, Adam and Praag, Bernard (2009), "A Simultaneous Approach to the Estimation of Risk Aversion and the Subjective Time Discount Rate", **Journal of Economic Behavior and Organization**, Vol. 70, No: 1-2, pp.374–388.

Brooks, Robert - Faff, Robert - Mulino, Daniel - Scheelings, Richard (2008), "Deal or No Deal, that is the Question: The Impact of Increasing Stakes and Framing Effects on Decision-Making under Risk", **Working Paper**, available at http://ssrn.com/abstract=1089981.

Daghofer, Fedor (2007), "Financial Risk-Taking on ''Who Wants to Be a Millionaire'': A Comparison between Austria, Germany, and Slovenia", **International Journal of Psychology**, Vol. 42, No: 5, pp.317–330.

Dohmen, Thomas - Falk, Armin – Huffman, David - Sunde, Uwe - Schupp, Jurgen - Wagner Gert (2005), "Individual Risk Attitudes: New Evidence from a Large, Representative, Experimentally-Validated Survey", **IZA Discussion Paper**, No. 1730, available at http:// www.iza.org/en/webcontent/publications/papers/viewAbstract?dp_id=1730.

Donkers, Bas – Melenberg, Bertrand - Van Soest, Arthur (2001), "Estimating Risk Attitudes Using Lotteries: A Large Sample Approach", **The Journal of Risk and Uncertainty**, Vol. 22, No: 2, pp.165–195.

Douglas, Mary and Wildavsky, Aaron (1982), **Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers**. Berkeley: University of California Press.

Eisenhauer, Joseph (2003), "Approximation Bias in Estimating Risk Aversion", **Economics Bulletin**, Vol. 4, No: 38, pp.1−10.

Grable, John (2000). "Financial Risk Tolerance and Additional Factors that Affect Risk Taking in Everyday Money Matters", **Journal of Business and Psychology**, Vol. 14, No: 4, pp.625–630.

Grable, John and Lytton Ruth (1998), "Investor Risk Tolerance: Testing the Efficacy of Demographics as Differentiating and Classifying Factors", **Financial Counseling and Planning**, Vol. 9, No: 1, pp.328–339.

Grable John and Lytton Ruth (1999), "Financial Risk Tolerance Revisited: The Development of a Risk Assessment Instrument", **Financial Services Review**, Vol. 8, pp.163–181.

Hallahan, Terrence - Faff, Robert - Mckenzie Michael (2003), "An exploratory Investigation of the Relation between Risk Tolerance Scores and Demographic Characteristics", **Journal of Multinational Financial Management**, Vol. 13, pp.483–502.

Harrison, Glenn - Lau, Morten - Rusträm, Elisabet. (2007), "Estimating Risk Attitudes in Denmark: A Field Experiment", **Scandinavian Journal of Economics**, Vol. 109, No: 2, pp.341–368.

Holt, Charles and Laury Susan (2002), "Risk Aversion and Incentive Effects", **American Economic Review**, Vol. 92, No: 5, pp.1644–1655.

Kahneman, Daniel and Tversky, Amos (1979), "Prospect theory: An Analysis of Decision under Risk", **Econometrica**, Vol. 47: 263–291.

Keller, Carmen and Siegrist, Michael (2006), "Investing in Stocks: The Influence of Financial Risk Attitude and Values Related Money and Stock Market Attitudes", **Journal of Economic Psychology**, Vol. 27, pp.285–303.

Maccrimon, Kenneth and Wehrung Donald, (1990), "Characteristics of Risk Taking Executives", **Management Science**, Vol. 36, pp.422–435.

Mcdaniels, Timothy and Gregory, Robin (1991), "A Framework for Structuring Cross-Cultural Research on Risk and Decision Making", **Journal of Cross-Cultural Psychology**, Vol. 22, pp.103–128.

Pennings, Joost and Smidts, Ale (2000), "Assessing the Construct Validity of Risk Attitude", **Management Science**, Vol. 46, No:10, pp.1337–1348.

Pratt, John (1964), "Risk Aversion in the Small and in the Large", **Econometrica**, Vol. 32, No: 1/2, pp.122–136.

Powell, Malanie and Ansic, David (1997), "Gender Differences in Risk Behavior in Financial Decision Making: an Experimental Analysis", **Journal of Economic Psychology**, Vol. 18, pp.605–628.

Reilly, Frank and Brown, Keith (2004), **Investment Analysis and Portfolio Management**, Thomson South Western College Publishing, Cincinnati, US.

Rohrmann, Bernd and Huichang, Chen (1999), "Risk Perception in China and Australia: An Exploratory Cross-cultural Study", **Journal of Risk Research**, Vol. 2, No: 3, pp.219–241.

Schomaker, Paul (1990), "Are Risk Preferences Related Across Payoff Domains and Response Models?", **Management Science**, Vol. 36, pp.1451–1463.

Thompson, Michael - Ellis, Richard - Wildavsky, Aaron (1990), **Cultural Theory**. Boulder Co, Westview Press: Westport, Conn, Praeger.

Wang, Hui and Hanna, Sherman (1997), "Does Risk Tolerance Decrease with Age?", **Financial Counseling and Planning**, Vol. 8, pp.27–32.

Weber, Elke and Hsee, Cristopher (1998), "Cross-cultural Differences in Risk Perception, but Cross-cultural Similarities in Attitudes towards Perceived Risk", **Management Science**, Vol. 44, No: 9, pp.1205–1217.

Weber, Elke - Blais, Ann-Rene´ - Betz, Nancy (2002), "A Domain-specific Risk-attitude Scale: Measuring Risk Perceptions and Risk Behaviors", **Journal of Behavioral Decision Making**, Vol. 15, pp.263–290

Yao, Rui and Hanna Sherman (2005), "The Effect of Gender and Marital Status on Financial Risk Tolerance", **Journal of Personal Finance**, Vol. 4, No: 1, pp.66–85.