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Financial Risk Tolerance: A South African Perspective.

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Financial Risk Tolerance: A South African Perspective.

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Abstract

Modern Portfolio Theory demonstrates that an investor's optimal portfolio is partly determined by the individual's indifference curve between risk and return. An individual's level of risk aversion, or risk tolerance, is therefore a critical factor in identifying their optimal investment portfolio but no consensus exists regarding how best to measure an individual's subjective risk tolerance. In addition, empirical evidence suggests that risk tolerance is affected by various demographic factors. This paper explores risk tolerance in the South African context using an instrument developed by Hanna and Lindamood to test the risk tolerance of students at the University of KwaZulu-Natal. Comparable risk tolerance levels are found with similar studies in the United States. Gender, race and religion are all found to have an effect on individual risk tolerance levels.

Keywords: Portfolio Selection, Risk Tolerance, Risk Aversion, Demographic Factors.

JEL Codes: G11, G23, D14, D81.

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1. Introduction

Markowitz's Modern Portfolio Theory demonstrates that an investor's optimal portfolio represents the combination of assets that will maximize an investor's utility function for risk and return (Yook & Everett, 2003: 1). An investor's relative risk aversion is thus critical in determining optimal portfolio allocations (Campbell & Viceria, 2002: 11; Hanna & Lindamood, 2004: 27). Correctly measuring an investor's risk tolerance and understanding the impact this factor has on their optimal investment strategy should therefore be an imperative for financial advisors. This point is clearly made by Subedar, McCrae and Gerace, 2006: 6,9) when they say

> "… in terms of investment advice, identification of an investor's risk tolerance determines the asset allocation decision … In order to satisfy the 'know your client rule', financial advisors should have some conception of an investor's psychological comfort and tolerance towards investments with uncertain outcomes."

In addition, various studies have found a relationship between risk aversion and various demographic variables including variables such as gender, race, religion, education and income brackets to name but a few (Halek and Eisenhauer, 2001: 10; Powell and Ansic, 1997: 606 and Bajtelsmit, Bernasek and Jiankoplos, 1999: 2).

Although a person's risk levels are the main ingredient when determining their weightings, not much emphasize has been placed on this variable due to its highly complex nature (Yook and Everett, 2003: 7). In addition, while it might be commonly accepted that risk aversion is an important factor in portfolio selection, actually measuring risk aversion is less common (Hanna & Lindamood, 2004: 29) and no generally accepted approach to measuring risk aversion exists. While the issue of risk tolerance is relevant to understanding individuals' investment preferences we are not aware of any study that has attempted to examine this issue in the South African context. This paper therefore attempts an exploratory study using an existing risk tolerance measure using a similar sample in order to investigate to what extent risk tolerance measures developed internationally can be used in the South African context and whether or not demographic variables identified in the literature are relevant factors in explaining risk tolerance in a South African context.

2. Literature Review

2.1 Risk Aversion

The concept of risk aversion is the product of work by Arrow (1964) and Pratt (1971) who developed a measure of risk aversion as a concave utility function denoted as U over wealth which is measured as W (Halek and Eisenhauer; 2001: 2). The Arrow-Pratt measure of risk aversion is split between absolute risk aversion and relative risk aversion. Absolute risk aversion can be defined as the change in a nominal amount that is allocated to a risky asset as wealth increases.

$$\text{Absolute risk aversion} = -\frac{U''(W)}{U'(W)} \qquad \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ (1)$$

Where:

U'' = Concave utility function differentiated twice

U' = Concave utility function differentiated once

W = Wealth.

Relative risk aversion on the other hand can be defined as a change in an individual's portfolio allocation as their wealth base increases (Arrow 1971 and Pratt 1964). Pratt's measure of relative risk aversion can be mathematically illustrated as follows:

$$\text{Relative risk aversion} = -W\,[U''(W)/U'(W)] \qquad \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ (2)$$

Whilst the Arrow-Pratt measure of risk aversion provides an important model of investors' investment behaviour in the aggregate it does not provide a tool for measuring an individual utility function. As a result it is necessary to develop a subjective measure of risk aversion. In addition, many studies choose to focus on the concept of risk tolerance, one's willingness to bear risk, rather than risk aversion. Risk tolerance generally being defined as the inverse of risk aversion (Barsky, Juster, Kimball and Shapiro, 1997: 542; and Gron &Winton, 2001: 593).

2.2 Demographic Variables

Studies, employing a variety of risk tolerance measurement techniques, have identified several demographic factors that appear to be related to an individual's risk tolerance.

2.2.1 Gender

The gender variable is a highly documented variable both in financial and social science literature. Whilst the issue has been the source of some debate a degree of consensus would appear to exist in both these disciplines that women are generally perceived to be less risk tolerant than men (Barsky, *et al* 1997: 550; Halek and Eisenhauer, 2001: 13; Bajtelsmit, Bernasek and Jianakoplos, 1999: 7; Cohn, Lewellen, Lease and Schlarbaum, 1975: 616 and Powell and Ansic, 1997: 607). There are essentially two schools of thought as to why this perception exists (Van de Venter; 2007: 12).

The first school of thought focuses on objective constraints and has attributed female's lower risk tolerance levels to a lower level of personal investment in human capital. The second school of thought focuses on subjective constraints and attributes female's lower risk tolerance levels to a lack of confidence when it comes to making risky financial decisions and the generalisation that women are more cautious and conservative relative to men.

Estes and Hasseini (1988: 4) supported the argument that women lacked self-confidence when making decisions, after controlling for other influential factors such as age, experience, education, knowledge and asset holdings. Grable and Joo (2000: 1) go further to state that the difference in risk aversion amongst men and women can be attributed to the individual's exposure to, and understanding of, financial knowledge.

Within the Hanna and Lindamood (2004) study, a significant difference between the risk aversion levels of males and females were recorded. "Gender differences also emerged in the student responses to the graphic-based pension choice question, with males being less risk averse than females…" (Hanna and Lindamood; 2004: 8).

2.2.2 Race

Colin and Camere (2003: 12) found that certain demographic variables such as an individual's culture (amongst others) has an impact on their investment decision making. In the United States, several studies have been conducted that analyse the relationship between financial risk aversion and race/ethnicity which found that White households (individuals) are more risk tolerant than similar non-White households (SCF data was analysed within these studies) (Sung and Hanna, 1996: 11; Yao, Gutter and Hanna, 2005: 51 and Bajtelsmit, *et al* 1999: 4). Zong and Xiao (1995: 11), Plath and Stevenson (2000: 10), Brown (2007:16) as well as Sung and Hanna (1996: 14) evaluated the allocations that households made within their investment portfolio's. They found that *ceteris paribus*, White households have a higher allocation of risky assets than that of non-White households (African-American and other racial groups).

Barsky, *et al* (1997:550), on the other hand, stated that there were noticeable differences in the risk tolerance levels of the respondents particularly in term of race and religion, but they found that White individuals were the least risk tolerant, amongst two other racial groupings, namely Blacks & Native Americans; and Asian & Hispanics which were found to be the most risk tolerant racial group. These results are consistent with those of Halek and Eisenhauer (2001: 13), where Blacks and Hispanics were found to be significantly more risk tolerant than their White counterparts.

2.2.3 Religion

A relatively small number of studies have been done in the United States, which deal with the connection between religion and risk aversion. Halek and Eisenhauer (2001: 2) found that certain demographic characteristics including religion did affect a person's level of risk aversion. Specifically, Halek and Eisenhauser (2001: 19) established that Catholics and Jews are much more averse to pure risk than members of other faiths. They also found that these two groups are more tolerant of speculative risk. This can be attributed to the differences in religious teachings regarding gambling. For example, Protestants and Muslims view gambling as sinful, while some Catholic priests employ games of chance for fund raising at church events. Barsky, *et al* (1997: 13) confirmed this view of Protestants, as they were found to be the least risk tolerant. Individuals from the Jewish faith were viewed as the most risk tolerant and Catholics fell in between the Protestants and the Jews.

2.2.4 Wealth

This is a compelling variable, as theory states that the more income an individual has at their disposal the less risk averse he/she will tend to be, *ceteris paribus* (Yook and Everett, 2003: 5 and Bajtelsmit, 1999: 14). "Income, non-financial asset levels and being self-employed generally have significantly positive effects on the willingness to take financial assets" (Yao, *et al* 2005: 56). Furthermore, an individual's level of financial security ties back to the concept of Absolute risk aversion. This is due to the fact that the nominal amount that is allocated to risky assets increases, as wealth increases. In addition being financially stable in terms of a large income and/or wealth base will enable investors to utilize leverage within their portfolio (Subedar, McCrae and Gerace; 2006: 19).

Cohn, *et al* (1975: 614) in their research paper on risk aversion designed a questionnaire that sought income levels and asset holding information from their participants. The authors listed four total asset categories, namely: less than $100 000; $100 001 to 175 000; $175 001 to $350 000; and over $350 000. A chi-square test indicated that a highly statistically significant relationship was found between level of wealth and the holding of risky assets. It was therefore concluded that, as wealth increases, the proportion of assets invested in risky securities also increases.

3. Research Methodology

3.1 Problem Statement & Hypotheses

It is clear from the preceding discussion that risk tolerance is an important component in understanding a person's financial decision making process and the process by which individuals select their optimal investment portfolio. In addition, it is evident that several demographic variables have an impact on risk tolerance levels. To date, however, no research has been undertaken to explore the issue of risk tolerance within the South African context. This study seeks to remedy this by addressing the question of whether or not South African measures of risk tolerance and sensitivity to demographic variables, are similar to international evidence.

Specifically the study aims to test the following hypotheses:

1. There is no difference between the results of the UKZN study and the Hanna & Lindamood study
2. There is no difference in the results of the two questions measuring risk aversion
3.a There is no difference in the results for males between the two questions measuring risk aversion
3.b There is no difference in the results for females between the two questions measuring risk aversion
4. There is no difference between the risk tolerance of males and females
5. There is no difference in risk tolerance across race
6. There is no difference in risk tolerance across religion
7. Risk tolerance is correlated to income

3.3 Sample

Hanna & Lindamood's (2004) revised questionnaire was administered to a sample of university students drawn from two personal finance courses at the Ohio State University and compared with the results of the previous studies conducted by Barsky, *et al* (1997) and Hanna, *et al* (2001). The total number of observations in the Hanna & Lindamood (2004) study was 152.

In order to allow for meaningful comparison with the Hanna & Lindamood study their subjective risk tolerance questionnaire was administered to a comparable sample of third and fourth year Accounting and Finance students at the Pietermaritzburg campus of the University of KwaZulu-Natal (UKZN). A total of 84 participants completed the questionnaire. This sample achieved a more even spread between male and female respondents (54% male respondents) than the Hanna & Lindamood study (2004: >>>), 74% male respondents. The mean age of the respondents for both samples was 23. The UKZN sample displayed the following spread within racial categories: 30 Indians; 28 Blacks, 23 Whites, and 5 Coloureds.

3.2 Instrument

Numerous risk aversion measures have been proposed over the years. A number of these however, required conducting interviews, but it is important to note that this process is subject to interviewer bias

(Lyons, *et al* 2008: 14). Assessing actual behaviour was also not practical for the purpose of this paper. As a result it was decided to adopt a survey approach to measuring risk tolerance.

Numerous academics such as Hanna and Lindamood (2004: 1); Yao, Gutter and Hanna (2005: 3) and Yook and Everett (2003: 5) believe that surveys are the easiest and fastest method of assessing risk aversion. "Questionnaires have the ability to scale responses, increase validity (eliminating response bias if being assessed by several financial advisors) (Grable and Lytton; 1999: 7), and can include a variety of questions that form the risk attitude construct" (Subedar, McCrae and Gerace; 2006:10). Yook and Everett (2003: 6) concluded that an efficient questionnaire is one that adequately addresses both risk attitude and risk capacity.

The study employed a subjective risk tolerance measurement technique developed by Hanna & Lindamood (2004) (H&L). Their survey technique was based on a pension risk question created by Hanna, *et al* (2001) which was in turn a modified form of a job risk type question used by Barsky, *et al* (1997: 540). The first question out of a series of questions within the Barsky, *et al* (1997: 540) study read as follows; "Suppose that you are the only income earner in the family, and you have a good job guaranteed to give you your current (family) income every year for life. You are given the opportunity to take a new and equally good job, with a 50-50 chance it will double your (family) income and a 50-50 chance that it will cut your (family) income by a third. Would you take the new job?"

Hanna, *et al* (2001) identified a concern that it was not clear to respondents in the Barsky *et al* study that income changes would be permanent and they therefore converted the Barsky *et al* question into a pension scenario in an attempt to reflect that losses in wealth would be permanent. Hanna and Lindamood (2004:1) then further refined the instrument by adding graphical illustrations to complement the pension scenario in order to reduce the need for respondent to hold and manipulate numbers in his/her head. Hanna and Lindamood (2004: 3) state that, "Both sets of questions required respondents to keep many numbers and percentages in their minds in order to reach appropriate choices, making it difficult for many of the responses to really measure risk aversion." In order to provide a basis for comparison, a second risk tolerance measure was included following the approach of Faff, *et al* (2004: 10) and Subedar, McGrae and Gerace (2006: 18). The original version of this question (henceforth described as FRT1) reads as follows:

Most investment portfolios have a mix of investments - some of the investments may have high expected returns but with high risk, some may have medium expected returns and medium risk, and some may be low-risk/low-return. (For example, shares and property would be high-risk/ high-return whereas cash and term deposits would be low risk/low-return.) Which mix of investments do you find most appealing? Would you prefer all low-risk/low-return, all high-risk/high-return, or somewhere in between?
Please select one of the seven portfolios listed below.

Portfolio	**High Risk/Return**	**Medium Risk/Return**	**Low Risk/Return**
1.	0%	0%	100%
2.	0%	30%	70%
3.	10%	40%	50%
4.	30%	40%	30%
5.	50%	40%	10%
6.	70%	30%	0%
7.	100%	0%	0%

The primary reason why this question was included within the questionnaire is because it is excellent for risk tolerance categorisation. “This question provides a set of responses that can categorise risk tolerance on a number of scales” (Subedar, McCrae and Gerace; 2006: 18). Secondly, this question was included within the study to validate and compare the results obtained within the subjective risk tolerance section of the survey.

3.3 Derivation of Risk Tolerance Score

The results of the Hanna and Lindamood (2004), Hanna, *et al* (2001) as well as the Barsky, *et al* (1997) study all determined an individual’s level of relative risk aversion in much the same way. Questions within all three studies essentially presented different percentage reductions in the participant’s pre-retirement income. If we denoted the cut in pre-retirement income as $(1-\lambda)$, then by asking what percentage cut the respondent is willing to take will be essentially asking; under what value of λ is the respondent willing to undertake the risk. The respondent is then guided through a series of potential income reduction questions. The participant will eventually choose a percentage that would validate him/her undertaking the risk. Then based on expected utility theory, Barsky, *et al* (1997: 540) showed that equation 3 must hold.

$$0.5U(2C) + 0.5(\lambda C) > U(C) \qquad \_\_\_\_\_(3)$$

Where:

C = permanent consumption

U = Concave utility function

λ = risk allocation.

If we utilize a constant relative risk aversion utility function, the following equation should illustrate the relationship between relative risk aversion and λ.

$$\lambda = (2\text{-}2^{(1-A)})^{[\,1\,/\,1-A\,]} \qquad \_\_\_\_\_(4)$$

Equation four will only hold if $A \neq 1$ and $\lambda = 1$. Thus, by obtaining an individuals λ, relative risk aversion can be directly calculated. "For instance, if one is indifferent between the current job and the new risky job with a 50-50 chance of either doubling income or a one-third cut, then $1\text{-}\lambda = 0.3333$ and relative risk aversion must equal 2.0" (Hanna and Lindamood; 2004: 3). From the improved graphical technique the participant was guided through seven different options of λ values. At this point the individual was required to choose one of the seven different options. The seven different λ values yielded the following mean relative risk aversion levels.

Table 1: Risk Tolerance and Risk Aversion with mean levels

Risk Tolerance level	**Risk Aversion level**	**Mean relative risk aversion**
Ext. High Risk Tolerance	Ext. Low Risk Aversion	0.7
Very High Risk Tolerance	Very Low Risk Aversion	1.5
High Risk Tolerance	Low Risk Aversion	2.9
Moderate Risk Tolerance	Moderate Risk Aversion	5.65
Low Risk Tolerance	High Risk Aversion	8.4
Very Low Risk Tolerance	Very High Risk Aversion	11.9
Ext. Low Risk Tolerance	Ext. High Risk Aversion	16

The risky portfolio question can essentially be interpreted in much the same way. Within the question there are seven different categories of portfolios. Each portfolio represents a different level of subjective risk tolerance, ranging from an extremely high subjective risk tolerance level; portfolio 7 to an extremely low subjective risk tolerance level; portfolio 1. It would therefore be appropriate to rank each portfolio according to the provided risk tolerance groups (see above) along with their determined mean relative risk aversion levels. Using these rankings one will therefore be able to determine the relative risk aversion levels for an individual from the perspective of a hypothetical investment scenario.

3.4 Statistical Analysis

Due to the fact that responses are captured within categories as is much of the demographic data it is necessary to use nonparametric techniques to analyse the data (Roscoe; 1969: 7). As a result, the Chi-Squared (χ^2) Test; Kendall's tau statistic; Spearman's rho; Mann-Whitney U test and Kruskal-Wallis test (*k*), will be employed to test the study's various hypotheses.

4 FINDINGS AND ANALYSIS

4.1 Risk Aversion Levels

As a starting point in the analysis it was hypothesized that the observed levels of risk aversion for the UKZN sample should not differ significantly from the H&L study. Stated formally:

H_0: $\mu_{UKZN} = \mu_{H\&L}$
H_1: $\mu_{UKZN} \neq \mu_{H\&L}$

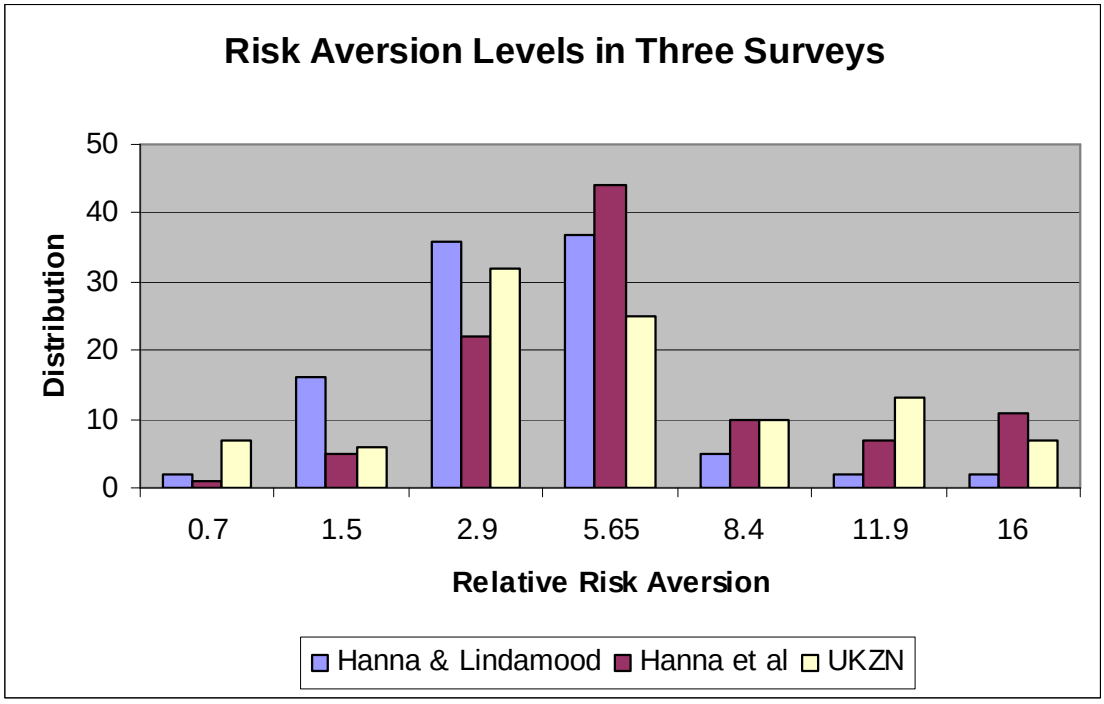
Figure 2 presents a summary of the risk aversions measured for the H&L, Hanna et al and UKZN studies.

Table 2: Percentage distribution between the two studies

	Hanna & Lindamood	**Hanna *et al***	**UKZN**
Extremely Low Risk Aversion (A< 1.0)	2	1	7
Very Low Risk Aversion (1.0 ≤ A < 2.0)	16	5	6
Low Risk Aversion (2.0 ≤ A < 3.8)	36	22	32
Moderate Risk Aversion (3.8 ≤ A < 7.5)	37	44	25
High Risk Aversion (7.5 ≤ A < 9.3)	5	10	10
Very High Risk Aversion (9.3 ≤ A ≤ 14.5)	2	7	13
Extremely High Risk Aversion (A > 14.5)	2	11	7

The mean relative risk ***aversion*** level of a UKZN student is 5.9865. This is higher than the mean relative risk aversion of an Ohio State University student recorded in the H&L study at 4.3665 but lower than the Hanna, *et al* (2001) result of 6.6 . Although the mean relative risk aversion values are not exactly the same between the studies, they do however, fall within the same risk aversion grouping namely; Moderate Risk Aversion. Graphically, as can be seen in Figure 1, while the mean levels of risk aversion might be similar, the UKZN responses are skewed to the right.

Figure 1: Comparative Risk Aversion Scores



A Chi^2 test comparing the mean level of risk aversion between the UKZN and H&L studies found that the mean level of risk aversion is significantly *higher* for the UKZN sample than the corresponding H&L sample with a Chi^2 value of 22.3922182 and a p-value of 0.001027813. The null hypothesis is therefore rejected and it is concluded that a significant difference in risk aversion exists between the two sample groups.

This difference could possibly be explained by the fact that the UKZN sample is far more balanced in terms of gender than the H&L study. If the hypothesis that females are more risk averse than males is found to be true then the greater representation of female respondents in the UKZN sample would naturally lead to an overall level of risk aversion that is greater.

4.2 Comparison between risk tolerance measures

Hypothesis 2 was that the manner in which the risk tolerance measure was framed would not affect the relative measure of risk tolerance. Specifically, the level of risk tolerance obtained using the SCF question should correspond to that observed using the H&L approach. Stated formally:

H_0: $\mu_5 = \mu_6$
H_1: $\mu_5 \neq \mu_6$

Where μ_5 = the risk tolerance obtained from question 5 of the survey (the SCF question) and μ_6 = the risk tolerance measured using the H&L approach.

As the responses are ordinal data comprising various ranks of risk aversion the appropriate approach to test for correlation between the two responses is to use the Spearman's rho and the Kendall's tau b correlation tests (Cooper and Schindler; 2000: 562). The results are presented in Table 3

Table 3: Correlation Between FRT1 and FRT2

			Financial Risk Tolerance 1	Financial Risk Tolerance 2
Kendall's tau_b	Financial Risk Tolerance 1	Correlation Coefficient	1.000	.231(**)
		Sig. (2-tailed)	.	.010
		N	84	84
	Financial Risk Tolerance 2	Correlation Coefficient	.231(**)	1.000
		Sig. (2-tailed)	.010	.
		N	84	84
Spearman's rho	Financial Risk Tolerance 1	Correlation Coefficient	1.000	.287(**)
		Sig. (2-tailed)	.	.008
		N	84	84
	Financial Risk Tolerance 2	Correlation Coefficient	.287(**)	1.000
		Sig. (2-tailed)	.008	.
		N	84	84

** = correlation is significant at the 0.01 level (2-tailed)

In addition to comparing the differences in responses for the whole sample, the differences were also compared by gender. Hypothesis 3 stated that there was no difference in the results for males between the two risk tolerance questions.

Table 4: Correlation For Male Respondents Between FRT1 and FRT2

			Financial Risk Tolerance 1	Financial Risk Tolerance 2
Kendall's tau_b	Financial Risk Tolerance 1	Correlation Coefficient	1.000	.364(**)
		Sig. (2-tailed)	.	.003
		N	45	45
	Financial Risk Tolerance 2	Correlation Coefficient	.364(**)	1.000
		Sig. (2-tailed)	.003	.
		N	45	45
Spearman's rho	Financial Risk Tolerance 1	Correlation Coefficient	1.000	.451(**)
		Sig. (2-tailed)	.	.002
		N	45	45
	Financial Risk Tolerance 2	Correlation Coefficient	.451(**)	1.000
		Sig. (2-tailed)	.002	.
		N	45	45

** = correlation is significant at the 0.01 level (2-tailed)

When the correlation between responses for the two questions was examined it was found that the correlation in responses for males was significant at the 1% level but the level of correlation was surprisingly low at only .364. When the correlation between the results of the two questions for female respondents was calculated no significant correlation was found.

These results are surprising. The low correlation for male respondents between the risk tolerance questions and lack of correlation for female respondents would appear to indicate that the manner in which the risk tolerance question is framed affects the results that are recorded. This finding is in line with that of Powell and Ansic (1997:609) who suggested that differences in risk preference could be explained by the way tasks were framed.

Table 5: Correlation For Female Respondents Between FRT1 and FRT2

			Financial Risk Tolerance 2	Financial Risk Tolerance 1
Kendall's tau_b	Financial Risk Tolerance 2	Correlation Coefficient	1.000	-.022
		Sig. (2-tailed)	.	.871
		N	39	39
	Financial Risk Tolerance 1	Correlation Coefficient	-.022	1.000
		Sig. (2-tailed)	.871	.
		N	39	39
Spearman's rho	Financial Risk Tolerance 2	Correlation Coefficient	1.000	-.024
		Sig. (2-tailed)	.	.885
		N	39	39
	Financial Risk Tolerance 1	Correlation Coefficient	-.024	1.000
		Sig. (2-tailed)	.885	.
		N	39	39

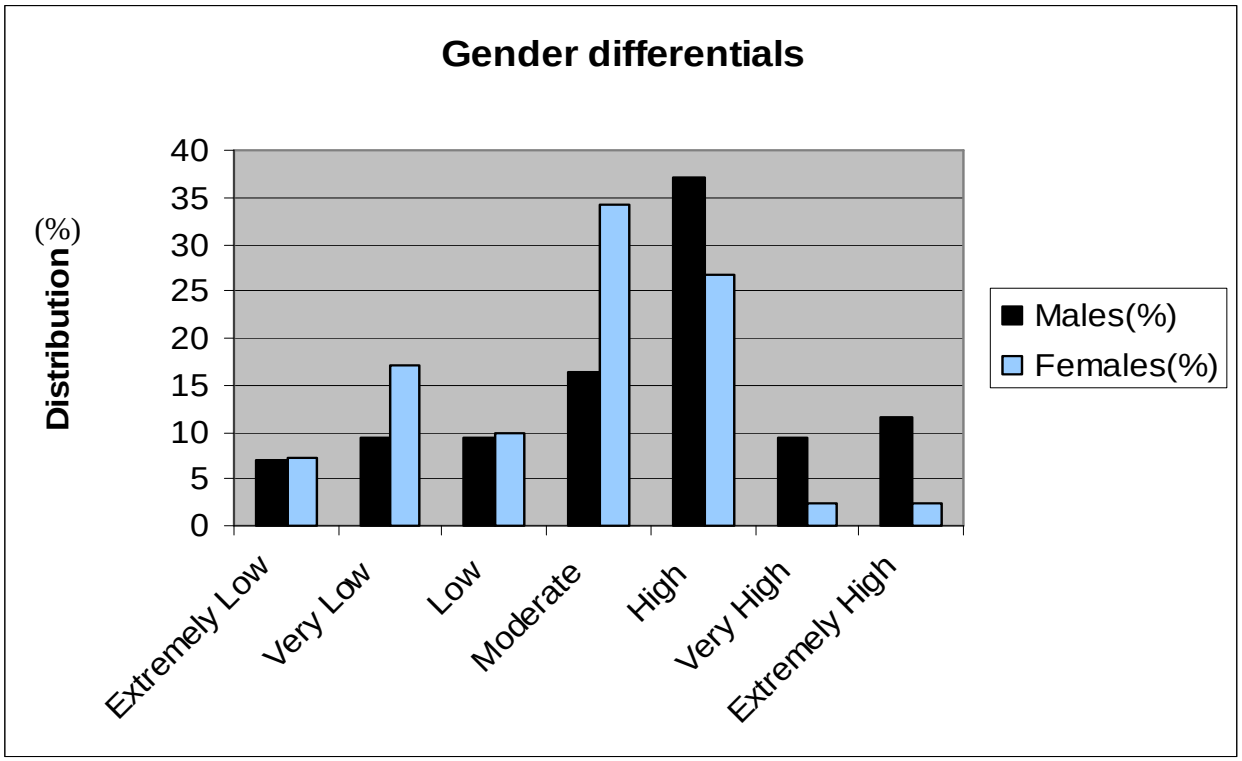
** = correlation is significant at the 0.01 level (2-tailed)

Schubert, Brown, Gysler and Brachinger (1999: 384) stated that “the comparative risk propensity of male and female subjects in financial choices strongly depends on the decision frame”. Their analysis supports the findings of this study that framing is important in measuring risk tolerance, and that the effect is greater for women than for men.

4.2 Gender and Risk Tolerance

In line with the international literature, hypothesis 4 was that there is no difference between the risk tolerance of males and females. Figure 2 shows a clear difference in the distribution of responses with more female respondents falling in the very low and moderate risk tolerance categories while far more male respondents fell into the very high and extremely high risk tolerance categories.

Figure 2: Distribution of Male and Female Respondents against FR2



A comparison of the means of the female and male respondents' risk tolerance levels was conducted for each of the risk tolerance questions using a Mann-Whitney test. With a test statistic of .234, the difference in means for FRT2 (the H&L measure) was not significant but the Mann-Whitney statistic for FRT (the SCF measure) was .014 indicating a significant difference. The difference in results between the two measures once again reinforces the impact of framing on the risk tolerance measured.

It is also worthwhile noting that while some authors have suggested that differences in self confidence (Estes and Hasseini; 1988: 4) and exposure to financial knowledge (Grable and Joo; 2000: 1) might explain differences in risk tolerance between males and females, the fact that this sample is made up of entirely of final year Accounting and Finance students effectively controls for these dimensions. All respondents have had exactly the same education, specifically in financial matters and therefore the difference in risk tolerance cannot be explained by differences in financial knowledge.

4.3 Risk Aversion Across Racial Categorisation

As a first step in examining whether or not a significant relationship exists between race and financial risk tolerance a Kruskal-Wallis test was performed on the joint hypothesis that no difference exists in the risk tolerance scores obtained using the H&L methodology. The test produced a Chi^2 statistic of 9.748 at three degrees of freedom which is significant at the 1% level indicating the presence of significant differences in the risk tolerance levels observed for different racial groups.

Table 6: Cross-tabulation of racial groups against FRT2

	Racial group to which respondent belongs	N	Mean Rank
FRT2	Black	26	44.38
	White	23	30.54
	Indian	30	50.7
	Coloured	5	38.5
Total		84	

Table 7 presents a median analysis of respondents by race group. It is evident that while the Black respondents are fairly evenly spread either side of the median the White respondents predominantly fell below the median while 50% more of the Indian respondents were above the median than below it. Unfortunately the fact that the sample only contains five Coloured respondents made it impossible to include this category in the analysis.

Table 7: Median analysis of racial groups

	Racial group to which respondent belongs			
FRT2	Black	White	Indian	Coloured
> Median	12	4	18	2
< Median	14	19	12	3

A Mann-Whitney test comparing the financial risk tolerance scores of Whites and Indians produced a test statistic of .001 confirming that there is a significant difference in the risk tolerance levels observed between the two groups. Similarly, the test statistic comparing Whites and Blacks was .052 again indicating that a significant difference exists in the risk tolerance levels of these two racial groups.

4.4 Risk Aversion Across Religion

Following authors such as Halek and Eisenhauer; (2001) and Barsky, *et al* (1997) the data was tested for differences in risk tolerance between different religious affiliations. There were no Jewish respondents in the sample and so this category was excluded from the analysis. The results for the various religious affiliations are presented in Table 8.

Table 8: Cross-tabulation of religious groups against FRT2

	Religious group to which respondent belongs	N	Mean Rank
FRT2	Christian	56	36.96
	Hindu	17	49.59
	Muslim	7	46.71
Total		80	

A Kruskal-Wallis test was performed comparing risk tolerance between the racial categories. The test statistic of .097 at two degrees of freedom indicates that there is a significant difference although the significance is borderline at the 10% level.

Table 9: Median Analysis of religious groups

	Religious group to which respondent belongs			
FRT2	Christian	Hindu	Muslim	Jewish
> Median	19	11	4	0
< Median	37	6	3	0

A median analysis reveals that almost twice as many Christian respondents fell on or below the median value while almost twice as many Hindu respondents had risk tolerance levels greater than the median value than below it. This would suggest that Hindu respondents are more risk tolerant than christen respondents. A Mann-Whitney test was carried out comparing the mean risk tolerance scores for the Hindu and Christian respondents. The p-value of .043 indicates that a significant difference exists between the risk tolerance levels of Hindu and Christian respondents. It is, however, not easy to interpret the true significance of these results as obviously a major overlap exists between the racial and religious classifications. While the Christian classification comprises respondents from all race groups (23 out of 56 Christian respondents are white) the Hindu respondents are all India. It is not clear, therefore, to what extent this difference in risk tolerance is as a result of the racial or religious classification.

Table 10: Mann-Whitney Results Comparing Christian & Hindu Risk Tolerance

	FRT2
Mann-Whitney U	325.500
Wilcoxon W	1921.500
Z	-2.022
Asymp. Sig. (2-tailed)	.043

4.7 Risk Tolerance And Income

While the literature suggests that income levels should have an impact on risk tolerance both a Kendall's tau and Spearman's rho test of the correlation between income level and risk tolerance indicated that no statistically significant correlation existed. Unfortunately limitations in the sample limit the usefulness of

this analysis. In the first instance only 48% of the sample (41 out of 84 respondents) answered the income question. Secondly, as they were reporting on household income rather than their own personal income, respondents were required to estimate their parent's joint income and such estimates are likely to be inaccurate. Finally, it is possible that the fact that the sample was restricted to final year university students it is possible that the sample may be biased if there is a greater likelihood that respondents from wealthier families are more likely to be able to attend university.

5. CONCLUSION

This paper attempted to provide an exploratory analysis of subjective risk tolerance using existing risk tolerance measurement questions for a sample of final year Finance and Accounting students at the University of KwaZulu-Natal. It was found that the UKZN respondents were significantly more risk averse than a similar sample of Personal Finance students at the University of Ohio. A comparison between the two risk tolerance questions employed, however, found that while a significant correlation in the responses of male respondents was evident between the two questions the correlation was surprisingly low. Even more striking was the fact that there was no correlation between the results of the two risk tolerance measure for the female respondents. These results raise serious questions regarding the impact of framing on the measure of risk tolerance and, more intriguingly, suggest that females are more sensitive to framing than males.

In line with international evidence, gender; race and religion were all found to be significantly related to risk tolerance suggesting that there is value in tailoring specific investment options on the basis of these variables. Income was not found to be related to risk tolerance but this may be as a result of limitations in the sample and in the questionnaire design. The lack of accurate income data, relatively small sample size, and the homogeneity of the sample in terms of age, marital status and educational level represent important limitations of the study. Productive areas for further research would include employing a more diverse sample that would allow an analysis of the relationship between risk tolerance and other demographic variables such as age, education, income and marital status. Further exploring the impact of framing on risk tolerance measures is also required.

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