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Article

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The nature of inconsistencies in two measures of risk preferences in a sample of young African South Africans

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Abstract: In this paper, we attempt to unpack the nature of revealed inconsistencies in two measures of risk preferences for a sample of young African South Africans. The first measure is a self-reported propensity to take risk in general, and the second is a risk preference elicited through a hypothetical financial gamble. We find that the majority of individuals are inconsistent in their responses that provide these two measures of risk preferences with the majority of contradictions coming from individuals reporting themselves as risk seeking, when their revealed risk preferences from the hypothetical gamble show them to be risk averse. Our results suggest that such inconsistencies are more prevalent amongst males, and amongst females with greater mathematical ability.

Subjects: Gender Studies - Soc Sci; Multidisciplinary Psychology; Cognitive Psychology; Economic Psychology; Microeconomics

Keywords: risk preference; inconsistency; self- reported; hypothetical gamble

1. Introduction

Risk preferences or attitudes are important because they provide a foundation for decision-making in numerous economic and non-economic settings. Indeed, risk preferences are often used in the economic and psychology literature as predictors of certain behaviors, such as financial decision-making (cf., Brown et al., 2013; Calvet & Sodini, 2014; Fan & Xiaio, 2006; Guiso et al., 2002; Karni, 1982; Nagano & Yeom, 2014; Yao et al., 2004), livelihood choice (c.f., Bellante & Link, 1981; Cramer et al., 2002; Dohmen & Falk, 2011; Fourage et al., 2014; Skriabikova et al., 2014) and many other behaviors that involve elements of risk. The importance of risk preferences in determining certain behaviors necessitates an understanding of these preferences by both researchers, and individuals engaging in these behaviors. Questions relating to whether different measures of risk preferences reflect the same thing; whether they are consistent with each other; and, whether individuals have a reliable understanding and awareness of their own risk preferences, are of importance.

Social Psychologists define an attitude as an evaluation of something, commonly expressed in terms of a preference for or against the attitude object. Attitudes are made up of cognitive (what one believes), affective (how one feels), and behavioral (how one acts) components. An Attitude is considered strong if it comes to mind quickly. Strong attitudes are held with confidence, do not change very much, and guide one's actions (Ferguson et al., 2005). Attitudes are stronger when affect, behavior and cognition all align. If there is attitude consistency (affect, behavior and cognition all aligning), then attitudes, as measured by a self-reported response, for example, should guide behavior (Stangor et al., 2022). Our focus in this paper is on the strength of risk

attitudes specifically, in terms of the degree to which the components of cognition and behavior are aligned for our particular sample.

Certain measures of risk attitudes rely on surveys asking about risk taking in general, or in specific domains. Other survey measures rely on questions attempting to elicit risk preferences through hypothetical gambles, while other measures involve complex experimental structures with real monetary payoffs to elicit risk preferences. It turns out, however, that various measures of risk preferences are often inconsistent with each other, even in situations where the context remains the same (c.f., Bruner, 2009; Deck et al., 2013; He et al., 2017; Hey et al., 2009; Lonnquist et al., 2015; Pedroni et al., 2017). While such inconsistencies are acknowledged in the literature, very few papers attempt to unpack the nature of and explain such inconsistencies, especially the issue relating to who is more likely to be inconsistent.

In this paper, we unpack the nature of the inconsistency between two measures of risk preferences for a sample of young African South Africans, ranging in age from 21 to 27. This age group of African South Africans, is of interest, since at the same time as attempting to make livelihood decisions, they are particularly affected by high unemployment. They need to make decisions as to whether they should accept jobs with lower but secure incomes, or whether to hold out for higher paying jobs. Decisions as to which job sector to enter, and an understanding of their suitability to entrepreneurial ventures where risk levels are particularly high (c.f., Shtudiner, 2018), are important issues for this group. Thus, an awareness of their risk appetites is very important, both for themselves in making decisions, and for policy makers in addressing unemployment.

The first measure of risk preference looked at in this paper, is a self-reported propensity to take risk in general, and the second is a risk preference elicited through a hypothetical financial gamble. In particular, we interrogate the suggestion that inconsistencies in measures of risk preferences are more likely in individuals with lower mathematical ability. Numerical ability has been shown to be a strong predictor of comprehension of everyday risk (Cokely et al., 2012), and a good predictor of decision strategies and comprehension in general (c.f., Banks et al., 2011; Cokely & Kelley, 2009; Reyna et al., 2009; Sobkow et al., 2020). Greenberg and Shtudiner, 2016 show that bounded rationality when assessing risk and returns was decreased in university students who had a background in financial education and quantitative analysis. For South Africa, in particular, (Reddy et al., 2012), showed that mathematics scores of grade 8s was a good indicator of analytical ability.

Anderson and Mellor (2009) and Dave et al. (2010) find that inconsistencies in risk preferences are more prevalent in individuals with lower cognitive ability, while (Reynaud & Conture, 2012; He et al., 2017) show cognitive ability to be insignificant.

Evidence on the consistency of risk preferences elicited by using a simple survey question indicating self-reported risk attitudes, and risk experiments, is mixed. Dohmen et al. (2011) and Vieder et al. (2015), find that self-reported risk preferences elicited through the survey measure are correlated with the experimental results, but that the survey measure is still a better predictor of risky behavior. Others show very little or no correlation between the survey measure and experimental measure (Charness & Viceisza, 2016; Deck et al., 2013; Lonnquist et al., 2015; Mudzingiri & Koumba, 2021). Our paper looks at a hypothetical gamble measure, in particular, and compares risk preferences as elicited by this measure, to those stated in the survey question.

In our paper, we find that inconsistencies in these measures arise mainly due to individuals subjectively classifying themselves as risk seeking, whereas answers to the hypothetical gamble show them to be risk averse. We find this effect predominantly for males, and surprisingly for individuals with *higher* mathematical cognitive ability, in particular for females with better mathematical ability.

The paper proceeds as follows. In section 2, we provide a literature review. Section 3 describes the data. In section 4, we carry out the statistical analysis. We present both descriptive data and

the results of the regression analyses. Section 5 provides a summary of the results and a conclusion.

2. Literature on in/consistency of risk preferences

Anderson and Mellor (2009) examined the stability of risk preferences in a sample of 236 university students at the College of William and Mary in the US. The first method was an economics experiment with real monetary payoffs, and the second, a survey with hypothetical gambles. They found that for the majority, risk preferences were not stable across the two methods. However, subjects with better comprehension, had preferences that were more stable across the two methods.

Dave et al. (2010) show the tradeoffs of using two different experimental methods of eliciting preferences for a sample of 900 adults. The more complex method (Holt & Laury, 2002) was shown to have better predictive accuracy, but was more noisy than the simpler method (Eckel & Grossman, 2002). However, when subjects had better numerical skills, the better predictive accuracy of the more complex method, outweighed the noise.

Dohmen et al. (2011) use a large representative sample of German adults to study the consistency of risk attitudes. The responses to a question on willingness to take risk in general were correlated with the responses to the experimental measure that used paid lottery choices. However, while the answers to the general risk question was a good all round predictor of risky behavior, the best predictor of specific risk behaviors, were the context specific risk attitude questions.

Reynaud and Conture (2012)) compare three different elicitation methods of measuring risk attitudes of French farmers. Two were experiments based on lottery choices, one by Holt and Laury (2002), and one by Eckel and Grossman (2002, 2008). The third measure was a questionnaire asking for self-reported risk attitudes in different domains. The authors found that risk attitudes elicited through lottery choices were highly correlated with self-reported risk attitudes in the domain of investments.

Deck et al. (2013) conducted a laboratory experiment using multiple paid elicitation tasks, and a survey on domain-specific risk attitudes. The results showed that variation between survey risk attitude questions and experimental measures could not be explained by domain-specific attitudes.

Lonnquist et al. (2015) used a sample of German university students to compare two prominent empirical measures of risk attitudes- the Holt and Laury (2002), lottery choice task and the (Dohmen & Falk, 2011), multi item questionnaire reporting risk attitudes. The measures themselves were uncorrelated, but it turned out that the questionnaire measure was the more adequate measure of risk attitudes, in that it exhibited re-test stability, and was correlated with actual risk taking behavior.

Charness and Viceisza (2016) use three distinct methods of eliciting preferences (The Holt Laury task, the Gneezy-Potters task, and a survey measure) in rural Senegal. They find that there are inconsistencies in the responses elicited by these three measures.

Pedroni et al. (2017) examined the consistency of risk preferences across six different experimental elicitation methods for a sample of 1507 Swiss adults. The results showed that preferences were not stable across the different methods. The results also indicated that cognitive ability as measured by statistical numeracy was not correlated with inconsistent preferences.

He et al. (2017) conducted a field experiment in China to investigate consistency across incentivized experimental risk measures, as well as consistency across non-incentivized survey measures,

and incentivized experiments. They found that inconsistent risk preferences across survey and experimental measures could be explained to an extent by the fact that subjects mix risk and ambiguity preferences in the survey measure.

Mudzingiri and Koumba (2021) used a sample of 193 South African University students to investigate the stability of financial risk preferences elicited through two methods. The two methods were 1) A self-reported perceived willingness to take a financial risk, and 2) an experimentally elicited incentivized revealed risk preference. The authors found that the two methods revealed inconsistent risk preferences, but that individuals with better financial literacy had preferences that are more consistent.

Adema et al. (2022) used a repeated survey experiment among students in four countries to explain the stability of risk preferences in the context of the Covid 19 pandemic. The authors found that self-assessed risk aversion increased since the Covid 19 pandemic, whereas preferences elicited by an incentivized lottery showed risk aversion had decreased. The authors suggest that the difference is due to specificity of preferences. The literature thus, provides an abundance of evidence of inconsistencies in risk preferences elicited through different methods. In our paper, we look specifically at risk preferences elicited through a self-reported survey measure, and through a hypothetical gamble for a sample of African South Africans in the age group 21 to 27 years of age. Further, we unpack the nature of any inconsistencies, and attempt to find the determinants of such inconsistencies. We also interrogate previous findings that inconsistencies are more prevalent in individuals with low cognitive ability.

3. Data

We use secondary data from the Labour Market Entry Survey. The data was originally collected by Rankin, Roberts and Schoer (see, Rankin et al., 2014) for the purposes of investigating the efficacy of a labour market intervention. The dataset, however, also provides measures of risk preferences (both subjectively assessed and from a hypothetical gamble), as well as measures of mathematical ability, and is thus useful for our study. The sample was collected from two sources: The EA sub-sample and LC sub-sample. The EA sub-sample consists of individuals who were randomly selected and interviewed in areas across the Johannesburg, Polokwane and Durban regions of South Africa. The LC sub-sample was obtained from interviewing young South Africans at the Departments of Labour, which are Labour Centres in the above-mentioned areas.

The study lasted over a four-year period where individuals were surveyed multiple times between 2009 and 2012. Individuals were between and including the ages of 20 and 24 when they were first interviewed in 2009. Some individuals only completed the survey once, while others up to a total four times. For the purposes of this study, we used the two waves that contained the questions of interest to us, the 2010 and 2011 waves. We only included individuals who answered the questions we needed in both 2010 and 2011. This was necessary as some of the questions needed were asked only in 2010, while other questions needed were asked only in 2011. Thus, by combining these two waves, we could achieve a sample who answered all the necessary questions for our analysis. There were a total of 1840 participants that formed our sample, both male and female, ranging in age when interviewed in 2010 and 2011 from 21 to 27. A broad spectrum of different education levels was observed from no formal schooling to a bachelor's degree.

Two different risk preference variables were used: a revealed risk preference index (obtained from the 2010 wave) and a self-reported risk preference index (obtained from the 2011 wave). The revealed risk preference index was developed using three hypothetical[1] questions. These questions offered a choice between a certain payoff and a 50/50 chance of winning a larger amount. The questions were asked one after the other in the following order: 1) take R100 or flip a coin to see if you win R400; 2) take R100 or flip a coin to see if you win R200 and 3) take R100 or flip a coin to see if you win R180. An individual who responded "Take R100" to the first question is given a value

of "1" (most risk averse). The expected value of the coin flip in the first question is 50% of R400, which is equal to R200; therefore choosing the certain amount is a risk averse decision. If the individual did not take the certain amount in the first question, the second question's response was observed. If the individual responded "Take R100", the individual is given a value of "2" (risk averse). This is because the expected return of the coin flip is R100, which indicates the individual would rather take the sure amount with an equal expected return. According to standard Expected Utility theory (Von Neumann & Morgenstern, 1944), choosing a certain amount instead of choosing a gamble that has an expected value of a *higher* or *equal* amount indicates risk aversion. If an individual did not take the certain amount in the second question, the third question's response was observed. An individual who responded "Take R100" to the third question is given a value of "3" (risk seeking). This is because the subject chose to take the uncertain coin flip to win R200 (expected value R100) which shows risk seeking behavior according to standard Expected Utility theory, but also chose the certain amount of R100 rather than a coin flip for R180 (expected value 90). Finally, an individual who chose the coin flip for the third question, i.e. chose a gamble with an expected value of 90, rather than taking the certain amount of R100, was assigned a value of "4" (most risk seeking). Thus, the revealed risk preference index consisted of values "1" to "4", increasing as behavior becomes more risk seeking.

Participants who had inconsistent *responses* (i.e., responded "Take R100" rather than flip a coin to see if you win R400 and then responded flip a coin to see if you win R180 instead of taking the R100) were excluded from the regression analyses. Inconsistency in responses could imply one of two things. Either the individual did not understand the questions being asked or the individual was not answering the questions honestly and therefore the responses were not suitable for analysis. Individuals with inconsistent responses formed 8% of the sample.

The second risk question used was a self-reported risk question. The question simply asked, "Do you like to take risks?" Individuals had the choice of three responses: 1) "No—I am generally cautious", 2) "Average—Sometimes I take risks, sometimes I am cautious" and 3) "Yes—I am generally a risk taker". Participants who responded "No—I am generally cautious" were assigned a value of "1", implying risk aversion. Those who responded "Average—Sometimes I take risks, sometimes I am cautious" were assigned a value of "2", implying risk neutrality. Finally, participants who responded "Yes—I am generally a risk taker" were assigned a value of "3", implying risk-seeking behavior. Therefore, a self-reported risk index could be used, again increasing in the extent of risk seeking behavior, this time from "1" to "3".

Two measures of mathematical ability were used as separate explanatory variables. The first is a six-question, basic mathematics test, which challenged simple mathematic operations (obtained from the 2011 wave). These questions were asked in the same order for all participants and the same numbers were used on each survey. Numbers "n1" to "n8" were stated above the first question and were used for five of the six questions. The questions were stated as follows:

Question 1: 'What is "{{n1_number}} + {{n2_number}}";

Question 2: "What is {{n3_number}} times {{n4_number}}";

Question 3: "What is {{n7_number}} divided by {{n6_number}}";

Question 4: "What is {{n8_number}}—{{n1_number}}";

Question 5: "How much change do you get if you buy R {{n8_number}} airtime with two R20 notes?"

Question 6: "13 x 13 = ".

Participants were scored from zero to six according to the number of correct responses. This implies that a participant with a score of "0" has poor basic mathematical ability and a participant with a score of "6" has good basic mathematical ability.

The second variable used to measure mathematical ability (asked in both the 2010 and 2011 waves) was the response to the questions, "In your last year of school did you take Mathematics?" and 'If you took Mathematics, did you pass? Participants that responded "No" to the first question were assigned a value of "0". A binary variable was then developed from the responses to the question, "If you took Mathematics, did you pass?" A value of "0" was also assigned if the response was "No" and "1" if "Yes". Therefore, both measures assumed an increase in mathematical ability as the value of the index increased (either "1" to "6" or "0" to "1").

Other variables included in the regression analysis were age, gender, level of education, marital status and whether or not the participant had children. Age varied from 21 to 27 and level of education was scaled from zero to 15, increasing with a higher level of qualification. The gender variable assigned a "0" to male participants and a "1" to female participants. Marital status was measured on a 4-point scale, with "0" assigned to unmarried participants, "1" assigned to participants who were unmarried but living with a partner, "2" assigned to participants who were married in a traditional ceremony and "3" assigned to participants who were married in a civil ceremony.

We feel that the power of the analysis and its validity is maximized in a few ways. First, the sample size is large (1840). Second, because we have panel data, we are able to get indexes of both subjective risk preferences and elicited risk preferences from the hypothetical gamble for the same individuals, even though the tasks were conducted in different years. Third, the hypothetical gamble is carried out using an ordered lottery task in the sense of Holt and Laury (2002). This is considered a valid and reliable method of eliciting risk preferences. At the same time, we can easily verify inconsistent responses given in the lottery task, and thus leave individuals giving these out of the analyses. In this way, we can be sure that individuals who did not understand the gamble were not included in the analyses.

4. Econometric analysis

4.1. Descriptive statistics

Table 1 shows the relationship between individuals who were excluded from the sample for giving inconsistent responses in the gamble task (in the sense explained in section 3 above), and the score for the mathematics questions. It is evident that individuals who had a zero score on the math questions had by far the greatest inconsistencies in responses. 45% of individuals with a zero score on the math questions clearly did not understand the gamble questions. Individuals who got

Table 1. Inconsistent responses in the lottery task by math score

Score	inconsistencies	Total	% Inconsistent
Total	150	1947	8%
0	57	128	45%
1	3	63	5%
2	11	161	7%
3	20	363	6%
4	24	494	5%
5	21	351	6%
6	14	387	4%

all six math questions correct had the lowest percentage of inconsistencies (4%). We do not see much difference in inconsistency of responses between those who got scores between one and five on the math questions.

Once we have excluded those with inconsistent responses in the lottery task from our sample, we start the analysis by observing whether contradictions (inconsistencies) in risk *preference* measures are in fact prevalent.[2]

We classify individuals as contradicting themselves if they subjectively classified themselves as risk seeking/risk averse and their revealed preference through the hypothetical gamble showed them to be risk averse/risk seeking, respectively. By risk seeking in the hypothetical gamble, we refer to individuals who were assigned a value of three or four, and by risk averse, we refer to individuals who were assigned a value of one or two. All other cases were seen as non-contradictions (including those who subjectively classified themselves as risk neutral. Since there was no exact risk neutral option in the revealed preference case, it would be presumptuous to classify individuals as contradicting themselves if they subjectively classify themselves as risk neutral, but their revealed preferences show them to be risk seeking or risk averse.)

Table 2 shows that contradictions in our two measures of risk preference are indeed prevalent and further that such contradictions are more common for males than for females.

Table 3 shows the percentage of total participants with contradicting risk measures who had self-reported their risk preference as risk seeking but their revealed risk preference was risk averse. A total of 70,16% of contradictions came from this type of discrepancy. Both males (73,04%) and females (67,72%) display this inconsistency. Therefore, as a group, this type of contradiction accounts for the majority of the total contradictions and males are more likely to contradict themselves in this manner.

We now break down in more detail the relationship between mathematical ability and the tendency to give inconsistent measures of risk preferences. In particular, we look at mathematical

Table 2. Frequency of contradictions between revealed risk preferences and self-reported risk preferences

	Gender		
Risk contradict	**Male**	**Female**	
No contradiction	246 (43.54%)	360 (48.78%)	606
Contradiction	319 (56.46%)	378 (51.22%)	697
Total	565	738	1303

Table 3. Nature of contradictions between revealed risk preferences and self-reported risk preferences

	Gender		
Risk contradict	**Male**	**Female**	
S/R R.S + A/R R.A	233	256	489
All contradictions	319	378	697
Percentage	73,04%	67,72%	70,16%

(S/R R.S + A/R R.A—indicates participants who had self-reported their risk preference as risk seeking but revealed themselves to be risk averse in the hypothetical gamble.)
(All Contradictions—indicates all participants who had differences between their self-reported risk preference and their revealed risk preference)

Table 4. Correlation matrix between revealed risk preference and self-reported risk preferences by mathematics score

Mathematical ability	Correlation
1	−0.08
2	0.08
3	0.10
4	0.07
5	−0.08
6	0.07
Overall	0.05

Table 5. Mathematics score and non-contradictory and contradictory measures of self-reported risk preferences and revealed risk preferences

	Math score	Total	-Non-Contradictory measures	Contradictory Measures	
Poor	0	47	30 (64%)	17(36%)	
	1	45	22 (49%)	23 (51%)	
	2	108	53 (49%)	55 (51%)	
	3	255	125 (48%)	130 (52%)	
	4	343	166 (48%)	177 (52%)	
	5	245	94 (38%)	151 (62%)	
Good	6	269	116 (43%	153 (57%)	
		1 312	606	706	
		{1840}			
			32,93%	38,37%	71,30%

ability as indicated by the test score in the survey. We present first a correlation matrix in Table 4 and then a frequency table in Table 5. The correlation matrix shows very low correlation between revealed risk preferences and self-reported risk preferences, with the correlation being slightly lower on average for mathematics scores from four to six, than for scores from one to three.

The frequency table shows that only 32,93% of participants had a revealed risk preference index that corresponded to their self-reported risk preference. 38,37% of participants had contradicting revealed risk preferences and self-reported risk preferences. The remaining 28,7% of participants had self-reported risk neutral and thus could not be classified as either contradicting or not contradicting the actual revealed risk preference index score. Contradictions between the two measures are also increasing on average with mathematics scores. This result is surprising. Tables A1 to A6 in the appendix break this down further by looking at the effect of the mathematics score on the revealed risk preference and on the self-reported measure, for the entire sample (A1 and A4), as well as for males (A2 and A5) and females (A3 and A6) separately. We see that while actual revealed risk preferences do not seem to change with the math score, there is an increase in the tendency for individuals (especially females) to report themselves as risk seeking as the math score increases.

Before we proceed to the regression analyses, as a robustness check, we look descriptively at the extreme cases of only those who we classify as most risk averse, i.e. were assigned an index of one in the hypothetical gamble, and most risk seeking, i.e., were assigned an index of four in the gamble. We are interested in the level of contradictions in this smaller, extreme, group, and how

they compare to the sample as a whole. Are the contradictions in the sample as a whole because of individuals who are moderately risk averse or risk seeking, according to the hypothetical gamble, and will we still see contradictions in individuals who revealed themselves to be very risk averse or risk seeking? The results are presented in Tables A7, A8 and A9 in the appendix. We see that while the level of contradictions in this group is slightly lower than in the group as a whole (including those assigned an index of two or three in the hypothetical gamble), they are still very substantial. The level of contradictions for males was 44.75%, and for females was 41.06%. Thus, the finding that there are inconsistencies in risk preferences across different measures is robust to whether we look at all individuals, or only at those that are revealed as most risk averse and most risk seeking in the hypothetical gamble. Our finding is consistent with the majority of the literature, as can be seen in the literature review, which finds that individuals have inconsistent risk preferences across different elicitation techniques. Furthermore, we find that for the group revealed as most risk averse and most risk seeking in the gamble, the proportion of contradictions, which arise from individuals reporting themselves to be risk seeking in the survey question, but revealing themselves risk averse, is now 84% for males and 80% for females (Table A8). Thus, individuals who reported themselves as risk seeking are actually very likely to present as the most risk averse in the hypothetical gamble. We also see, from Table A9 that individuals in this smaller sample who had a math score of zero, had the least amount of contradictions (27%), again indicating, as in the bigger sample, that contradictions are increasing with mathematical ability.

Thus, we see that in general, the extreme sample, consisting of only those revealed in the hypothetical gamble as most risk averse and most risk seeking, resembles very closely the general sample, with respect to the descriptive findings. We thus proceed with the regression analysis using the entire sample of individuals revealing themselves as most risk averse (1), risk averse (2), risk seeking (3), and most risk seeking (4), as it comprises the entire spectrum of risk preferences.

4.2. Regression analysis

Key to understanding the inconsistencies in our two measures of risk preferences is to analyze how the determinants of the two measures differ.

Table 6 shows the ordinal logistic regression results looking at the determinants of preferences as revealed by answers to the hypothetical gamble questions. The measure of the revealed risk preference index ranged from "1" (most risk averse) to "4" (most risk seeking). Columns 1 to 3 use

Table 6. Determinants revealed risk preference

	Maths = Score			Maths = Passed		
Column	**1 (All)**	**2 (Males)**	**3 (Females)**	**4 (All)**	**5 (Males)**	**6 (Females)**
Maths	0.015 (0.53)	0.014 (0.30)	0.012 (0.33)	−0.029 (0.31)	0.016 (0.12)	−0.065 (−0.51)
Female	0.099 (1.08)			0.095 (1.03)		
Education	−0.010 (−0.40)	−0.008 (−0.24))	− 0.011 (−0.33)	−0.010 (0.40)	−0.008 (−0.40)	−0.011 (−0.34)
Marital stat	0.063 (0.45)	−0.029 (−0.13)	0.143 (0.78)	0.060 (0.43)	−0.027 (−0.13)	0.142 (0.77)
Children	−0.146 (−0.53)	−0.035 (−0.23)	−0.226* (−1.71)	−0.142 (1.43)	−0.033 (−0.22)	−0.219* (−1.67)
Age	0.035 (1.11)	0.078* (1.68)	−0.033 (−0.06)	0.035 (1.13)	0.079* (1.70)	−0.002 (−0.33)
N	1772	778	994	1773	778	995

*$p < 0.1$ ** $p < 0.05$; *** $p < 0.01$.
t statistics indicated in parentheses

the number of correct responses to the math questions in the survey as the measure of mathematical ability, whilst columns 4 to 6 use whether or not an individual passed mathematics in their final year of schooling as the measure of mathematical ability. Columns 1 and 4 show the results for the full sample, columns 2 and 5 show the results for males, and columns 3 and 6 for females. It should be noted that because education level is included as an explanatory variable, whether or not an individual passed mathematics in their final year of schooling, shows, how, at any particular level of education reached, passing mathematics at this level affects risk preference compared to an individual who did not pass mathematics at that level of schooling.

The results of the regression show that males appear to become more risk seeking as they get older and females more risk averse as they have more children. However, it does not appear that as a whole, women presented as more risk averse than men in this task. It seems to be an accepted stylized fact in the economics literature that females in general, are more risk averse than males (see surveys by Eckel & Grossman, 2008c; Croson & Gneezy, 2009). While much of the research conducted in the field confirm this fact, the results from laboratory experiments with lottery type choices do not consistently demonstrate this effect (c.f., Filippin & Crosetto, 2016; Nelson, 2016). In fact, (Filippin & Crosetto, 2016), analyzed the original data for 54 published papers (covering about 7000 subjects) that used the Holt and Laury (2002) task. They found that gender differences emerged in less than 10% of the published papers. Thus, our result is consistent with this finding. It is also noteworthy that the "maths" variable is not significant. Thus, it appears that cognitive ability, as measured by the "maths" variable" does not influence risk-taking behavior in the lottery task. Marital status and education level are also not found to be significant in the lottery task.

Table 7 shows the ordinal logistic regression results looking at the determinants of self-reported risk preference. Again, columns 1 to 3 use the number of correct responses to the math questions in the survey as the measure of mathematical ability, whilst columns 4 to 6 use whether or not an individual passed mathematics in their final year of schooling as the measure of mathematical ability. Columns 1 and 4 show the results for the full sample, columns 2 and 5 show the results for males, and columns 3 and 6 for females.

The results show that greater mathematical ability, regardless of which measure is used, leads individuals, and females especially to classify themselves as more risk seeking. Males

Table 7. Determinants of self-reported risk preference

	Maths = Score			Maths = Passed		
Column	**1 (All)**	**2 (Males)**	**3 (Females)**	**4 (All)**	**5 (Males)**	**6 (Females)**
Maths	0.097*** (3.29)	0.091* (1.95)	0.095** (2.52)	0.205** (2.16)	0.095 (0.67)	0.300** (2.32)
Female	−0.210** (−2.26)			−0.203** (−2.17)		
Education	0.008 (0.35)	0.060 (1.73)	− 0.038 (−1.15)	0.007 (0.31)	0.060* (1.73)	−0.040 (−1.19)
Marital stat	−0.128 (−0.93)	−0.281 (−1.23)	−0.030 (−0.17)	−0.122 (−0.88)	−0.258 (−1.13)	−0.042 (0.25)
Children	−0.032 (−0.32)	0.105 (0.67)	−0.134 (−1.02)	−0.034 (−0.34)	0.155 (0.73)	−0.150 (−0.14)
Age	0.018 (0.58)	0.059 (1.26)	−0.014 (−0.33)	0.015 (0.46)	0.061 (1.29)	−0.023 (−0.54)
N	1727	760	967	1728	760	968

*$p < 0.1$ ** $p < 0.05$; *** $p < 0.01$.
t statistics indicated in parentheses

were more likely than females in general to classify themselves as risk seeking. Thus, while males were not seen to be more risk seeking than females in the lottery task, when giving an answer to the survey question asking about risk in general, they are likely to have drawn on real-life experiences and behavior in many domains. As noted in the discussion above, most of the literature looking at real behavior as opposed to laboratory type experiments have found males to be more risk seeking than females. Many laboratory experiments using lottery type experiments do not, however, observe this. Another possibility is that in giving a self-reported response about risk taking, males might find it more socially acceptable to report themselves as risk seeking, and females to report themselves as risk averse. The same may be true of individuals, especially females, with higher cognitive ability. Dohmen, 2018, in a review of studies looking at the effect of cognitive ability on risk behavior found that many studies showed that while cognitive ability is associated with risk aversion in harmful risky situations, it is associated with risk seeking behavior in advantageous situations. Indeed, risk taking behavior has been shown to have a positive effect on economic outcomes (c.f., Liu, 2013; Liu & Huang, 2013). Given that this sample of individuals was being asked extensively about labour market activities, as they were part of a randomized control trial on wage subsidies, individuals with better numerical cognitive ability may have reported themselves as risk taking as they considered it more advantageous to be so, in the context of the survey in general.

Table 8 shows who is more likely to give contradictory risk preference measures when looking at elicited risk preferences from a hypothetical gamble and self-reported risk preferences. The results are based on a binary logit regression, where the outcome is a dummy variable equal to one if there was a contradiction, and zero if there was no contradiction. Those with better mathematical ability, especially females who scored better in the math questions from the survey were more likely to give contradictory measures. Based on previous regressions, this seems to be the case because females with better mathematical ability were more likely to classify themselves as risk seeking, even though their elicited risk preferences were unaffected by mathematical ability. Males in general were more likely to give contradictory measures, again because they were more likely to classify themselves as risk seeking when their elicited risk preference did not prove them to be so (see, Tables 6 and 7 for regressions, and Table 3 for descriptive stats). Older females also seemed more likely to contradict themselves.

Table 8. Determinants of contradictory risk measures

	Maths = Score			Maths = Passed		
Column	**1 (All)**	**2 (Males)**	**3 (Females)**	**4 (All)**	**5 (Males)**	**6 (Females)**
Maths	0.097*** (2.66)	0.069 (1.17)	0.100** (2.07)	0.145 (1.26)	−0.077 (−0.04)	0.241 (1.51)
Female	−0.197* (−1.73)			−0.198* (−1.73)		
Education	0.011 (0.35)	0.001 (0.02)	0.019 (0.44)	0.008 (0.26)	−0.001 (−0.01)	0.014 (0.33)
Marital stat	−0.099 (−0.61)	0.041 (0.15)	−0.318 (−1.40)	−0.097 (−0.59)	0.050 (0.19)	−0.332 (−1.45)
Children	−0.048 (−0.41)	−0.127 (−0.67)	−0.123 (−0.75)	−0.038 (−0.32)	−0.119 (−0.62)	−0.125 (−0.77)
Age	0.103** (2.15)	0.042 (0.71)	0.118** (2.19)	0.084** (2.13)	0.044 (0.32)	0.119** (2.21)
N	1294	544	710	1295	544	711

*$p < 0.1$ ** $p < 0.05$; *** $p < 0.01$.
t statistics indicated in parentheses

5. Discussion and conclusion

In this paper, we attempted to unpack the nature of revealed inconsistencies in two measures of risk preferences for a sample of African South Africans in the age group 21 to 27. The first measure is a self-reported propensity to take risk in general, and the second is a risk preference elicited through a hypothetical financial gamble. This sample of individuals is of particular interest, since while they are at an age where they are entering the labour market; they are particularly affected by high youth unemployment in South Africa. Understanding their risk preferences is of importance in designing policies to reduce unemployment. While inconsistencies in different measures of risk preferences have been found and acknowledged in the literature, our paper explicitly and thoroughly investigates the nature and determinants of the inconsistencies for our sample.

We find that the majority of individuals are indeed inconsistent in their responses that provide these two measures of risk preferences. The majority of contradictions arise from individuals reporting themselves as risk seeking when their revealed risk preference as elicited through the hypothetical gamble, shows them to be risk averse.

The contradictions seem to stem from the fact that the determinants of the revealed risk preference measure are very different to the determinants of self-reported risk preferences. The main determinants of revealed risk preferences are having children for females and age for males. In particular, females with children reveal themselves to be more risk averse, while older males are more risk seeking. On the contrary, the main determinants of self-reported risk preference are gender and mathematical ability. Males report themselves to be more risk seeking than do females, and individuals (especially females) with better mathematical ability report themselves to be more risk seeking. Gender and mathematical ability have no effect, however, on revealed risk preferences for this sample and thus contradictions seem to stem from this fact.

Inconsistencies in the two measures are prevalent for males, and surprisingly for females with better mathematical ability. Indeed, mathematical ability is seen in the literature as one of the best measures of cognitive ability. This is in contrast to suggestions that inconsistencies in risk preference measures are more prevalent in individuals with weaker cognitive ability. Thus, in light of our findings, it would be difficult to attribute such inconsistencies to a lack of understanding of questions or gambles.

Research has shown that attitudes will guide behavior only under certain conditions (Stangor et al., 2022). These conditions are: 1) When the attitude and the behavior occur in similar social situations; 2) When the same component of the attitude (cognition or affect) is accessible when the attitude is assessed (self-reported response) and when the behavior is performed.; 3) When attitudes are measured at a specific, rather than a general level (Davidson & Jaccard, 1979); 4) When individuals are low self-monitors, i.e. when they are less influenced by peer pressure, and the need to adapt to social expectations (Kraus, 1995).

In the context of our paper, we feel that two of the above-mentioned conditions for the alignment of self-reported preferences and revealed preferences (the alignment of attitudes and behavior) might be at play. First, the fact that the self-reported risk preference is asked as a general question, rather than relating to specific domains. Preferences resulting from the hypothetical gamble relate specifically to a financial domain. Thus, when answering the general risk question, respondents (in particular, males and those with better numerical ability) might be drawing on beliefs and experiences, in domains other than the financial realm. Other authors, such as (Dohmen et al., 2011) confirm that self-reported measures of risk preferences are better correlated with experimental measures of risk preferences, when they are domain specific.

Secondly, the issue of conforming to social expectations may be at play. The fact that many of the contradictions stem from males reporting themselves as risk seeking, when in fact they reveal themselves (knowingly or not) to be risk averse. Males might believe that society expects them to be risk seeking, and thus answer the risk question in the way they feel may be expected of them.

The same may hold true of individuals with better mathematical ability. While this age group may feel it is socially more acceptable to be considered a risk taker and thus answer the survey question accordingly, their rational minds might take over when faced with an actual gamble that reveals their true risk preferences.

Whether the better approximation of true preferences is the hypothetical gamble, or the self-reported subjective measure, is a matter to be debated and investigated further. While there is contention in the literature as to the legitimacy of using gambles with hypothetical payoffs as opposed to real monetary payoffs in eliciting risk preferences, the consensus among psychologists seems to be that hypothetical choices give a reasonable, qualitatively accurate picture of real choices. While researchers such as Harrison and co-authors (c.f. Neill et al., 1994; Cummings et al., 1995; Harrison & Rutstrom, 2008; Holt & Laury, 2002) are more pessimistic in this regard and suggest that risk preferences are not well predicted by gambles with hypothetical payoffs, Holt and Laury do show that the discrepancy between choices with real and hypothetical payoffs is most prevalent when stakes are high.

In general, however, there is quite a bit of evidence supporting the fact that hypothetical gambles are a good representation of real choices (c.f., Kahneman & Tversky, 1979; Camerer & Hogarth, 1999; Beattie & Loomes, 1997; Locey et al., 2011; Kuhberger et al., 2002). Either way, despite the differing opinions regarding real and hypothetical gambles, both approaches are widely used. The purpose of this paper is merely two compare preferences elicited through hypothetical gambles and a survey question, both of which are commonly used to elicit preferences. Indeed, even though Harrison et al. would argue that hypothetical bias exists in the case of the hypothetical gamble, they would hardly argue that the self-reported subjective measure does not entail bias, most likely more so. Whether this arises in our context because certain individuals incorrectly perceive themselves to be risk seeking when they reveal themselves to be risk averse, whether this has to do with lack of domain specificity in the survey question, or whether this is a matter of reporting bias in that such individuals would like to falsely portray themselves as risk seeking, we cannot say. The fact is in using risk preferences as a predictor of various behaviors, cognizance needs to be taken of the fact that such risk preferences are dependent on the particular measure used. Thus, caution needs to be exercised in this regard. In particular, researchers and policy makers need to contemplate very carefully the best measure of risk preference to consider in any particular context.

Lastly, we must emphasize that we do not profess all our results in this paper to be generalizable, not even to the South African population as a whole. Rather, we see this as an interesting study of determinants of measures of risk preferences (and inconsistencies between them) in a sample of younger African South Africans, trying to enter the labour market – many of whom are unemployed. It is precisely the uniqueness of the sample, and the context that makes the study interesting. As already mentioned, an understanding of risk preferences amongst this group, as well as best elicitation methods of such for the purpose of policies aimed at alleviating youth unemployment are likely to be important. What is generalizable though is that while the exact determinants of our two measures of risk preferences might be specific to the context here, the determinants of subjective risk preferences and elicited risk preferences are likely to be different, regardless of the context. Future research might aim to replicate the analysis in other populations, looking at the role played by context (culture and other sociological and economic factors) in the determinants of different measures of risk preferences and inconsistencies in these.

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Notes

1. Hypothetical in the sense that there is no actual monetary payout.
2. Note the difference between individuals who we refer to as being inconsistent in responses in the lottery task (and are thus excluded from the analysis), and individuals with inconsistent risk *preferences*, and are thus of interest in our analysis.

References

Anderson, L., & Mellor, J. (2009). Are risk preferences stable? Comparing an experimental measure with a validated survey-based measure. *Journal of Risk and Uncertainty*, *39*(2), 137–160. https://doi.org/10.1007/s11166-009-9075-z

Banks, J., O'Dea, C., & Oldfield, Z. (2011). Cognitive function, numeracy and retirement saving trajectories. *Econ J (London)*, *120*(548), 381–410. https://doi.org/10.1111/j.1468-0297.2010.02395.x

Beattie, J., & Loomes, G. (1997). The impact of incentives upon risky choice experiments. *Journal of Risk and Uncertainty*, *14*(2), 155–168. https://doi.org/10.1023/A:1007721327452

Bellante, D., & Link, A. N. (1981). Are public sector workers more risk averse than private sector workers. *Industrial & Labor Relations Review*, *34*(3), 408–412. https://doi.org/10.1177/001979398103400307

Brown, S., Garino, G., & Taylor, K. (2013). Household debt and attitudes towards risk. *Review of Income and Wealth*, *59*(2), 283–304. https://doi.org/10.1111/j.1475-4991.2012.00506.x

Bruner, D. M. (2009). Changing the probability versus changing the reward. *Experimental Economics*, *12*(4), 367–385. https://doi.org/10.1007/s10683-009-9219-7

Calvet, L. E., & Sodini, P. (2014). Twin peaks: Disentangling the determinants of risk taking in household portfolios. *Journal of Finance*, *69*(2), 869–908. https://doi.org/10.1111/jofi.12125

Camerer, C. F., & Hogarth, R. M. (1999). The effect of financial incentives in experiments: A review and capital-labor production framework. *Journal of Risk and Uncertainty*, *19*(1), 7–42. https://doi.org/10.1023/A:1007850605129

Charness, G., & Viceisza, A. (2016). Three risk elicitation methods in the field: Evidence from rural Senegal. *Review of Behavioral Economics*, *3*(2), 145–171. https://doi.org/10.1561/105.00000046

Cokely, E. T., & Kelley, C. M. (2009). Cognitive abilities and superior decision making under risk: A protocol analysis and process model evaluation. *Judgment and Decision Making*, *41*(1), 20–33. https://journal.sjdm.org/81125/jdm81125.pdf

Cokely, E. T., Galesic, M., Schult, E., Ghazal, S., & Garcia-Retamero, R. (2012). Measuring risk literacy: The berlin numeracy test. *Judgment and Decision Making*, *7*(1), 25–47. https://doi.org/10.1037/t45862-000

Cramer, J. S., Hartog, J., Jonker, N., & Van Praag, C. M. (2002). Low risk aversion encourages the choice for entrepreneurship: An empirical test of truism. *Journal of Economic Behavior and Organisation*, *48*(1), 29–36. https://doi.org/10.1016/S0167-2681(01)00222-0

Croson, R., & Gneezy, U. (2009). Gender differences in preferences. *Journal of Economic Literature*, *47*(2), 448–474. https://doi.org/10.1257/jel.47.2.448

Cummings, G. R., Harrison, G. W., & Rutstrom, E. E. (1995). Homegrown values and hypothetical surveys: Is the dichotomous choice approach incentive-compatible. *American Economic Review*, *85*(1), 260–266.

Dave, C., Eckel, C. C., Johnson, C. A., & Rajas, C. (2010). Eliciting risk preferences: When is simple better. *Journal of Risk and Uncertainty*, *41*(3), 219–243. https://doi.org/10.1007/s11166-010-9103-z

Davidson, A. R., & Jaccard, J. J. (1979). Variables that moderate the attitude-behaviour relation. results of a longitudinal survey. *Journal of Personality and Social Psychology*, *37*(8), 1364–1376. https://doi.org/10.1037/0022-3514.37.8.1364

Deck, C., Lee, J., Reyes, J., & Rosen, C. (2013). A failed attempt to explain within subject variation in risk taking behavior using domain specific risk attitudes. *Journal of Economic Behavior and Organisation*, *87*(C), 1–24. https://doi.org/10.1016/j.jebo.2012.11.010

Dohmen, T., Falk, A., Huffman, D., Sunde, J., Schupp, J., & Wagner, G. G. (2011). Individual risk attitudes: measurement, determinants and behavioural consequences. *Journal of the European Economic Association*, *9*(3), 522–550. https://doi.org/10.1111/j.1542-4774.2011.01015.x

Dohmen, T., & Falk, A. (2011). Performance pay and multidimensional sorting: Productivity, preferences and gender. *The American Economic Review*, *10*(2), 556–590. https://doi.org/10.1257/aer.101.2.556

Dohmen, T., Falk, A., Huffman, D., & Sunde, U. (2018). . On the Relationship between Cognitive Ability and Risk Preference. *Journal of Economic Perspectives*, *3*(2), 115–134. https://doi.org/10.1257/jep.32.2.115

Dohmen, T., Adema, J., Huffman, D., & Nikolka, T. (2022). On the stability of risk preferences: Measurement matters. *Economic Letters*, 210. https://doi.org/10.1016/j.econlet.2021.110172

Eckel, C., & Grossman, P. (2002). Sex differences and statistical stereotyping in attitudes towards financial risk. *Evolution and Human Behaviour*, *23*(4), 281–295. https://doi.org/10.1016/S1090-5138(02)00097-1

Eckel, C., & Grossman, P. (2008). Men, women and risk aversion: Experimental evidence. *Handbook of Experimental Economics Results*, *1*(113), 1061–1073. piotr-eudokimov.com/gender2.pdf

Fan, J. X., & Xiaio, J. J. (2006). Cross cultural differences in risk tolerance: A comparison between Chinese and americans. *Journal of Personal Finance*, *5* (3) , 54–75 https://www.researchgate.net/publication/27472830_Cross-Cultural-differences_in_consumer_decision_making_styles.

Ferguson, M. J., Bargh, J. A., & Nayak, D. A. (2005). How automatic evaluations influence the interpretation of subsequent unrelated stimuli. *Journal of Experimental Social Psychology*, *41*(182–191), 182–191. https://doi.org/10.1016/j.jesp.2004.05.008

Filippin, A., & Crosetto, P. (2016). A reconsideration of gender differences in risk attitudes. *Management Science*, *62*(11), 3138–3160. https://doi.org/10.1287/mnsc.2015.2294

Fourage, D., Krieckel, B., & Dohmen, T. (2014). Occupational sorting of school graduates. The role of economic preferences. *Journal of Economic Behavior and Organization*, *1-61*, 335–351. https://doi.org/10.1016/j.jebo.2014.07.007

Greenberg, D., & Shtudiner, Z. (2016). Can Financial Education Extend the Border of Bounded Rationality?. *Modern Economy*, *7*(02), 103–108. https://doi.org/10.4236/me.2016.72012

Guiso, L., Japelli, T., & Pistaferri, L. (2002). An empirical analysis of earnings and employment risk. *Journal of Business and Economic Statistics*, *20*(2), 241–253. https://doi.org/10.1198/073500102317351985

Harrison, G. W., & Rutstrom, E. C. (2008). Chapter 81. In P. Charles, S. Vernon (Eds.), *Handbook of Experimental*

Economics Results, 1st ed., 752–767. Elsevier. https://EconPapers.repec.org/RePec:eee:expchp:5-81

He, P., Veronesi, M., & Engel, S. (2017). Consistency of risk preference measures and the role of ambiguity: An artefactual field experiment from rural china. *The Journal of Development Studies*, *54*(11), 1955–1973. https://doi.org/10.1080/00220388.2017.1336542

Hey, J. D., Morone, A., & Schmidt, U. (2009). Noise and bias in eliciting preferences. *Journal of Risk and Uncertainty*, *39*(3), 213–235. https://doi.org/10.1007/s11166-009-9081-1

Holt, C. A., & Laury, S. (2002). Risk aversion and incentive effects. *American Economic Review*, *92*(5), 1644–1655. https://doi.org/10.1257/000282802762024700

Kahneman, D., & Tversky, A. (1979). An analysis of decision under risk. *Econometrica*, *47*(2), 263–291. https://doi.org/10.2307/1914185

Karni, E. (1982). Risk aversion and saving behavior: Summary and extension. *International Economic Review*, *23*(1), 35–42. https://doi.org/10.2307/2526461

Kraus, S. J. (1995). Attitudes and the prediction of behaviour: A meta-analysis of the empirical literature. *Personality & Social Psychology Bulletin*, *21*(1), 58–75. https://doi.org/10.1177/0146167295211007

Kuhberger, A., Schulte-Mecklenbech, M., & Perner, J. (2002). Framing decisions: Hypothetical and real. *Organisational Behavior and Human Decision Processes*, *89*(2), 1162–1175. https://doi.org/10.1016/S0749-5978(02)00021-3

Liu, E., & Huang, J. (2013). Risk preferences and pesticide use by cotton farmers in China. *Journal of Development Economics*, *103*(c), 202–215. https://doi.org/10.1016/j.jdeveco.2012.12.005

Liu, E. (2013). Time to change what to sow: Risk preferences and technology adoption decisions of cotton farmers in China. *The Review of Economics and Statistics*, *95*(40), 1386–1403. https://doi.org/10.1162/REST_a_00295

Locey, M. L., Jones, B. A., & Rachlin, H. (2011). Real and hypothetical rewards. *Judgment and Decision Making*, *6*(6), 552–564. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3348706

Lonnquist, J. E., Verkasalo, M., Walkowitz, G., & Wichardt, P. C. (2015). Measuring individual risk attitudes in the lab. task or ash? An empirical comparison. *Journal of Economic Behavior and Organisation*, *119*(C), 254–266. https://doi.org/10.1016/j.jebo.2015.08.003

Mudzingiri, C., & Koumba, U. (2021). eliciting risk preferences experimentally versus using a general risk question. Does financial literacy bridge the gap? *Risks*, *9*(8), 140. https://doi.org/10.3390/risks9080140

Nagano, M., & Yeom, D. H. (2014). Another determinant of household leverage: Evidence from Japan's mortgage loan data. *International Review of Finance*, *14*(1), 105–139. https://doi.org/10.1111/irfi.12025

Neill, H. R., Cummings, R. G., Ganderton, P. T., Harrison, G. W., & McGuckin, T. (1994). Hypothetical surveys and real economic commitments. *Land Economics*, *70*(2), 145–154. https://doi.org/10.2307/3146318

Nelson, J. (2016). Not so strong evidence for gender differences in risk taking. *Feminist Economics*, *22*(2), 114–142. https://doi.org/10.1080/13545701.2015.1057609

Pedroni, A., Frey, R., Bruhin, A., Dutilh, G., Hertwig, R., & Rieskomp, J. (2017). The risk elicitation puzzle. *Nature, Human Behavior*, *1*(11), 803–809. https://doi.org/10.1038/s41562-017-0219-x

Rankin, N. A., Roberts, G. A., & Schoer, V. (2014). A Guide to the South African Labour Market Entry Survey. https://www.ekon.sun.ac.za/nrankin

Reddy, V., Van der Berg, S., Van Rensberg, D. J., & Taylor, S. (2012). Educational outcomes: Pathways and performance in South African high schools. *South African Journal of Science*, *108*(3/4), Art #620. https://doi.org/10.4102/sajs.v108i3/4.620

Reyna, V. F., Han, P. K. J., Dieckman, N. F., & Nelson, W. (2009). How numeracy influences risk comprehension and medical decision making. *Psychological Bulletin*, *135*(60), 943–973. https://doi.org/10.1037/a0017327

Reynaud, A., & Conture, S. (2012). Stability and risk preference measures: Results from a field experiment on French farmers. *Theory and Decision*, *73*(2), 203–221. https://doi.org/10.1007/s11238-012-9296-5

Shtudiner, Z. (2018). Risk tolerance, time preferences and financial decision making: Differences between self-employed people and empoyees. *Modern Economy*, *9*(12), 2150–2163. https://doi.org/10.4236/me.2018.912133

Skriabikova, O., Dohmen, T., & Krieckel, B. (2014). New evidence on the relationship between risk attitudes and self employment. *Labour Economics*, *30*(C), 176–184. https://doi.org/10.1016/j.labeco.2014.04.003

Sobkow, A., Zaleskiewicz, T., Petrova, P., Garcia-Retamero, R., & Traczyk, J. (2020). Worry, risk perception and controllability predict intentions towards covid-19 preventative behaviours. *Frontiers in Psychology-Personality and Social Psychology*, *11*(November), 1–15. https://doi.org/10.3389/fpsyg.2020.582720

Stangor, C., Jhangiani, R., & Tarry, H. (2022). *Principles of social psychology-1st international H5P edition*. BCC Campus.

Vieder, F. M., Beyene, A. D., Bluffstone, R., Dissanyache, S. T., & Gebreegziabher, Z. (2015). *Measuring risk preferences in rural Ethiopia: Risk tolerance and exogenous income proxies*. Portland State University, PPX Scholar, Publication.

Von Neumann, J., & Morgenstern, O. (1944). *Theory of games and economic behaviour*. Princeton University Press.

Yao, R., Hanna, S., & Lindamood, S. (2004). Changes in financial risk tolerance, 1983-2001. *Financial Services Review*, *13*(4), 249–266. https://ssrn.com/abstract=2740157

Appendix

Table A1. Mathematics score and revealed risk preference: all

Frequency							
			Risk averse			Risk seeking	
		Risk Index	1	2	3	4	
	Maths score						Total
Poor	0		39 (54%)	11(15%)	7 (10%)	15 (21%)	72
	1		32 (53%)	11 (12%)	9 (15%)	9 (19%)	61
	2		91(59%)	19 (12%)	11 (7%)	33 (21%)	154
	3		195 (55%)	41(12%)	36 (10%)	84(24%)	356
	4		264 (55%)	48 (10%)	58 (12%)	111 (23%)	481
	5		185 (55%)	33 (10%)	44 (13%)	75 (22%)	337
Good	6		211 (56%)	40 (11%)	39 (10%)	88 (23%)	378
		Total	1017 (55%)	203 (11%)	204 (11%)	415 (23%)	1839

Table A2. Mathematics score and revealed risk preference: males

Frequency							
			Risk averse			Risk seeking	
		Risk Index	1	2	3	4	
	Maths score						Total
Poor	0		12 (55%)	4(18%)	3 (14%)	3 (14%)	22
	1		14 (54%)	3 (12%)	4 (15%)	5 (19%)	26
	2		31(59%)	9 (17%)	2 (4%)	11 (21%)	53
	3		90 (57%)	16(10%)	16 (10%)	35(22%)	157
	4		116 (54%)	25 (12%)	28 (13%)	47 (22%)	216
	5		87 (55%)	15 (10%)	20 (13%)	36 (23%)	158
Good	6		103 (58%)	40 (8%)	20 (11%)	39 (22%)	176
		Total	453 (56%)	86 (11%)	93 (12%)	176 (22%)	808

Table A3. Mathematics score and revealed risk preference: females

Frequency							
			Risk averse			Risk seeking	
		Risk Index	1	2	3	4	
	Maths score						Total
Poor	0		27 (54%)	7(14%)	4 (8%)	12 (24%)	50
	1		18 (51%)	8 (23%)	5 (14%)	4 (11%)	35
	2		60(59%)	10 (10%)	9 (9%)	22 (21%)	101
	3		105 (53%)	25(13%)	20 (10%)	40(25%)	199
	4		148 (56%)	23 (9%)	30 (11%)	64 (24%)	265
	5		98 (55%)	18 (10%)	24 (13%)	39 (22%)	179
Good	6		108 (53%)	26 (13%)	19 (9%)	49 (24%)	202
		Total	564 (55%)	117 (11%)	111 (11%)	239 (23%)	1031

Table A4. Mathematics score and self-reported risk preference: all

Frequency						
			Risk averse		*Risk seeking*	
		Self-reported risk	1	2	3	
	Maths score					Total
Poor	0		22 (31%)	23(33%)	25 (36%)	70
	1		16 (27%)	14 (24%)	29 (49%)	59
	2		36(24%)	42 (28%)	72 (48%)	150
	3		84 (25%)	88(26%)	171 (50%)	343
	4		103 (22%)	126 (27%)	240 (51%)	469
	5		46 (14%)	84 (26%)	199 (61%)	329
Good	6		68 (18%)	113 (30%)	19 1(51%)	372
		Total	375 (21%)	490 (27%)	927 (52%)	1792

Table A5. Mathematics score and self-reported risk preference: male

Frequency						
			Risk averse		*Risk seeking*	
		Self-reported risk	1	2	3	
	Maths score					Total
Poor	0		4 (18%)	10(46%)	8 (36%)	22
	1		8 (32%)	4 (16%)	13 (52%)	25
	2		7(14%)	19 (37%)	26 (50%)	52
	3		36 (24%)	38(25%)	76 (51%)	150
	4		34 (16%)	61 (29%)	118 (55%)	213
	5		20 (13%)	42 (27%)	92 (60%)	154
Good	6		29 (17%)	50 (29%)	94(54%)	173
		Total	138 (18%)	224 (28%)	427 (54%)	789

Table A6. Mathematics score and self-reported risk preference: female

Frequency						
			Risk averse		*Risk seeking*	
		Self-reported risk	1	2	3	
	Maths score					Total
Poor	0		18 (38%)	13(27%)	17 (35%)	48
	1		8 (24%)	10 (29%)	16 (47%)	34
	2		29(30%)	23 (23%)	46 (47%)	98
	3		48 (25%)	50(26%)	95 (49%)	193
	4		69 (27%)	65 (25%)	122 (48%)	256
	5		26 (15%)	42 (24%)	107 (61%)	175
Good	6		39 (20%)	63 (32%)	97(49%)	199
		Total	237 (24%)	266 (27%)	500 (50%)	1003

Table A7. Frequency of contradictions between revealed risk preferences and self-reported risk preferences: extreme cases of most risk averse and most risk seeking

	Gender	
Risk contradict	**Male**	**Female**
No Contradiction	55,25%	58.94%
Contradiction	44.75%	41.06%
Total	100,00%	100,00%

Table A8. Nature of contradictions between revealed risk preferences and self-reported risk preferences: extreme cases of most risk averse and most risk seeking

	Gender		
Risk contradict	**Male**	**Female**	
S/R R.S + A/R R.A	138	165	303
All Contradictions	165	207	372
Percentage	84%	80%	81%

(S/R R.S + A/R R.A—indicates participants who had self-reported their risk preference as risk seeking and their actual revealed risk preference as risk averse)
(All Contradictions—indicates all participants who had differences between their self-reported risk preference and their actual revealed risk preference)

Table A9. Contradictions between revealed risk preferences and self-reported risk preferences by mathematical ability: extreme cases of most risk averse and most risk seeking

Math score	**Inconsistencies**	**Total**	**% Inconsistent**
0	9	33	27%
1	12	27	44%
2	36	87	41%
3	63	172	37%
4	94	234	40%
5	82	154	53%
6	76	183	42%

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