A Note on Measuring Risk Aversion

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[Very Preliminary Version!]

Abstract In this paper we propose a new method to elicit the intensity of individual's risk preferences. Our method uses a simple multiple price-list format and is based on the increasing risk definitions of Rothschild and Stiglitz (1970, 1971). We are thus able to classify individuals as more or less risk-averse without assuming an expected utility framework. In a lab experiment we directly compare our method to the well-known method of Holt and Laury (2002) and find that our approach yields higher estimates of relative risk aversion that are much closer to what is observed in the field.

Keywords: Risk Aversion, CRRA, Multiple Price-List, Elicitation, Laboratory Experiment.

JEL Classification Numbers: D81, C91.

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1 Introduction

In order to measure individual's risk attitudes, the multiple price-list method of Holt and Laury (2002) has become *the* standard way used in experiments nowadays. Major advantages that led to the popularity of the Holt and Laury (HL) tables include its transparency to subjects (easy to explain and implement), its incentivized elicitation, and that it can be easily attached to other experiments where risk aversion may have an influence. Nevertheless, the HL method has also several disadvantages. For instance, one disadvantage is that it is quite sensitive to probability weighting since it uses variations of probabilities instead of outcomes in its elicitation. Another disadvantage is that the HL tables need an expected utility (EUT) framework in order to make predictions on the intensity of risk aversion. They are thus unable to classify subjects as being more or less risk averse without imposing EUT on them.

We propose a new multiple price-list method that shares the advantages of the HL method but not its disadvantages. Our method is based on the well-known increasing risk definitions of Rothschild and Stiglitz (1970, 1971). By just imposing "duality" asserting that less risk-averse individuals accept riskier gambles, our method enables us to classify subjects as more or less risk averse without assuming EUT. This seems especially relevant in experiments as they are often designed to reveal non-EUT behavior. Contrary to the HL tables our method uses variations in outcomes between choices (i.e. mean-preserving spreads) and holds probabilities of outcomes constant at 50%. Probability weighting should therefore have no influence on our tables.

In a lab experiment we directly compare the HL method and our method using low and high stakes. We find that our method yields substantially higher intensities of risk aversion that are much closer to what is observed in the field. Furthermore, estimates of relative risk aversion in our method are robust toward multiplying the stakes by five, contrary to the HL method.

The paper is structured as follows. In section 2 we review the HL tables and note further advantages and disadvantages. We then propose a new method that shares the advantages but not the disadvantages of the HL tables in section 3. The experiment where we directly compare the HL method and our method is explained in section 4. The results of our experiment are discussed in section 5 and the conclusion can be found in section 6.

2 The HL Method

Measuring the intensity of risk preferences is very important for theoretical predictions. Also, in experiments individual's decisions are often (partly) driven by their risk preferences. In order to control for that, the multiple price-list method of Holt and Laury (2002) is commonly used in experiments nowadays. Table 1 presents the original HL design.

Table 1: Holt and Laury (2002)

Row No.	Option A Outcome A 1 = \$2.00	Outcome A 2 = \$1.60	Option B Outcome B 1 = \$3.85	Outcome B 2 = \$0.10	RRA if row was last choice of A and below all B	Proportion choices payoffs x1	Proportion choices payoffs x20
1	Prob. 1/10	Prob. 9/10	Prob. 1/10	Prob. 9/10	$[-1,71; -0.95]$	0.01	0.01
2	Prob. 2/10	Prob. 8/10	Prob. 2/10	Prob. 8/10	$[-0.95; -0.49]$	0.01	0.01
3	Prob. 3/10	Prob. 7/10	Prob. 3/10	Prob. 7/10	$[-0.49; -0.14]$	0.06	0.04
4	Prob. 4/10	Prob. 6/10	Prob. 4/10	Prob. 6/10	$[-0.14; 0.15]$	0.26	0.13
5	Prob. 5/10	Prob. 5/10	Prob. 5/10	Prob. 5/10	$[0.15; 0.41]$	0.26	0.19
6	Prob. 6/10	Prob. 4/10	Prob. 6/10	Prob. 4/10	$[0.41; 0.68]$	0.23	0.23
7	Prob. 7/10	Prob. 3/10	Prob. 7/10	Prob. 3/10	$[0.68; 0.97]$	0.13	0.22
8	Prob. 8/10	Prob. 2/10	Prob. 8/10	Prob. 2/10	$[0.97; 1.37]$	0.03	0.11
9	Prob. 9/10	Prob. 1/10	Prob. 9/10	Prob. 1/10	$[1.37; \infty)$	0.01	0.06
10	Prob. 10/10	Prob. 0/10	Prob. 10/10	Prob. 0/10	non-monotone	0.00	0.00

An individual makes a decision between option A and option B in each of the ten rows. Option A as well as option B can have two different realizations (A1 or A2 and B1 or B2) with varying probabilities over the ten rows. The expected outcome of option A is higher for the first four rows and lower for the last six rows. So, a risk-neutral subject should choose option A in row 1 to 4 and then switch over and choose option B in row 5 to 10. However, as option B has a higher variance, there is a trade-off when to switch to option B. Clearly, by row 10 everybody should have switched to option B as it yields the higher outcome with certainty. An individual who switches to option B between row 6 and row 10 is classified as being risk-averse and the more risk-averse individual will switch later as she needs a higher expected value to choose the more variable option. Someone who switches earlier to option

B (between row 1 and row 4) is classified as risk-seeking by similar arguments. In column 6 of table 1 we report the risk preference intensity measured by the amount of relative risk aversion[1] (RRA) that is induced from the switching behavior.[2] And in columns 7 and 8 we report the proportion of subjects found by Holt and Laury (2002) that fell into a specific range of RRA for low and high stakes, respectively.

The advantages of the HL method are due to its design. It is very easy to explain to subjects since they only have to choose between option A and option B in each row. It is incentivized and usually one of the ten rows is randomly selected and paid out for real. And because it is so easy to implement, the HL table can be attached to other experiments where risk aversion may play a role.

Nevertheless, the HL method also has some disadvantages. One disadvantage is that there is no flexibility in adjusting the ranges of RRA without affecting the round-numbered probabilities. So, for instance, if one would want to decrease the RRA range in row 4 to 6 in order to better classify most subjects risk attitudes, one would have to give up the round-numbered probabilities in table 1. One way to circumvent this problem is proposed by Andersen et al. (2006) using a complex more-stage procedure and thereby loosing the advantages of the simple HL design mentioned above.

Another disadvantage is that it is hard to compute expected values in the HL tables. Harrison and Rutström (2008) note that giving information about expected values significantly reduces risk aversion. The question arises whether this reflects better estimates of true preferences due to removing the cognitive burden of calculating expected values or whether it simply reflects an anchoring response.

Since the HL tables are not based on a general notion of increasing risk, they rely on an expected utility framework. In order to discriminate between intensities of risk aversion, HL

[1]As in Holt and Laury (2002) we measure relative risk aversion by assuming the class of constant relative risk averse (CRRA) utility functions throughout.

[2]Note that the bound in rows 3 and 4 of $r = -0.15$ as reported in the original article of Holt and Laury (2002) is in fact according to our calculation $r = -0.14$. Also, if the subject chooses always option B, his relative risk aversion is $r \in (-\infty; -1.71]$.

use the specific class of CRRA functions. Since experiments are often designed to reveal non-standard preferences, it seems problematic to impose EUT in the elicitation of risk attitudes. Hence, a more *general* measure of risk aversion intensity is needed.

The HL tables use variations in probabilities whereas outcomes are held constant. This feature makes results sensitive to probability weighting. For instance, by using the standard parametric prospect theory assumptions (Tversky and Kahneman, 1992) on the probability weighting function, we obtain the result that a subject with a linear utility function (i.e. risk-neutral) should choose A only for the first three and not for the first four rows. Such an individual would be classified as risk-seeking in HL. Of course, this makes it difficult to draw conclusions about the shape of the utility function and recent studies identify a fifty-fifty share of prospect theory and EUT among individuals (see e.g. Harrison and Rutström, 2008).

3 Our Method

In this section we propose a new method that shares the advantages of the HL tables but not its disadvantages as mentioned above. Table 2 presents our new approach.

Table 2: Our Method of Elicitation

Row No.	Option A Prob 1/2 Outcome A 1	Prob 1/2 Outcome A 2	Option B Prob 1/2 Outcome B 1	Prob 1/2 Outcome B 2	RRA if row was first choice of A and above all B	RRA if row was last choice of A and below all B
1	0.05	4.95	2.65	2.75		$[-0.51; -0.13]$
2	1.10	3.90	2.65	2.75		$[-\infty; -0.51]$
3	**2.40**	**2.60**	**2.65**	**2.75**		non-monotone
4	2.40	2.60	2.00	3.40	$[2.27; \infty]$	
5	2.40	2.60	1.90	3.50	$[1.70; 2.27]$	
6	2.40	2.60	1.75	3.65	$[1.18; 1.70]$	
7	2.40	2.60	1.60	3.80	$[0.86; 1.18]$	
8	2.40	2.60	1.45	3.95	$[0.65; 0.86]$	
9	2.40	2.60	1.05	4.35	$[0.36; 0.65]$	
10	2.40	2.60	0.20	5.20	$[0.13; 0.36]$	

Again, subjects choose in each row between option A and option B. As in the HL tables, option A as well as option B has two possible outcomes. However, instead of varying the probabilities and keeping the outcomes constant over all rows as in HL, we rather vary the outcomes and keep the probabilities constant (i.e. all probabilities are equal, namely 50%).

First note that an individual with monotone preferences will always prefer option B over option A in row 3 of table 2 (this is similar to row 10 in table 1) as here option B first-order stochastically dominates (or more specifically, state-wise dominates) option A. We now compare options in row 4 to those in row 3. While option A is identical to the one in row 3, option B in row 4 is a mean-preserving spread of the one in row 3. We can therefore say that option B becomes more risky in the sense of the very general increasing risk definition by Rothschild and Stiglitz (1970, 1971), while option A stays the same. In row 5 option A is again unaltered whereas option B is a further mean-preserving spread of the one in row 4 and thus a further increase in risk. This continues until row 10. By just imposing "duality" stating that less risk-averse individuals should take riskier gambles, we can say that someone who preferred option B in the first four rows and option A in the last six rows is more risk averse than someone who preferred option B in the first five rows and option A in the last five rows. Such a statement can be made without referring to any particular utility framework. To illustrate how our table relates to the one of HL, we state in column 6 and 7 how our method would elicit measures of RRA.

Risk seeking is identified through switches of choices in the first two rows of the table. Consider again the options in row 3, but now compare them to options in row 2. Now the 'less attractive' option A is altered by a mean-preserving spread when going from row 3 to row 2, while option B stays the same. Only a very risk-seeking individual would like this spread so much that she would now prefer option A in row 2. In row 1 option A is a further mean-preserving spread. Now, also less extreme risk seekers, who in row 2 were still choosing option B, are lured by the further increase in risk toward choosing option A in row 1. An individual who is risk-neutral, or is very close to being risk-neutral, will always choose option B in table 2 since its expected value is higher than the one of option A in all rows.

"Clearly riskiness is related to dispersion, so a good riskiness measure should be monotonic with respect to second-order stochastic dominance. Less well understood, perhaps, is that riskiness should also relate to location and thus be monotonic with respect to first-order stochastic dominance, in particular, that a gamble that is sure to yield more than another should be considered less risky. Both stochastic dominance criteria are uncontroversial, ...” (Aumann and Serrano, 2008, p. 811)

In table 2 we use both criteria. Option B first-order stochastically dominates option A in row 3 and can therefore be considered less risky. Going downward from row 3 option A stays unaltered whereas option B gets worse in terms of second-order stochastic dominance. Going upward from row 3 option A gets worse in terms of second-order stochastic dominance whereas option B stays the same. Individuals who switch from option B to A after row 3 are risk-averse (the earlier the more risk-averse). And individuals who switch from option A to option B before row 3 are risk-seeking (the later the more risk-seeking).

Using variations of outcomes (i.e. mean-preserving spreads) not only makes it easy to compute expected values but also allows us quite some flexibility in designing the range of the intervals to elicit estimates of relative risk aversion if we adopt the CRRA framework of HL. In principle, HL could also achieve this but only at the price of stating odd probabilities. By contrast, in our table probabilities stay always 1/2 and only outcomes vary. We believe that subjects are more experienced in dealing with odd outcomes (such as price tags) than with odd probabilities.

More importantly, constant probabilities of 1/2 are insensitive to any probability weighting.[3] Especially, for experiments which often make use of non-expected utility theories it seems favorable to measure risk attitudes without having to assume linear probability weighting.

4 The Experiment

The experiment was computer-based and was conducted at the experimental laboratory MELESSA of the University of Munich. It used the experimental software z-Tree (Fischbacher, 2007) and the organizational software Orsee (Greiner, 2004). 232 subjects

[3]For instance, Quiggin (1981) suggested 1/2 as plausible fixed point.

(graduate students were excluded) participated in 10 sessions and earned 11 Euro (including 4 Euro show-up fee) on average[4] for a duration of approximately one hour.

In the beginning of the experiment subjects received written instructions that were read privately by them. At the end of these instructions they had to answer test questions that showed whether everything was understood. There was no time limit for the instructions and subjects had the opportunity to ask questions in private. The experiment started on the computer screen only after everybody answered the test questions correctly and there were no further questions.

The further procedure of the experiment was the following. Each subject made decisions in four tables.[5] Again, they could take as much time as they wanted in order to make their decisions. After all subjects made their decisions, an experimental instructor came to each subject to let them randomly determine their payoff from the tables.[6] Before they saw what their payoff from the experiment was they could again see how they actually decided in the randomly determined relevant table. At the end of the experiment all subjects further answered a questionnaire about their socio-economic characteristics. As soon as everybody had answered the questionnaire they were payed in private and could leave.

As mentioned above, each subject made decisions in four tables. Two of the tables were low-stakes tables and two of them were high-stakes tables, where all outcomes were multiplied by five. In total, we had eight different tables.

One of them was the original HL table (HLol) as outlined in section 2 (table 1) and another was the original HL table but with all outcomes multiplied by five (HLoh). In order to being able to directly compare the HL method and our method, we adjusted our tables to the exact same ranges of RRA that were used by HL. A third table therefore used our

[4]With a maximum of 30 Euro and a minimum of 4.10 Euro.

[5]Eight treatments varied which tables in which order a subject received. The treatments are further explained below.

[6]Each subject had to role four dices. First, a four-sided dice determined which of the four tables was payoff-relevant. Second, a ten-sided dice determined which row in the payoff-relevant table was selected. And lastly, two ten-sided dices determined whether the amount A1 or A2 (if A was chosen in the relevant table and row) or whether the amount B1 or B2 (if B was chosen in the relevant table and row) was payed out to them (in addition to the show-up fee of 4 Euro).

method but adjusted to the original low stakes of HL (MRal) as outlined in table 3. And a fourth table used our method adjusted to the high stakes version of HL (MRah), where all outcomes in table 3 are multiplied by five.

Table 3: Our Method of Elicitation, Adjusted

Row No.	Option A Prob 1/2 Outcome A 1	Prob 1/2 Outcome A 2	Option B Prob 1/2 Outcome B 1	Prob 1/2 Outcome B 2	RRA if row was first choice of A and above all B	RRA if row was last choice of A and below all B
1	0.03	4.89	2.62	2.72		[−0.49; −0.14]
2	1.01	3.91	2.62	2.72		[−0.96; −0.49]
3	1.40	3.52	2.62	2.72		[−1.70; −0.96]
4	1.65	3.27	2.62	2.72		[−∞; −1.70]
5	**2.36**	**2.56**	**2.62**	**2.72**		non-monotone
6	2.36	2.56	1.77	3.57	[1.37; ∞]	
7	2.36	2.56	1.61	3.73	[0.97; 1.37]	
8	2.36	2.56	1.42	3.92	[0.68; 0.97]	
9	2.36	2.56	1.09	4.25	[0.41; 0.68]	
10	2.36	2.56	0.26	5.08	[0.15; 0.41]	

Subjects further received our table (table 2) from section 3 (MRol). In designing this table we employed criteria mentioned by HL. There is an approximately symmetric range of RRA around 0, 0.5, 1, and 2. Based on the experimental results of HL, our table has only two risk-seeking ranges and therefore more ranges for reasonable degrees of risk aversion. There was also a high-stakes version of this table where all outcomes are multiplied by five (MRoh). Again, in order to directly compare both methods, we also adjusted the HL tables to the exact same ranges of RRA that were used in our tables. Table 4 shows the adjusted HL table for low stakes (HLal). Again, the high-stakes version of table 4 (HLah) multiplied all outcomes by five.

Table 4: Holt and Laury (2002), Adjusted

Row No.	Option A Outcome A 1 = \$2.00	Outcome A 2 = \$1.60	Option B Outcome B 1 = \$3.85	Outcome B 2 = \$0.10	RRA if row was last choice of A and below all B
1	Prob. 29/100	Prob. 71/100	Prob. 29/100	Prob. 71/100	[−0, 53; −0.14]
2	Prob. 40/100	Prob. 60/100	Prob. 40/100	Prob. 60/100	[−0.14; 0.12]
3	Prob. 49/100	Prob. 51/100	Prob. 49/100	Prob. 51/100	[0.12; 0.36]
4	Prob. 58/100	Prob. 42/100	Prob. 58/100	Prob. 42/100	[0.36; 0.65]
5	Prob. 69/100	Prob. 31/100	Prob. 69/100	Prob. 31/100	[0.65; 0.85]
6	Prob. 76/100	Prob. 24/100	Prob. 76/100	Prob. 24/100	[0.85; 1.19]
7	Prob. 86/100	Prob. 14/100	Prob. 86/100	Prob. 14/100	[1.19; 1.70]
8	Prob. 95/100	Prob. 5/100	Prob. 95/100	Prob. 5/100	[1.70; 2.37]
9	Prob. 99/100	Prob. 1/100	Prob. 99/100	Prob. 1/100	[2.37; ∞)
10	Prob. 100/100	Prob. 0/100	Prob. 100/100	Prob. 0/100	non-monotone

Each of all eight different tables was received by 116 subjects and all 232 subjects were in either of eight different treatments. The treatments were designed to control for order effects, not only whether subjects answered low- or high-stakes tables first, but also whether HL tables or our tables (adjusted and original) were answered first. The eight treatments ensured that every subject had the same ex-ante expected income.[7]

In the comparison of the HL method and our method, we will ask two main questions. Firstly, whether the distributions of RRA are different between both methods. Such systematic differences may be due to probability weighting or limited cognitive ability in the expected value calculation. And secondly, what is the effect of increasing the stakes, i.e. multiplying all outcomes by five.

5 Results

Before analyzing the intensities of risk attitudes, we can ask how many subjects are classified as risk-averse, risk-seeking, and risk-neutral. Under low stakes, we find that 79% are risk-averse, 11% are risk-neutral, and 10% are risk-seeking in the HL tables. The respective numbers for our tables are 81%, 9%, and 10%. Under high stakes, 88% are risk-averse, 7% are risk-neutral, and 5% are risk-seeking in the HL tables whereas the respective numbers are 88%, 6%, and 6% in our tables. This suggests that both methods yield identical classifications of subjects concerning the *direction* of risk attitude.

Concerning the *intensity* of risk attitude, however, we find systematic differences between both methods. Figure 1 shows the cumulative distributions of RRA for all eight different elicitation tables.[8] The cumulative distributions of relative risk aversion of all four HL tables lie above those of our four tables. While almost none of the subjects lies in the highest RRA range in the HL tables, many subjects fall into the highest RRA range when our method is used.[9] The medians of RRA using the HL method are all below the medians when our method is used.

[7]The eight treatments were: 1. HLol, MRal, HLoh, MRah; 2. MRol, HLal, MRoh, HLah; 3. MRal, HLol, MRah, HLoh; 4. HLal, MRol, HLah, MRoh; 5. HLoh, MRah, HLol, MRal; 6. MRoh, HLah, MRol, HLal; 7. MRah, HLoh, MRal, HLol; 8. HLah, MRoh, HLal, MRol.

[8]We used uniform distributions within the RRA ranges.

[9]Note that as the highest range goes to infinity, the cumulative distribution functions do not end at 100.

Figure 1: Cumulative Distributions of RRA

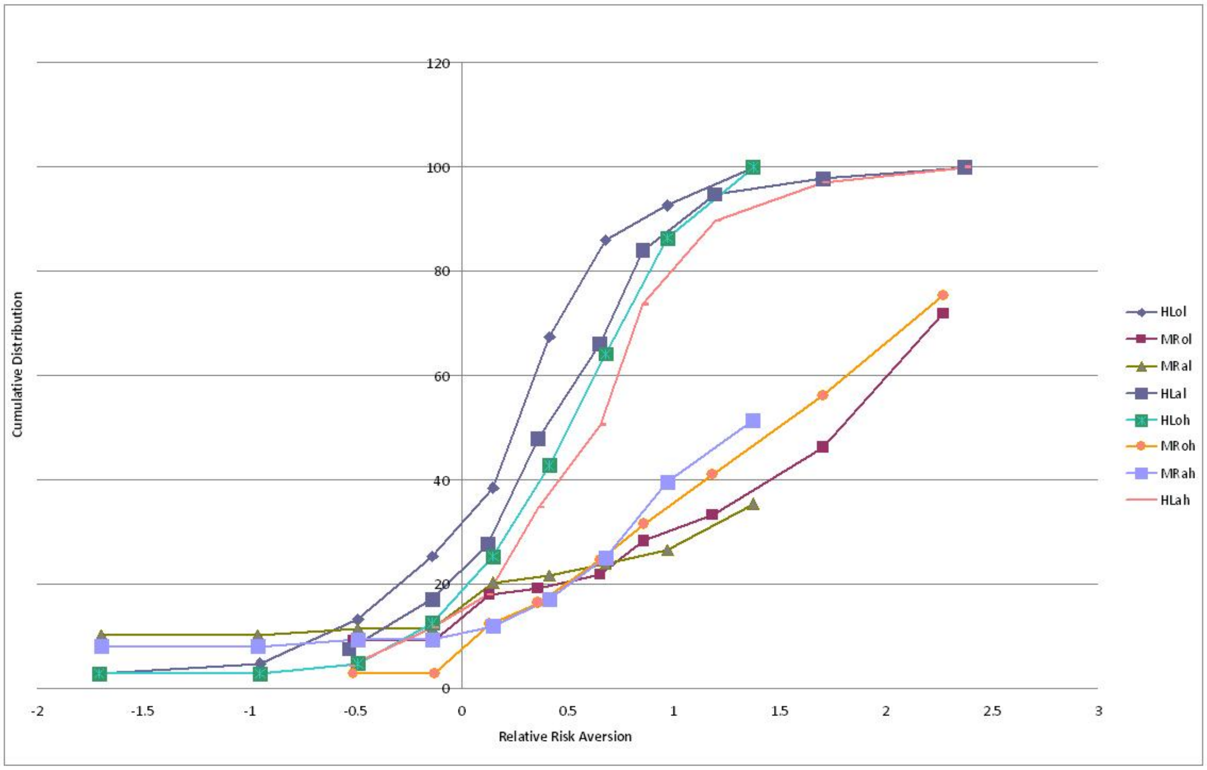

Figure 1 also shows the effect of increasing the stakes. Since the cumulative distributions of the high-stakes HL tables (HLoh and HLah) lie below those of the low-stakes HL tables (Hlol and HLal), increasing the stakes seems to increase relative risk aversion. This is in contrast to our method where increasing the stakes does not cause risk aversion to increase. The cumulative distributions of our high-stakes tables (MRoh and MRah) rather cross those of our low-stakes tables (MRol and MRal) in figure 1.

We also test these differences using a Wilcoxon signed-rank sum test. Table 5 relates the original HL tables and our adjusted tables, such that RRA ranges are identical and can be directly compared. And table 6 relates the adjusted HL tables and our original tables. Reported are the outcomes of the Wilcoxon signed-rank sum statistic such that they follow a standard normal distribution under the null.[10]

Comparing first the HL method and our method, we observe a significantly higher mea-

[10]In both tables *** denotes significance at 1%-level.

Table 5: Wilcoxon signed-rank sum test, standardized (HLo and MRa)

$\frac{w^+-\mu}{\sigma}$	HLol	HLoh	MRal	MRah
HLol		-5.0996^{***}	-4.8880^{***}	-4.5062^{***}
HLoh			-4.2110^{***}	-2.7451^{***}
MRal				0.7734
MRah				

Table 6: Wilcoxon signed-rank sum test, standardized (HLa and MRo)

$\frac{w^+-\mu}{\sigma}$	HLal	HLah	MRol	MRoh
HLal		-4.6924^{***}	-3.5848^{***}	-4.7553^{***}
HLah			-3.1398^{***}	-4.3152^{***}
MRol				-0.4918
MRoh				

sure of RRA using our method (HLol vs. MRal and HLoh vs. MRah in table 5; and HLal vs. MRol and HLah vs. MRoh in table 6). Looking at the effect of increasing the stakes, we see that there is a significantly positive effect on the RRA measure in the HL tables (HLol vs. HLoh in table 5; and HLal vs. HLah in table 6). In contrast, there is no such effect observed when our method is used (MRal vs. MRah in table 5; and MRol vs. MRoh in table 6).

These results show that our method not only yields higher risk aversion estimates than the HL method but also that our estimates are robust toward multiplying all outcomes by five. This is not the case for the HL estimates. Here, we find increasing relative risk aversion (IRRA). Our findings for the HL method are completely in line with the findings of Holt and Laury (2002). Nevertheless, the results for our method are much closer to what is observed in the empirical literature. For instance, an experimental study by Levy (1994) rejects the existence of IRRA. And other empirical studies by Szpiro (1986) or Friend and Blume (1975) find supportive evidence for CRRA. Several empirical studies indicate a measure of RRA between 1 and 2 (e.g. Tobin and Dolde, 1971; Friend and Blume, 1975; Kydland and Prescott, 1982; Hildreth and Knowles, 1982; or Szpiro, 1986) and Mehra (2003, p59) notes that "most studies indicate a value for α that is close to 2."[11]

One may be concerned that the differences in the RRA estimates between the HL method and our method may be due to identical switching behavior across tables. For instance, if a

[11]Here, α is the measure of RRA.

subject always switches after row 5 (from A to B in the HL tables and from B to A in our tables) we would measure higher RRA in our tables. However, we can test whether switching behavior is the same across tables and do not find any evidence for this explanation.

6 Conclusion

In this paper we first proposed a new multiple price-list method to elicit the intensity of individuals risk attitudes. This method is based on the very general definition of increasing risk (Rothschild and Stiglitz, 1970, 1971). This feature makes it possible to classify subjects as more or less risk-averse without assuming an EUT framework. Furthermore, since it uses variations in outcomes and holds probabilities constant at 50% our method is not sensitive to any probability weighting.

We then compared our proposed method to the well-known method of Holt and Laury (2002) in a lab experiment. Our results for the HL method replicate the findings of Holt and Laury (2002). However, with our method we found systematic differences. Compared to the HL method, our method yields higher estimates of relative risk aversion that are much closer to what is observed in the field. Furthermore, while increasing the stakes increases risk aversion with the HL method (and thus indicating IRRA), our method is robust toward such stakes effects (thus indicating CRRA).

So far, we restricted our analysis to a specific class of utility functions (namely CRRA) and assumed deterministic choice behavior. In a next step, we will use the data to fit a stochastic choice model and allow for other more flexible utility functions. Moreover, we will analyze order effects via the different treatments and relate our results to socio-economic characteristics of our subjects.

References

Andersen, Steffen, Glenn W. Harrison, Morten Igel Lau, and E. Elisabet Rutström (2006). "Elicitation using multiple price list formats", *Experimental Economics* 9, pp383-405.

Aumann, Robert J., and Roberto Serrano (2008). "An Economic Index of Riskiness", *Journal of Political Economy* 116(5), pp810-836.

Fischbacher, Urs (2007). "Z-Tree: Zurich toolbox for ready-made economics experiments", *Experimental Economics* 10, pp171-178.

Friend, I., and M.E. Blume (1975). " The demand for risky assets", *American Economic Review* 65, pp900-922.

Greiner, Ben (2004). "An Online Recruitment System for Economic Experiments", in K. Kremer and V. Macho, eds., 'Forschung und wissenschaftliches Rechnen 2003, GWDG Bericht 63', Ges. für Wiss. Datenverarbeitung, Göttingen, Germany, pp79-93.

Harrison, Glenn W., and E. Elisabet Rutsröm (2008). "Risk Aversion in the Laboratory", in: J. Cox and Glenn W. Harrison (eds.): *Risk Aversion in Experiments* Research in Experimental Economics vol. 12, pp41-196, Bingley: Emerald.

Hildreth, C., and G.J. Knowles (1982). "Some estimates of Farmers' utility functions", *Technical bulletin* 335, Agricultural Experimental Station, University of Minnesota, Minneapolis.

Holt, Charles A., and Susan K. Laury (2002). "Risk Aversion and Incentive Effects", *American Economic Review* 92(5), pp1644-1655.

Kydland, F.E., and E.C. Prescott (1982). "Time to build and aggregate fluctuations", *Econometrica* 50, pp1345-1370.

Levy, Haim (1994). "Absolute and Relative Risk Aversion: An Experimental Study", *Journal of Risk and Uncertainty* 8(3), pp289-307.

Mehra, Rajnish (2003). "The Equity Premium: Why Is It a Puzzle?", *Financial Analysts Journal* 59(1), pp54-69.

Rothschild, Michael, and Joseph E. Stiglitz (1970). “Increasing Risk: I. A Definition”, *Journal of Economic Theory* 2(3), pp225-243.

Rothschild, Michael, and Joseph E. Stiglitz (1971). “Increasing Risk II: Its Economic Consequences”, *Journal of Economic Theory* 3(1), pp66-84.

Szpiro, George (1986). “Measuring Risk Aversion: An Alternative Approach”, *Review of Economics and Statistics* 68(1), pp156-159.

Tobin, J., and W. Dolde (1971). “Wealth, liquidity and consumption”, in ‘Consumer spending and monetary policy: The linkage’, Federal Reserve Bank of Boston, Boston, MA, pp99-146.

Tversky, Amos, and Daniel Kahneman (1992). “Advances in Prospect Theory: Cumulative Representation of Uncertainty”, *Journal of Risk and Uncertainty* 5(4), pp297-323.

Quiggin, John (1981). “Risk Perception and the Analysis of Risk Attitudes”, *Australian Journal of Agricultural Economics* 25(2), pp160-169.