

RTG 1666 GlobalFood

Transformation of Global Agri-Food Systems:
Trends, Driving Forces, and Implications for Developing Countries

Georg-August-University of Göttingen

GlobalFood Discussion Papers

No. 24

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October 2013

Do Changing Probabilities or Payoffs in Lottery-Choice Experiments Matter? Evidence from Rural Uganda

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Abstract

This study compares risk attitudes of smallholder farmers elicited from two different lottery designs (i) with fixed payoffs and changing probabilities and (ii) with fixed probabilities and changing payoffs. We utilize a combination of experimental and household survey data collected from 332 randomly selected smallholder coffee farmers in Uganda. Both methods reveal high proportions of farmers who are classified as risk averse. However, comparing the different risk categories shows that the two elicitation methods yield significantly different results. Furthermore, we relatively find low inconsistency rates in the response behavior for the two methods compared to other studies in the past. Specific socio-demographic and socio-economic characteristics also affect farmers' risk attitudes.

Keywords: inconsistency rates; laboratory experiment in the field; risk elicitation; Uganda.

JEL classifications: C91, C93, D81, O13.

Acknowledgment: This research was financially supported by the German Research Foundation (DFG).

1. Introduction

The majority of people in developing countries rely on agriculture for their livelihoods and often perform in precarious and risky conditions. In agricultural production, where farmers' crop yields and incomes are dependent on various exogenous factors such as weather conditions and price fluctuations, risk is ubiquitous in farming decisions (Menapace et al., 2012). Ultimately, risk plays a significant role in almost every important economic farm decision such as crop selection (Price and Wetzstein, 1999), technology adoption (Purvis et al., 1995), conservation intervention (Winter-Nelson and Amegbeto, 1998), and crop insurance markets (Hill and Viceisza, 2012). However, people naturally differ in the way they make decisions involving risk, and these differences are often described as differences in risk attitude. Therefore, understanding the risk attitude of economic agents provides useful insights in understanding their economic behavior (Reynaud and Couture, 2012). From a policy-maker's perspective, it is imperative to understand farmers' risk attitudes in order to gain insight of how risk affects the decision behavior and to predict this behavior under different policy conditions (Bhattamishra and Barrett, 2010). Harrison (2011) notes that welfare evaluation of any proposed policy with risky outcomes should consider people's risk attitudes. As a result, numerous researchers have studied individual risk attitudes, and a variety of methods have been used for testing risk attitudes in laboratory and field settings.

There is extensive literature regarding the elicitation of individuals' risk attitudes in both developed and developing countries. A variety of methods have evolved for testing these attitudes, including lottery choice task decisions (eg., Holt and Laury, 2002), self-assessment questions (e.g., Dohmen et al., 2011), hypothetical gambles (e.g., Anderson and Mellor, 2009) and willingness to pay analyses (e.g., Kahneman et al., 1990), among others. Studies that explored risk attitudes of individuals in a developed country setting include among others Holt and Laury (2002), Eckel and Grossman (2002, 2008), Dave et al. (2010), and Reynaud and Couture (2012). The studies conducted by Binswanger (1980), Humphrey and Verschoor (2004), Jacobson and Petrie (2009), Yesuf and Bluffstone (2009), and Harrison et al. (2010) examined risk attitudes of individuals in a developing country context. A troubling result of previous investigations is that often risk attitudes of an individual vary significantly across different elicitation methods (Isaac and James, 2000; Andersen et al., 2006; Dave et al., 2010; Reynaud and Couture, 2012). Furthermore, several developing country field studies utilizing complex risk elicitation methods, including lottery choice task decisions, reported relatively high inconsistency rates in individuals' response behavior, which may indicate a low level of

comprehension (e.g., Galarza, 2009; Jacobson and Petrie, 2009; Doerr et al., 2011; Engle-Warnick et al., 2011). As a result, inconsistent subjects are usually excluded from the analysis, which often means excluding a large portion of the data. These problems show that there is a danger that risk attitudes are not estimated correctly and consequently might result in different policy recommendations. A valid measure of risk attitudes is a critical input for properly designing effective policy instruments in the agricultural sector as well as for an adequate single-farm decision support.

In the last decade, the Holt and Laury lottery (HLL hereafter) has virtually become the standard method for the elicitation of subjective risk attitudes. It has been used in a great variety of contexts and with different subject groups, including convenience groups such as students (e.g., Andersen et al., 2006; Deck et al., 2008; Abdellaoui et al., 2011) and real decision-makers such as managers (e.g., Masclet et al., 2009; Holm et al., 2012). Brick et al. (2012) applied a similar design to that of Holt and Laury (2002) but differs in that, instead of changing probabilities and fixing payoffs, probabilities are fixed and payoffs change (BL hereafter). Brick et al. (2012) assumed that people have more difficulties with varying probabilities than with varying amounts of payoffs and thus modified the HLL accordingly. Conducting a standard HLL with individuals in a rural developing country setting might not be appropriate; thus, we incorporated some modifications aiming to reduce inconsistency rates and to provide more reliable measures of risk attitudes.

The objectives of this study are threefold: First, we elicit the risk attitude of smallholder farmers in Uganda using two different elicitation methods based on the well-known incentive-compatible lottery used in Holt and Laury (2002) in which subjects were given a series of choices between two systematically varied options. The two methods differ in the variation of probabilities and the fixing of payoffs or vice versa. In our experiment, both risk elicitation methods are modified from the original lottery-choice experiments by replacing monetary values with images of bags of colored balls to represent probabilities of different payoffs and henceforth are described as modified HLL and modified BL. Second, we compare the two elicitation methods to answer the questions of how the choice of method affects the results and how well these methods are understood by individuals in a rural, developing country setting. Specifically, we evaluate the consistency of risk measures in the two elicitation methods as well as the inconsistency rates in the response behavior. Third, we identify and compare influencing socio-demographic and socio-economic factors of risk attitudes across the two elicitation methods. This allows us to check the robustness of explanatory factors of

risk attitudes and examine whether these factors vary depending on the elicitation method. To achieve these objectives, we combine data generated from lottery-choice experiments with comprehensive household survey data which were collected in Uganda from July to August 2012.

Our study contributes to the extant literature by addressing the following two aspects: First, to the best of our knowledge, this study is the first to compare the effects of changing probabilities while keeping payoffs constant or vice versa on risk attitudes based on the Holt and Laury (2002) experimental design. Second, our work extends the previous research by using a relatively simple experimental design to measure risk attitudes of people with a limited level of education, which may be used as an appropriate elicitation tool within a developing country context.

The remainder of this paper is structured as follows: Section 2 presents the relevant literature from which the research hypotheses are derived. In Section 3, we explain the two elicitation methods used to measure the risk attitudes. The sampling procedure, incentive design, and the experimental implementation are described in detail in Section 4. We present and discuss our findings in Section 5, and lastly, Section 6 concludes this paper.

2. Literature Review and Hypotheses

The existing literature on risk behavior suggests various methods to measure risk attitude, but only few studies that compare different elicitation methods, in particular, for data collected in developing countries among resource-poor farmers. Binswanger (1980) measured the risk attitudes of Indian farmers by using two different methods, a hypothetical questionnaire and an experimental gambling method with real payoffs, and discovered inconsistencies in the measures of risk aversion in the two methods. Reynaud and Couture (2012) compared two different risk elicitation methods, namely the Holt and Laury (2002) and the Eckel and Grossman (2008) lottery tasks, on a sample of French farmers. They found that the risk preference measures were affected by the type of method used and demonstrated that risk attitudes were context-dependent. However, both lotteries applied were not incentive-compatible. Charness and Viceisza (2011) compared three distinct non-incentivized elicitation methods, the Holt and Laury (2002) lottery tasks, an adaptation of a simple binary method initially proposed by Gneezy and Potters (1997), and a willingness-to-risk scale pioneered by Dohmen et al. (2011) using a sample drawn from the rural population in Senegal. The results indicated that the simple binary method had substantially more predictive power compared to the HLL, which revealed a relatively low level of understanding. The willingness-to-risk

question generated results that were unlikely to be accurate according to patterns in other risk elicitation studies. Dave et al. (2010) used two different elicitation methods with different degrees of difficulty for participants and also came to a similar conclusion. They analyzed how and when a simpler but coarser risk elicitation method may be preferred to the more complex but finer one and found that the more complex method had superior predictive accuracy but had the disadvantage that participants made inconsistent choices. Andersen et al. (2006) examined the properties of the multiple price list method as well as some variants on the basic design and found that the elicitation of risk attitudes was sensitive to procedures, subject pools, and the format of the multiple price list tables. They recruited a sample from Denmark. Maart-Noelck and Musshoff (2013) applied the incentive-compatible HLL and two psychometric methods on a sample of German students and German and Kazakhstani farmers and found that students responded consistently across all three elicitation methods, whereas German farmers, and especially Kazakhstani farmers, were more inconsistent. Thus far, it has not been investigated how risk attitudes assessed by two different risk elicitation methods differing in the variation of probabilities or payoffs based on Holt and Laury (2002) and Brick et al. (2012) compare to each other in a within-sample experiment. Therefore, we analyze the consistency of risk measures across the two different elicitation methods which we have used and adapted to individuals in a rural developing setting. We formulate the following hypothesis:

H1 'Modified HLL vs. modified BL': There are consistencies between the risk attitudes determined in the modified HLL and the response behavior in the modified BL.

Risk attitudes measured in lottery choice task decisions are usually based on the point at which participants switch from the safe option to the risky one. A common problem with such designs is that when participants fail to understand a task, they tend to switch back and forth between the lottery options as they move down the decision rows. This makes a risk measure based on a switching point from risky to safe lottery option problematic. Multiple switching behaviors have been observed in numerous studies but were especially prevalent in a developing country context. Galarza (2009) observed an inconsistency rate of 52% in a study conducted with Peruvian cotton farmers. Jacobson and Petrie (2009) found that approximately 55% of Rwandan participants made at least one inconsistent switch. The experiment was conducted with a random sample of the adult population in Rwanda. Brick et al. (2012) found that about 41% of the sample of South African fishers showed multiple switching behaviors, and Charness and Viceisza (2011) found that 51% of the participating farmers in Senegal

switched lotteries at least twice. De Brauw and Eozenou (2011) found an inconsistency rate of 14% among Mozambican farmers, which matched with most case studies of developed countries which had lower inconsistency rates. Holt and Laury (2002) found an inconsistency rate of 13% for students in the United States, and Dave et al. (2010) found an inconsistency rate of 8.5% for an adult population in Canada. The relatively large proportion of participants in developing countries that made inconsistent choices in lottery choice task decisions could indicate that this risk elicitation method might not be the most appropriate within this setting. Therefore, we analyze the inconsistency rates of the two elicitation methods and evaluate whether the modified BL is better able to reduce inconsistencies in the response behavior compared to the modified HLL following the argumentation of Brick et al. (2012). Our hypothesis is:

H2 'Inconsistency rates of modified BL vs. modified HLL': The modified BL outperforms the modified HLL in reducing the inconsistency rates in the response behavior.

Individuals' characteristics naturally vary and may also have an impact on the risk attitudes (Doss et al., 2008). In our study, we focus on specific socio-demographic (age, gender, education, household size and number of dependents, and district) and socio-economic characteristics (wealth, farm size, access to a savings account, and access to credit) of respondents to examine whether these factors influence their risk attitudes and whether these factors are consistent across the two elicitation methods. In the extant literature, there is no consensus whether risk attitudes are influenced by socio-demographic and socio-economic characteristics. Although some studies find that risk attitudes differ significantly based on these characteristics, other studies find no significant relationship. Table 1 provides a summary of the variables and their impact on the risk attitude from other studies. Our last hypothesis is as follows:

H3 'Farmer-specific effects for risk attitude': Socio-demographic and socio-economic variables have a significant effect on the risk attitude of farmers.

Table 1
Overview of socio-demographic and socio-economic variables and their impact on risk attitude

Variable	Study	Impact
<i>Socio-demographic variables</i>		
Age	e.g., Nielsen et al. (2013)	+ Older individuals are more risk averse than younger ones
Gender	e.g., Maart-Noelck and Musshoff (2013)	- No significant effect
	e.g., Croson and Gneezy (2009)	+ Women are more risk averse than men
Education	e.g., Mosley and Verschoor (2005)	- No significant effect
	e.g., Harrison et al. (2007)	+ Individuals with higher education are more risk averse than those with less education
Household size	e.g., Reynaud and Couture (2012)	- No significant effect
	e.g., Miyata (2003)	+ Individuals with larger households are more risk averse
Number of dependents	e.g., Maart-Noelck and Musshoff (2013)	- No significant effect
	e.g., Hallahan et al. (2004)	+ Individuals with a larger number of dependents are more risk averse
	e.g., Picazo-Tadeo and Wall (2011)	- No significant effect
<i>Socio-economic variables</i>		
Wealth	e.g., Cohen and Einav (2007)	+ Wealthier individuals are more risk averse
Farm size	e.g., Tanaka et al. (2010)	- No significant effect
	e.g., Wik et al. (2004)	+ Individuals with more land are more risk averse
Access to a savings account	e.g., Reynaud and Couture (2012)	- No significant effect
	e.g., Jacobson and Petrie (2009)	+ Individuals with access to a savings account are less risk averse
Access to credit	e.g., Eswaran and Kotwal (1990)	+ Individuals with access to credit are less risk averse

Source: Author's own illustration.

3. Experiment Design

This section provides an overview of how the experiment was designed. Farmers were faced with two different methods for measuring risk attitudes. Both risk elicitation methods were chosen in a randomly determined order. A complete set of instructions for the experiment is included in Appendix 1. The experiment was preceded by a household survey that collected information on household demographics and economic characteristics.

3.1. The Holt and Laury lottery and its modification

In the Holt and Laury (2002) experiment, participants had to make 10 choices between two systematically varied options, namely option A (the relatively safer option) or option B (the

relatively riskier option). In our design, option A offered the chance to either win UGX 6,000 or UGX 4,800 with a certain probability, while option B offered the chance to win UGX 11,550 or UGX 300 with the same probability (see Table 2). The payoffs in the safer option have a lower range than those in the riskier option. We use the rate of 1:3,000 (which corresponds to the exchange rate) to get the equivalent payoffs in Ugandan shillings compared to the original task. The earnings are held constant across the choice tasks, whereas the probabilities of the earnings vary in intervals of 10% between the choice tasks. The expected values of the options change as participants move from one to the next choice task. Up to the fourth choice task, the expected value of the safer option A is higher than the expected value of the riskier option B. From the fifth task, the expected value of option B exceeded the expected value of option A.

Table 2
Payoff matrix of the Holt and Laury lottery

Task	Option A	Option B	EV ^A	EV ^B	CRRA ranges ^a	Risk aversion class ^b
1	With 10% prize of 6,000 With 90% prize of 4,800	With 10% prize of 11,550 With 90% prize of 300	4,920	1,425	$r < -1.71$	Extremely RL
2	With 20% prize of 6,000 With 80% prize of 4,800	With 20% prize of 11,550 With 80% prize of 300	5,040	2,550	$-1.71 < r < -0.95$	Highly RL
3	With 30% prize of 6,000 With 70% prize of 4,800	With 30% prize of 11,550 With 70% prize of 300	5,160	3,675	$-0.95 < r < -0.49$	Very RL
4	With 40% prize of 6,000 With 60% prize of 4,800	With 40% prize of 11,550 With 60% prize of 300	5,280	4,800	$-0.49 < r < -0.14$	RL
5	With 50% prize of 6,000 With 50% prize of 4,800	With 50% prize of 11,550 With 50% prize of 300	5,400	5,925	$-0.14 < r < 0.15$	RN
6	With 60% prize of 6,000 With 40% prize of 4,800	With 60% prize of 11,550 With 40% prize of 300	5,520	7,050	$0.15 < r < 0.41$	Slightly RA
7	With 70% prize of 6,000 With 30% prize of 4,800	With 70% prize of 11,550 With 30% prize of 300	5,640	8,175	$0.41 < r < 0.68$	RA
8	With 80% prize of 6,000 With 20% prize of 4,800	With 80% prize of 11,550 With 20% prize of 300	5,760	9,300	$0.68 < r < 0.97$	Very RA
9	With 90% prize of 6,000 With 10% prize of 4,800	With 90% prize of 11,550 With 10% prize of 300	5,880	10,425	$0.97 < r < 1.37$	Highly RA
10	With 100% prize of 6,000 With 0% prize of 4,800	With 100% prize of 11,550 With 0% prize of 300	6,000	11,550	$1.37 < r$	Extremely RA

Source: Author's own illustration according to Holt and Laury (2002).

Notes: Prizes are displayed in Ugandan shillings (UGX). At the time of the experiments, the exchange rate was approximately €1 to UGX 3,000, so prizes range from approximately €0.1 to €3.85. The fourth and fifth columns show the expected values (EV) of the respective option.

^aConstant relative risk aversion coefficient assuming a power risk utility function.

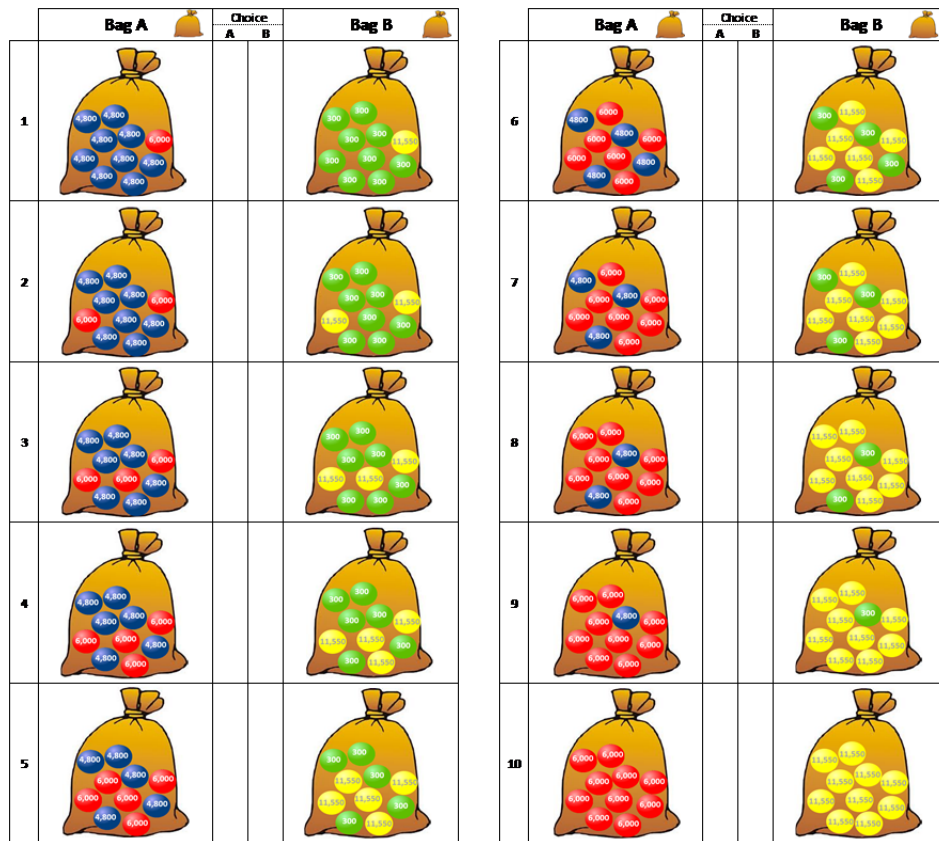
^bRL, RN, and RA respectively for risk lover, neutral, and averse.

Participants were asked to make 10 choices of either option A or option B, one for each choice task. The switching point from the safer to the riskier option allowed us to determine their individual risk attitude. A risk-seeking participant would switch to option B in the first

three decision rows, while a risk-averse participant would switch to option B between the decision rows five to nine. In turn, a risk-neutral participant would always decide in favor of the option with the higher expected value. Therefore, the person would switch from choosing option A to option B in row five. A HLL-value (= number of safe choices) between one and three expresses risk preference, a HLL-value of four implies risk neutrality, and a HLL-value between five and 10 expresses risk aversion of the participant. Following Holt and Laury (2002), a constant relative risk aversion (CRRA) function defined over the lottery prize was used to calculate a range of relative risk aversion compatible with each choice. The CRRA function is of the form $U(x) = (x^{1-r})/(1-r)$ where x is the lottery prize and r is the latent risk coefficient. Using this utility function, we can calculate the implied bounds of an individual's CRRA coefficient. For instance, a participant who chose option A six times before switching to option B reveals a CRRA coefficient interval between 0.15 and 0.41. Positive values of the CRRA coefficient denote risk aversion ($r > 0$), a value of zero indicates risk neutrality ($r = 0$), and negative values denote risk seeking ($r < 0$).

Conducting a standard HLL with individuals in a rural, developing country setting like Uganda might not be appropriate, thus, we incorporated some modifications. The standard HLL is modified in this experimental design by replacing monetary values with images of bags of colored balls (green, blue, red, and yellow) representing probabilities of different payoffs (UGX 300, UGX 4,800, UGX 6,000, and UGX 11,550). Each payoff is a ball of a particular color. The choice tasks were presented all at once to the participants. Figure 1 shows the 10 choice tasks the participants faced in this lottery.

● = 300 UGX
 ● = 4,800 UGX
 ● = 6,000 UGX
 ● = 11,550 UGX



Source: Author's own illustration.

Figure 1. Graphical display of the modified Holt and Laury lottery (in Ugandan shillings)

3.2. The Brick lottery and its modification

The experiment design used in Brick et al. (2012) is similar to that of Holt and Laury (2002), but with one main difference. Instead of keeping payoffs constant and varying the probabilities of receiving the high and low outcomes, the probabilities are constant and the payoffs are varied. We use the rate of 1:500 to get the equivalent payoffs in Ugandan shillings compared to the original task and to adjust to the payoffs of the HLL. For each choice task, participants were asked to choose between option A and option B. Fixed probabilities of 100% and 50% were used in the experiment. In the first task, for example, option A offered a 100% chance to win UGX 10,000, while option B offered a 50% chance to either win UGX 10,000 or UGX 0 (see Table 3). The payoff associated with option A declines systematically throughout the eight tasks from UGX 10,000 to UGX 1,000, while the payoff for option B remains unchanged and is fixed at UGX 10,000 and UGX 0. A highly risk seeking participant would choose option B in the first choice task, while a highly risk averse participant would choose option A in the eighth choice task. A risk-neutral participant would

switch from choosing option A to option B in row four, when the expected value of both is approximately the same.

Table 3
Payoff matrix of the Brick lottery

Task	Option A	Option B	EV ^A	EV ^B	CRRRA ranges ^a	Risk aversion class ^b
1	With 100% prize of 10,000	With 50% prize of 10,000 With 50% prize of 0	10,000	5,000	$r < -1.41$	Highly RL
2	With 100% prize of 7,500	With 50% prize of 10,000 With 50% prize of 0	7,500	5,000	$-1.41 < r < -0.36$	Very RL
3	With 100% prize of 6,000	With 50% prize of 10,000 With 50% prize of 0	6,000	5,000	$-0.36 < r < 0$	RL
4	With 100% prize of 5,000	With 50% prize of 10,000 With 50% prize of 0	5,000	5,000	$0 < r < 0.24$	RN
5	With 100% prize of 4,000	With 50% prize of 10,000 With 50% prize of 0	4,000	5,000	$0.24 < r < 0.42$	Slightly RA
6	With 100% prize of 3,000	With 50% prize of 10,000 With 50% prize of 0	3,000	5,000	$0.42 < r < 0.57$	RA
7	With 100% prize of 2,000	With 50% prize of 10,000 With 50% prize of 0	2,000	5,000	$0.57 < r < 0.70$	Very RA
8	With 100% prize of 1,000	With 50% prize of 10,000 With 50% prize of 0	1,000	5,000	$r < 0.70$	Highly RA

Source: Author's own illustration according to Brick et al. (2012).

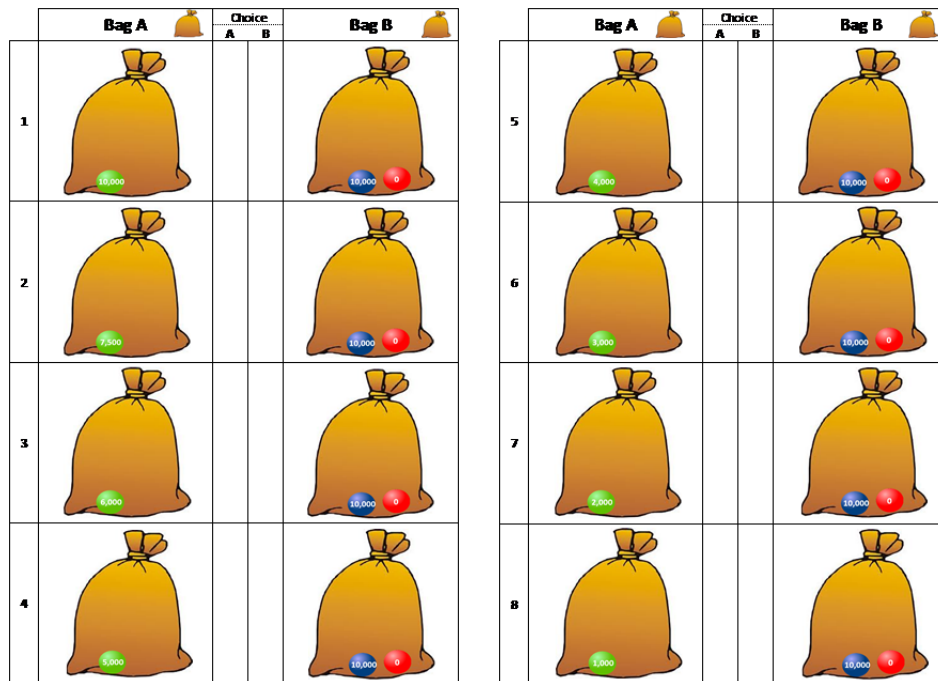
Notes: Prizes are displayed in Ugandan shillings (UGX). At the time of the experiments, the exchange rate was approximately €1 to UGX 3,000, so prizes range from approximately €0.33 to €3.33. The fourth and fifth columns show the expected values (EV) of the respective option.

^aConstant relative risk aversion coefficient assuming a power risk utility function.

^bRL, RN, and RA respectively for risk lover, neutral, and averse.

In our version of the lottery, we use images of bags of colored balls (red, blue, and green) representing probabilities of different payoffs (UGX 0, UGX 10,000, and between UGX 10,000 and UGX 1,000). Figure 2 shows the eight choice tasks presented to participants. The choice tasks were presented all at once to the participants.

● = 0 UGX
 ● = 10,000 UGX
 ● = between 10,000 UGX and 1,000 UGX



Source: Author's own illustration.

Figure 2. Graphical display of the modified Brick lottery (in Ugandan shillings)

3.3. Variables used in analysis

In addition to the lottery-choice experiments, participants attended a household survey during which they completed a comprehensive questionnaire capturing information on household demographics and economic characteristics. The main variables collected through the survey were age, gender, education, household size, number of dependents, district, per capita household expenditure, and number of rooms at homestead as proxy variables for wealth, total land owned, access to savings account, and access to credit.

A participant's ability to reason with numbers and probabilities may affect the understanding and choice among risky lotteries, and hence, the opportunity to obtain an accurate measurement of risk attitudes (Dave et al., 2010). Therefore, we included three additional tasks, adapted from Viceisza (2011) and Charness and Viceisza (2011), to assess farmers' ability to process percentage and probabilistic information and to explore the relationship between their decision behavior and the test score in the quiz: (i) "Imagine, we toss a coin and 'heads' comes up. What comes up if we toss the coin again?" Participants were faced with three possible answers: heads, tails, one cannot predict exactly. (ii) "If the chance of winning a prize is 10%, how many people out of 100 would be expected to get the prize?" Participants had to name the appropriate value. (iii) "When you draw the red ball, you win! Look at the

two boxes and mark the correct sentence.” One box contains two red and two blue balls, while the other box contains four red and four blue balls. Participants have to decide whether the chance of winning is higher if they choose the first box, the second box, or the chance of winning is equal regardless of which box they choose.

4. Data Collection

4.1. Sampling procedure

Data used in this study was obtained from experiments and a household survey of 332 smallholder coffee farmers randomly selected from two districts of Masaka and Luwero in Uganda from July to August 2012. These two districts, located in the Central Region, have been broadly classified as having similar agro-climatic conditions and farming systems. The data was collected in collaboration with various local administrative institutions and three non-governmental organizations (NGOs), and conditions were purposively selected based on the project areas of our partners in Uganda. We had access to complete lists of farmers that we obtained from three NGOs that are involved with farmer groups in these regions. To select farmers, we used a stratified random sampling based on complete lists of participating farmers in activities conducted by the three NGOs. In a first step, we randomly selected parishes and villages. In a second step, we randomly chose farmers at the village level. The farmers were then recruited via the local extension service to participate in a household survey and an experiment. The invitation to attend our experiment was provided orally by the recruiters and contained the date, time, and place of the study, a brief and general purpose of the study, and the type of compensation that could be expected. The household survey took place one day prior to the actual experiments. Our participants were either the household head or the spouse because they are those most likely to be faced with risky choices and important economic decisions.

4.2. Experiment implementation

The 332 smallholder coffee farmers were allocated randomly to groups for the experimental sessions. In total, we conducted 56 sessions during the course of 30 days. Two sessions were held each day and each session involved a group of six farmers¹. In the experiment, choices made by participants were not time constrained. On average, the complete session lasted

¹ However, four farmers were excluded from the analysis. One farmer left before completing all tasks, and three farmers participated in the household survey but were not able to undertake (or arrived too late to participate) the experiment.

between 60 and 90 minutes. The experimental sessions were held in several villages and conducted in classrooms of local schools or in a meeting room at the main gathering place of a farmers' group or association. All of the sessions were held in locations which were familiar to the farmers and usually within walking distance or accessible by bicycle. The rooms were equipped with tables and chairs and were spaced out to prevent conferring among the participants. A team of seven enumerators conducted all of the experimental sessions. One of the enumerators served as the experimenter, and the author served as the assistant experimenter. The other enumerators were placed next to the participants to record their choices in case participants were illiterate. Each participant had their own enumerator. All sessions were conducted in Luganda, one of the main indigenous Bantu languages in south central Uganda. Prior to the first session, the enumerators were trained on the experiment protocol and how to carefully avoid giving specific instructions about how to answer.

Each experiment session consisted of registration, instruction, practice, decision making, and payment. In the beginning of the experiment, each participant received a personal number, which randomly determined his/her seat that remained to be the individual's location throughout the session. The experiment instructions were read aloud to all participants as a group by the experimenter and supported by posters of graphical examples displayed on a large board at the front of the room to improve the understanding. During the presentation of the instructions, participants were encouraged to ask questions about any unclear issues. To further facilitate comprehension, we used real bags of colored balls representing probabilities of the different payoffs. Each choice task in the experiment was conducted in the following way: The assistant experimenter placed the appropriate balls in the bags, while the experimenter explained the values attached to each ball. The participants then considered their decision and made their choice by pointing to the preferred bag on the sheet in front of them, and their enumerator recorded the choice. Participants were informed about all parameters and assumptions underlying the experiment, and they had to answer some control questions to ensure that they entirely understood the instructions. Our overall impression was that our version of the instructions was well understood by the participants because of the various interview techniques applied, such as visual, oral, and written explanations, as well as the practical implementation with real bags and colored balls.² Further support of respondents' comprehension of the instructions is seen, for example, in the unproblematic answering of the control questions during the experiment.

² Pretests have shown that to conduct a standard HLL and BL with individuals in a rural developing setting like Uganda would not have been feasible.

4.3. Incentive design

The decisions in the lottery-choice experiments were related to real earnings to ensure incentive compatibility of the experiment and to motivate participants to take the tasks more seriously. Participants were informed at the beginning of the experiment that when they have completed all decision tasks in the respective lottery, one task would be selected at random and played out for real money. This random lottery incentive system is commonly used in lottery-choice risk experiments (Humphrey and Verschoor, 2004). Nevertheless, there is an ongoing controversial debate on the use of monetary incentives as rewards for participants in experiments and the practice of paying only some participants for only some of their decisions. Camerer and Hogarth (1999) found that using high financial incentives for a fraction of participants rather than providing small incentives for each of the participants often improves participants' performance during the experiment. We chose one participant at random for payment for each lottery-choice experiment of our payment design; hence we had two winners per session. The earning of the participant was based on his/her preference expressed between various mutually exclusive options in the two lotteries. Each decision task had exactly the same probability to be drawn. The potential earning varied between UGX 300 and UGX 11,550 for the modified HLL and between UGX 0 and UGX 10,000 for the modified BL. The average payoffs of the two lotteries were UGX 6,674 (approximately €2.2) and UGX 5,687 (approximately €1.9). Furthermore, all participants received a show-up fee of UGX 5,000 as a compensation for their time. This compares to one day of casual farm labor wage in this area. Participants were paid in cash by the assistant experimenter at the end of the experiment.

5. Experimental Results

5.1. Descriptive statistics

Table 4 below presents descriptive statistics on socio-demographic and socio-economic characteristics of participants in the experiment. On average, participants were aged 50.21 years. Of all participants, 39% were female. The education level of the household head was on average 6.67 years of schooling. The average household size and dependency ratio were 6.56 and 1.51, respectively. Of all participants, 57% were from Masaka district, while 43% of them were from Luwero district. In order to assess whether farmers have a basic comprehension of probabilities, we conducted a short quiz composed of three simple questions before the experimental session started. On average, each farmer answered two out of the three questions correctly. The average annual per capita household expenditure on non-

food items was approximately UGX 516,855 and on average participants had 4.45 rooms in their homestead. The mean farm size for each farmer was about 5.73 acres. Of all participants, 28% indicated to have access to a savings account, while 43% claimed to be able to access financial credit for agricultural activities whenever they need it.

Table 4
Descriptive statistics of respondent characteristics (N = 332)

Variable name	Variable definition	Mean	Std. dev.
<i>Socio-demographic characteristics</i>			
Age	Age in years	50.21	14.28
Gender	Dummy = 1 if female, 0 otherwise	0.39	-
Education	Years of formal schooling	6.67	3.60
Household size	Number of household members	6.56	3.10
Dependency ratio	Ratio of dependent (less than 15 years of age or greater than 64) to nondependent household members	1.51	1.18
District	Dummy = 1 if from Masaka, 0 = Luwero	0.57	-
Probability test score	number of probability questions correctly answered	2.05	0.78
<i>Socio-economic characteristics</i>			
Per capita household expenditure	Annual per capita household expenditure in UGX ^a	516.855	392.949
Number of rooms	Number of rooms at homestead	4.45	1.51
Total land owned	Total land owned in acres ^b	5.73	4.53
Access to a savings account	Dummy = 1 if access to a savings account, 0 otherwise	0.28	-
Access to credit	Dummy = 1 if access to credit, 0 otherwise	0.43	-

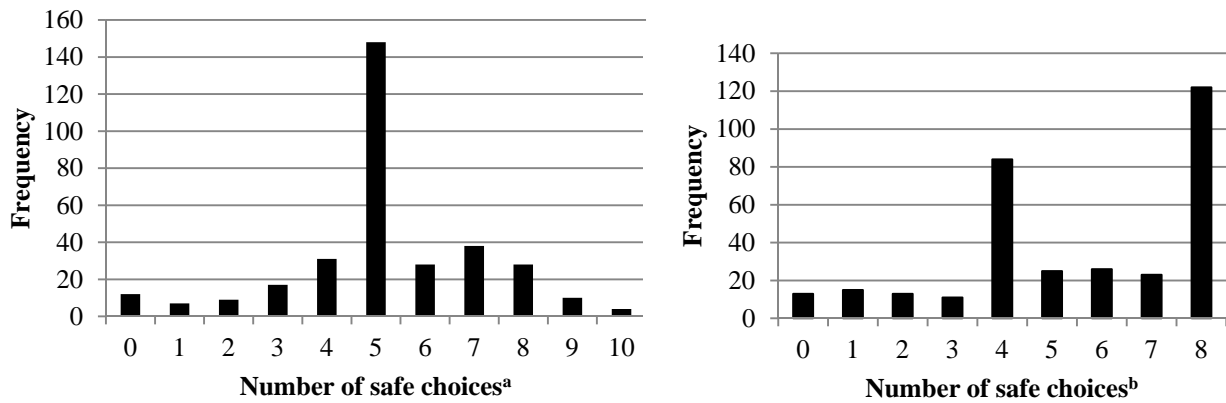
Source: Survey data.

^a At the time of the experiments, the exchange rate was approximately €1 to UGX 3,000.

^b 1 acre = 0.40 hectare.

Figure 3 presents the distribution of safe choices before switching to the risky lottery option by elicitation method.³ The individual risk attitudes vary between risk seeking and strong risk aversion. The histogram of the modified HLL shows a high peak at 5 (the average value in the range), while there is a high peak at 4 (the average value in the range) and a very high peak at 8 in the histogram of the modified BL. The latter one may be explained by the fact that in lottery option B participants had a 50% chance of receiving nothing, and thus rather chose the safer option A eight times.

³ For the participants who showed an inconsistent behavior (i.e. participants who switched at least twice), we assumed the HLL-value at which the participant switched for the first time.



^a Number of safe choices in the HLL: range of 0-3 = risk seeking (CRRRA range: -1.71 to -0.14), 4 = risk neutral (CRRRA range: -0.14 to 0.15), range of 5-10 = risk averse (CRRRA range: 0.15 to 1.37).

^b Number of safe choices in the BL: range of 0-3 = risk seeking (CRRRA range: -1.41 to 0), 4 = risk neutral (CRRRA range: 0 to 0.24), range of 5-8 = risk averse (CRRRA range: 0.24 to 0.70).

Figure 3. Distribution of safe choices in the modified HLL (left figure: N= 332) and modified BL (right figure: N = 332)

5.2. Validity test of hypotheses

5.2.1 Test of H1 'Modified HLL vs. modified BL'

Table 5 presents the summary statistics of the two risk elicitation methods. The two lotteries reveal that there are slightly more risk seeking (15.66%) (52), more risk neutral (25.30%) (84), and less risk averse (59.04%) (196) participants in the modified BL than compared to the modified HLL with 13.55% (45) risk seeking, 9.34% (31) risk neutral, and 77.11% (256) risk averse participants. The results of the chi-square tests show that there is a significant difference in the proportions of the categories of risk neutral ($p < 0.01$) and risk averse participants ($p < 0.01$) in the two elicitation methods, while there is no significant difference in the category of risk seeking participants. Due to the non-normal distribution⁴ of the number of safe choices, it is more appropriate to use the Wilcoxon rank-sum test to examine whether there is a statistically difference between the two elicitation methods. The results reveal that there is a statistically significant difference ($p < 0.10$).⁵ Thus, we reject H1 'Modified HLL vs. modified BL'. Essentially, this means that risk attitude measures are affected by the type of method used. Although we found inconsistencies in the individual risk attitude across the two

⁴ In order to test whether the distribution of the safe choices are normally distributed and to check robustness, we conduct three different tests, namely the Shapiro Francia, the Shapiro Wilk, and the Skewness Kurtosis. All three tests show that the distribution of safe choices in the modified HLL and the modified BL are non-normally distributed ($p < 0.05$). This finding compels us to use non-parametric test statistics to compare whether the two distributions are significantly different from each other (Gardner, 1975).

⁵ An additional analysis, which excludes participants who showed an inconsistent response behavior (e.g., a multiple switching behavior), generates similar results. We exclude 19 participants of the modified HLL and 25 participants of the modified BL.

elicitation methods, the tendency of participants being risk averse is the same, which corroborates empirical findings of other studies conducted in developing countries (e.g., Jacobson and Petrie, 2009; Yesuf and Bluffstone, 2009; Harrison et al., 2010).

Table 5
Summary statistics of the two risk elicitation methods

	Risk category	Modified HLL	Modified BL	Test of significance
Risk category (%)	Risk seeking	13.55 (0.02)	15.66 (0.02)	$\chi^2 = 0.59$
	Risk neutral	9.34 (0.02)	25.30 (0.02)	$\chi^2 = 29.9***$
	Risk averse	77.11 (0.02)	59.04 (0.03)	$\chi^2 = 24.9***$
Distribution of safe choices ^a (%)	Mean	52.04	68.83	$z^b = -1.75^*$
	Std. dev.	19.58	30.27	
	Median	50	75	
	Skewness	-0.37	-0.55	
	Kurtosis	3.85	2.27	

Source: Survey data.

Notes: N = 332. Standard errors are indicated in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01.

^a Due to the difference in scale value, the number of safe choices in the modified HLL (range of 0-10) and the modified BL (range of 0-8) are converted into percentages of safe choices for comparison.

^b Based on the Wilcoxon rank-sum (Mann-Whitney) test.

5.2.2 Test of H2 'Inconsistency rates of modified BL vs. modified HLL'

To analyze whether the modified BL is better able to reduce inconsistency rates in the response behavior compared to the modified HLL, individuals are classified into four groups as shown in Table 6. With respect to the modified HLL, the first group encompasses participants who first choose option A and at some point switch to option B. The second group comprises participants who always choose option B. We assume that participants in these two groups understood the lottery and therefore consider them as to be consistent. The third group comprises participants who always choose option A. This group is considered as to be inconsistent as we think that participants did not completely understand the lottery, since they should have switched to option B at the latest in decision task 10. In the fourth group there are participants who switch at least twice. With respect to the modified BL, the first group also encompasses participants who first choose option A and at some point switch to option B. The second group comprises participants who always choose option A and the third group comprises participants who always choose option B. Although the third group is consistent in their response behavior, we think that participants did not completely understand the lottery, since they should have chosen option A at least in the first decision task, which offered a 100% chance to win UGX 10,000. Hence, this group is considered as being inconsistent. The last group comprises participants who switch at least twice. Also in the

modified BL, the first two groups are classified as to be consistent, while the last two groups are classified as to be inconsistent in our analysis.

Table 6
Classification of groups by consistency and inconsistency rate (N = 332)

	Group	Description	Modified HLL
Consistent	1	Switch once	303
	2	Always choose option B	10
Inconsistent	3	Always choose option A	4
	4	Switch at least twice	15
	Group	Description	Modified BL
Consistent	1	Switch once	185
	2	Always choose option A	122
Inconsistent	3	Always choose option B	10
	4	Switch at least twice	15

Source: Survey data.

According to this classification scheme, 313 of 332 participants (94.3%) understood the modified HLL. Another 4 participants (1.2%) always chose option A, and 15 participants (4.5%) switched at least twice. In the modified BL, 307 of 332 participants (92.5%) understood the lottery. Another 10 participants (3.0%) always chose option B, and 15 participants (4.5%) switched at least twice. In both elicitation methods, the inconsistency rates of 5.7% in the modified HLL and 7.5% in the modified BL are relatively low compared to other studies in this field (Galarza, 2009; Jacobson and Petrie, 2009; Brick et al., 2012; Charness and Viceisza, 2011). The relatively low rates of inconsistency may be an indication that our design of the modified HLL and the modified BL was well understood by the participants in Uganda. The inconsistency rates are even lower in the modified HLL compared to the modified BL. Against the assumption of Brick et al. (2012) that people have more difficulties with varying probabilities than with varying amounts of payoffs, we do not find any evidence in our results given the relatively low rates of inconsistency in both methods. On this basis, we fail to reject *H2 'Inconsistency rates of modified BL vs. modified HLL'*.

5.2.3 Test of H3 'Farmer-specific effects for risk attitude'

The interval and ordered probit regression models are used to analyze how socio-demographic and socio-economic factors affect risk attitudes. The interval regression model uses the midpoint CRRA coefficients of the modified HLL and the modified BL as the dependent variable, while the ordered probit regression model uses the number of times a participant chose the safe option in the respective lottery as the dependent variable. We use two

regression models as a robustness check of the regression results of each of the two models. Table 7 presents the results of two interval and two ordered probit regression models.

First, the results show that the effects of socio-demographic and socio-economic factors on risk attitudes are the same across the two regression models, confirming robustness of our results. For example, education, district, quiz test score, number of rooms at homestead, and winner modified BL all significantly have an effect on risk attitudes in the interval and ordered probit models. Second, all statistically significant explanatory variables (except for quiz test scores in the interval regression) of risk attitude vary across the two elicitation methods. For example, education has a statistically significant negative effect on risk aversion in the modified BL but shows no significant effect in the modified HLL. Third, the results offer insights into characteristics significant in increasing or decreasing risk aversion as well as their relative impact. The coefficients of district indicate that participants from the Masaka district are substantially less risk averse in the modified HLL than compared to participants from the Luwero district. Participants who correctly answered more questions in the quiz are significantly more risk averse in both elicitation methods in the interval regression. Per capita household expenditure and the number of rooms at homestead, which are proxies for wealth, have a positive impact on risk aversion for both elicitation methods. Age, gender, household size, dependency ratio, total land owned, access to a savings account, and access to credit show no significant effects.

The extant literature offers conflicting evidence on how individual characteristics influence risk attitude. For example, we found that risk aversion decreases with education, which is contradictory to other studies (e.g., Harrison et al., 2007), although deviating from other studies, which did not find a significant impact (e.g., Reynaud and Couture, 2012). Previous studies found a positive relationship between risk aversion and wealth (e.g., Cohen and Einav, 2007), whereas others do not find one (e.g., Tanaka et al., 2010). We found that proxies for wealth such as per capita household expenditure and number of rooms at homestead are positively associated with risk aversion. Moreover, some of the socio-demographic (age, gender, household size, and dependency ratio) and socio-economic characteristics (total land owned, access to a savings account, and access to credit) are not significant, which is interesting because many studies found an effect (Eswaran and Kotwal, 1990; Miyata, 2003; Hallahan et al., 2004; Wik et al., 2004; Croson and Gneezy 2009; Jacobson and Petrie, 2009; Nielsen et al., 2013). Although we found a significant effect of several socio-demographic and socio-economic factors on risk attitude, these factors are not consistent across the two

elicitation methods. On this basis, we fail to reject *H3 'Farmer-specific effects for risk attitude'*.

Besides testing the effects of socio-demographic and socio-economic characteristics on individuals' risk attitudes, we test for a potential 'order effect' in the experiment to check whether farmers show different decision behavior when they are faced with the two lottery-choice experiments in a different order. Some participants were at first faced with the modified HLL and then with the modified BL or vice versa. According to Harrison et al. (2005) prior experience with one task may influence participants' behavior in a subsequent task. However, it may also indicate a 'learning effect', meaning that participants acquire routines in one task and apply them to later decisions even if they are related to another task (Scheufele and Bennett, 2013). We also included a binary indicator for winning in the first lottery-choice experiment in order to test whether there is an impact on the second lottery-choice experiment. Order in the experiment is not statistically significant in the regression models. However, a participant who first played the modified BL and won is more risk averse in the subsequent modified HLL. This indicates that conducting various successive experiments should be done with caution as prior experience with one task affects behavior in a subsequent task, which was also found by Harrison et al. (2005).

Table 7

Results of the interval and ordered probit regression with the individual risk attitude as the dependent variable (N = 332)

Variable	Interval regression		Ordered probit regression	
	Modified HLL	Modified BL	Modified HLL	Modified BL
Age (<i>years</i>)	0.00 (0.00)	-0.00 (0.01)	0.00 (0.00)	-0.00 (0.00)
Gender (<i>1 = female</i>)	-0.03 (0.08)	-0.03 (0.15)	-0.07 (0.13)	-0.03 (0.13)
Education (<i>years</i>)	0.01 (0.01)	-0.05** (0.02)	0.00 (0.02)	-0.04** (0.02)
Household size (<i>number</i>)	-0.01 (0.01)	-0.03 (0.02)	-0.02 (0.02)	-0.02 (0.02)
Dependency ratio ^a	0.00 (0.03)	-0.06 (0.06)	0.04 (0.06)	-0.05 (0.06)
District (<i>1 = Masaka</i>)	-0.26*** (0.08)	-0.03 (0.15)	-0.47*** (0.13)	-0.01 (0.14)
Quiz test score (<i>number</i>)	0.12** (0.05)	0.20** (0.09)	0.15** (0.08)	0.13 (0.08)
Per capita household expenditure (<i>UGX</i>) ^b	4.60 (0.00)	0.00** (0.00)	9.97 (0.00)	0.00** (0.00)
Number of rooms at homestead	0.05* (0.03)	0.06 (0.05)	0.09* (0.05)	0.08 (0.05)
Total land owned (<i>acres</i>) ^c	0.00 (0.01)	-0.01 (0.02)	0.00 (0.01)	-0.01 (0.01)
Access to a savings account (<i>dummy</i>)	0.01 (0.09)	0.17 (0.16)	0.06 (0.14)	0.15 (0.15)
Access to credit (<i>dummy</i>)	-0.02 (0.08)	0.01 (0.14)	-0.09 (0.12)	0.01 (0.13)
Order of experiment (<i>1 = first modified BL</i>)	0.05 (0.08)	-0.15 (0.14)	0.08 (0.12)	-0.14 (0.13)
Winner modified BL (<i>dummy</i>)	0.27* (0.15)	-	0.46* (0.25)	-
Winner modified HLL (<i>dummy</i>)	-	0.27 (0.26)	-	0.21 (0.23)
Constant	-0.47** (0.22)	0.05 (0.42)	-1.30*** (0.37)	-1.73*** (0.39)
Observations	332	332	332	332
Chi ²	26.21	20.53	27.63	18.62
Log likelihood	-698	-621.7	-616.5	-598
Interval observations	290	169		
Right censored observations	14	122		
Left censored observations	19	41		
Uncensored observations	9	0		

Source: Survey data

Notes: Standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01.

Dependent variables: Interval regression: midpoint CRRA coefficients of the modified HL and BL; Ordered probit regression: number of safe choices in the modified HL and BL.

^a A measure showing the number of dependents (aged 0-14 and over the age of 65) to the number of people (aged 15-64).

^b At the time of the experiments, the exchange rate was approximately €1 to UGX 3,000.

^c 1 acre = 0.40 hectare.

6. Conclusions

Smallholder farmers in a rural developing country setting face risky decisions regularly in their daily lives. Thus, a better understanding of farmers' risk attitudes is crucial in order to gain insight of how risk affects their decision behavior, interpreting agricultural outcomes, and designing policies such as insurance instruments and other safety nets that effectively assist farmers. However, several studies quantifying individual risk attitudes showed that results of different elicitation methods may vary and reported relatively high inconsistency rates in individuals' response behavior, which may indicate a low level of comprehension. Comparison of different risk elicitation methods allows insights into which method may be better adapted to assess risk attitudes of farmers in a developing country. In this study, we elicit the risk attitude of Ugandan smallholder farmers using two different methods based on the Holt and Laury (2002) and Brick et al. (2012) lottery tasks, which differ in the variation of probabilities and the fixing of payoffs or vice versa. Brick et al. (2012) assumed that people have more difficulties with varying probabilities than with varying amounts of payoffs. Furthermore, we evaluate the inconsistency rates in the response behavior and investigate whether risk attitudes are influenced by farmers' socio-demographic and socio-economic factors and whether these factors are consistent across the elicitation methods.

Our results show first that farmers, on average, are risk averse, which is not surprising considering the inherent risk in agriculture. Second, the different categories of risk attitude indicate a statistically significant difference across the two elicitation methods. That means that risk attitude measures are affected by the type of method used, even though the tendency of participants being risk averse is the same. Third, we found a relatively low rate of inconsistent decisions in both lottery-choice experiments. This finding may be an indication that our version and implementation of the modified HLL and the modified BL was well understood by the participants and thus, an appropriate elicitation method within a developing country context. It also disproves the expectation of Brick et al. (2012) that people have more difficulties with varying probabilities than with varying amounts of payoffs. Fourth, specific socio-demographic and socio-economic factors are significant determinants of risk attitudes: education, district, per capita household expenditure, and number of rooms at homestead. The factors quiz test score and winner modified BL also have an impact on individuals' risk attitudes. Although these factors are consistent across the two applied regression models, they are not consistent across the two different elicitation methods. This shows that one has to be

cautious in making meaningful conclusions about the impact of these factors on risk attitude and therefore policy recommendations.

When interpreting the results, it is important to take into account that our experimental design is abstracted from reality and is considerably simpler than risky situations that would occur in an actual setting. Participants may act differently in the experimental situation than they do in a similar situation in the real world. A common criticism of experiments has to do with whether experimental results are likely to provide reliable inferences outside the experimental setting and can be extrapolated to the real world (Levitt and List, 2007; Roe and Just, 2009). This lack of external validity is considered to be the major weakness of laboratory experiments (Loewenstein, 1999). Nevertheless, we believe that a careful experimental design and implementation, which is adapted to a rural, developing country setting, is essential for a valid measure of individuals' risk attitudes.

Some extensions of the present study might further verify the validity of our results. First, it would be interesting to examine whether increases in real payoff levels in the two modified lottery-choice experiments have an effect on farmers' risk attitudes. Second, different risk tasks involving different degrees of difficulty could be considered in order to more carefully address the question of how a participant's ability to reason with numbers and probabilities affects the results of different risk measures. Third, more research is needed in identifying more explanatory factors of risk attitudes. Fourth, another interesting path to be taken would be to test whether farmers in developed countries show similar risk attitudes and inconsistency rates in the two lottery-choice experiments as farmers in developing countries.

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Appendix 1. Experimental Instructions

Outline

The experiment session comprises:

1. Sign-in (location and arrival)
2. Introduction and agenda (an introduction of the experimenter, enumerators, assistant experimenter, and the project)
3. Quiz
4. Instructions, practice, and decision making (coin tossing games are randomized)
 - 4.1 Lottery game (1)
 - 4.2 Lottery game (2)
5. Payment

1. Sign-in (location and arrival)

- Each participant will present his/her photo ID before he/she will be signed in. The participant will then draw a number out of a bag. This number (personal number of the respondent) randomly determines his/her seat, which is the individual's location throughout the experiment session.
- The experiment will be conducted in sessions of six participants in classrooms in local schools or in a meeting room at the main gathering place of a farmer's group or association.
- Each participant will have his/her own enumerator.
- The typical layout of the room will be as follows:

Front of room (experimenter, and white board)	
Seat 1	Seat 2
Seat 3	Seat 4
Seat 5	Seat 6
Back of room (assistant experimenter/cashier)	

Notes:

- *Text in italics is not part of the participant instructions.*
- *The instructions are explained orally by the experimenter in the local language.*
- *Once all the participants are seated, the explanation will start.*

2. Introduction and agenda

- Hello and welcome. Thank you for coming to our workshop today.
- *The experimenter introduces himself, the enumerators, and the assistant experimenter. The experimenter introduces the institution and the project, typically as follows:*
 - In Uganda, we are conducting a research project on farmers' decision behavior in risky situations.
 - We have been holding discussions with farmers across many parts of Uganda. In particular, we have talked to farmers in ..., but we have not been here before.
 - We are very grateful that we can do the workshop in this area today and that you have found some time to participate. Thank you very much for that.
 - For the upcoming tasks, you will receive cash payments for the decisions you make. We provide these payments for two purposes:
 - i. Because you came here today and you are spending your time with us. This is time in which you could be doing something else, so we would like to remunerate this.
 - ii. Also, we would like you to take this decision seriously, so that it represents your decision making behavior of normal real life decisions.
- Today's workshop will include the following steps:
 - First, we explain the instructions of the different tasks on decision making.
 - Then, we will do a practice run together to show how it works. Then, you will make your decisions. Today, we will do several types of decisions. In a moment, I will explain all the different tasks on decision making in more detail, one after another.
 - Then, you will receive your payment. Payment will be effected in private and in cash at the end of today's workshop.

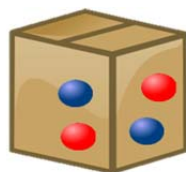
I have some additional general comments:

- Please turn off your mobile phones, etc.
- All decisions you make or answers you give during the workshop are private, confidential, and anonymous.
- Since all decisions and answers are private, please do not talk to each other anymore. If you have questions, please ask us by raising your hand.
- Please do not discuss with your neighbor except for the enumerator next to you. The enumerator next to you will record your answers.

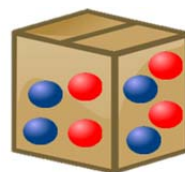
- When making decisions, you should make the decision that you prefer the most as you will receive the cash payment on the basis of that decision, given that you have been selected as a winner. Please make your decisions as if they are real-life decisions.
- If there are any questions at any point, please raise your hand and ask.
- Any questions before we start?

3. Quiz

- *The experimenter hands out the questionnaire to the enumerator. Then, explanation and decision making would start.*
- We will start today's workshop with a short quiz.
- The quiz contains several tasks. It is not a test; you do not need to worry if the questions seem difficult.
- *Questions are asked with regard to probabilities and percentage calculation. This basically enables the participants to start thinking about the material and the decisions they will be presented with during the workshop. The participants make their choice, and their enumerators record the answers and tick the relevant box.*
- Now, we are coming to the first task.
- 1. Imagine, we toss a coin and the "heads" (emblem) comes up. What comes up if we toss the coin again? (possible answers: a = heads, b = tails, c = one cannot predict exactly)
- Now, we are coming to the second task.
- 2. If the chance of winning a prize is 10%, how many people out of 100 would be expected to get the prize? If you don't know, put an X.
- Now, we are coming to the last task of this quiz.
- 3. When you draw the red ball, you win! Look at the two boxes and mark the correct sentence. (Possible answers: a = my chance to win is higher if I choose Box A. b = my chance to win is equal, it does not matter which box I choose. c = my chance to win is higher if I choose Box B.)



Box A



Box B






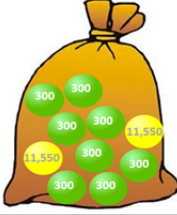
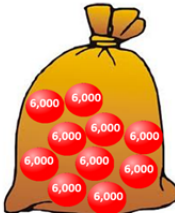
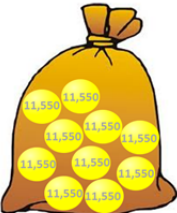
4. Instructions and decision making

4.1. Lottery game (1)





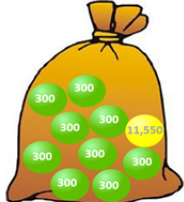
- In the first/second session, you are asked to choose between two bags. You will be asked to make a number of repeated choices.
- I will now explain the first session. Then, you will make your decisions in this session.
- *Posters are displayed on a large white board at the front of the room. This is used to illustrate the basics of the game as explained below.*
- The objective of this task is to win money. There are four possible prizes: 300 UGX, 4,800 UGX, 6,000 UGX, and 11,550 UGX. The four different colored balls represent the four possible prizes. The green ball is worth 300 UGX, the blue ball is worth 4,800 UGX, the red ball is worth 6,000 UGX, and the yellow ball is worth 11,550 UGX.
- Note that we will randomly select one winner out of you for this task.
- *Show poster 1: The picture of the sheet with the lottery game*
- *Real balls will also be shown.*

Choose your preferred bag by marking either **Bag A** or **B** in each row.

 = 300 UGX
  = 4,800 UGX
  = 6,000 UGX
  = 11,550 UGX





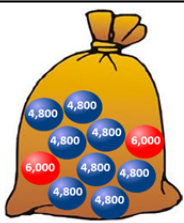
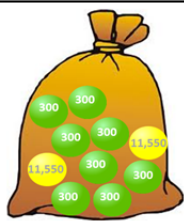
	Bag A 	Choice		Bag B 
		A	B	
1				
2				
	[...]			[...]
10				

- How are you going to win these prizes?
- To win these prizes, you will first have to choose between two bags, Bag A and Bag B, for each of the 10 rows. How do these two bags differ? Each bag contains 10 balls. The two bags contain differently colored balls (green, blue, red, and yellow) with a different value. We draw only one ball from the selected bag, which will be the prize. If you choose Bag A, you can win a prize of 6,000 UGX (red ball) or a prize of 4,800 UGX (blue ball). And if you choose Bag B, you can win a prize of 11,550 UGX (yellow ball) or a prize of 300 UGX (green ball). We are going to ask you which of these two bags you prefer.
- Note that with Bag A the difference between the prizes is small, while it is large in the case of Bag B.
- In addition, in Bag A the prize of 6,000 UGX is smaller than the prize of 11,550 UGX in Bag B, and the prize of 4,800 UGX in Bag A is greater than the prize of 300 UGX in Bag B.
- Thus, you will choose between Bag A and Bag B in 10 rows, one after another.
- Let's focus on the first row.
- *Show poster 2: example for Bag A or Bag B in row one*

		Bag A 	Choice	Bag B 
			A B	
1				




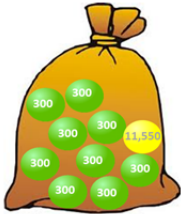
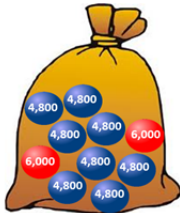
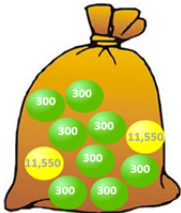
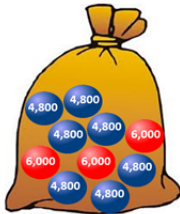

- Bag A:
 - Bag A contains nine blue balls and one red ball. Each blue ball is worth 4,800 UGX, and the red ball is worth 6,000 UGX.
 - If this bag is selected and the red ball is subsequently drawn, you will win 6,000 UGX. In the case that one of the blue balls is drawn, you will win 4,800 UGX.
 - So, if we pick a ball from the bag, it may be blue or red. But, it is more likely that we pick one of the blue balls because there are more blue balls (than red balls) in the bag.
- Bag B:

- Now, let's look at Bag B. What is different about it? Well, this bag contains nine green balls and one yellow ball. Each green ball is worth 300 UGX, and the yellow ball is worth 11,550 UGX.
- If this bag is selected and the yellow ball is subsequently drawn, you will win 11,550 UGX. In the case that one of the green balls is drawn, you will win 300 UGX.
- So, if we pick a ball from the bag, it may be a green or a yellow one. But, it is more likely that we pick one of the green balls because there are more green balls (than yellow balls) in the bag.
- This explains row one. How do the other rows differ from row one?
- *Show poster 3: example for Bag A or Bag B in row two*

		Bag A 	Choice	Bag B 
			A B	
1				
2				

- Note that when we go from row one to row two, the only aspect that changes is the number of red balls in the bags. That is, the value of the balls does NOT change.
- Bag A:
 - Bag A contains eight blue balls and two red balls. Each blue ball is worth 4,800 UGX and each red ball is worth 6,000 UGX.
 - If this bag is selected and the red ball is subsequently drawn, you will win 6,000 UGX. In the case that one of the blue balls is drawn, you will win 4,800 UGX.
 - So, if we pick a ball from the bag, it may be blue or red. But it is more likely that one of the blue balls is drawn because there are more blue balls (than red balls) in the bag.
- Bag B:

- Bag B contains eight green balls (each worth 300 UGX) and two yellow balls (each worth 11,550 UGX). Each green ball is worth 300 UGX, and each yellow ball is worth 11,550 UGX.
- If this bag is selected and the yellow ball is subsequently drawn, you will win 11,550 UGX. In the case that one of the green balls is drawn, you will win 300 UGX.
- So, if we pick a ball from the bag, it may be green or yellow. But, it is more likely that one of the green balls is drawn because there are more green balls (than yellow balls) in the bag.
- *Quiz participants for understanding (control questions):*
- Now, what happens if we go from row two to row three?
- *Show poster 4: example for Bag A or Bag B in row three*

	Bag A 	Choice		Bag B 
		A	B	
1				
2				
3				

- How many blue and red balls does Bag A contain?
- How many green and yellow balls does Bag B contain?
- Suppose you choose Bag A and the red ball is drawn, how much do you win?
- Suppose you choose Bag B and the yellow ball is drawn, how much is it worth?
- *etc.*
- So, we are going to ask you to decide for bag A or B in each of the 10 rows.




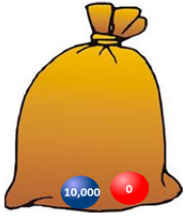

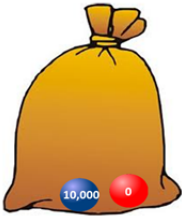

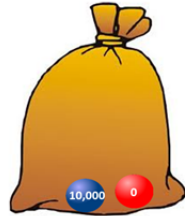
- Note that your choice should really be guided by your attitudes. There are no wrong or right decisions.
- *Then, participants are informed that only one row will be selected for payment and that only one person wins the prize.*
- How will we determine the amount of money you will win for participating in this task? Now, we will explain the payment for this game.
- Only one person will receive a payment for one of the choices he/she made in this task. However, you do not know yet for which of the choices the selected person will receive the payment, so you will want to think about each choice very carefully. You will only find out at the end of this task for which of these choices the selected person is going to receive a payment.
- The payment in this game comprises three draws:
 - The first draw is to determine the person who wins a prize. Remember, in the beginning of today's workshop, you got a personal number. We will ask one of you to draw a number between 1 and 6 out of a bag. The holder of the number that is picked from the bag will be the winner of one of the prizes.
 - The second draw is to determine the row for which you will get paid. We will ask the selected person to draw a number between one and 10 out of a bag. The number that is picked from the bag will be the choice that counts for the selected person.
 - The third draw is to determine whether the person receives the low or high prize. We will ask the selected person to draw a ball out of Bag A in case he/she chose Bag A or one out of Bag B in case he/she chose Bag B. The ball that is picked from the respective bag will be the choice that counts for him/her.
- Are there any questions before we start?
- *Then, decisions will be made.*
- Which bag do you choose? Choose your preferred bag by marking either Bag A or B in each row.
- *The enumerators ask their farmers for each of the 10 rows which bag they prefer. The participants make their choice by pointing at the bag they prefer, and their enumerators record the answers and tick the relevant box.*

4.2. Lottery game (2)

- In the first/second session, you are asked to choose between two bags. You will be asked to make a number of repeated choices.
- I will now explain the second/third session. Then, you will make your decisions in this session.
- *Posters are displayed on a large white board at the front of the room. This is used to illustrate the basics of the game as explained below.*
- The objective of this task is to win money. The differently coloured balls represent the possible prizes. The red ball is worth 0 UGX, the blue ball is worth 10,000 UGX, and the value of the green ball ranges from 10,000 UGX to 1,000 UGX.
- Note that we will randomly select one winner for this task.
- *Show poster 1: The picture of the sheet with the lottery game*
- *Real balls will also be shown.*

Choose your preferred bag by marking either **Bag A** or **B** in each row.

 = 0 UGX
  = 10,000 UGX
  = between 10,000 UGX and 1,000 UGX

	Bag A 	Choice		Bag B 
		A	B	
1				
2				
	[...]			[...]
8				







- How are you going to win these prizes?

- To win these prizes, you will first have to choose between two bags, Bag A and Bag B, for each of the 10 rows. How do these two bags differ? The two bags contain differently coloured balls (green, blue, and red). The value of the green ball changes in each decision row, while the values of the blue and the red ball remain the same across the decision rows. We draw only one ball of the selected bag, which will be the prize.
- If you choose Bag A, you can win for sure a certain amount of money (green ball). If you choose Bag B, you can win a prize of 10,000 UGX (blue ball) or nothing (red ball). We are going to ask you which of these two bags you prefer.
- The questions deal with the question of whether you prefer to have a guaranteed smaller amount of money, OR a larger amount of money that involves some risk and you might end up getting nothing. You can never lose any money irrespective of what you choose.
- We will ask you to choose between Bag A and Bag B in eight rows, one after another.
- Let's focus on the first row.
- *Show poster 2: example for Bag A or Bag B in row one*









	Bag A	Choice	Bag B
		A	B
1			

- Bag A:
 - Bag A contains one green ball. This ball is worth 10,000 UGX.
 - If this bag is selected and the green ball is subsequently drawn, you will win 10,000 UGX.
 - So, if you choose bag A, you know what you get for sure.
- Bag B:
 - Now, let's look at Bag B. What is different about it? Well, this bag contains one blue ball and one red ball. The blue ball is worth 10,000 UGX and the red is worth nothing.
 - If this bag is selected and the blue ball is subsequently drawn, you will win 10,000 UGX. There is also the chance that the red ball is drawn. In this case, you will get nothing.
- This explains row one. How do the other rows differ from row one?

- Show poster 3: example for Bag A or Bag B in row two

	Bag A 	Choice		Bag B 
		A	B	
1				
2				

- Note that when we go from row one to row two, the only aspect that changes is the value of the green ball.
- Bag A:
 - Bag A contains one green ball. Now, this ball is worth 7,500 UGX.
 - If this bag is selected and the green ball is subsequently drawn, you will win 7,500 UGX.
 - So, if you choose bag A, you know what you get for sure.
- Bag B:
 - Now, let's look at Bag B. This bag contains one blue ball and one red ball like in the first example. The blue ball is worth 10,000 UGX and the red is worth nothing.
 - If this bag is selected and the blue ball is subsequently drawn, you will win 10,000 UGX. There is also the chance that the red ball is drawn. In this case, you will get nothing.
- *Quiz participants for understanding. Control questions are asked with regard to the probabilities and earnings.*
- Now, what happens if we go from row two to row three?
- Show poster 4: example for Bag A or Bag B in row three

	Bag A 	Choice		Bag B 
		A	B	
1				
2				
3				



- How many balls does bag A contain?
- What is the value of the green ball?
- How many blue and red balls does Bag B contain?
- Suppose you choose Bag A and the green ball is drawn, how much do you win?
- Suppose you choose Bag B and the red ball is drawn, how much do you win?
- *etc.*
- So, we are going to ask you to make a decision for each of the eight rows: Bag A or Bag B.
- Note that your choice should really be guided by your attitudes. There are no wrong or right decisions.
- *Then, participants are informed that only one row would be selected for payment and that only one person wins the prize.*
- How will we determine the amount of money you will win for participating in this task? Now, we will explain the payment for this task.
- Only one person will receive a payment for one of the choices he/she made in this task. However, you do not know yet for which of the choices the selected person will receive the payment, so you will want to think about each choice very carefully. You will only find out at the end of this task for which of these choices the selected person is going to receive a payment.

- The payment in this game comprises three draws:
 - The first draw is to determine the person who wins a prize. Remember, in the beginning of today's workshop, you got a personal number. We will ask one of you to draw a number between one and six out of a bag. The number that is picked from the bag will determine the winner of one of the prizes.
 - The second draw is to determine the row for which you will get paid. We will ask the selected person to draw a number between one and eight out of a bag. The number that is picked from the bag will be the choice that counts for him/her.
 - If the person chose bag A, which means he/she decided to take the money for sure, he/she will get that amount of money. If the person chose bag B, he/she will draw a ball out of the bag to determine whether he/she receives 10,000 UGX or nothing. The ball that is picked from the respective bag will be the choice that counts for the selected person.
- Are there any questions before we start?
- *Then, decisions will be made.*
- Which bag do you choose? Choose your preferred bag by marking either Bag A or B in each row.
- *The enumerators ask their participants for each of the eight rows which bag they prefer. The participants make their choice by pointing to the bag they prefer, and their enumerators record the choice/tick the relevant box.*