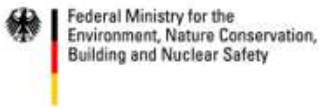


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INTERNATIONAL CLIMATE INITIATIVE (IKI)



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Protocol of implementing behavioral experiments for fruit tree marketing options in Rwanda: A trust experiment

International Climate Initiative (IKI)

Harnessing the potential of trees on farms (TonF) for meeting national and global biodiversity targets

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OBJECTIVE OF THE STUDY

The objectives of this study are (1) to elicit trust, risk and time preferences of smallholder fruit tree farmers in eastern Rwanda using monetary incentivized experiments, and (2) to investigate key attributes or features of marketing contracts that are preferred by farmers using a discrete choice experiment (DCE). We investigate farmer preferences related to six hypothetical marketing contract attributes: sales mode, timing of payment, input/service provision, form of contract, relation to the buyer, and investment costs. To demonstrate the relation between trust, risk and time preferences and the adoption of marketing contracts, we couple these experimental data with the results from the DCE about farmers' preferences for marketing contract attributes. We estimate a random parameters logit model, including interaction terms between contract attributes and behavioral preferences, to disentangle preference heterogeneity. Disentangling these behavioral preferences can give interesting insights on how contracts should be designed in order to meet farmers' preferences. The results can also provide guidance for the fruit marketing development to ensure that smallholder farmers benefit from the full potential of their fruit trees.

DESCRIPTION OF EXPERIMENTS

a. Experiment on risk preferences

We measured individual trust, risk and time preferences using monetary incentivized experiments. At the end of the three experiments, one experiment was randomly selected to be played for real money to encourage participants to reveal their true preferences (Andersen, Harrison, Lau, & Rutström, 2006; Holt & Laury, 2002). Risk preferences were measured using the method developed by Eckel and Grossman (2002, 2008). This method was explicitly designed to be a simple way of eliciting risk preferences that allows enough heterogeneity in choices to estimate utility parameters. The method asks respondents to make only one choice. That is respondents are presented with a number of lotteries and are asked to choose one that they would like to play (Figure 1). Each of the lotteries, listed in Table 1, involves a 50 % chance of receiving the low payoff and a 50 % chance of the high payoff. One of the lotteries is a sure alternative. In this case, 'Lottery 1' with a certain payoff of 2,800 RWF. For 'Lottery 1' to 'Lottery 5', the expected payoff increases linearly with risk, as represented by the standard deviation. Note that 'Lottery 6' has the same expected payoff as 'Lottery 5', but with a higher standard deviation. The lotteries are designed so that risk-averse respondents should choose those with a lower standard deviation ('Lottery 1' to 'Lottery 4'), risk-neutral respondents should choose the lottery with the higher expected return ('Lottery 5'), and risk-seeking respondents should choose 'Lottery 6' (Dave, Eckel, Johnson, & Rojas, 2010).

Table 1. Design of risk experiment (in Rwandan franc)

Lottery (50/50)	Low payoff	High payoff	Expected return	Standard deviation	Implied CRRA ^a range	Risk category ^b
1	2,800	2,800	2,800	0	$3.46 < r$	RA
2	2,400	3,600	3,000	600	$1.16 < r < 3.46$	RA
3	2,000	4,400	3,200	1,200	$0.71 < r < 1.16$	RA
4	1,600	5,200	3,400	1,800	$0.50 < r < 0.71$	RN
5	1,200	6,000	3,600	2,400	$0 < r < 0.50$	RN
6	200	7,000	3,600	3,400	$r < 0$	RS

^a Coefficient of relative risk aversion.

^b Risk category RA = risk-averse, RN = risk-neutral, and RS = risk-seeking.



















LOTTERY 1			2,800 RWF
			2,800 RWF
LOTTERY 2			3,600 RWF
			2,400 RWF
LOTTERY 3			4,400 RWF
			2,000 RWF
LOTTERY 4			5,200 RWF
			1,600 RWF
LOTTERY 5			6,000 RWF
			1,200 RWF
LOTTERY 6			7,000 RWF
			200 RWF

Figure 1. Picture card of the risk experiment. Source: Authors.

b. Experiment on time preferences

Time preferences were elicited with a simple money allocation task similar to the task developed by Angerer et al. (2015). In this experiment, respondents are endowed with 1,000 RWF and have to allocate money between two dates in time – ‘tomorrow’ and ‘in four weeks’. The money that is allocated to the later date, that is ‘in four weeks’, is doubled and paid out only four weeks after the experiment. The money that is allocated to ‘tomorrow’ is paid out tomorrow (Figure 2). The amount invested in the future is a simple measure of farmers’ future orientation and patience, without explicitly eliciting discount rates.

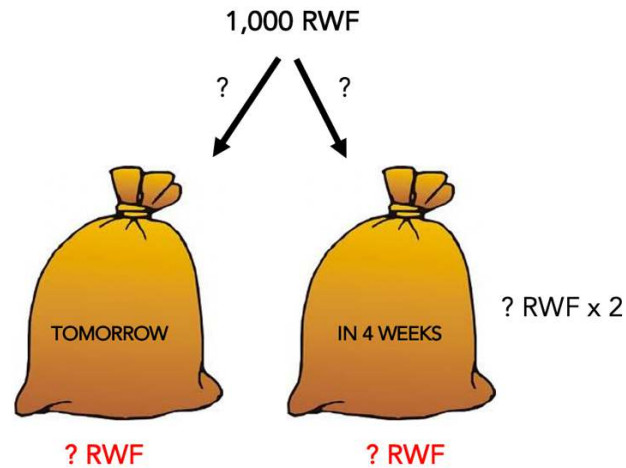


Figure 2. Picture card in the time experiment. Source: Authors.

c. Experiment on trust

We also conduct a two-person binary version of the trust game (Berg, Dickhaut, & McCabe, 1995). Random pairs of respondents are formed and assigned the role of 'sender' and 'receiver'. The 'sender' receives 1,000 RWF and has to choose whether to send any round amount between 0 and 1,000 RWF to the 'receiver' or to keep them. The money sent is then tripled by the experimenter. The 'receiver' then makes a decision using the strategy method. Accordingly, the 'receiver' is asked to decide whether, in the event that the sender sends some money, he/she would keep the money or split it evenly between himself/herself and the 'sender' (Figure 3).

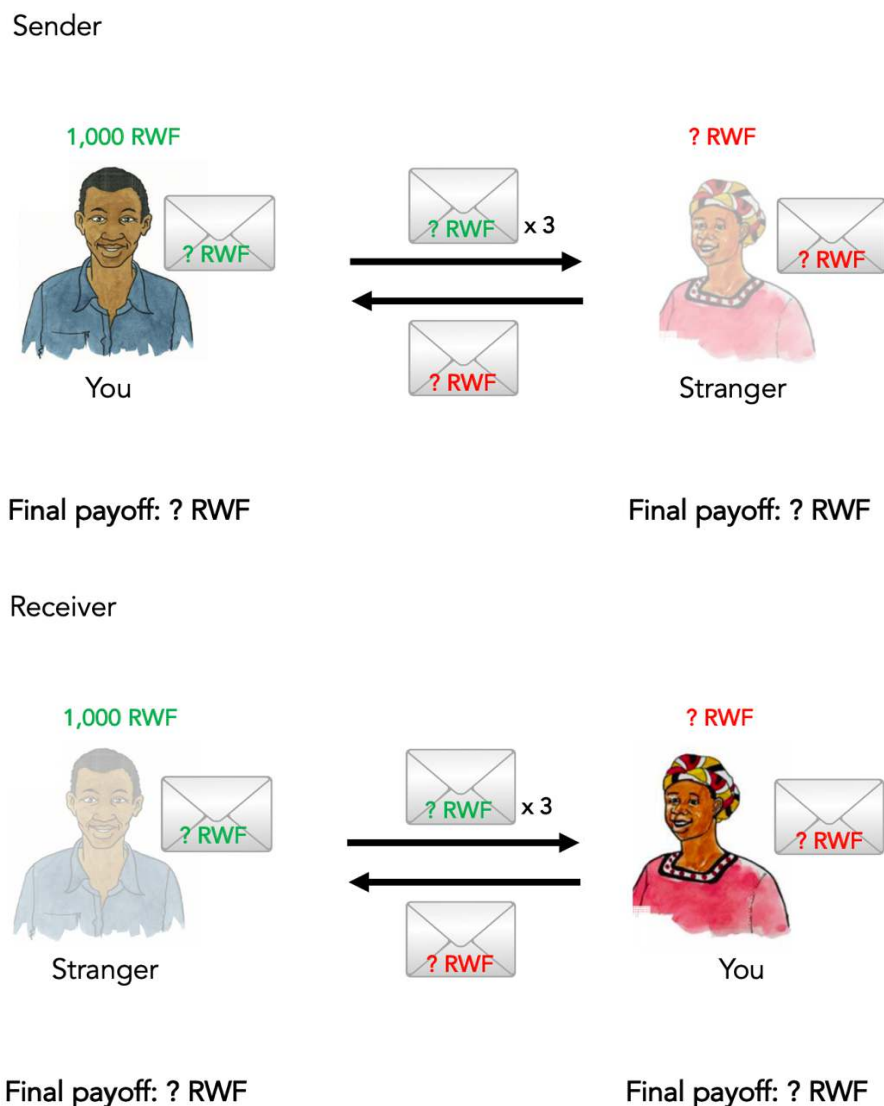


Figure 3. Picture card in the trust experiment. Source: Authors.

d. Discrete choice experiment

We used a DCE to analyze farmers’ marketing preferences of fruit tree products. In a DCE, respondents are presented with alternative descriptions of a good, differentiated by their attribute levels, and are asked to choose one of the alternatives (Holmes & Adamowicz, 2003). In order to identify contextually relevant attributes and their levels, we conducted key informant interviews and focus group discussions with farmers during a preliminary field visit to the study area. Based on their feedback, we selected six attributes that they deemed important in a marketing profile with two to four levels (Table 2). The first attribute relates to the sales mode, namely individual marketing (i.e. payment for the quantity produced), and collective marketing (i.e. payment as share of total revenue). The timing of payment is the second attribute. The two levels are immediate payment (i.e. at delivery), and delayed payment (i.e. four weeks after purchase). As the third attribute we consider input/service provision and define four levels: none, inputs (seedlings, fertilizer), inputs (seedlings, fertilizer), and credit, and inputs (seedlings, fertilizer), credit, and training. The fourth attribute is the form of contract, either a written or no written contract. The fifth attribute concerns the relation to the buyer in three levels: buyer personally known, buyer known by friends, relatives, or cooperative, and buyer not known at all. The last attribute in the choice experiment is the investment cost, categorized in four levels: no entry costs, 10,000 RWF, 20,000 RWF, and 30,000 RWF.

Table 2. Overview of attributes and levels used in the choice experiment

Attributes	Definition	Attribute levels
Sales mode	Refers to the mode of selling and payment system	1. Individual marketing (payment for the quantity produced) 2. Collective marketing (payment as share of total revenue)
Timing of payment	Farmers can be paid cash on delivery or payment can be delayed	1. Immediate payment (at delivery) 2. Delayed payment (4 weeks after purchase)
Input/service provision	Refers to input and/or service provision to alleviate the operating capital constrains often faced by farmers	1. None 2. Inputs (seedlings, fertilizer) 3. Inputs (seedlings, fertilizer), and credit 4. Inputs (seedlings, fertilizer), credit, and training
Form of contract	Refers to the contract/agreement form	1. No written contract 2. Written contract
Relation to the buyer	Refers to the relationship with the buyer	1. Buyer personally known 2. Buyer known by friends, relatives, or cooperative 3. Buyer not known at all
Investment costs	Corresponds to membership fees to become a cooperative member/ entry costs	1. None (no investment costs) 2. 10,000 RWF 3. 20,000 RWF 4. 30,000 RWF

The six attributes and their different levels imply a full factorial design with 384 ($4^2 \times 3^1 \times 2^3$) combinations. Theoretically, each unique combination of attribute levels represents a specific market profile. To produce a more manageable experiment, a d-optimal design was used to generate a subset of market profiles that covers the range of variability between all possible combinations (Hensher, Rose, & Greene, 2015). In total, 32 choice sets were included in our design. The choice sets were further subdivided into four subsets containing eight choice sets each. To reduce the response burden and to avoid fatigue, respondents were randomly assigned one of these four subsets, with an even number of households allocated to each of the subsets. A choice set consisted of two alternative market profiles (A and B) and an status quo ('none of the market profiles') option. The status quo option is provided because a respondent might not have a preference for either of the market profiles listed. Moreover, illustrations were included in the choice sets to increase respondents' comprehension of the attributes and levels (Figure 4). Before conducting the DCE, we explained to the respondents that the drawings used hypothetical marketing profiles rather than real ones. The attributes and levels used were carefully explained. Respondents were also informed that the choices they made in the experiment would not have any immediate consequence. It was clarified that the results would be used more generally to better understand farmers' preferences for particular characteristics of market profiles that may inform project design or future project implementation.



Figure 4. Example of a choice card. Source: Authors.

References

- Andersen, S., Harrison, G. W., Lau, M. I., & Rutström, E. E. (2006). Elicitation using multiple price list formats. *Experimental Economics*, 9(4), 383–405. <https://doi.org/10.1007/s10683-006-7055-6>
- Angerer, S., Glätzle-Rützler, D., Lergetporer, P., & Sutter, M. (2015). Donations, risk attitudes and time preferences: A study on altruism in primary school children. *Journal of Economic Behavior and Organization*, 115, 67–74. <https://doi.org/10.1016/j.jebo.2014.10.007>
- Berg, J., Dickhaut, J., & McCabe, K. (1995). Trust, reciprocity, and social history. *Games and Economic Behavior*, 10(1), 122–142.
- Dave, C., Eckel, C. C., Johnson, C. A., & Rojas, C. (2010). Eliciting risk preferences: When is simple better? *Journal of Risk and Uncertainty*, 41(3), 219–243. <https://doi.org/10.1007/s11166-010-9103-z>
- Eckel, C. C., & Grossman, P. J. (2002). Sex differences and statistical stereotyping in attitudes toward financial risk. *Evolution and Human Behavior*, 23(4), 281–295. [https://doi.org/10.1016/S1090-5138\(02\)00097-1](https://doi.org/10.1016/S1090-5138(02)00097-1)
- Hensher, D. A., Rose, J. M., & Greene, W. H. (2015). *Applied Choice Analysis 2nd*. In *Cambridge University Press*. <https://doi.org/10.1017/CBO9781107415324.004>
- Holmes, T. P., & Adamowicz, W. L. (2003). *Attribute-Based Methods. A Primer on Nonmarket Valuation. The Economics of Non-Market Goods and Resources* (P. A. Champ, K. J. Boyle, & T. C. Brown, eds.). Dordrecht: Springer, Dordrecht.
- Holt, C. A., & Laury, S. K. (2002). Risk aversion and incentive effects. *The American Economic Review*, 92(5), 1644–1655. <https://doi.org/10.2307/3083270>

Trust game (sender): 'Play with a stranger'

[1] Instructions for the experiment: Experimenter explains to respondent

1. *For this game, we have randomly formed pairs of people. Each pair is made up of two people; that is, you and another person (we call him/her 'a stranger'). You can earn some money by playing together with 'a stranger. The stranger is a person that also participates in our survey. None of you will know with whom you have been paired. We are the only ones who know who is paired with whom.*
2. *You will receive 1,000 RWF (experimenter places the 1,000 RWF in front of the respondent). Now, you can choose to send any round amount between 0 and 1,000 RWF (that is 100 RWF, 200 RWF, 300 RWF, 400 RWF, 500 RWF, 600 RWF, 700 RWF, 800 RWF, 900 RWF, or 1,000 RWF) to the stranger or not to send any money to the stranger and keep the 1,000 RWF. You will be given two empty envelopes; one for the money that you want to send to the stranger and the other one for the money that you want to keep. Your decision has a few implications:*
 - a. *If you decide to keep the 1,000 RWF, the stranger receives nothing.*
 - b. *Whatever amount you decide to send to the stranger, we will triple the money before it is passed on to the stranger. So, the stranger will receive three times as much as what you sent.*
 - c. *The stranger then has a choice to keep all of the money you sent him/her, or to send half of the money back to you.*
 - d. *Both of you will receive your final payoff via mobile money within two days.*

[2] Experiment explanation example: Experimenter explains to respondent

1. *Let's consider an example:*
 - a. *If you, for instance, decide to send 100 RWF to the stranger. How much money will the stranger receive if you send this much? [ANSWER OF THE RESPONDENT: The money will be tripled by you and the stranger will receive 300 RWF. The stranger then can decide to keep the money or to send half of the money back to me.]*
 - b. *And what happens with the remaining 900 RWF? [ANSWER OF THE RESPONDENT: I can keep it.]*
 - c. *How and when will you receive your final payoff? [ANSWER OF THE RESPONDENT: Via mobile money within two days.]*
 - d. *How and when will the stranger receive his/her final payoff? [ANSWER OF THE RESPONDENT: Via mobile money within two days.]*
2. *Is this clear?*
3. *To make sure you understand the game, could you please repeat the rules of the game?*

[3] Instructions to the experimenter

1. *Examples are repeated until the experimenter feels confident about the respondent's understanding.*

2. Once the experimenter is satisfied with the respondent's understanding, the actual decision is made.

[4] Instructions for the experiment: Experimenter explains to respondent

1. *Please take your decision now.*

2. *You can decide if you want to send some money to the stranger and if yes which amount you would like to send. Once you are ready, please close both envelopes and return it to me.*

3. *Take as much time as you need for your decision. In the meantime, I will turn around, so that I don't disturb you. Just call me when you are done.*

4. *Do you have any questions?*

Experimental material

1 bag

Cards 1 to 3

1,000 RWF (in small denominations)

2 envelopes (for respondent/stranger)

2 credit vouchers (for respondent/enumerator to sign and keep, respectively)

Trust game (receiver): 'Play with a stranger'

[1] Instructions for the experiment: Experimenter explains to respondent
1. <i>For this game, we have randomly formed pairs of people. Each pair is made up of two people; that is, you and another person (we call him/her 'a stranger'). You can earn some money by playing together with a stranger. The stranger is a person that also participates in our survey. None of you will know with whom you have been paired. We are the only ones who know who is paired with whom.</i>
1. <i>The stranger will receive 1,000 RWF and can choose to send any round amount between 0 and 1,000 RWF (that is 100 RWF, 200 RWF, 300 RWF, 400 RWF, 500 RWF, 600 RWF, 700 RWF, 800 RWF, 900 RWF, or 1,000 RWF) to you or not to send any money to you and keep the 1,000 RWF. His/her decision has a few implications:</i> <i>a. If the stranger decides to keep the 1,000 RWF, you receive nothing.</i> <i>b. Whatever amount the stranger decides to send to you, we will triple the money before it is passed on to you. So, you will receive three times as much as what the stranger sent.</i> <i>c. You then have a choice to keep all of the money the stranger sent you, or to send half of the money back to him/her.</i> <i>d. Both of you will receive your final payoff via mobile money <u>within two days</u>.</i>
[2] Experiment explanation example: Experimenter explains to respondent
1. <i>Let's consider an example:</i> <i>a. If the stranger, for instance, decides to send 100 RWF to you. How much money will you receive if the stranger sends this much? [ANSWER OF THE RESPONDENT: The money will be tripled by you and I will receive 300 RWF. I then can decide to keep the money or to send half of the money back to the stranger.]</i> <i>b. And what happens with the remaining 900 RWF? [ANSWER OF THE RESPONDENT: The stranger keeps it.]</i> <i>c. How and when will you receive your final payoff? [ANSWER OF THE RESPONDENT: Via mobile money within two days.]</i> <i>d. How and when will the stranger receive his/her final payoff? [ANSWER OF THE RESPONDENT: Via mobile money within two days.]</i>
2. <i>Is this clear?</i>
3. <i>To make sure you understand the game, could you please repeat the rules of the game?</i>
[3] Instructions to the experimenter
1. <i>Examples are repeated until the experimenter feels confident about the respondent's understanding.</i>
2. <i>Once the experimenter is satisfied with the respondent's understanding, the actual decision is made.</i>
[4] Instructions for the experiment: Experimenter explains to respondent
1. <i>Please take your decision now.</i>

- | |
|---|
| 2. <i>You can decide if you want to keep all the money you received or to send half of the money back to the stranger. Once you are ready, please close both envelopes and return it to me.</i> |
| 3. <i>Take as much time as you need for your decision. In the meantime, I will turn around, so that I don't disturb you. Just call me when you are done.</i> |
| 4. <i>Do you have any questions?</i> |

Experimental material
1 bag
Cards 1 to 3
1,000 RWF (in small denominations)
2 envelopes (for respondent/stranger)
2 credit vouchers (for respondent/enumerator to sign and keep, respectively)