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INTERNATIONAL CLIMATE INITIATIVE (IKI)

Protocol of implementing behavioral experiments for fruit tree marketing options in Rwanda: An experiment on time preferences

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.

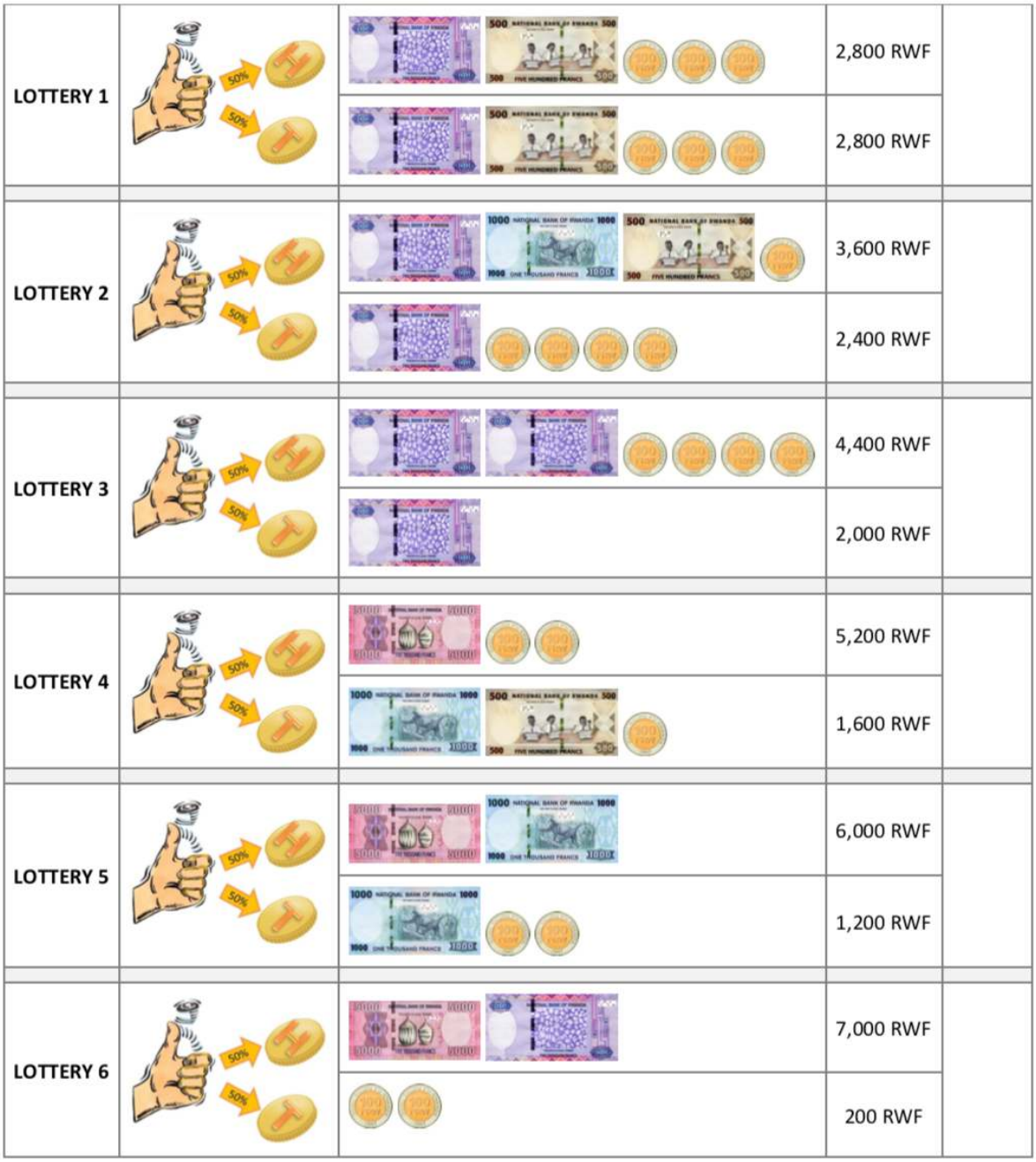

Figure 1. Picture card of the risk experiment. Source: Authors.

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.

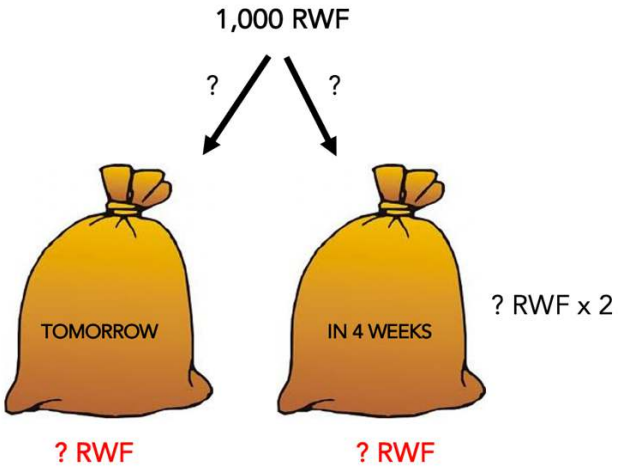

Figure 2. Picture card in the time experiment. Source: Authors.

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).

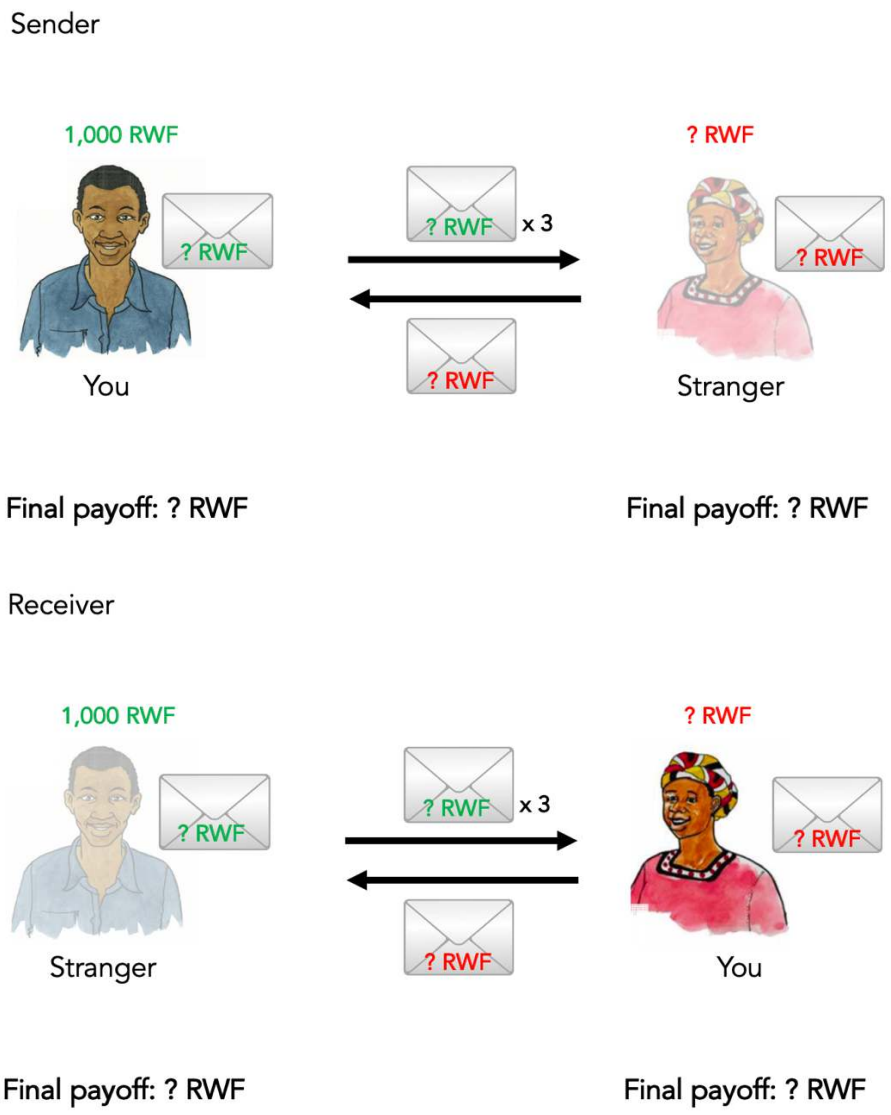

Figure 3. Picture card in the trust experiment. Source: Authors.

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.

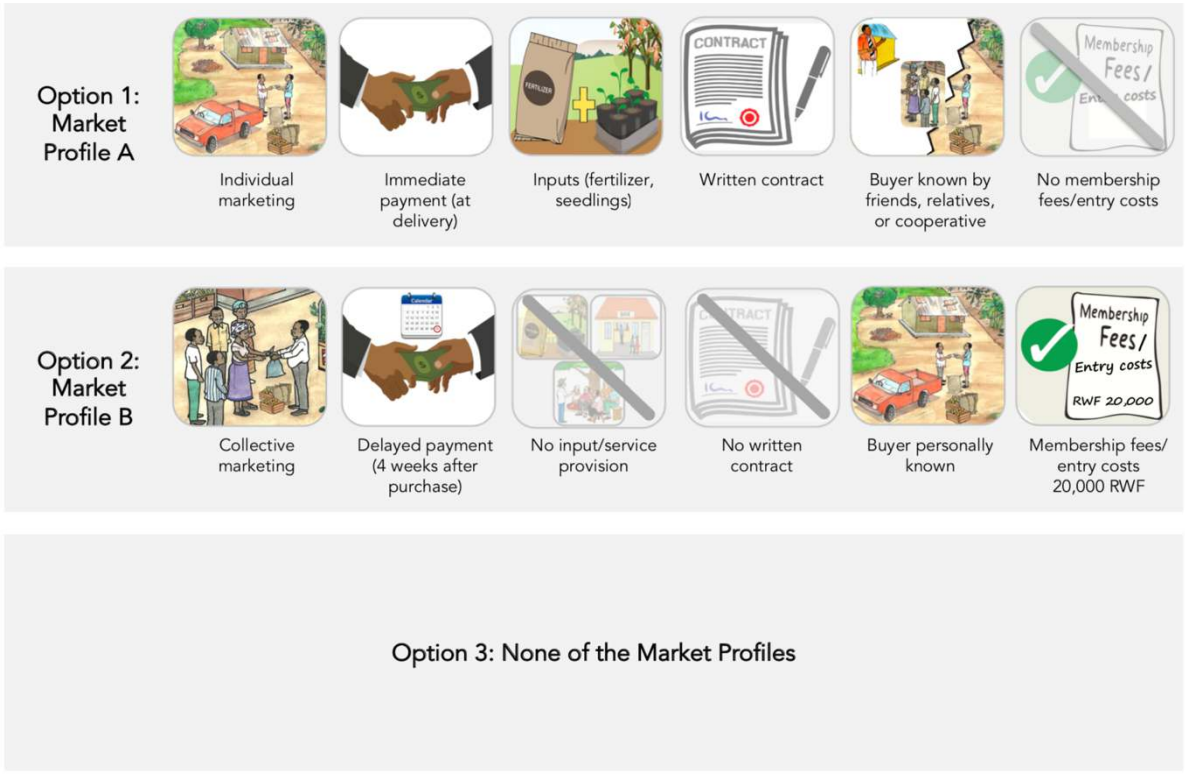

Figure 4. Example of a choice card. Source: Authors.

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

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

Experiment on time preferences: 'Allocate money'

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

1. *Our second game works as follows: At the beginning you will receive 1,000 RWF* (experimenter places the 1,000 RWF in front of the respondent)
2. *You have to decide how much of these 1,000 RWF you want to put in the bag labeled 'TOMORROW'* (experimenter points at the left bag) *and how much of this 1,000 RWF you want to put in the bag labeled 'IN 4 WEEKS'* (experimenter points at the right bag). *You can put all of it in one or the other bag, or put some of it in one bag and the rest in the other. Whether and how you divide it is up to you.*
3. *There is an important element to consider in your decision for 'tomorrow' or 'in four weeks': You will receive the exact amount of the money that you put in the bag 'TOMORROW' by tomorrow. The money will be sent via a mobile money transfer to your number tomorrow. On the other hand, the money that you put in the bag 'IN 4 WEEKS' will be doubled (so you will receive twice as much as you place in the bag labelled 'in four weeks' – but you will only receive the money in 4 weeks' time. The money will then be sent via a mobile money transfer to your number in 4 weeks.*

[2] Experiment explanation example: Experimenter explains to respondent

1. *Let's consider an example:*
   a. *If you, for instance, want to receive 400 RWF tomorrow, what do you have to do?* [ANSWER OF THE RESPONDENT: I have to put 400 RWF in the left bag.]
   b. *And what happens with the remaining 600 RWF?* [ANSWER OF THE RESPONDENT: I will put the 600 RWF in the right bag.] (please let the respondent demonstrate this)
   c. *How many RWF will be added to this bag?* (point at the right bag) [ANSWER OF THE RESPONDENT: 600 RWF.] (experimenter demonstrates this)
   d. *How many RWF are in the bag in total?* [ANSWER OF THE RESPONDENT: 1,200 RWF.]
   e. *When will you receive the 1,200 RWF?* [ANSWER OF THE RESPONDENT: In 4 weeks.]
   f. *And what happens if you put 1,000 RWF in that bag?* (experimenter points at the left bag) [ANSWER OF THE RESPONDENT: Then I will receive 1,000 RWF tomorrow.]
   g. *And what happens if you put all 1,000 RWF in that bag?* (experimenter points at the right bag) [ANSWER OF THE RESPONDENT: Then these 1,000 RWF will be doubled, and I will receive the money only in 4 weeks. The 2,000 RWF will be sent via a mobile money transfer to my number.]
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. *Please put the amount of RWF which you would like to receive tomorrow in this bag* (experimenter points at the left bag) *and the amount of RWF which you would like to receive in 4 weeks in that bag* (experimenter points at the right bag).
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 labeled 'TOMORROW'
1 bag labeled 'IN 4 WEEKS'
1,000 RWF (in small denominations)
2 credit vouchers for respondent/enumerator to sign and keep