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**Preferences for Tree Fruit Market Attributes  
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# Preferences for tree fruit market attributes among smallholder farmers in Eastern Rwanda: A discrete choice experiment

Hanna Julia Ihli<sup>a,\*</sup>, Ronja Seegers<sup>b</sup>, Etti Winter<sup>b</sup>, Brian Chiputwa<sup>c</sup>, and Anja Gassner<sup>d</sup>

June 2021

**Abstract.** The increasing demand for high-value agricultural products such as fresh fruit presents opportunities for farmers in developing countries due to their higher market value compared with traditional staple crops. This study uses data on trust, risk, and time preferences obtained through behavioral experiments, combined with a discrete choice experiment to understand their effect on farmers' choices of marketing attributes, collecting data from 252 farmers from Eastern Rwanda. The results reveal that farmers, overall, have positive attitudes toward collective marketing channels with guaranteed immediate payments, written contracts, provision of inputs, credit, and training, a personal relationship with a buyer, and low investment costs. Additionally, farmers with lower levels of risk aversion were found to have a greater preference for immediate payment than farmers with higher levels of risk aversion. Farmers with higher future orientation are more likely to choose contracts that guarantee inputs and/or services and written contracts, and they attach lower relative importance to immediate payments than farmers with lower future orientation. Farmers with higher trust levels attach lower relative importance to immediate payments, written contracts, and a personal relationship with a buyer than farmers with lower trust levels.

**Keywords:** choice experiment; field experiments; marketing preferences; trust, risk, and time preferences; Rwanda.

<sup>a</sup> University of Bonn, Institute for Food and Resource Economics (ILR), Nussallee 21, 53115 Bonn, Germany

<sup>b</sup> Leibniz University Hannover, Institute for Environmental Economics and World Trade (IUW), Koenigsworther Platz 1, 30167 Hannover, Germany

<sup>c</sup> World Agroforestry (ICRAF), Research Methods Group, United Nations Avenue, Gigiri, Nairobi, Kenya, PO Box 30677, 00100, Nairobi, Kenya

<sup>d</sup> World Agroforestry (ICRAF), Research Methods Group, 2/F Khush Hall, International Rice Research Institute (IRRI), Los Baños 4031, Laguna, Philippines

# **Preferences for tree-fruit market attributes among smallholder farmers in Eastern Rwanda: A discrete choice experiment**

## **1. INTRODUCTION**

The demand for fruits in Sub-Saharan Africa is estimated to grow substantially due to economic and human population growth, rapidly increasing urbanization rates, and shifts in dietary patterns towards healthier and more sustainable diets (James & Zikankuba, 2017; OECD/FAO, 2016; Ola & Menapace, 2020b; Omotayo & Aremu, 2020). Fruit production offers great marketing and income opportunities, especially for small-scale producers of tree fruits in developing countries (Dagar, Sileshi, & Akinnifesi, 2020; Jamnadass et al., 2011; Kehlenbeck, Asaah, & Jamnadass, 2013; Van Damme, 2018). Besides contributing to household income, the integration of fruit trees in agricultural lands plays an important role in mitigating risks caused by land degradation and climate change (Elagib & Al-Saidi, 2020; Leakey, 2018). Thus, fruit trees are often part of large-scale agroforestry programs (Dave et al., 2019). Most agroforestry programs and projects focus primarily on the planting of trees rather than the marketing of the tree products, leaving a considerable risk to both the smallholder as well as the sustainability of the program (Russell & Franzel, 2004). To ensure that agroforestry programs deliver on both the livelihood and environmental outcomes they are designed for, it is essential for development practitioners to understand the marketing motivations and preferences of smallholders and to include these into the design of the programs (Ola & Menapace, 2020a; Poku, Birner, & Gupta, 2018). This is of particular relevance as some evidence suggests that there are high dropout rates in contract farming schemes in developing countries (Barrett et al., 2012; Romero Granja & Wollni, 2018). Poorly designed contracts can expose smallholders to additional risks and exploitation by larger agricultural actors, as noted by Poku, Birner, and Gupta, (2018). By better addressing smallholders' differentiated barriers, needs, and preferences in planned interventions, fruit production and especially fruit marketing can become more attractive to a greater number of smallholders.

There is an emerging body of literature analyzing smallholders' preferences for contract designs, market characteristics, and characteristics of transaction partners. One strand of the literature explores their preferences for different contract attributes and generally concludes that smallholders prefer contracts that provide a guaranteed market for their products without subjective product rejections and buyers supplying agricultural inputs (Abebe, Bijman, Kemp, Omta, & Tsegaye, 2013; Blandon, Henson, & Islam, 2009; Ochieng, Veetil, & Qaim, 2017;

Ruml & Qaim, 2020). However, there is some degree of heterogeneity when it comes to specific contract characteristics that have mostly been explained by various demographic and socio-economic factors. A second strand of literature argues that trust and familiarity with buyers play an important role in smallholders' market preferences, which is assumed to be related to issues of trust and more in line with traditional markets (Gelaw, Speelman, & Van Huylenbroeck, 2016; Schipmann & Qaim, 2011a).

Empirical evidence focusing on the role of behavioral characteristics in explaining differences in marketing choices and contract preferences is still thin. This is despite several studies showing that risk preferences play a role in smallholders' marketing-channel choices (Kamoyo & Makochekanwa, 2018; Zheng, Vukina, & Shin, 2008). Furthermore, Clot and Stanton (2014) observe that present-biased farmers are more likely to participate in contracts than those who show time-consistent or future-biased preferences. However, with the exception of a few studies (i.e., Fischer & Wollni, 2018; Vassalos et al., 2016), available studies on contract and market choices discuss behavioral preferences on the effects of risk aversion and trust on market preferences and choices but without explicitly accounting for subjective attitudes (Gelaw et al., 2016; Ochieng et al., 2017; Schipmann & Qaim, 2011b; Vassalos et al., 2016). Information regarding smallholders' acceptance and perceived trade-offs between the different marketing attributes in interaction with their trust, risk and time preferences are vital information in designing better market participation options.

The current study advances this evidence base by looking at how smallholder's individual trust, risk and time preferences affect their choice of attributes for fruit marketing. More specifically, we use data on trust, risk and time preferences elicited through behavioral experiments, combined with a discrete choice experiment (DCE) to understand their effect on smallholder's choice on six marketing attributes, namely: sales mode, timing of payment, input/service provision, form of contract, relation to the buyer, and investment costs. We also estimate the willingness to pay (WTP) for the different marketing attributes. The WTP can help to better understand the economic relevance and smallholders' incentive structures and quantify their preference levels. Data used in this study is collected from 252 smallholder farmers in Eastern Rwanda.

Rwanda is a particularly interesting case for examining smallholders' preferences for market attributes that could promote sustained market participation. Not only is Rwanda one of the early adopters of landscape restoration, with the ambitious goal to restore 2 Mio hectares of land with trees, but it is also strongly depending on agriculture. Incentivizing smallholders to

integrate trees on their land, strengthening value chains and developing markets for tree fruits are key to realize this vision (Dave et al., 2019). With almost 75% of Rwanda’s land under agricultural production, the sector is accounting for 39% of GDP and nearly three quarters of employment and is considered a key growth engine for economic development and poverty reduction (IFC, 2019).

## 2. CONCEPTUAL FRAMEWORK

This section describes a framework that reveals how key attributes of tree-fruit marketing affect participation of smallholders and how they relate to behavioral preferences. Table 1 gives an overview of our expectations of the relationships between different marketing profile attributes and trust, risk and time preferences.

Table 1. Expected relationships between behavioral preferences and preferences for marketing profile attributes.

Attribute levels	Expected sign of preference coefficient	Risk preference ( $r_i$ )	Time orientation ( $\delta_i$ )	Trust ( $\theta_i$ )
Individual marketing	+			
Immediate payment	+	–	–	–
Inputs (seedlings, fertilizer) and access to credit and training	+	–	–	
Written contract	+		+	–
Buyer personally known	+			–
Investment costs	–			

*Sales mode:* The ‘sales mode’ refers to the way tree-fruit products are marketed, which can either be individually or collectively through cooperatives. While collective marketing through cooperatives can help smallholders to commercialize their products, the literature shows various reasons that may discourage them to collectively market their products, including uncertainty about the performance of cooperatives (Blandon et al., 2009), free-riding behavior of other members (Blandon et al., 2009) and insufficient lucrativeness of cooperatives (Fischer & Qaim, 2014). We therefore expect that smallholders would prefer selling individually instead of collectively.

*Timing payment:* The timing of payment captures the time period between delivery of product and payment. Immediate payment is the typical payment mode of traditional markets, which means that smallholders are directly paid at product delivery. Delayed payment means

that smallholders receive their payment at a specific time in the future after they delivered the produce (Ola & Menapace, 2020b). However, smallholders usually have very low savings and the day-to-day consumption requirements of their families force them to sell their products to buyers who pay immediately, even if that means poor prices. A delayed payment represents uncertainty for smallholders, especially when they do not know the buyer (Blandon et al., 2009; Fischer & Qaim, 2014; Ochieng et al., 2017). We therefore expect that smallholders have positive preferences for an immediate payment over a delayed payment. Recent research suggests that risk and time preferences are related and that individuals who are or can afford to be more risk tolerant are also more patient (Clot, Stanton, & Willinger, 2017). This might allow drawing the reverse conclusion: that impatient, risk-averse individuals may rather prefer immediate payments over delayed payments. We furthermore assume that smallholders with higher levels of trust attach less relative importance to immediate payments.

*Input/service provision:* Concerning the ‘input/service provision’ attribute, which refers to services provided by the buyer (i.e., tree seedlings, fertilizer, access to credit and training), we expect that smallholders have positive preferences. Smallholders are often constrained by low access to quality input markets, credit, and training, which results in impediments to market participation by smallholder farmers (IFC, 2019; Mbitsemunda & Karangwa, 2017). Lack of credit access can lead to inability of smallholders to invest in production inputs, like fertilizer, seeds and agricultural technologies, which are necessary to increase their productivity and competitiveness. We, thus, expect that smallholders consider the provision inputs and/or services an important mechanism to reduce production uncertainty. Accordingly, more risk-averse smallholders are expected to attach higher importance to contracts that come with these services.

*Form of contract:* Marketing contracts typically refer to oral or written agreements between a buyer and a seller, specifying a fixed price, possible price adjustments, quality requirements and a delivery period schedule (Katchova & Miranda, 2004; Vassalos et al., 2016). In terms of the ‘form of contract’ attribute, we expect that smallholders have preferences for a written contract. While written contracts impose penalties for non-compliance in a formal and agreed way, oral contracts rest on reputation and repeated interactions. One of the most important reasons for contracting are secured markets and maintenance of a long-term future relationship with a buyer (Cook et al., 2001; Vassalos et al., 2016). We, therefore, expect that high future orientation to be positively related to the preference for written contracts. Oral contracts, on the other hand, create uncertainty for the smallholder and open up the risk of opportunistic

behavior on the part of the seller due to disaggregation of agreement, product delivery and payment. Thus, we expect that smallholders with higher levels of trust attach less relative importance to written contracts.

*Relation to the buyer:* The attribute ‘relation to the buyer’ refers to the strength of the relationship between the buyer and the smallholder and is specified as ‘personally known’; ‘known by friends, relatives, or cooperative’; or ‘not personally known’. Selling products to an unknown buyer is typical for spot marketing, where the relationship is more flexible and based on random, short-term encounters. We assume that a stronger relationship increases the probability of regular transactions and we, therefore, expect that smallholders prefer a relationship in which the buyer is personally known or known by friends, relatives, or a cooperative rather than an unknown buyer. Previous studies highlighted the importance of long-standing or personal relationships for smallholders (Mujawamariya, D’Haese, & Speelman, 2013; Schipmann & Qaim, 2011a), which might be explained by a higher degree of trustworthiness (Gelaw et al., 2016). We, therefore, expect that smallholders with lower levels of trust attach more relative importance to a personal relationship with a buyer.

*Investment costs:* Smallholders often face several barriers to market participation, such as high investment or entry costs. Entry costs are associated with the capacity to invest in specific assets (e.g., high quality seedlings, irrigation equipment, storage facilities, etc.). Investment costs also include transaction costs, such as time and effort in learning about a new crop or a new farming technique or to interact with a new value chain (Jagwe, Machethe, & Ouma, 2010). Aggregating smallholders into farmer organizations is a common approach to distribute and lower these transaction costs for individual smallholders, while linking them to markets (Gramzow, Batt, Afari-Sefa, Petrick, & Roothaert, 2018). Particularly at start-up, cooperatives often require membership fees in order to become a member that are considered as investment costs here (Blandon et al., 2009; Verhofstadt & Maertens, 2014). Concerning the ‘investment costs’ attribute, we expect that smallholders prefer low barriers to entry and, thus, little or no upfront investment.

### **3. DATA AND BACKGROUND**

#### **3.1 Study area**

This study was conducted in Bugesera District, which is located in the Eastern Province of Rwanda and is part of the Kagera River Basin, a social-ecological hotspot in Eastern Africa (Khan et al., 2019). Increasing population pressure, highly variable rainfall, prolonged droughts and loss of water catchment areas because of deforestation is making rain-fed agriculture a



very risky livelihood (Khan et al., 2019; UNEP, 2011). The majority of farms are very small, with an average farm size of 0.5 ha, growing a variety of food crops (Iiyama et al., 2018; NISR, 2019). Bugesera is one of the main fruit producing areas in the country, producing avocado, mango, apple, papaya, orange, lemon, guava and mulberry (NISR, 2019). However, productivity as well as quality remain low and most of the fruits are used for domestic consumption (Clay & Turatsinze, 2014; NISR, 2012). Fruit producers sell their products predominantly to traders, who then sell them at markets in and around the district. Generally, the demand for fruits exceeds the supply, which implies great potential for intensification and marketing. However, unavailability of planting material, either in the form of grafting material or germplasm, as well as high input prices and inadequate access to fertilizer and pesticides constitute major constraints to produce fruits in Bugesera. Moreover, the cultivation of fruit trees is aggravated by the lack of extension services and storage facilities. The farming community in Bugesera was strongly impacted by resettlement schemes, both before and after 1994 (Buckley-Zistel, 2009), but also badly affected by the Genocide in 1994. The combination of new settlement and the post conflict impacts disrupted the social networks and local institutions in the district, as they did in similar areas in the country (Coo, 2012). Post conflict interventions saw the rise of large farmer cooperatives focused on specific commodities and farmer groups to access NGO support (Bourne, Gassner, Makui, Muller, & Muriuki, 2017).

### **3.2 Data collection**

Data used in this study were obtained from five different data collection segments carried out among smallholders in Bugesera District in March 2020: a household survey, an experiment on risk preferences, an experiment on time preferences, a trust game, and a DCE (see Section 4). The survey gathered information on the smallholders' socio-economic characteristics, farm characteristics, and fruit marketing strategies.

We used a multi-stage sampling approach to form our survey sample. During the first stage, we purposively selected three sectors<sup>1</sup>, namely, Juru, Nyamata and Rweru across Bugesera District. Fruit trees are commonly grown in these three and they are among the major fruit-producing sectors in the district for domestic and traditional markets (NISR, 2019). During the second stage, we randomly selected cells, namely, Mugorore, Murama, Nemba and Rwinume. We then randomly selected 12 villages and 20 households within each village using updated,

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<sup>1</sup> The administrative structure of Rwanda is organized into provinces, districts, sectors, cells and villages.

village-level household lists. The households were contacted and mobilized by local extension officers and village chairpersons. A total of 252 households were interviewed.

All selected households were visited in their homesteads to conduct a two-hour face-to-face interview and the experiments. A team of 10 local enumerators were carefully selected, trained and supervised by the researchers and they conducted all the interviews and experiments. To ensure that respondents were able to comprehend the survey questions and experimental choices presented to them, all tools were translated into the official language *Kinyarwanda*. All respondents provided consent before participating in the study. Data was collected electronically using tablets based on the Open Data Kit platform and then uploaded to a server on a daily basis by the enumerators.

## **4. METHODS**

### **4.1 Behavioral economic experiments**

We used a series of incentivized experiments to elicit behavioral characteristics related to trust, risk and time preferences. The order of the experiments was held constant.<sup>2</sup> At the end of the survey, one of the three experiments was randomly selected to be paid out to the participant. Average payouts per person were RWF 2,460 (USD 2.60).

The experimental game eliciting risk preferences was designed following Eckel and Grossman (2002, 2008) and Dave, Eckel, Johnson and Rojas (2010). The game was designed in a simple manner and elicited risk preferences that allow enough heterogeneity in choices for estimation of utility parameters. Participants were presented with an array of six lotteries and one of these had to be chosen. Each of the lotteries, listed in Table 2, involved a 50% chance of receiving the low payout and a 50% chance of the high payout. One of the lotteries was a sure alternative. Participants made their choice based on a picture card that illustrated the different lotteries (see Figure A1 in the Supporting Information). Based on their choices, participants were classified into different risk groups: ‘Lottery 1’ to ‘Lottery 4’ were classified as risk-averse; ‘Lottery 5’ and ‘Lottery 6’ were classified as risk-neutral and risk-seeking, respectively (Dave, Eckel, Johnson, & Rojas, 2010). For the econometric analysis, a continuous variable  $r_i$  was generated, which takes values from 1 to 6. A low value indicates strong risk aversion, whereas a high value represents risk-seeking behavior.

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<sup>2</sup> See Supporting Information for more information on the experimental design.

Table 2. Design of risk preference experiment.

Lottery (50/50)	Low payout	High payout	Expected value	Standard deviation	Implied CRRA <sup>a</sup> range	Risk category <sup>b</sup>
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	$0.50 < r < 0.71$	RA
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

Notes: Payouts are displayed in Rwandan Franc (RWF). Exchange rate: USD 1 = RWF 920 (March 2020)

<sup>a</sup> Coefficient of relative risk aversion.

<sup>b</sup> Risk category RA = risk-averse, RN = risk-neutral, and RS = risk-seeking.

Time preferences were elicited with a simple money allocation task following Angerer et al. (2015). In this experiment, participants were endowed with RWF 1,000 (USD 1.10) and had to allocate any round amount of money in RWF 100 (USD 0.10) denominations between two dates in the future: ‘tomorrow’ and ‘in four weeks’. The money allocated to ‘in four weeks’ was doubled and was to be paid out four weeks after the experiment; money allocated to ‘tomorrow’ was paid out the following day (see Figure A2 in the Supporting Information). We did not include an option for an immediate payout to correct for ‘present bias’.<sup>3</sup> The amount of money that was allocated to the later date was a simple measure of farmers’ future orientation and a reflection of their patience. A variable  $\delta_i$  was generated, which takes values from 0 (i.e., RWF 0) to 10 (i.e., RWF 1,000), reflecting the amount of money that was allocated to the future.

To strengthen the trust of receiving the money in the future (Harrison, Lau, Rutström, & Sullivan, 2005), the participant received a credit voucher indicating the amount of money he or she would receive and the date of payment. The credit voucher was issued by team members assigned to conduct the experiment with the supervision of the Principal Investigator (PI). For both choices the money was sent via a mobile money transfer to the participant’s number by a finance officer of our institution exactly on the date of payment as indicated on the credit voucher. These considerations may be important in a field context, particularly in less developed countries.

<sup>3</sup> Most decision makers have a high present bias, meaning that they have a high preference for an immediate payout in comparison to a delayed payout, which results in extremely high discount rates due to quasi-hyperbolic discounting (Frederick, Loewenstein, & O’Donoghue, 2002).

We also conducted a two-person binary trust game (Berg, Dickhaut, & McCabe, 1995; Clot & Stanton, 2014; Fischer & Wollni, 2018). According to this game, random pairs of participants were formed and assigned the role of ‘sender’ and ‘receiver’. In our case, the ‘sender’ received RWF 1,000 (USD 1.10) and had to choose whether to send any round amount between RWF 0 and RWF 1,000 (USD 1.10) to the ‘receiver’ or to keep the money. The money sent was then tripled by team members assigned to conduct the experiment with the supervision of the PI. Accordingly, the ‘receiver’ was asked to decide whether, in the event that the sender sent some money, he or she would keep the money or split it evenly between himself/herself and the ‘sender’. The procedure is graphically illustrated in Figure A3 in the Supporting Information. Based on the choices made by the participants, a dummy variable  $\theta_i$  was generated that reflects trust and coded 1 for ‘money sent’ and 0 for ‘money not sent’.

## 4.2 Discrete choice experiment

We used a DCE to elicit preferences of smallholders for different features of fruit marketing profiles. For more detailed information on the DCE, readers are referred to Hensher, Rose, and Greene (2015). The levels used to describe each attribute in the DCE were determined after thorough discussion and in consultation with scientists, community leaders, and agricultural extension officers. Additionally, four focus groups were conducted in different villages to further examine how smallholders would understand the levels of the marketing profiles we considered in our DCE. Based on their feedback, we selected six attributes that they deemed important in fruit marketing with two to four levels (Table 3).

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 marketing profile. To produce a more manageable experiment, a D-optimal design<sup>4</sup> was used to generate a subset of marketing profiles that covered the range of variability between all possible combinations. 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, participants were randomly assigned one of these four subsets, with an even number of households allocated to each of the subsets. A choice set

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<sup>4</sup> There are several approaches to reduce the number of alternatives, including orthogonal fractional and D-optimal designs. The decision between these approaches represents a trade-off between statistical efficiency (D-optimal design) and non-correlation between attributes (orthogonal design) (Hensher et al., 2015). We consider statistical efficiency to be more important. Therefore, we used the D-optimal design, taking into account the possibility that attributes might be correlated.

consisted of two alternative marketing profiles (A and B) and a status-quo (‘none of the market profiles’) option.

The status-quo option was provided because a participant might not have a preference for either of the marketing profiles listed. The status-quo option captures unobserved factors over and beyond the variations of attitude levels of the choice sets included in the DCE. Inclusion of this alternative allows the participants to choose another alternative rather than the two market profiles given in the DCE. The status-quo option furthermore reflects smallholders’ preference towards no change to the current situation with respect to all given attributes.

Table 3. Overview of attributes and levels used in the discrete 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	Smallholders 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 constraints often faced by smallholders	1. Inputs (seedlings, fertilizer) 2. Inputs (seedlings, fertilizer), and access to credit 3. Inputs (seedlings, fertilizer), and access to credit and training 4. None
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 or entry costs	1. None 2. RWF 10,000 3. RWF 20,000 4. RWF 30,000

Illustrations were included in the choice sets to increase participants’ comprehension of the attributes and levels (see Figure A4 in the Supporting Information). Before conducting the DCE, we explained to the participants that the drawings used hypothetical marketing profiles rather than real ones. The attributes and levels used were carefully explained before giving the actual choice sets to ensure that participants understood the aim of the task of making trade-offs. Participants were also informed that the choices they made in the experiment would not

have any immediate consequence and would not bind them to undertake actual marketing decisions. It was clarified that the results would be used more generally to better understand smallholders' marketing preferences that may inform project design or future project implementation. One known drawback of the DCE approach is the hypothetical bias that may occur as a result of inconsistent behavior of individuals. That means that an individual may behave differently in a hypothetical situation than he or she would behave in real life (Hensher et al., 2015).

### 4.3 Estimation approach

To demonstrate the effects of trust, risk and time preferences on smallholders' marketing choices, we used data from both the experimental games and the DCE. The econometric analysis was based on mixed logit models that were estimated using maximum simulated likelihood (Train, 2009). Our models included an alternative specific constant (ASC) to account for the fact that the choice sets included a status-quo ('none of the market profiles') option. The ASC was a dummy variable, coded 1 for the status-quo alternative and 0 for the market profile alternatives. All attribute variables were effect coded instead of dummy coded to avoid correlation of the attribute estimates with the ASC (Bech & Gyrd-Hansen, 2005; Holmes & Adamowicz, 2003). The 'investment costs' attribute was specified as continuous in all models. Further, all attribute variables and the ASC were specified as having a random component except for the investment costs, which was specified as fixed in all models since we assumed that smallholders have a homogeneous preference for low costs. All model coefficients were assumed to be normally distributed.

We ran different model specifications.<sup>5</sup> In model (1), we analyzed the relative importance of different marketing profile characteristics for smallholders' marketing choice. The base specification included only the ASC and the attribute levels as explanatory variables. In simplified terms, it can be expressed as:

$$Y_{ijk} = \beta_0 ASC + \beta_1 S_{ijk} + \beta_2 P_{ijk} + \beta_3 I_{ijk} + \beta_4 C_{ijk} + \beta_5 R_{ijk} + \beta_6 IC_{ijk} + e_{ijk} \quad (1)$$

where  $Y$  denotes the binary decision made by smallholder  $i$  for alternative  $j$  and choice set  $k$ ;  $S$ ,  $P$ ,  $I$ ,  $C$ ,  $R$ , and  $IC$  are the marketing profile attributes sales mode, timing of payment, input/service provision, form of contract, relation to the buyer, and investment costs, respectively, and  $e$  represents a random error term.

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<sup>5</sup> The models are estimated by maximum simulated likelihood using 500 Halton draws (Hole, 2007).

Models (2) to (4) included interaction terms between marketing attributes and behavioral preferences to test the effects hypothesized in the conceptual framework in Section 2. As described previously,  $r_i$  and  $\delta_i$  are continuous variables and  $\theta_i$  is a dummy variable that measures risk aversion, time preference, and trust, respectively. In model (2), we explored the relationship between risk preference and timing of payment and input/service provision and added the respective interaction terms (*Immediate payment*  $\times$  *risk*) and (*No input provision*  $\times$  *risk*). In model (3), we tested the relationship between time preference and the timing of payment (*Immediate payment*  $\times$  *time*), input/service provision (*Input and credit provision*  $\times$  *time*), and the form of contract (*Written*  $\times$  *time*), respectively. In model (4), we explored the relationship between trust and the timing of payment, the form of contract, and the relation to the buyer. We add interaction terms (*Immediate payment*  $\times$  *trust*), (*Written contract*  $\times$  *trust*), and (*Buyer known personally*  $\times$  *trust*).

$$Y_{ijk} = \beta_0 ASC + \beta_1 S_{ijk} + \beta_2 P_{ijk} + \beta_3 I_{ijk} + \beta_4 C_{ijk} + \beta_5 R_{ijk} + \beta_6 IC_{ijk} + \gamma_1(I_{ijk} \times r_i) + e_{ijk} \quad (2)$$

$$Y_{ijk} = \beta_0 ASC + \beta_1 S_{ijk} + \beta_2 P_{ijk} + \beta_3 I_{ijk} + \beta_4 C_{ijk} + \beta_5 R_{ijk} + \beta_6 IC_{ijk} + \gamma_1(P_{ijk} \times \delta_i) + e_{ijk} \quad (3)$$

$$Y_{ijk} = \beta_0 ASC + \beta_1 S_{ijk} + \beta_2 P_{ijk} + \beta_3 I_{ijk} + \beta_4 C_{ijk} + \beta_5 R_{ijk} + \beta_6 IC_{ijk} + \gamma_1(P_{ijk} \times \theta_i) + \gamma_2(C_{ijk} \times \theta_i) + \gamma_3(R_{ijk} \times \theta_i) + e_{ijk} \quad (4)$$

The coefficient estimates of model (1) were used to calculate smallholders' WTP for the different marketing profile attributes as follows:

$$WTP_{attribute} = \frac{\beta_{attribute}}{-\beta_{costs}} \quad (5)$$

where  $\beta$  represents the coefficient of the cost attribute and of the attribute for which the WTP is calculated.

## 5. RESULTS AND DISCUSSION

### 5.1 Summary statistics of the sample

About 35% of our respondents were female, the mean age was 48 years, and the number of years spent in school was 4 and 3 for men and women, respectively. From the sample, 58% of the respondents accommodated five or more family members in their household. A respondent's household had a 40% likelihood of living at or below the poverty line of USD

1.90 per day. Although most households owned only a small area of land, averaging 0.6 ha, the majority relied on agricultural activities, either solely crop farming or in combination with livestock farming. Income from non-agricultural business was neglectable. With 89% of smallholders sampled growing fruit trees on their farms, only 32% sold their fruits<sup>6</sup>. About half who did not market their fruits indicated using the fruits they produced for own consumption. On average, smallholders had 17 fruit trees on their farms. While across the sample there was a high variation in types of fruits trees, the diversity at an individual farm level was low, with only two fruit-tree species. A majority of fruits were sold at the farm gate (58%) and at the local market (42%). Selling directly to supermarkets, institutions or traders was not common. The smallholders sold their produce individually and none of them indicated being involved in collective marketing. Contracts between sellers and buyers were not common. Of five sellers who had a contract with a buyer, only one seller had a written contract while four had oral contracts. Smallholders decided to sell fruits on the basis of various conditions, including timely payment (54%), good price offers (49%), and knowing the buyer personally (20%).

About 34% of our sample smallholders were members of a cooperative. On average, smallholders had been members for about 8 years and paid RWF 18,000 (USD 19.00) in order to become a cooperative member. Cooperatives supported their members by providing saving schemes, access to credit, as well as farm inputs including planting material and mineral fertilizer. Beyond that, about half of the respondents indicated receiving extension service or technical advice on production techniques, pest management, and post-harvest handling of their products. Reasons cited for not to being a member of a cooperative included high associated costs owing to membership entry fees, and lack of knowledge of the cooperatives' existence. About 17% of non-members were not interested in becoming members and assumed that cooperatives did not confer benefits to smallholders. The results further suggest that cooperatives are somewhat exclusive since remoteness and lack of capacity to fulfil membership criteria further prevent smallholders from joining. See Tables A1, A2 and A3 in the Supporting Information for more detailed summary characteristics, an overview of smallholders' fruit production and cooperative membership.

## **5.2 Trust, risk and time preferences**

Table 4 show the results of the behavioral economic experiments on trust, risk and time preferences (see Figure A5 in the Supporting Information for a graphical representation).

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<sup>6</sup> Smallholders who had produced and sold fruits in the last 12 months.



Results of the risk preference experiment showed that about 69% of the sampled smallholders were risk-averse, confirming the results obtained by other studies conducted in developing countries (Charness & Viceisza, 2016; Fischer & Wollni, 2018; Liebenehm & Waibel, 2014; Senapati, 2020; Ward & Singh, 2015). Beyond that, about 27% of the sampled smallholders could be considered to be risk-seeking and about 3% were found to be risk-neutral. In the time-preference experiment, participants allocated about twice as much money to the later date than to the sooner date. This indicates that the sampled smallholders were relatively patient. Based on the findings of several studies, we expected that people living in poor environments would prefer smaller immediate rewards over larger deferred rewards and were generally impatient (Anderson, Dietz, Gordon, & Klawitter, 2004; Liebenehm & Waibel, 2014; Tanaka, Camerer, & Nguyen, 2010). Results of the trust game showed that a majority of participants, irrespective of their assigned role as either ‘sender’ or ‘receiver’, sent money to a stranger. The average amount sent by farmers was about RWF 436 (USD 0.50), which represents 44% of the initial endowment. Our result is similar to results found in other studies (Berg et al., 1995; Nguyen, Villeval, & Xu, 2016).

Table 4. Results of risk, time and trust experiments (n = 252).

	Mean	Standard deviation
Risk preference		
Risk-averse (%)	69.44	
Risk-neutral (%)	3.17	
Risk-seeking (%)	27.38	
Time preference		
Amount of money allocated to ‘tomorrow’ (RWF)	315.48	392.48
Amount of money allocated to ‘in four weeks’ (RWF)	648.52	392.91
Trust		
Sender <sup>a</sup>		
Sent money to stranger (%)	80.47	
Amount of money sent to stranger (RWF)	435.94	307.58
Receiver <sup>b</sup>		
Sent money back to sender (%)	81.45	

Notes: Exchange rate: USD 1 = RWF 920 (March 2020)

<sup>a</sup> n<sub>Sender</sub> = 128

<sup>b</sup> n<sub>Receiver</sub> = 124

### 5.3 General preferences for marketing attributes

The results of the mixed model are summarized in Table 5. Positive coefficients in the model indicate a positive preference (utility) and negative coefficients indicate a negative preference (disutility) for a specific attribute level compared with the reference category. Non-significant attribute levels indicate respondents’ indifference to the choices given. In the following, we

discuss the results of the entire sample (Table 5, column 1) first, before analyzing how smallholders' attitudes towards risk, time and trust influenced their choices (Table 5, columns 2–4). The ASC has a negative and significant coefficient, indicating that smallholders strongly preferred the marketing profile alternatives over maintaining the status-quo. This result is particularly noteworthy given that a majority of sample smallholders did not sell fruits. It suggests that there is a huge demand for marketing strategies.

Table 5. Mixed logit model estimates.

Variables	(1) Basic	(2) Risk	(3) Time	(4) Trust
<i>Mean parameters</i>				
ASC <sup>a</sup>	-12.16*** (2.48)	-12.21*** (2.47)	-11.72*** (2.52)	-12.30*** (2.52)
Investment costs	-0.00*** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)
Individual marketing <sup>b</sup>	-0.12*** (0.04)	-0.12*** (0.04)	-0.12*** (0.04)	-0.12*** (0.04)
Immediate payment <sup>c</sup>	0.36*** (0.04)	0.24*** (0.08)	0.53*** (0.09)	0.42*** (0.10)
No input provision <sup>d</sup>	-0.92*** (0.09)	-1.05*** (0.15)	-0.89*** (0.09)	-0.92*** (0.09)
Input and credit provision <sup>d</sup>	0.29*** (0.07)	0.29*** (0.07)	0.10 (0.12)	0.29*** (0.07)
Input and training provision <sup>d</sup>	0.71*** (0.08)	0.71*** (0.08)	0.70*** (0.08)	0.71*** (0.08)
Written contract <sup>e</sup>	0.30*** (0.04)	0.30*** (0.04)	0.16** (0.07)	0.40*** (0.09)
Buyer known personally <sup>f</sup>	0.16*** (0.06)	0.16*** (0.06)	0.15*** (0.06)	0.27** (0.12)
Buyer not known at all <sup>f</sup>	-0.21*** (0.06)	-0.21*** (0.06)	-0.21*** (0.05)	-0.21*** (0.06)
<i>Interactions</i>				
Immediate payment × risk		0.04* (0.02)		
No input provision × risk		0.04 (0.03)		
Immediate payment × time			-0.03** (0.01)	
Input and credit provision × time			0.03* (0.01)	
Written contract × time			0.02** (0.01)	
Immediate payment × trust				-0.07* (0.10)
Written contract × trust				-0.11* (0.10)
Buyer known personally × trust				-0.14* (0.13)
Input and training provision × marketing				
Buyer known personally × marketing				
<i>SD parameters</i>				
ASC	5.22*** (1.06)	5.26*** (1.08)	4.96*** (1.06)	5.30*** (1.09)
Individual marketing	0.47*** (0.06)	0.47*** (0.06)	0.46*** (0.06)	0.47*** (0.06)
Immediate payment	0.41*** (0.06)	0.40*** (0.06)	0.38*** (0.06)	0.41*** (0.06)
No input provision	0.47*** (0.11)	0.46*** (0.11)	0.44*** (0.12)	0.48*** (0.11)
Input and credit provision	0.02 (0.31)	0.01 (0.30)	0.06 (0.37)	0.02 (0.29)
Input and training provision	0.42*** (0.12)	0.42*** (0.12)	-0.42*** (0.12)	0.42*** (0.12)
Written contract	0.23*** (0.07)	0.24*** (0.07)	0.22*** (0.08)	0.23*** (0.07)
Buyer known personally	-0.21* (0.12)	-0.21* (0.12)	-0.20 (0.13)	-0.20* (0.12)
Buyer not known at all	0.24** (0.11)	0.24** (0.12)	0.19 (0.13)	0.24** (0.11)
Log likelihood	-1189.87	-1187.42	-1182.86	-1188.48
Chi squared	187.68***	187.14***	183.66***	188.72***
Observations	6048	6048	6048	6048

Notes: Standard errors in parentheses. The number of observations is  $n = 8 * 3 * 252 = 6048$ . \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

<sup>a</sup> Alternative specific constant.

<sup>b</sup> Reference category is collective marketing.

<sup>c</sup> Reference category is delayed marketing.

<sup>d</sup> Reference category is input provision (seedlings, fertilizer).

<sup>e</sup> Reference category is no written contract.

<sup>f</sup> Reference category is buyer known by friends, relatives, or cooperative.

Smallholders did prefer immediate rather than delayed payments. This was expected and in line with previous studies (Blandon et al., 2009; Gelaw et al., 2016; Ochieng, 2020; Schipmann & Qaim, 2011b). In Malawi, Ochieng (2020) reported a positive attitude towards contracts that offered immediate payments and farm inputs to cushion against farm-level risks. Since the majority of smallholders are resource-constrained farmers whose liquidity is often constrained, they prefer immediate payments despite delayed payments offering higher amounts (Fischer & Qaim, 2014). In Ghana, Poku et al. (2018) found that outgrower schemes were more successful when paying cash instantly and providing inputs.

We also observed a positive preference towards input provision among smallholders, especially when combined with additional credit and training. Low input use is described as one major factor that hampers agricultural productivity in Rwanda, which is further aggravated by insufficient provision of extension services (Nahayo et al., 2017). For example, only 55% of smallholders applied organic fertilizer and approximately one fourth used inorganic fertilizer. The use of improved seeds and pesticides was even smaller with 17% and 16%, respectively (NISR, 2019). Use of inorganic fertilizer, pesticides, irrigation practices and improved seedlings was more common for larger-scale farmers because they had better access and more financial opportunities to cover the costs of inputs than smallholders (NISR, 2019). Supporting smallholders to access quality inputs, credit, training and extension services can improve both quality and productivity, preconditions for them to participate in the market. As expected, the coefficient for 'no input provision' is negative and significant.

Consistent with the literature, our results show that smallholders generally preferred written contracts to oral or no contracts. Ola and Menapace (2020b) identified a higher preference of smallholders for formal relationships than informal or spot relationships, indicating their willingness to enter into written contracts. They concluded that smallholders preferred written to oral contracts because they explicitly specify the expectations of both transaction partners and provide output market security. Since smallholders bear the majority of risks, such as non-payment if products do not meet the agreed standard or in case of crop failure, smallholders prefer written contracts that have the potential to mitigate these risks to a certain extent (Barrett, 2008). Furthermore, in the case of violation or non-compliance, written contracts allowed smallholders to hold their contract partners accountable and obtain legal compensation (Mugwagwa, Bijman, & Trienekens, 2020). Our results illustrate that smallholders' preferences for written contracts contrast with the actual situation given that written contracts

are rare. This indicates the need to consider smallholders' preferences for contract designs and policy interventions to successfully integrate smallholders into markets.

As expected, the coefficient for 'buyer not known' was negative and significant, which reveals that smallholders prefer personally knowing the buyer. Since markets are often characterized by limited information, smallholders may rely on their personal judgment and experience to assess the trustworthiness of buyers in terms of providing market information, measuring the quality and quantity, keeping promises, and complying with contracts as noted by Gelaw et al. (2016).

In contrast to our expectations and the literature (Blandon et al., 2009; Fischer & Qaim, 2014), the smallholders preferred collective marketing rather than individual marketing. Again, this finding contrasts starkly with the smallholders' current mode of sales, which take place exclusively on an individual basis. This suggests that smallholders are not satisfied with their current sales mode and have a high expectation of collective marketing. Another possible explanation is that smallholders may be aware of the benefits of collective marketing while not being able or willing to access such opportunities. The negative coefficient of the attribute 'investment costs' further suggests that smallholders would like to minimize their transaction costs. Several studies have shown that collective marketing through farmer groups can reduce transaction costs, improve marketing coordination, access to market information and bargaining power, as well as increase producer prices (Chiputwa, Spielman, & Qaim, 2015; Hagos, Dibaba, Bekele, & Alemu, 2019; Mutonyi, 2019; Verhofstadt & Maertens, 2014). Thus, collective marketing can be an important strategy for smallholders to be competitive in rapidly changing markets (Fischer & Qaim, 2012) and to increase farm income (Verhofstadt & Maertens, 2014). At the same time, Lutz and Tadesse (2017) find that 'free riding' is a major challenge for agricultural cooperatives with relatively open membership because cooperatives need significant investment and commitment from their members to develop a competitive position in the market. It is also important to stress that during the interviews, smallholders mentioned that one of the entry barriers for joining existing cooperatives were high membership fees (i.e., high investment costs). In line with previous studies (Tefera & Bijman, 2019; Wossen et al., 2017) our results therefore stress the importance of governmental interventions to aggregate smallholders to ensure that resource-poor communities can be linked to existing markets.

The attribute 'investment costs' captures fees to become a cooperative member and market entry costs, but also strategic resources, certification and management costs (van Rijsbergen,

Elbers, Ruben, & Njuguna, 2016). The negative and significant coefficient of this attribute indicates that smallholders prefer selling to markets that do not require significant up-front costs. It is well established that smallholders are resource-constrained with limited access to capital markets (Collier & Dercon, 2014; Lutz & Tadesse, 2017). This is supported by our descriptive results showing, for instance, that high membership fees are a core barrier to cooperative membership. In line with Tefera and Bijman (2019), who found significant socioeconomic differences among Ethiopian smallholders who were members and non-members of farmer cooperatives, the sampled smallholders' resource constraints might indeed have impeded their membership of cooperatives.

#### **5.4 Differences in preferences for marketing attributes in relation to behavioral preferences**

We found that behavioral preferences correlated with preference heterogeneity for several attributes (Table 5, columns 2–4). The model predicted that smallholders with lower levels of risk aversion had a greater preference for immediate payments than those with higher levels of risk aversion (Table 5, column 2). This was somewhat surprising, especially as the focus groups suggested that delayed payment was perceived to be a significant source of risk for smallholders. Our results further showed that risk attitude does not influence smallholders' preferences for provision of inputs and/or services. This result could indicate that the provision of inputs and/or services is not perceived as an essential part of mitigating risks at farm level by the smallholders in our sample.

Smallholders with higher future preference attached lower relative importance to immediate payments than those with lower future preference (Table 5, column 3). This result corresponds to work on pineapple farmers in Ghana (Fischer & Wollni, 2018), whereby higher future preference resulted in willingness to wait a longer period for payment after purchase. Also, time preference had a strong effect on 'input and credit provision' and 'written contract': smallholders with higher future preference were more likely to choose contracts with input provision, especially when combined with additional credit provision, and written contracts compared to those with lower future preference. This suggests that smallholders with a long-term vision of their fruit business are well aware of the importance of farm inputs, credits and written contracts. Clot et al. (2017) suggests that 'impatient' farmers favor investing in fast-growing crops that generate immediate benefits compared to enrolling in long-term strategies, such as tree growing.

Trust (Table 5, column 4) influenced more attributes than risk and time preferences: smallholders with higher trust levels attached lower relative importance to immediate payments, written contracts and a personal relationship with a buyer than those with lower trust levels. These results are in line with findings of other studies (S. Fischer & Wollni, 2018; Ochieng et al., 2017; Schipmann & Qaim, 2011b). Fischer and Wollni (2018) show that trust has economically negative effects on the willingness to pay for transparent quality controls. They found that increasing trust levels were associated with lower price premiums for high transparency. Ochieng et al. (2017) indicate that an unfavorable payment mode may be related to issues of distrust of smallholders in buyers. In their study dealing with smallholders' marketing preferences for sweet pepper in Thailand, Schipmann and Qaim (2011b) identified that companies used written contracts as a result of distrust towards smallholders but without addressing the concerns of the smallholders. However, written contracts may also be desired by smallholders if they have no confidence in the buyer. The design of written contracts must therefore consider the needs of both producers and buyers in order to reduce mutual distrust and avoid withdrawal of one or both parties. Schipmann and Qaim (2011b) also indicate that smallholders with higher levels of trust evaluate a personal relationship with the buyer as less decisive.

### **5.5 Willingness to pay for marketing attributes**

The model estimates (Table 5, column 1) can also be used to calculate smallholders' WTP for, or willingness to accept (WTA), the different marketing profile attributes. This can help to better understand smallholders' incentive structures and quantify their preference levels. WTP estimates can be derived as the ratio of the value of the coefficient of interest to the negative of the cost attribute; in our case, investment costs. This approach is known as calculation in preference space (Hole & Kolstad, 2012). WTP estimates and 95% confidence intervals are presented in Table 6. WTP estimates can be interpreted as the indicative amount of money that smallholders are willing to pay, opt for — or accept — a particular feature of the marketing profile. Smallholders were willing to pay about RWF 15,037 (USD 15.80) if an immediate payment at delivery was guaranteed; about RWF 11,972 (USD 12.60) if inputs and additional credit were made available; about RWF 18,458 (USD 19.40) if inputs, additional credit and training were offered; about RWF 12,645 (USD 13.30) if a written contract was provided; and about RWF 6,590 (USD 6.90) if the buyer was known personally. The highest WTP can be observed for the attribute level referring to input provision, especially when combined with additional credit and training provision. The WTP coefficients of the other significant variables

are negative. The negative WTP coefficients can be interpreted as the compensation that smallholders would have to receive to accept the particular attribute compared to the other reference level. Smallholders would need a cost reduction of about RWF 4,920 (USD 5.20) if fruits were marketed individually; about RWF 38,493 (USD 40.50) if no inputs and/or services were provided; and about RWF 8,709 (USD 9.20) if the buyer was not known personally. This suggests that the capacity of buyers to provide support services for smallholders is essential for smallholders' market participation. The results also indicate the importance of personal links between buyers and smallholders, which is probably related to issues of trust and is an important result for improving contractual relationships in agri-food markets. However, the exact WTP values should be interpreted with caution given the well-known hypothetical bias that often afflicts stated preferences data. Specifically, WTP estimates might potentially be biased upwards (Hensher, 2010).

Table 6. Willingness to pay (WTP) estimates (in Rwandan Franc).

Attribute	WTP	95 % Confidence Interval	
Individual marketing	-4920.49	-8724.47	-1116.50
Immediate payment	15037.47	9497.55	20577.39
No input provision	-38492.81	-51061.90	-25923.73
Input and credit provision	11971.94	5486.33	18457.54
Input and training provision	18457.54	19118.03	40098.97
Written contract	12644.98	7952.84	17337.12
Buyer known personally	6589.72	1451.08	11728.36
Buyer not known at all	-8708.88	-14034.20	-3383.56

*Notes:* WTP estimates were derived from mixed logit parameter estimates (base specification), using the delta method. Number of observations  $n = 6048$ . Exchange rate: USD 1 = RWF 920 (March 2020)

## 6. CONCLUSION

The intent of the study was to support the improvement of smallholders' market participation by providing scientific insights into options to design appropriate policy interventions. To achieve this objective, we analyzed the relationship of smallholders' behavioral preferences and their preferred contracts and marketing characteristics. We therefore elicited trust, risk and time preferences of smallholders in Rwanda by using behavioral economic experiments and investigated key attributes or characteristics of fruit-tree marketing profiles that were preferred by smallholders using a DCE. By coupling smallholders' behavioral parameters with DCE data, we were able to observe how trust, risk and time preferences correlated with smallholders' marketing choices. This allowed us to contribute empirical insights to the few existing DCE studies in this field of research (Fischer & Wollni, 2018; Vassalos et al., 2016). Our results can help to improve the design of marketing contracts to meet smallholders' preferences and

potentially increase adoption of mutually beneficial contracts. While we are aware that conducting behavioral economic field experiments entails imperfections, our results correspond with observations from other studies and are sufficiently robust to draw the relevant conclusions.

Our results show that in the context of Rwanda, smallholders who had participated in governmental agroforestry programs to plant fruit trees had a high interest in participating in selling their produce. We were able to show that our smallholders were characterized by high levels of risk aversion, future preference, and trust. Still, they preferred collective fruit marketing and marketing options that guaranteed immediate payments, input provision (i.e., seedlings and fertilizer), especially when combined with additional credit and training, written contracts, a personal relationship with the buyer, and low investment costs. Strengthening the role of cooperatives in supply chains is therefore a key political task, as recommended by several other studies as well (Lutz & Tadesse, 2017; Tefera & Bijman, 2019). While smallholders are ‘willing to invest’ in certain marketing features, such as the provision of inputs, credit and training, immediate payments, and a written contract, their willingness to accept a certain less-preferred feature comes with compensation. These include marketing profiles with no provision of inputs, no personal relationship with the buyer, and when marketing is done individually rather than through a cooperative. While our data reveals a general willingness to pay to join a cooperative, required investment costs are cited as a barrier to membership. This emphasizes the importance of local financial markets, the promotion of which we strongly recommend. We also find that differences in the importance of marketing characteristics are associated with differences in individual behavioral preferences. It is therefore essential that tree-growing programs do not use a ‘one-size fits all’ approach when designing marketing strategies. Policy interventions that aim to improve smallholders’ market participation have to be participatory and be adjusted to the contextual preferences of each community.

Besides this study, further study of the relationship between market participation and preference formation in agri-food markets in developing countries is required. Identification of factors that affect trust, risk and time preferences would further contribute to a better understanding of smallholders’ behavior choice. While our study focused on six core attributes, additional marketing attributes could be investigated as well. Finally, a sustainable inclusion of smallholders in agri-food markets can only be successful if the interests of producers and



buyers coincide. Further analyses of buyers' preferences could make an important contribution to the debate.

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