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Transformation of Global Agri-Food Systems:
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University of Goettingen

GlobalFood Discussion Papers

No. 110

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November 2017

RTG 1666 GlobalFood · Heinrich Düker Weg 12 · 37073 Göttingen · Germany
www.uni-goettingen.de/globalfood

ISSN (2192-3248)

Suggested Citation:

Fischer, S., M. Wollni (2017). The Role of Farmer's Trust, Risk and Time Preferences for Contract Choices: Experimental Evidence from the Ghanaian Pineapple Sector. GlobalFood Discussion Paper 110, University of Goettingen. http://www.uni-goettingen.de/de/213486.html.

The Role of Farmer's Trust, Risk and Time Preferences for Contract Choices: Experimental Evidence from the Ghanaian Pineapple Sector

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Abstract

In the last decades global food value chains have seen the need for increasing vertical coordination in order to secure quality standards. A prominent way to govern the relationships between farmers and agri-business firms are farming contracts. We study the role of trust, risk and time preferences for farmers' contract choices in a discrete choice experiment among Ghanaian pineapple farmers. We find that experimental measures of trust, risk and time preferences can predict preferences for contract attributes. Especially trust has economically important effects on the willingness to pay for transparent quality controls. Differences in preferences for timing of payment and timing of agreement making cannot be explained by trust levels but by time preferences. Risk-sharing in form of reduced quality requirements is less important for risk-seeking individuals compared to risk-neutral or risk-averse farmers. Including behavioral preferences can significantly improve the explanatory power of the models. Our results indicate that preferences affect farmers' participation constraints and argue that a diversification of contract offers might increase the willingness of farmers to participate in contract farming. This has implications for companies who aim at developing stable long-term relationships with farmers.

JEL Codes: O13, Q12, Q13

Keywords: lab in the field experiment; discrete choice experiment; contract choice; preferences; contract farming

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Financial support of the German Research Foundation (DFG) through the GlobalFood research training group is gratefully acknowledged. For helpful comments we thank Yasemin Boztug, Ossama Elshiewy, Eva Meemken, Emmanuel Peterle and David Wüpper.

1 Introduction

Contract farming has strongly gained in importance in developing countries in the last decades. Major reasons for this development are the modernization of agri-food chains and the evolvement of private food standards, which require tight levels of coordination in order to secure quality and production requirements as well as supply chain efficiency (Reardon and Barrett 2000; Henson and Reardon 2005). This trend goes along with a shift from traditional spot-market transactions to coordinated buyer-supplier interactions, which are characterized by oral or written agreements that predefine production requirements or transaction characteristics. Vertical coordination in the form of contract farming can have positive welfare effects for farmers by increasing market access, reducing market failures by providing production inputs, and increasing incomes of smallholders and hence leading to pro-poor growth (Glover and Kusterer 1990; Kirsten and Sartorius 2002; da Silva 2005; Barrett et al. 2012; Bellemare 2012; Prowse 2012; Wang, Wang, and Delgado 2014; Otsuka, Nakano, and Takahashi 2016; Gatto et al. 2017; Maertens and Vande Velde 2017). Development policies are therefore promoting the integration of farmers into global value chains via contract farming.

Although it has been found that contract farming can potentially increase welfare of smallholder farmers, there is evidence for high dropout rates in contract farming schemes in developing countries (Barrett et al. 2012; Wang, Wang, and Delgado 2014). One particular reason for this instability of contract relationships is contract breach. Since formal institutions to enforce contracts are oftentimes absent in developing countries, contracts often remain loose non-binding agreements. Moreover, as a result of the stochastic nature of farming, moral hazard problems arise, which promotes side-selling of products, diverting provided inputs to other crops, or non-compliance with production requirements (Key and Runsten 1999; Barrett et al. 2012). In a contract farming experiment Kunte, Wollni, and Keser (2017) show that individuals engage in contract breach, if short-term benefits can be gained. However, contract breach is reduced when individuals interact repeatedly. The key to reaching contract compliance is therefore to design contracts that involve considerable incentives for both parties in order to maintain the relationship and not to jeopardize future transactions by opportunistic behavior (Klein 1996; Gow, Streeter, and Swinnen 2000; Barrett et al. 2012). Designing contracts that consider the preferences of farmers is hence an important tool for development policies that aim at creating stable farmer-buyer relationships and fostering the participation of farmers in global value chains.

A growing body of literature analyzes farmers' preferences for contract designs, market characteristics or characteristics of transaction partners. General findings from these studies are that elements, which reduce transaction costs, mitigate risks, and avoid behavioral uncertainties, can increase the probability of choosing a specific contract or market outlet (Blandon, Henson, and Islam 2009; Schipmann and Qaim 2011; Abebe et al. 2013; Gelaw, Speelman, and Van Huylenbroeck 2016; Ochieng, Veettil, and Qaim 2017).

Personal relationships also seem to play an important role for farmers' marketing choices (Schipmann and Qaim 2011; Gelaw, Speelman, and Van Huylenbroeck 2016). Many of the above mentioned studies find considerable heterogeneity in farmers' preferences for certain contract characteristics. This heterogeneity has mostly been explained by observable characteristics like socio-demographics, empowerment status (van den Broeck, van Hoyweghen, and Maertens 2016), infrastructure, farm-size or actual contract or market experiences (Blandon, Henson, and Islam 2009; Schipmann and Qaim 2011; Abebe et al. 2013; Gelaw, Speelman, and Van Huylenbroeck 2016; Ochieng, Veettil, and Qaim 2017).

Although most of the authors of choice experimental studies on contract and market choice are discussing behavioral preferences (frequently mentioned are risk aversion and trust) as important factors that explain average preferences for choice characteristics, their role in explaining preference heterogeneity has mostly not been tested. For example Schipmann and Qaim (2011) find that the personal relationship to a buyer plays a major role in farmers' market channel choices among sweet pepper producers in Thailand, which might be due to trust preferences. Abebe et al. (2013) assume that farmers are risk averse and therefore choose contracts that mitigate production and market uncertainties. Ochieng, Veettil, and Qaim (2017) argue that delayed payment increases the "subjectively felt risk of contract partners defaulting". Furthermore they find that farmers' dislike of payment modes in supermarket contracts that are based on the amount sold to the end-consumer rather than the amount delivered to the supermarket is stronger without physical verification by the farmer. The authors argue that this may also be a trust issue. Since there is evidence that behavioral preferences, like trust, risk and time preferences play a role for participation in contracts (e.g. Zaheer and Venkatraman (1995); Zheng, Vukina, and Shin (2008); Clot and Stanton (2014)), it is reasonable to expect that these behavioral preferences may affect the preferences for particular characteristics of a contract.

We hypothesize that risk preferences, trust and time preferences play a considerable role in explaining heterogeneity in contract preferences and affect the relative importance of contract attributes. Firstly, individual risk preferences might influence how farmers evaluate the riskiness of a contract. How risky it is for a farmer to engage in a contract, depends first and foremost on production risks. Production risks may increase if contracts require the production of more risky varieties. The riskiness of a contract also depends on how production risk is distributed between seller and buyer (e.g. Hobbs and Young 2000). A relaxation of quality requirements can mitigate the economic consequences of production risks by creating a form of risk-sharing. Risk preferences may influence how farmers assess the relative importance of risk-sharing elements in a contract. For example, risk-averse farmers are likely to prefer contracts with lower quality requirements, if production is risky. Secondly, trust may play an important role for contract preferences. Houser, Schunk, and Winter (2010) show that people behave differently under exogenous risk compared to analogous situations in which risk stems from the possibility of being betrayed. Elements of a contract that increase behavioral uncertainty, like delayed payment or nontransparent quality controls, may be evaluated less negatively by farmers who have high trust levels compared to farmers with low trust levels. Whether farmers prefer contracts that are made

before the cultivation process or rather contracts that are made immediately before harvest might also depend on their trust levels. Commitments of this kind involve the risk that buyers finally do not show up to buy the products. Lastly, time preferences may play a role in how farmers evaluate the timing of agreement making and the timing of payment. Disentangling these different motivational drivers can give interesting insights on how to design contracts.

To our knowledge there is only one study that explicitly tests the effect of behavioral preferences for the relative importance of contract characteristics in a discrete choice experiment: Vassalos et al. (2015) analyze the effect of risk-aversion on contract choice among US tomato growers. They do not find any effect of risk preferences on contract choice. This may be due to the fact that they are using a very small sample size and measure risk only with stated preference measures, i.e. a multiple pricing list task (Binswanger 1980, 1981) and likert scale questions.

We add to the literature on preferences for contract designs by explicitly testing to what extent individual trust, risk and time preferences, measured with monetary incentivized lab experiments, can explain heterogeneity in preferences for contract attributes. We aim at filling this research gap by conducting experiments with 494 Ghanaian pineapple farmers. We measure farmers' risk aversion, trust and time preferences with canonical lab experiments and relate the results to farmers' contract choices in a discrete choice experiment. Our study contributes to the literature in the following ways: Firstly, we can add to the discussion on how contracts should be designed in order to meet farmers' preferences. Secondly, we are going beyond existing findings of simply stressing preferences for contract characteristics but are examining how those are affected by inherent trust, risk and time preferences and disentangle these motivational drivers. Thirdly, we are contributing to the body of literature that links experimental measures of preferences to economic outcomes. Fourthly, we are analyzing the economic relevance of trust, risk and time preferences by analyzing their effects on the willingness to pay for certain contract characteristics.

The article proceeds as follows: Section 2 gives some background information on the Ghanaian Pineapple Sector. Section 3 gives an overview of the methods and data used. Section 4 shows descriptive and estimation results. We conclude by discussing the implications of our results in Section 5.

2 Vertical coordination in the Ghanaian pineapple sector

The Ghanaian pineapple sector has a long history of vertical coordination between smallholder farmers and exporting and processing companies. While at the end of the 1990s and early 2000s smallholders were mostly involved in fresh exports, access to the export market for smallholders is now mostly gained via processing companies. At the

peak of the Ghanaian fresh pineapple exports in 2004 it is estimated that smallholders contributed about 50 percent of the exported produce through outgrower schemes with exporting firms (Gatune et al. 2013). Between 2001 and 2004 on average 50 exporting companies were present in Ghana (Gatune et al. 2013). Many of these companies did not produce themselves but maintained relationships with smallholders and relied on their supply. The pineapples were mostly packed directly on the field, since companies did not own pack houses. Farmers and companies usually had only loose agreements, but vertical coordination in the form of input provision or involvement in the de-greening and harvesting processes by the buyers were common. Farmers received payments after a minimum of 6 weeks for sea-freighted exports (with initial down-payments), or immediately after harvest and validation of weight (with minimal delay) for air-freighted exports.

In the last decade, the sector has scaled down due to changes in the international market. A new pineapple variety called MD2, which is characterized by longer shelf-life, has started to dominate the global market and has mostly replaced the variety Smooth Cayenne in western supermarkets. The adoption of the new variety has been a major challenge for pineapple producers and many smallholders and exporting companies dropped out of the market. At the same time, quality standards increased due to the requirement of GlobalGAP certification. These global changes have led to structural changes in the Ghanaian pineapple sector. The share of smallholders producing pineapples for fresh exports has diminished strongly in favor of large plantations (Gatune et al. 2013).

Despite the challenges the pineapple sector was facing after the sudden drop in global demands for Ghana's pineapples, pineapple is still an important export crop for the Ghanaian economy. Development programs were successful in helping some farmers to adopt the new variety MD2 and keep aiming at establishing long-term business relationships between farmers and exporting and processing companies. Farmers also receive training and information about export requirements and contract farming from development programs.

Those farmers who remained in the export market either produce for processing firms or in small quantities for fresh exporting companies. However, the majority of farmers have switched to producing exclusively for the local fresh market, selling their pineapples to market women who supply end-consumers. A small fraction of farmers also sells their pineapples to local juice producers, but their prices are not competitive in comparison to exporting companies. Apart from fresh export companies who maintain outgrower schemes with some farmers, there are four major processing companies present who export pineapple fresh cut, pineapple juice, dried pineapple, fruit bars, and pineapple concentrates to the European market. Since farmers are reluctant to sell their produce to companies and land scarcity limits vertical integration, those companies are currently competing for supply.

Forms of vertical coordination are still available in both export and local market but tend to be more formal and frequent in the export market. There are also differences in contract characteristics between companies. Contracts can either be written or verbal and are often characterized by the provision of inputs, credit and production advises. While some companies are negotiating prices beforehand, prices are mostly not predefined but depend on the current market situation. Contracts mostly do not include agreements on predefined quantities either. However farmers are informed about the necessary quality and production requirements. Contracts are made either prior to the production cycle or within the production cycle before forcing or before harvesting.

Despite the competitive prices of export companies and available trainings for producing for the export market, some farmers are reluctant to sell products to the export market. One reason relates to the risk involved. Since quality standards are high, inferior quality is frequently rejected by companies. At the same time, marketing the export varieties in the local market is difficult, since Ghanaian consumers prefer the local variety Sugarloaf. Companies may also arbitrarily reject products, if demands from import countries drop (Suzuki, Jarvis, and Sexton 2011). In particular, after the demand shift in the international market towards MD2 pineapple, contract breaches and high rejection rates were common in the Ghanaian pineapple sector. Many farmers who had sold their pineapple on credit did not receive their payments (Barrett et al. 2012). As a result, farmers' trust in exporting companies has been deteriorated. These experiences are likely to affect farmers' market channel choices and new contract designs are critical in order to reintegrate small-scale farmers in the global market.

3 Methods

3.1 Sample

We collected data from 494 pineapple farmers in Ghana following a multi-stage sampling strategy. First we identified the major pineapple producing regions in Ghana with help of the ministry of agriculture. We obtained lists of communities where pineapple farming is prevalent for each of the selected regions. From this community list we randomly selected communities according to the relative number of pineapple producing communities in this region. In each selected village all pineapple farmers were invited through the village head and lead farmers to participate in our behavioral experiments.[1] Table 1 gives an overview of the number of interviewed farmers and villages in each region. The data collection took place from November to December 2015 in the form of individual face-to-face sessions consisting of a Discrete Choice Experiment, experimental games to elicit behavioral

[1] As is common in behavioral experiments, participation was based on self-selection, which limits the external validity of our results.

preferences and a survey on attitudinal, household and farm-level data. On the average, each individual session took about 1.5 hours.

Table 1 Overview of sample areas

Pineapple growing area	Number of communities	Number of Farmers	Percentage
Awutu Senya and Gomoa East	8	117	0,24
Ga-West	7	128	0,26
Akwapim South	7	149	0,30
Cape Coast Area (Mfantseman and Elmina)	5	100	0,20
Total	**27**	**494**	**1**

3.2 Behavioral preferences

We measured trust, risk and time preferences using monetary incentivized experiments. The farmers were payed via mobile money the following day and/or four weeks after the survey, depending on their decisions. The order of the experiments was held constant, starting with a risk elicitation task, followed by the time preference measure and finally the trust measure.

We measured trust using a modified version of the standard investment game (Berg, Dickhaut, and McCabe 1995). In the traditional trust game senders have an initial endowment and are asked to send any amount to another person, the receiver. The amount sent is tripled by the experimenter. The receiver is then asked to decide how much to send back to the sender. We modified the game in the following ways: The receivers were randomly chosen people on the streets in a village in Ghana who made their decision using the strategy method. However, the decision was not conditional on the amount sent. In order to keep it simple the second movers only had one decision to make: Whether they would keep the money if a stranger sent something to them, or whether they would send back half. The receivers knew that they would later on be matched randomly with a participant of our main study who would decide whether to send money to them. In total we collected 20 decisions. During the main survey farmers were virtually endowed with 10 Ghana Cedi and could decide to send an amount between 0 and 10 to the receiver, which would be tripled. The farmers received the information that they play the game with a stranger of Ghana who had been interviewed in October 2015. The enumerators never knew the decision themselves before the farmer had made her choice and therefore could

not influence them in any way.[2] From the choices of the farmers we generate a variable θ_i, which takes values from 0 to 10, corresponding to the amount sent to the stranger. We use theta as a continuous variable that reflects trust in the empirical models.

The risk preferences were measured using the Eckel-Grossmann risk elicitation method (Eckel and Grossman 2002; Dave et al. 2010). This is a rather simple method that has been found to be superior to the more complicated Holt and Laury method (2002), if subjects have low mathematical skills, and can give more stable results over time (Dave et al. 2010). Subjects can choose one out of six lotteries, with different standard deviation and expected payoffs. The lotteries were presented as bags that contain two balls with different amounts of money inside.[3] An overview of the lotteries is illustrated in Table 2. From the lottery choice, risk preferences can be derived. People who choose lotteries 1-4 are classified as risk-averse. Risk-neutral subjects are predicted to choose lottery 5 or 6, while risk-seeking subjects are predicted to choose lottery 6. We are going to use dummy variables for these three risk preference categories in the subsequent analysis[4].

Table 2 Description of lotteries in risk elicitation taks (Payoffs in Ghana Cedi)

Choice (50/50 Gamble)	Low payoff	High payoff	Expected return	Standard deviation
Gamble 1	14	14	14	0
Gamble 2	12	18	15	3
Gamble 3	10	22	16	6
Gamble 4	8	26	17	9
Gamble 5	6	30	18	12
Gamble 6	1	35	18	17

In order to measure time preferences we decided to use a simple money allocation task similar to a task developed by Angerer et al. (2015). Subjects have an endowment of 10 Ghana Cedi.[5] They can allocate the money between two dates in time – tomorrow and four weeks later. The money that is allocated to the later date is multiplied by a factor of 1.5. The amount invested in the future is a simple measure of farmers' future-orientation and patience, without explicitly eliciting discount factors.[6] Since both points in time lie in the future, we rule out that the decision is affected by trust. Experimental measures of time preferences basically allow choosing between different income streams, not consumption streams. This makes the use of time preferences experiments difficult for the induction of

[2] After we finished the main survey all receivers were paid out according to one randomly selected decision of a sender. The payments were done using mobile money.

[3] We did not put real money in the bags, but vouchers with printed bills and written amounts in order to visualize the payoffs. The real payoffs were transferred via mobile money.

[4] Subjects who are choosing lottery 5 are classified as risk-neutral, while subjects who choose lottery 6 are classified as risk-seeking in our experiment.

[5] Note that Angerer et al. (2015) are using tokens that can be exchanged in non-monetary items in a gift store instead of money.

[6] The elicitation of discount factors involves complicated lottery choices that are cognitively demanding. Since we are only interested in having a simple measure for time preferences, we decided to use a task that is less cognitively demanding and therefore minimizes respondent fatigue.

intertemporal consumption preferences (Cubitt and Read 2007). However, our aim is not to make predictions about consumption preferences, but about preferences on the timing of payments in contracts, which represents an income stream. We generate a continuous variable δ_i, which takes values from 0 to 10, reflecting the amount of money a farmer has invested into the future. We refer to this variable as future-orientation throughout the article.

Detailed experimental instructions for the three experiments can be found in the Appendix.

3.3 Choice experiment

Design

Discrete Choice Experiments have been used in many domains to measure preferences for choice alternatives, for example to derive farmers' preferences for contract and market channel characteristics (Blandon, Henson, and Islam 2009; Schipmann and Qaim 2011; Abebe et al. 2013; Vassalos et al. 2015; Gelaw, Speelman, and Van Huylenbroeck 2016; Ochieng, Veettil, and Qaim 2017).

To gain a qualitative understanding of how behavioral preferences might affect the evaluation of contract characteristics among Ghanaian farmers, we conducted focus group discussions. These discussions helped us to assess the relevance of certain contract characteristics for farmers and decide how to design the attributes and which levels to include in the Discrete Choice Experiment. Based on farmers' qualitative statements, we selected five attributes and let them differ systematically in their levels: The unit price a farmer gets for Grade A products, the timing of making the agreement, the quality requirements (i.e. whether Grade B can be sold to the buyer), the transparency of the quality control (i.e. whether products can be rejected at the company level), and the timing of payments (see Table 3). Since there is no standardized classification system across companies we introduce two pineapple qualities, Grade A and Grade B, in the Discrete Choice Experiment. We define Grade A pineapples as high quality pineapples with larger sizes and free of sunburn and spots. Grade B pineapples are defined as pineapples with a maximum size of 1kg and being affected by sunburn, but still suitable for human consumption. This definition allows us to make sure that farmers have a common understanding of quality differences.

Table 3 Overview of contract attributes

Level	Contract Attributes				
	Price for Grade A	**Timing of agreement**	**Quality requirements**	**Transparency of quality control**	**Timing of payment**
1	50 p	Agreement before planting	Grade B can be sold to same buyer for 35 p/kg	Rejection only at farm possible	Immediately after purchase
2	60 p	Agreement before harvest	Grade B cannot be sold to same buyer	Rejection at farm and company/ pack house possible	Four weeks after purchase
3	70 p				
4	80 p				

(1) The price attribute can take the levels 50, 60, 70 or 80 pesowas per kg. The price range represents farmers' actual market prices and was identified in the focus group discussions.

(2) The timing of agreement classifies whether the transaction involves a commitment of both contract partners, before the product is actually produced, or whether the contract parties are only agreeing on the purchase once the products are about to be harvested.

(3) The quality requirements attribute has two levels: whether or not Grade B products can be sold to the same buyer for a price of 35 pesowas per kg[7]. As discussed earlier, quality requirements are an important aspect of the riskiness of a contract. The characterization of the export and local markets in the Ghanaian pineapple sector shows that riskiness stems mostly from the fact that modern pineapple varieties are more difficult to cultivate and that lower quality products are not accepted in the export market and achieve lower prices when sold in the local market compared to traditional pineapple varieties. Depending on whether minor quality is accepted or not, a contract therefore turns out to be more or less risky.

(4) The location of product classification is included as an attribute reflecting transparency. The focus group discussions revealed that farmers are especially concerned about companies arbitrarily rejecting good quality products. Therefore the levels of the attribute are whether rejections are only possible at the field or also at a location where the farmer has no access to (i.e. company or pack house).

[7] This price was identified in focus group discussions as to cover average production costs of the product.

(5) The timing of payment was identified as important source of strategic risk and was included as either immediate payment or payment four weeks after purchase. We define payments as "immediate" if the payment occurs within a maximum of 2 days after the purchase. This was done to rule out unrealistic attribute combinations (i.e. immediate payment and rejections at the company).

Table 4 summarizes the expected preferences of farmers towards contract attributes and the expected relationships between behavioral preferences and contract preferences.

Table 4 Expected contract preferences and relationship with behavioral preferences

	Contract Attribute			
	Grade B accepted	Transparency	Agreement before cultivation	Immediate payment
Expected sign of preference coefficient	+	+	?	+
Expected influence of:				
Trust		-	+	-
Risk aversion	+			
Future-orientation			-	-

We expect that farmers have positive preferences for risk-sharing. Since a relaxation of quality requirements can be regarded as a form of risk-sharing, we expect that the possibility to sell Grade B products is more important the more risk averse a farmer is. Further we expect that farmers prefer contracts that only allow for rejections directly at the field, rather than at a location where the classification is not transparent. However, we expect that for farmers with high trust levels, transparency is relatively less important. Generally we also expect positive preferences of farmers towards immediate payment, compared to payments four weeks after the purchase. Since delayed payment requires patience, we expect that the relative importance of immediate payment is smaller the higher the farmers' future-orientation. At the same time delayed payment is a source of behavioral uncertainty and requires trust. We expect that farmers with high trust put less relative importance on immediate payment compared to farmers with low trust levels. For the timing of agreement making, we do not have a particular hypothesis to whether farmers have generally positive or negative preferences towards it. An early agreement may reduce the flexibility of the contract partners. On the other hand, the commitment may reduce market uncertainty for the farmer by providing security of having a buyer. However, if farmers are averse to betrayal, the fear of the buyer not showing up to buy the products might lead to a negative attitude towards early agreements. Therefore, we expect that trust increases the preference for agreements before cultivation. Farmers with high future-orientation on the other hand may be more likely to prefer flexibility in choosing the best contract partner once the products are cultivated. Therefore we expect a negative relationship between future-orientation and the preferences for agreements before cultivation.

The full factorial design of the Discrete Choice Experiment consists of 64 choice profiles, from which we created an orthogonal design with 16 runs using the statistical program R. The design was blocked into two blocks, resulting in eight choices with two alternatives for each farmer.[8] The alternatives were framed as market channels that involve the production of the pineapple variety MD2, which is dominating the global market.[9] In order to make sure that respondent fatigue has no systematic effects on our results, we created four different versions of every block, in which we changed the order of the eight choice tasks. An example for a choice card can be found in the Appendix.

Empirical strategy

Since we assume that farmers have individual preferences for contract characteristics and maximize their utility through their marketing choices, we consider a random utility model. We use a random parameter logit model, also called mixed logit model, which extends the standard conditional logit model (McFadden 1974). The mixed logit model can account for unobservable preference heterogeneity among respondents, by allowing coefficients in the model to vary across decision makers. Another benefit of the model is that it does not assume independence of irrelevant alternatives.

Based on the random utility model, the utility a decision maker i derives from alternative j in choice situation k is given by

$$U_{ijk} = V_{ijk} + \varepsilon_{ijk} ,$$

where V_{ijk} is a linear function of observable attributes of the alternatives and characteristics of the decision maker, x'_{ijk}, and parameters β_i, and ε_{ijk} is a random error term.

The mixed logit choice probability of choosing alternative j in a choice situation k is given by

$$P(Y_{ijk} = 1) = \int \frac{\exp(x'_{ijk}\beta)}{\sum_{j=1}^{J} \exp(x'_{ijk}\beta)} f(\beta)\, d\beta ,$$

Where $x'_{ijk}\beta = V_{ijk}$ and Y_{ijk} is the choice variable of individual i for alternative j in choice situation k. The variable takes the value 1 if the alternative is chosen, and 0 if it is not

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[8] For each choice set the farmer had the possibility to choose a "neither option" in the first step in order to express his preferences for the status quo. In case the "neither option" was chosen we asked the farmer in a second step to choose out of the two alternatives given. Since we are mostly interested in how farmers trade off individual contract characteristics and to avoid status quo biases, we use the farmer's second choice as dependent variable in our analyses.

[9] In order to make the choice alternatives attractive to the farmers we presented training as given for both alternatives. Abebe et al. (2013) find that training is an important factor for farmers to choose contracts. Also, training for MD2 production is widely available to farmers in Ghana.

chosen. $f(\beta)$ is the density function for the random parameters β (Train 2003). We assume a normal mixing distribution.

We model the price coefficient as fixed, since we assume homogenous preferences of farmers for high prices. This is a common approach in similar studies (e.g. Schipmann and Qaim (2011), Ochieng, Veettil, and Qaim (2017)).

We apply different specifications of V_{ijk}: With model (1) we are analyzing the relative importance of different contract characteristics for farmers' contract choices:

(1) $V_{ijk} = \beta_i X_{jk} + e_{ijk}$

The first model consists of a vector of coefficients, β_i, and a vector of contract characteristics for alternative j in choice situation k, X_{jk}, which include the product price (PR), the timing of agreement (AG), the level of risk-sharing (RS), the location of quality controls (CO) and the timing of payment (PA). e_{ijk} represents the random error term.

Models (2)-(4) include interaction terms between contract attributes and behavioral preferences according to our hypotheses. The aim is to analyze to what extent trust, risk and time preferences determine preferences for contract characteristics. As described previously, θ_i and δ_i are continuous variables measuring trust and future-orientation, respectively. Furthermore, r_i^s is a dummy for risk seeking and r_i^n is a dummy for risk neutrality. With model (2) we test the effect of trust on the preferences towards transparency of quality classification, timing of payment and timing of agreement making. The effects of risk preferences on the preference towards quality requirements are tested with model (3). Finally, model (4) tests the effects of future-orientation on farmers' preferences for the timing of payments and the timing of making agreements.

$$(2)\ V_{ijk} = \beta_1 PR_{jk} + \beta_{2i} AG_{jk} + \beta_{3i} RS_{jk} + \beta_{4i} CO_{jk} + \beta_{5i} PA_{jk} + \gamma_1(AG_{jk} \times \theta_i) + \gamma_2(CO_{jk} \times \theta_i) + \gamma_3(PA_{jk} \times \theta_i) + e_{ijk}$$

$$(3)\ V_{ijk} = \beta_1 PR_{jk} + \beta_{2i} AG_{jk} + \beta_{3i} RS_{jk} + \beta_{4i} CO_{jk} + \beta_{5i} PA_{jk} + \gamma_1(RS_{jk} \times r_i^s) + \gamma_2(RS_{jk} \times r_i^n) + e_{ijk}$$

$$(4)\ V_{ijk} = \beta_1 PR_{jk} + \beta_{2i} AG_{jk} + \beta_{3i} RS_{jk} + \beta_{4i} CO_{jk} + \beta_{5i} PA_{jk} + \gamma_1(AG_{jk} \times \delta_i) + \gamma_2(PA_{jk} \times \delta_i) + e_{ijk}$$

The models are estimated by maximum simulated likelihood using 500 Halton draws (Hole 2007a)[10]. We estimate uncorrelated coefficients in preference space using dummy coding following Hensher, Rose, and Greene (2005).

In order to examine the economic significance of the interactions between behavioral preferences and contract characteristics, we calculate the willingness to pay (WTP) for the individual attributes m and the interaction terms. The average WTP is obtained by dividing the mean of the preference coefficient for attribute m, β^m, by the negative price coefficient, β^{price}:

(6) $E(WTP^m) = -\frac{E(\beta^m)}{\beta^{price}}$

We calculate the WTP for each attribute and its confidence intervals using the user-written Stata command "*wtp*". Confidence intervals are derived with the delta method (see Hole, 2007b).

Depending on individual behavioral preferences, we aim to identify different market segments. Therefore we use a latent class conditional logit model. The latent class conditional logit model estimates simultaneously preference coefficients for different classes and the probability of an individual to belong to a class based on choice patterns and individual covariates. While the mixed logit model accounts for preference heterogeneity by estimating individual taste coefficients for every decision maker, the latent class model identifies unobserved segments of individuals with homogenous preferences[11]. The former approach has an advantage for analyzing correlations between preference coefficients and particular covariates, while the latter has an advantage for making statements about market shares and deriving policy implications.

The choice probability of choosing alternative j from a number of J alternatives in a choice situation t depending on membership in class q is given by

$$P_{ijk}|q = \frac{\exp(x'_{ijk}\beta_q)}{\sum_{j=1}^{J}\exp(x'_{ijk}\beta_q)}.$$

We re-estimate model (1) with a latent class approach, including covariates for trust, risk and time preferences into the membership likelihood function[12]. The model is estimated using an Expectation-Maximization (EM)-Algorithm (Train 2008).

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[10] We use the mixlogit package in STATA.

[11] This means that the mixing distribution is discrete.

[12] See Greene and Hensher (2008) for a technical overview of and comparison between the latent class approach and the mixed logit approach.

4 Results

4.1 Descriptive statistics

Socio-economic characteristics of the sample

Table 5 gives an overview of the socio-demographic characteristics of the farmers included in our sample. The majority of farmers are male, with a fraction of only 9.5 percent of farmers being female. On average, farmers are 45 years old, went to school for 10 years, and live in households with seven persons. Their pineapple farms have an average size of 3.5 acres and are located on average 33 km from the next company that buys pineapples from smallholders. 54 percent of farmers in our sample are members in farmer-based organizations (FBO). For 75 percent of farmers pineapple farming constitutes the major income source. 21.5 percent of farmers produce other crops apart from pineapples for sale, mostly cassava, maize, and yam, and 39 percent of farmers have additional income sources, either off-farm income or animal farming. Overall, 39 percent of farmers in our sample sell pineapples to the export market.

Table 5 Overview of farmer characteristics of sample

Variable	mean	sd	median	min	max
Female (%)	9.51				
Age	45.09	11.73	45	21	82
Number of school years	9.93	4.08	11	0	20
Pineapple major income source (%)	74.90				
Other crops for sale (%)	21.46				
Other income sources (%)	38.66				
Distance to next company in KM	22.40	30.17	7.76	0.9	155.9
Size of pineapple farm (acres)	3.53	6.49	2	0.3	100
Household Size	6.90	3.41	6	1	31
Member in FBO (%)	53.85				
Selling to export market (%)	39.07				
Observations	494				

Characteristics of market transactions

Table 6 illustrates the transaction and contract characteristics that farmers in our sample face in the pineapple sector. As illustrated before, pineapple farmers in Ghana sell their products either to exporting companies or to the local market. There are no unique transaction characteristics associated with a particular market channel. Nevertheless, we can find significant differences in the frequency with which certain characteristics occur. The data is based on the description of transaction characteristics in the farmers' actual

market channel. In case, a farmer sells in both channels, information was elicited for the preferred market channel[13].

The quality classifications Grade A and Grade B refer to the predefined quality criteria that are described in section 1.3.3. After having explained the two quality grades to the farmers, they were asked to report the prices they get for a pineapple with these characteristics in their preferred market channel. Average prices for Grade A pineapples are significantly higher in the export market than in the local market, for all pineapple varieties. While there are no significant price differences between pineapple varieties in the export market, in the local market prices for the traditional pineapple variety Sugarloaf are significantly higher than for the MD2 variety. This reflects consumer preferences in Ghana, since Sugarloaf pineapples are preferred over the modern variety. This also illustrates the marketing risk involved in producing MD2. If MD2 producers are not able to market their pineapples via the export industry and have to switch to the local market, they face considerable opportunity costs[14]. The same is true for lower quality products: Although for all varieties Grade B products obtain generally higher prices in the export market compared to the local market, MD2 and Smooth Cayenne reach significantly lower prices in the local market than Sugarloaf. Thus, opportunity costs in case MD2 or Smooth Cayenne pineapples are rejected in the export market are particularly high. Only 62 percent of the farmers can sell their Grade B pineapples in the export market (compared to 98 percent of farmers in the local market[15]. This means that 38 percent of farmers in the export market need to search for an alternative buyer in the local market instead, which is associated with high transaction costs. Further risk arises, since the probability to produce minor quality is higher for MD2 pineapples due to disease susceptibility.

In the export market agreements on the purchase of the produce are significantly more often made already before the actual cultivation starts compared to the local market. 95 percent of farmers in the local market indicate that product rejections are only possible at the farm, which reflects high transparency of quality control, while this is the case for only 51 percent of farmers in the export market. Immediate payment is the dominant payment mode in the local market. On average farmers receive their payments 4 days after the sale, while in the export market farmers receive payments on average 18 days after the sale. About half of the farmers, whose preferred market channel is export, produce the pineapple variety MD2, which dominates the international market. In the local market the share is around 7 percent. Contracts tend to be more formal in the export sector, where 74 percent of farmers claim to have a written contract. In comparison, only 10 percent of farmers in the local market have written contracts with their buyers.

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[13] Twenty-one farmers who sell both to the local and to the export market declared local market as their preferred channel.

[14] A solution to circumvent this marketing risk would be to produce only Sugarloaf pineapples for the export market but the demand is limited.

[15] 92% sell Grade B to the same buyer as to whom they sell Grade A, while 6% sell it to an alternative buyer, but still in the local market.

Table 6 Transaction characteristics in different markets

	(1) Local Market		(2) Export Market		
Market Characteristics	mean	sd	mean	sd	Significance
Price for Grade A per kg	60.51[a]	22.29	77.77[b]	26.05	p < 0.001
MD2	46.36	17.96	74.67	26.08	p < 0.001
Smooth Cayenne	53.81	18.02	78.99	21.82	p < 0.001
Sugarloaf	61.93	22.40	83.89	30.92	p < 0.001
Price for Grade B per kg[c]	44.54[d]	19.53	55.62	23.20	p < 0.001
MD2	35.45	13.44	51.78	15.73	p <0.001
From other buyer			37.58	10.91	
Smooth Cayenne	36.43	17.81	53.59	22.37	p= 0.015
From other buyer			34.74	11.11	
Sugarloaf	45.66	19.78	69.25	38.54	p < 0.001
From other buyer			48.57	21.79	
Grade B sold in channel	98.14 %		61.63%		p < 0.001
Agreement before cultivation	6.21%		20.35%		p < 0.001
Agreement before harvest	74.84%		73.84%		p = 0.807
Sale on spot	18.94%		5.81%		p < 0.001
Rejection only at field	95.33%		51.16%		p < 0.001
Payment (days after purchase)	3.99	8.36	17.56	11.75	p<0.001
Written Contract	9.97 %		73.84 %		
Observations	322		172		
MD2	22 (6.83%)		87 (50.58%)		p < 0.001
Smooth Cayenne	14 (4.35%)		51 (29.65%)		p < 0.001
Sugarloaf	286 (88.82%)		34 (19.77%)		p < 0.001

Notes: Significance has been tested using two-sided t-tests for continuous variables and Pearson's chi-squared test for categorical variables. Prices are displayed in pesowas.

[a]Statistically significant differences in prices for Sugarloaf versus MD2 variety (t-test, p= 0.0017)

[b]No statistically significant difference between the different varieties

[c]This is the average price received by farmers within the particular market channel. It does not take into account prices that farmers might obtain in alternative market channels.

[d]Statistically significant difference between MD2 and Sugarloaf (t-test, p=0.0182) and Smooth Cayenne and Sugarloaf (t-test, p=0.0881)

Preferences

Figures 1-3 and Table 7 display descriptive statistics of the behavioral preference measures used. Figure 2 shows the shares of chosen lotteries in the risk elicitation task. We find that in our sample 21 percent of farmers are choosing lottery 6, while 16 percent are choosing lottery 5 and 63 percent are choosing lottery 1-4. As explained earlier we classify farmers who choose lottery 6 as risk-seeking, those who choose lottery 5 as risk-neutral and those who choose lottery 1-4 as risk-averse. Dave et al. (2010) find in their study that 77.9 percent are risk-averse, while 11.7 percent are choosing lottery 5 and only 10.7 percent are choosing lottery 6. The rather high share of risk-seeking individuals in our sample probably can be explained by the fact that our participants are farmers and not students. For example, Maart-Noelck and Musshoff (2014) find that German farmers are less risk-averse than German students. This is also consistent with the finding that self-employed individuals are less risk-averse than workers (Masclet et al. 2009). Since pineapple farming is a particularly risky business, it is possible that we are dealing with a relatively risk-seeking population. As was found by Suzuki (2016), farmers with higher risk aversion were more likely to exit the pineapple market after the global demand-shifts. It should also be mentioned that the high percentage of male individuals in our sample might further explain the higher share of risk-seeking individuals compared to Dave et al. (2010), since men tend to be less risk-averse than women (Eckel and Grossman 2002).

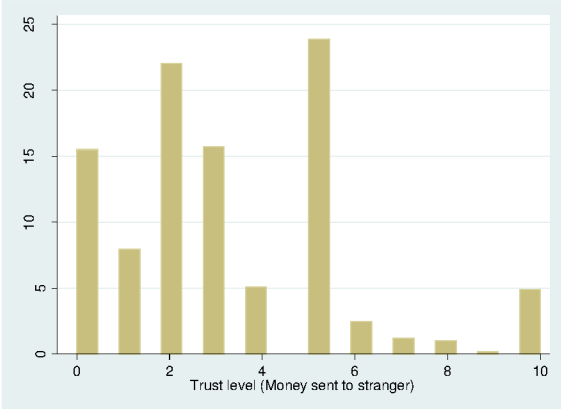

Figure 1 Overview of money invested in trust game

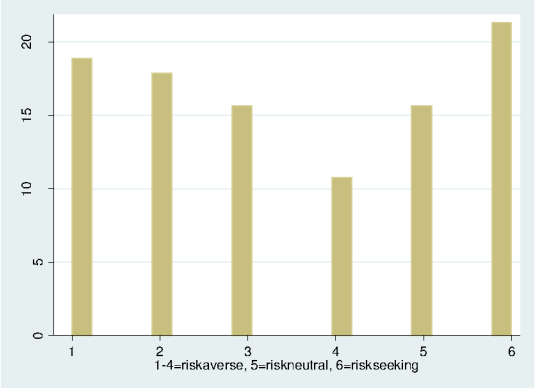

Figure 2 Overview of Lotteries chosen in risk game

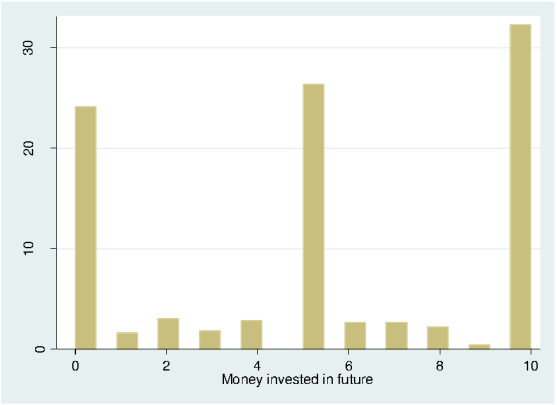

Figure 3 Overview of money invested in time experiment

Table 7 Summary Statistics on Behavioral Preferences

	mean	sd
Trust level (Money sent to stranger)	3.21	2.46
Money invested in future	5.35	3.88
Risk-averse	0.63	
Risk-neutral	0.16	
Risk-seeking	0.21	

The average amount sent by farmers in the trust game lies at 3.21 GHS, which is equal to 32 percent of the initial endowment. This amount is lower than what has been found in the standard game, where usually a fraction of around 50 percent of the endowment is sent to the second player (Berg, Dickhaut, and McCabe 1995). However, according to previous studies, amounts sent in Africa are typically significantly lower than in North America, which may explain our results. Furthermore, it has been found that changes in the experimental protocol can significantly change amounts sent (Johnson and Mislin 2011). The fact that we use second movers that have been interviewed at different points in time and in different locations might have affected the results. It can also be seen from Figure 1 that only a small percentage of individuals sent more than 5 GHS.

Figure 3 shows a trimodal distribution of the time preference measure with peaks at 0, 5 and 10 GHS invested into the future. The peaks at 0 and 10 are consistent with findings in more complex time preference measures, in which the choice of corner solutions is frequently observed (Andreoni and Sprenger 2012; Andreoni, Kuhn, and Sprenger 2015).

4.1.1 Estimation results

Mixed Logit Results

The estimation results displayed in Table 8 show farmers' preferences for contract characteristics. We first examine the general contract preferences without covariates, displayed in column (1). As indicated by the positive coefficient signs, we find that farmers prefer transparent quality controls, immediate payments and low quality criteria – contract characteristics that are less often associated with high value chains. This is consistent with the findings of other studies (Abebe et al. 2013, 2013; Blandon, Henson, and Islam 2009; Ochieng, Veettil, and Qaim 2016). We also find positive preference coefficients for having agreements before cultivation, which is less straight-forward. Having a secure buyer before planting seems to be very important for farmers when producing modern pineapple varieties. Making agreements before cultivation facilitates planning and reduces uncertainty for the farmer. As expected, the price coefficient is also positive, indicating that utility of farmers increases with increasing prices. The magnitude of the coefficients shows the relative importance of the individual contract attributes. Having the possibility to sell Grade B products has the highest rank, followed closely by immediate payment and the contract term that rejections can only take place directly at the farm gate. Having agreements about the purchase of products before cultivation seems to be less important compared to the other attributes. The standard deviations for the contract attributes are significant, indicating that there is preference heterogeneity.

Columns (2)-(4) of Table 8 present the results of models (2)-(4), which include interaction terms between contract attributes and behavioral preferences of farmers according to the empirical framework. Risk-seeking is interacting with the preferences for low quality criteria as illustrated in column (2) of Table 8. This indicates that indeed a relaxation of quality criteria is perceived as a form of risk-sharing. Risk-seeking farmers attach less importance to being able to sell low quality pineapples to the same buyer, compared to risk-averse farmers. The interaction term between risk-sharing and the dummy for risk-neutrality is not significant, meaning that risk-neutral farmers do not evaluate the possibility of selling Grade B products significantly different than risk-averse farmers.

Table 8 Mixed Logit Results - Preference Space

	(1) Basic	(2) Risk	(3) Trust	(4) Time	(5) All
Mean					
Price for Grade A per kg	0.072***	0.072***	0.073***	0.072***	0.074***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Agreement before cultivation	0.313***	0.312***	0.274**	0.536***	0.535***
	(0.076)	(0.076)	(0.121)	(0.128)	(0.129)
Grade B accepted	1.796***	1.920***	1.801***	1.801***	1.901***
	(0.137)	(0.162)	(0.137)	(0.137)	(0.151)
Transparent quality control	1.147***	1.145***	2.190***	1.153***	2.202***
	(0.133)	(0.133)	(0.275)	(0.134)	(0.276)
Immediate payment	1.689***	1.685***	1.836***	2.021***	2.028***
	(0.118)	(0.118)	(0.175)	(0.186)	(0.186)
Grade B accepted x risk-seeking		-0.461*			-0.454*
		(0.265)			(0.259)
Grade B accepted x risk-neutral		-0.173			
		(0.308)			
Agreement before cultivation x trust			0.013		
			(0.029)		
Transparent quality control x trust			-0.526***		-0.529***
			(0.135)		(0.135)
Transparent quality control x trust sq.			0.020***		0.020***
			(0.007)		(0.007)
Immediate payment x trust			-0.046		
			(0.038)		
Agreement before cultivation x time				-0.041**	-0.040**
				(0.019)	(0.019)
Immediate payment x time				-0.061**	-0.063**
				(0.025)	(0.025)
SD					
Agreement before cultivation	0.682***	0.679***	0.689***	0.678***	0.687***
	(0.130)	(0.130)	(0.128)	(0.130)	(0.128)
Grade B accepted	1.527***	1.513***	1.532***	1.528***	1.518***
	(0.157)	(0.157)	(0.156)	(0.158)	(0.157)
Transparent quality control	2.104***	2.100***	2.025***	2.123***	2.032***
	(0.167)	(0.166)	(0.163)	(0.168)	(0.163)
Immediate payment	1.297***	1.293***	1.297***	1.285***	1.284***
	(0.139)	(0.139)	(0.139)	(0.138)	(0.138)
Observations	7760	7760	7760	7760	7760
AIC	3995.329	3996.280	3981.194	3989.687	3972.001
BIC	4057.939	4072.805	4071.632	4066.211	4069.395
Log Likelihood	-1988.664	-1987.140	-1977.597	-1983.844	-1972.000

Standard errors in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

The coefficient for the interaction between trust and transparency of quality controls in column (3) is significant and has a negative sign. This means that farmers with high trust levels attach relatively less importance to transparency than farmers with low trust levels. The interaction of the transparency attribute with the squared trust term has the opposite sign, however, implying that the preference for transparency decreases with trust at a decreasing rate. The effect of the squared term should not be over-interpreted though, since only a small fraction of farmers invested amounts over 5 GHS in the trust game (see

figure 1). Trust does not significantly affect the preferences for agreements before cultivation and immediate payment.

As can be seen from the interactions between time preferences and contract attributes in column (4) of Table 8, future-orientation, measured by the money allocation task, affects the preferences for immediate payment and timing of agreement negatively, as expected. Farmers with higher future-orientation attach relatively less importance to immediate payment and agreements before cultivation. It is interesting that trust does not significantly interact with preferences for early commitments and immediate payment, although farmers identified these two contract characteristics as important sources of strategic risk. Apparently, time preferences play a stronger role in explaining heterogonous preferences for these two attributes than trust. Especially regarding delayed payment, it is possible that farmers are using strategic concerns, such as the fear of not being payed, as an excuse for impatience.

Column (5) in Table 8 presents the estimation results from a model that includes all significant interactions from the previous estimations. It can be seen that the results hold in this regression. Including covariates for the behavioral preferences significantly improves the model fit (Likelihood Ratio test between basic model (1) and model with interactions (column (5)): chi2=33.33, $p<0.01$). We are using this full model specification in the next step to calculate how willingness to pay for contract attributes is affected by behavioral preferences.

Willingness to pay and Latent Class Analysis

In order to illustrate the economic significance of the behavioral preferences, we calculate the average willingness to pay (WTP) for contract attributes and analyze how it is modified by trust, risk seeking and time preferences. The left side of table 9 shows the average WTP for contract attributes based on the basic regression model (1) in Table 8. The negative WTP coefficients can be interpreted as the price reduction that farmers are willing to accept for having the particular attribute compared to the other reference level. An average farmer in our sample is for example willing to accept a price reduction of 4 pesowas per kg (for Grade A products), if the purchase is agreed upon already before the farmer starts cultivating. To have the possibility of selling Grade B products for a price of 35 pesowas to the buyer, farmers are willing to accept a price reduction of around 25 pesowas per kg of Grade A products. Receiving payments immediately is worth around 24 pesowas to farmers on the average. Finally, farmers are willing to accept a price reduction of 15 pesowas per kg, if rejections are only possible at the farm gate (transparent quality control). The individual willingness to pay for the attributes will certainly depend on several factors, like the farmers' opportunity costs, beliefs about producing high or low quality, experiences with contract partners and transaction costs. We are particularly interested in the role of behavioral preferences and therefore aim to illustrate how unobserved characteristics, in our case trust, risk seeking and time preferences, change the

willingness to pay for contract characteristics. The results are displayed on the right side of Table 9 and are based on the estimations in model (5) in Table 8.

Table 9 Willingness to pay for contract attributes

	WTP	Confidence - Interval		WTP	Confidence - Interval	
Attribute		ll	ul		ll	ul
Agreement before cultivation	-4.36	-6.40	-2.33	-7.25	-10.63	-3.87
Grade B accepted	-25.03	-29.61	-20.46	-25.77	-30.52	-21.01
Transparent quality control	-15.98	-20.01	-11.96	-29.84	-37.48	-22.19
Immediate payment	-23.54	-27.35	-19.73	-27.48	-32.86	-22.10
Grade B accepted x risk seeking				6.15	-0.74	13.04
Transparent quality control x trust				7.17	3.56	10.78
Transparent quality control x trust sq.				-0.27	-0.47	-0.08
Agreement before cultivation x time				0.54	0.04	1.03
Immediate payment x time				0.85	0.20	1.51

Note: WTP means and confidence intervals derived using delta-method (Hole 2007b). Confidence intervals are given at 95%.

The estimated interaction terms show how risk-seeking, increasing trust and increasing future-orientation affect the WTP for certain contract attributes. We find that farmers who are risk-seeking have a 6.15 pesowas lower willingness to pay for the opportunity to sell Grade B products to the same buyer[16]. For every GHS that a farmer invests into the future the WTP for immediate payment and making agreements before cultivation is reduced by 0.85 and 0.54 pesowas, respectively. Trust seems to play a particularly important role in determining the WTP for transparency. A farmer with a trust level of zero requires a price premium of around 30 pesowas in order to accept the possibility of rejections at company level, while the required price premium in order to accept this reduction of transparency is close to zero for farmers with a trust level of 5. Figures (4)-(6) illustrate the changing WTP for selected contract attributes conditional on trust[17] and future-orientation, respectively.

[16] The result is significant at the 10% level.

[17] Figure 4 indicates that farmers with trust levels of 6 or higher require positive price premiums for accepting transparency. This result is counterintuitive but should not be over-interpreted, since only a small fraction of farmers invested more than 5 GHS in the trust game (see figure 1).

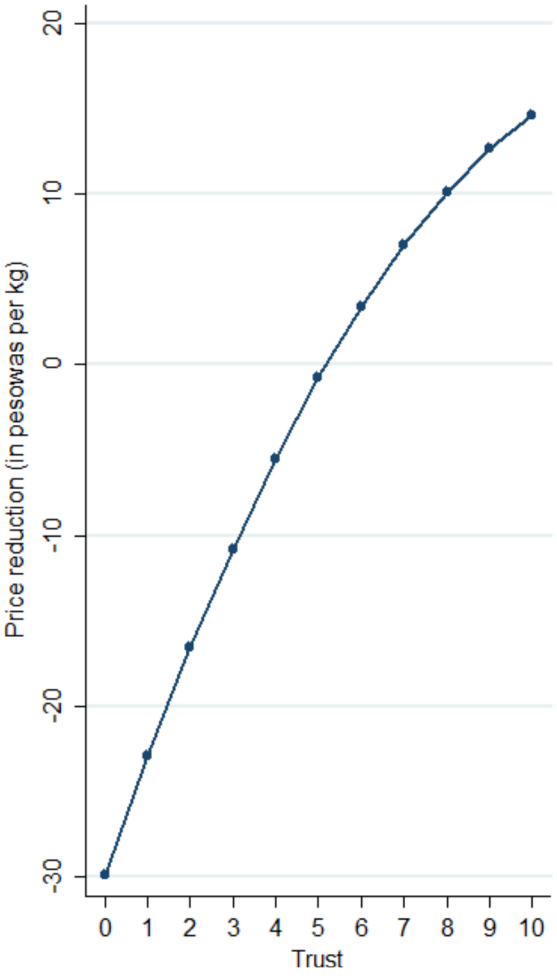

Figure 4 Effect of trust on WTP for rejections only at farm gate

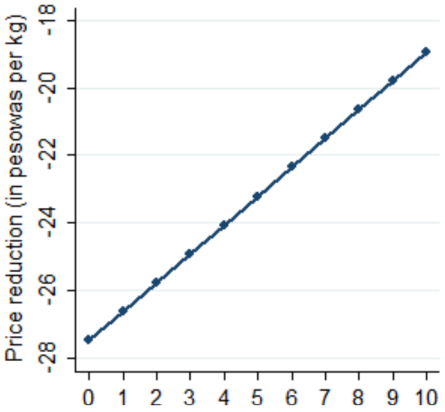

Figure 5 Effect of time preferences on WTP for immediate payment

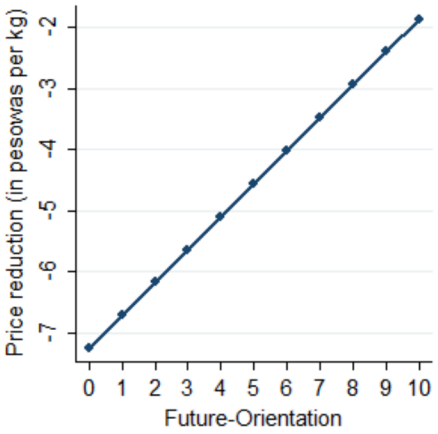

Figure 6 Effect of time preferences on WTP for agreements before cultivation

A closer look at the WTP results reveals that the ranking of attributes may differ between people according to their preferences. For example for a risk-averse or risk-neutral farmer the possibility to sell Grade B products to the same buyer is the most important characteristic for choosing a contract, while for a risk-seeking farmer immediate payment is the most important characteristic, ceteris paribus. This means that depending on behavioral preferences farmers may have different participation constraints for entering contract farming. This is further illustrated in an example in Table 10. For example, a risk-averse farmer with an intermediate trust level ($\theta_i = 5$), and low future-orientation ($\delta_i = 0$) would rank immediate payment first, followed by acceptance of grade B, agreements before cultivation and finally transparent quality controls. A risk-seeking farmer with low trust level ($\theta_i = 0$) and strong future-orientation ($\delta_i = 10$) would rank transparent quality controls first, followed by acceptance of Grade B, immediate payment, and agreements before cultivation as least important attribute.

Table 10 Example of shifts in ranking of attributes depending on preference profiles

	Profile 1		Profile 2	
Contract Attribute	WTP	Rank	WTP	Rank
Grade B accepted	-25,77	**2**	-19,62	**2**
Agreement before cultivation	-7,25	**3**	-1,87	**4**
Immediate payment	-27,48	**1**	-18,94	**3**
Transparent quality controls	-0,80	**4**	-29,84	**1**

Profile 1: Trust = 5, Future orientation = 0, risk-averse
Profile 2: Trust = 0, Future orientation = 10, risk-seeking

On an aggregate level, these different choice patterns may be connected to different farmer segments with similar preference profiles. In order to identify different preference segments we use a latent class analysis. The difficulty in latent class modeling lies in its vulnerability to local maxima (Sawtooth Software 2004; Train 2008). Therefore, it is necessary to estimate several models from different starting points. The optimal number of classes has to be determined by the researcher. The Bayesian Information Criterion (BIC) and the Consistent Akaike Information Criterion (CAIC) suggest a three-class solution for our data. However, the results of the three-class solution differ strongly with each estimation, depending on the starting point. This suggests that the data does not naturally support a three-class solution. The two-class solution gives more stable results when estimated repeatedly from different starting points and is therefore preferred. We include trust, risk and time preferences in the class membership function of the model in order to examine to what extent heterogeneity in behavioral preferences expresses itself in different market segments. Table 11 shows the estimation results of the two-class solution. Class 1 has an estimated share of 43 percent, whereas Class 2 accounts for 58 percent of the farmers in our sample. For farmers belonging to Class 1 transparency is the most important contract attribute. Having agreements before cultivation does not play a role for this segment. For Class 2, on the other hand, transparency is not relevant for choosing a contract. The most important contract attributes are risk-sharing and immediate payment. In contrast to Class 1, having agreements before cultivation is also relevant for choosing a contract for this segment. As expected, the class membership probability for an individual is significantly determined by trust levels. Farmers with high trust levels are more likely to be in Class 2, while farmers with low trust levels are more likely to be in Class 1. The sizes of the class shares suggest that it might be a valid strategy for companies to diversify their contract offers to target farmers with different participation constraints.

Table 11 Latent Class Conditional Logit Model

	Class 1	Class 2
Price for Grade A	0.031***	0.076***
	(0.005)	(0.007)
Agreement before cultivation	0.045	0.251***
	(0.045)	(0.054)
Grade B accepted	0.410***	0.876***
	(0.067)	(0.081)
Transparent quality control	0.981***	-0.052
	(0.099)	(0.069)
Immediate payment	0.434***	0.806***
	(0.061)	(0.086)
Class Membership		Reference
Risk seeking	0.347	
	(0.283)	
Trust level	-0.117**	
	(0.052)	
Future orientation	-0.007	
	(0.031)	
Constant	0.025	
	(0.264)	
Class Share (%)	42.48	57.52
Observations	7760	
AIC	4035.238	
BIC	4132.632	
Log likelihood	-2003.619	

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5 Conclusion

In this study we analyzed farmers' preferences for contract designs in the Ghanaian pineapple sector. We discussed how trust, risk and time preferences may affect contract choice and studied the relationship between experimentally measured behavioral preferences and the relative importance of and willingness to pay for contract characteristics.

We establish the following results: (i) Low quality criteria and immediate payment are ranked as the most important factors for choosing a contract, followed by transparent quality controls and agreements before cultivation. Standard deviations show considerable preference heterogeneity.

(ii) We find that differences in the importance of contract characteristics are associated with differences in individual behavioral preferences, measured through monetary incentivized lab experiments. Trust affects farmers' preferences for transparent quality controls, while risk-seeking affects the importance of the acceptance of Grade B products.

This indicates that a relaxation of quality criteria is considered as a risk-sharing mechanism of a contract. Time preferences are associated with the preferences for immediate payments and agreement-making before cultivation. By disentangling trust and time preferences we raise doubts about the common interpretation that immediate payment is preferred due to reasons of strategic concerns. Impatience or liquidity constraints might be better explanations.

(iii) We further show that the effects of trust, risk and time preferences are economically relevant, by analyzing their effects on the willingness to pay for certain contract characteristics. Especially trust seems to be a relevant factor for the willingness to pay for transparent quality controls. Additionally, we were able to show that the effects of preferences are strong enough to change the ranking of contract attributes. This means that people with different preference profiles prefer different contracts, everything else being equal.

(iv) Conducting a latent class analysis, we find two farmer segments with different preference profiles. The first segment represents 42 percent of the farmers in our sample. For this segment, transparency, which is reflected by the location of quality classification, is the most important attribute for choosing a contract. In contrast, for the second segment (58 percent of the farmers) immediate payment and the possibility of selling Grade B products are the most important criteria, while transparency is not relevant. The class membership is predicted by trust levels.

Since it is costly for firms to provide contracts that include terms that are favorable for farmers, it is practically not possible to offer a "perfect contract", which includes all contract attributes preferred by farmers. From a firm's perspective, it could therefore be beneficial to offer different types of contracts, which trade off different attributes against each other. Farmers could then self-select into their preferred contracts. For farmers whose major participation constraint is transparency, firms could offer arrangements in which farmers have access to the grading process. For farmers whose major participation constraint is immediate payment, firms could offer arrangements that involve advanced down payments, etc. Especially in sectors in which firms compete for produce, and vertical integration is not possible due to land scarcity, as it is the case in the Ghanaian pineapple sector, diversification in contract offers might be an effective strategy to build stable long-term business relationships with producers and secure market shares.

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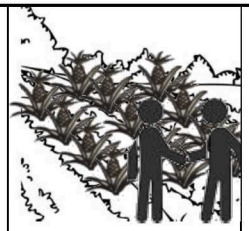
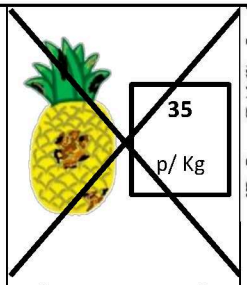
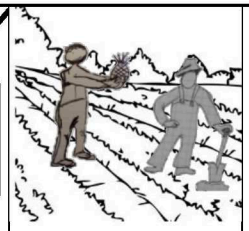
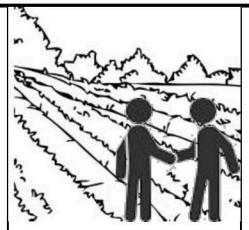
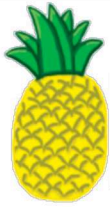
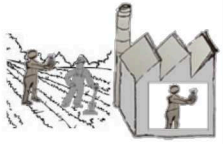
7.1 Choice Card Example

Alternative 1 Producing MD2 under market channel A (Training provided)	 Farmer and buyer agree on purchase before harvest	 60 p/ Kg Price for Grade A	 35 p/ Kg Farmer cannot sell Grade B to same buyer	 Rejection only at field possible	 Payment immediately after purchase
Alternative 2 Producing MD2 under market channel B (Training provided)	 Farmer and buyer agree on purchase before planting	 50 p/ Kg Price for Grade A	 35 p/ Kg Farmer can sell Grade B to same buyer	 Rejection at field and company/ pack house possible	 Payment 4 weeks after purchase
Alternative 3	NONE OF THESE (My current market channel for pineapples is better.)				

7.2 Experimental Instructions

The instructions were translated into local languages by trained enumerators. After the instructions, farmers were confronted with control questions to make sure, the experiment was understood and given the possibility to ask questions before making their decision.

General Instructions

We would like to ask you to take part in three short experiments, in which you can earn money. How much you can earn in the three experiments depends on your decisions. There are *no* right or wrong answers in the experiment. We are not expecting you to take any particular answers and your answers will be completely confidential and analyzed anonymously.

After finishing all experiments you will draw a random number, which will determine, which of the three experiments will be paid out to you. Please note that **only one** of the three experiments will be paid out to you via mobile money in the following days.

Experiment 1: Choose a bag

In this experiment you will be asked to choose one out of six bags from which you would like to draw a ball from. Each bag contains 2 balls. In each ball, there is a voucher with a certain amount of money.

Bag Number one contains two balls; the two balls contain 14 Cedi.

Bag Number two contains two balls; one contains 12 Cedi and the other contains 18 Cedi.

Bag Number three contains two balls; one contains 10 Cedi and the other contains 22 Cedi.

Bag Number four contains two balls; one contains 8 Cedi and the other contains 26 Cedi.

Bag Number five contains two balls; one contains 6 Cedi and the other contains 30 Cedi.

Bag Number six contains two balls; one contains 1 Cedi and the other contains 35 Cedi.

If this experiment is chosen for payment you will earn the amount of money that is written on the voucher in the ball that you draw.

Please ask if you have further questions to the experiment.

You can now decide from which of the six bags you would like to draw one ball. We will note your answer and you can draw the ball in the end of the survey, if this is the experiment that is randomly chosen for payment.

Experiment 2: Allocate Money

In this experiment, you start with an endowment of 10 Ghana Cedi from us. You can decide how you would like to allocate the 10 Ghana Cedi on two dates in time. The two dates are **tomorrow** and **in 4 weeks**. You can decide to allocate some money to the date of tomorrow and some money to the date of in 4 weeks. You can also decide to allocate all the money on the date of tomorrow or all the money on the date of in 4 weeks.

If this is the experiment that is randomly chosen for real payment you receive the following payoffs: Each Cedi that you allocate to the date of **tomorrow** will be transferred to you tomorrow. For Each Cedi that you allocate to the date of **in 4 weeks** you will be transferred 1.50 Cedis in 4 weeks. That means that we will add 50 pesowas to every Cedi that you allocate to the date of **in 4 weeks.**

Please decide how you would like to allocate the money between the date of tomorrow and the date of in 4 weeks.

Experiment 3: Play with a stranger

In this experiment, you can earn money by playing together with a stranger. You start with an endowment of 10 Ghana Cedi from us. You can decide to keep the money or to send money to a stranger. The stranger is a person that we have interviewed in October. In total we have interviewed 20 Ghanaians that we chose randomly. You are now randomly matched with one of these 20 persons.

We explained the stranger in October that they would play together with a stranger (that is now you) who receives 10 Ghana Cedi from us. We explained the person that you can decide to **keep the money** or to **send any amount between 1 and 10 Ghana Cedi** to the person. We explained that any amount that you would send to the person would be tripled (multiplied by three). For example, if you send one Cedi, then the person would receive three Cedi.

After we made sure that the person had understood the experiment, we asked the person if in case you would send money to him/her, the person would either keep the money or share the money equally with you. That means he/she would send back half of the received money.

If you decide to keep the money then the stranger receives nothing and can send nothing back. If you decide to send 1 Ghana Cedi then the stranger receives 3 Ghana Cedi and can decide to keep the money or to send half of the money back (1.50 Ghana Cedi). If you decide to send 2 Ghana Cedi then the stranger receives 6 Ghana Cedi and can decide to keep the money or to send half of the money back (3 Ghana Cedi). If you decide to send 2 Ghana Cedi then the stranger receives 6 Ghana Cedi and can decide to keep the money or to send half of the money back (3 Ghana Cedi), and so on.

We explained the stranger that the more you would send the more both of you could potentially earn. The stranger made his/her decision whether he/she would keep the money or share it with

you (in case you send something to him/her) already in October. This decision is in a sealed envelope that we have with us. We do not know which decision is written on the sheet.

In case you decide to send something, the stranger will receive his/her final payoff also via mobile money.

Now you can decide if you want to send something to the stranger and if yes which amount you would like to send. We will open the envelope with the decision of the stranger at the end of the survey, if this is the experiment that will be chosen for payment.