Farmers' Preferences for Supermarket Contracts in Kenya

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Abstract

Empirical analysis of contractual arrangements between supermarkets and smallholder farmers remains scarce, yet farmers' contract preferences influence their participation in supermarket contracts. We employ mixed logit model to analyze farmers' preferences for contracts using discrete choice data from a sample of vegetable farmers of central Kenya, sampled through stratified random sampling procedure. Results show that farmers generally do not exhibit risk aversion to contracts and would choose them depending on their attributes. Certain farmer characteristics influence decision to contract and preferences for contract design attributes. Findings also show that group marketing could be an interesting option to reduce individual risks and transaction costs. Designing contracts that lower risks to smallholder farmers, and or with transparent risk-sharing clauses would enhance their participation in supermarket contracts. Some wider policy implications are discussed.

Keywords: supermarkets, contracts, farmers' preferences, choice experiment, Kenya

JEL codes: O12, O13, Q12, Q13, Q18

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1. INTRODUCTION

The existing literature shows that the rapid expansion of supermarkets in developing countries can provide interesting new marketing opportunities for smallholder farmers. Smallholder farmers, who are largely the rural poor, dominate agricultural production in most agriculture-dependent economies. They can benefit from supplying supermarkets by earning higher household income through high and more stable prices, as well as better access to information and technology (Barrett et al., 2012; Reardon and Timmer, 2014). The expansion of supermarkets therefore could significantly contribute to poverty reduction and rural development. However, available impact studies show mixed results. While a few studies confirm positive effects on farm productivity (Rao and Qaim, 2013), household incomes (Andersson et al., 2015; Rao and Qaim, 2011), and household nutrition (Chege et al., 2015) in the small farm sector, others find that marginalized farms are unable to participate in supermarket channels due to constraints such as stringent private quality standards, quantity, and initial investment requirements (Hernández et al., 2007; Neven et al., 2009) thereby contributing to high dropout rates witnessed in the supermarket channels in some cases (Andersson et al., 2015).

Inclusion and successful participation by smallholders seem to depend on contract design, which is sometimes mentioned as a constraint but not further analyzed. Contract design could significantly influence decision to contract. Marketing contracts are instrumental in stabilizing volumes supplied by farmers , standardizing quality of commodities (Saenger et al., 2013) and coordinating production and marketing activities thereby lowering transaction costs (Blandon et al., 2009a). Contracts vary in attributes depending on context and nature of commodities involved.

Against this background it is important to analyze what types of contracts facilitate smallholder participation in supermarket channels. This is difficult to analyze using observational data alone because variations in contractual design rarely occur in the same setting. We address this gap by examining farmers' preferences for contracts and contract design attributes using a choice experiment with smallholder vegetable farmers in Kenya. To the best of our knowledge, our study is

one of the few endeavors particularly in the context of marketing contracts offered by supermarkets. Besides, none of the previous studies have analyzed drivers of farmers' contract preferences using panel data variables as we do.

In the experiment, we varied design attributes of contracts with supermarkets and other traders to examine farmers' contract preferences and how they vary with socioeconomic characteristics. We also calculated farmers' willingness to accept (WTA) output price changes for certain contract attributes. The contract attributes included various levels of price, place of sale, form of sale, timing of sale, and payment mode, whereby the respondents were presented with choice cards bearing various choice options. Stratified random sampling procedure was used to sample 409 vegetable farmers from Central Kenya who were then interviewed using a structured questionnaire. The questionnaire sections covered the farming activities, other socio-economic characteristics of the farming households, and choice experiment. We employed mixed logit (ML) model on the discrete choice data to analyze the preferences for preference heterogeneity of respondents.

The findings could provide useful information in designing contracts that incentivize both parties to the marketing contracts. Examinations of the tradeoffs between the contract design attributes also provide insights on how smallholder farmers view this marketing opportunity and the retailers' view of the contractual arrangements. Mutually beneficial contracts that balance marketing risks of both parties could facilitate consistent and adequate supplies of vegetables supermarkets and other contract marketing channels.

After introduction, we contextualize the study, followed by theoretical model of farmer's utility from contracts then data and methods. The fourth section presents the estimation procedure adopted. We then discuss the empirical results of farmers' preferences for contracts, contract attributes, and drivers of the preferences before concluding the paper.

2. STUDY CONTEXT

Kenya ranks second after South Africa in growth and expansion of supermarkets in Sub-Saharan Africa (Planet Retail, 2016). Foreign owned supermarkets are limited in Kenya and the five dominant supermarkets are largely indigenous. They include; Nakumatt, Uchumi, Tuskys, Naivas, and Ukwala. These supermarkets traditionally served urban dwellers in major cities but are increasingly expanding to smaller towns, courtesy of rapid urbanization, growth of middle class, and change in taste and preferences of consumers. Supermarkets account for 10% of retail business in Kenya and offer a wide variety of products including processed and fresh foods (Chege et al., 2015). Vegetables (Kales in particular) were an interesting case to study, owing to their perishable nature, challenges in marketing, production dominated by smallholders, and as some of the products purchased by supermarkets.

Interviews with supermarket officials revealed how procurement systems have modernized to reduce coordination costs while ensuring food safety, traceability and quality, and consistent supplies. This was more profound in the procurement of fresh fruits and vegetables (FFVs) where supermarkets are increasingly sourcing from wet markets, wholesale markets, farmers, or specialized traders from areas close to the cities (Neven et al., 2009). Supermarkets, like other high value marketing channels, have strict quantity and quality requirements that sometimes smallholder farmers are unable to meet (Rao and Qaim, 2011). Supermarket procurement officials occasionally conduct on-farm visits to inspect production and post-harvest handling activities to assess quality and reliability of supplies. Further, the farmers are instructed to deliver the vegetables at specific supermarket outlets where needed unlike before when the procurement was centralized.

Contract defaulters are excluded from supplier lists and opt to sell in traditional markets that do not involve contracts. Prior to the baseline survey in 2008, there was a non-governmental organization in the study area that linked smallholder vegetable farmers to supermarkets in Nairobi. The farmers were organized in groups to aggregate sufficient quantities, reinforce quality requirements, and reduce marketing costs. Some of the farmer groups are still supplying supermarkets. Supermarket

farmers rarely sell to other channels owing to their limited marketable surpluses whereas those selling in traditional market channels (hereafter referred to as TCs) do not access the supermarket channels.

The supermarket contracts have evolved over time and increasingly shifting all the marketing risks to the farmers. Payments are usually delayed by up to two weeks but terms of payment have significantly changed. Farmers were previously paid for their supplies at an agreed price but from year 2012, payments were based on prices fixed by supermarkets on their notice boards on the days of vegetable deliveries. The prices were slightly below the prevailing market prices but less volatile over time. By 2015, the payments were based on quantities sold by supermarkets rather than those supplied. Farmers therefore were not paid for what was not sold (breakages). Despite the risks of high rejection rates during delivery and breakages in supermarket channels, farmers find the supermarket channels favorable for the stable prices they offer and assured market. In the light of the dynamics of contractual arrangements in supermarket channels, our study focused on contract design and specifically examined farmers' preferences for contracts, contract design attributes and other socio economic factors that influence preferences.

3. FARMERS' UTILITY FROM CONTRACTS: CHOICE EXPERIMENT

Choice experiments (CEs) have been widely used in diverse areas of research to assess preferences of respondents. For example in the fields of: marketing, to assess marketing preferences (Green et al., 2001; Louviere et al., 2010); environmental science, to evaluate environmental conservation programs (Veettil et al., 2011); and also gaining popularity in agricultural sciences, in assessing marketing preferences of farmers (Blandon et al., 2009b; Saenger et al., 2013; Schipmann and Qaim, 2011; Vassalos et al., 2015), technology adoption among other policy issues.

CEs are grounded on the Microeconomic theory of consumer behavior proposed by Lancaster (1966) and Random utility theory by McFadden and Zarembka (1974), with a proposition that utilities are derived from characteristics (attributes) of a good rather than the good itself. Individuals are

assumed to choose alternatives that yield highest utilities among available ones, thereby enabling analysis of choices to reveal the utility functions. In the context of our study, the goods are the different contracts with varying design attributes presented to farmers. Farmer's utility for contract i is composed of observable and unobservable parts:

$$\boldsymbol{V_i^j = V\left(A_i, F_i^j\right) + \varepsilon_i^j} \quad (1)$$

Where the observable component, $\boldsymbol{V\left(A_i, F_i^j\right)}$ is derived from $\boldsymbol{A_i}$, a vector of design attributes of the contract i and $\boldsymbol{F_i^j}$, a vector of farmer or farm specific socio-economic characteristics that influences the farmer's choice of contract. $\boldsymbol{\varepsilon_i^j}$ is the independent and identically distributed error term that captures unobservable influences on farmer's choice. The contract attributes include: price per bundle of vegetable sold; place of sale; form of sale; timing of sale; and payment mode. The characteristics in $\boldsymbol{F_i^j}$ vector include: contract experience; contextual factors such as group marketing and geographical factors; age, gender, level of education of the household head. A farmer chose an alternative *i,* when $\boldsymbol{V_i > V_k}$ that is the utility of alternative i is more than alternative k . The choice probabilities are derived with assumption that the error term follows a logistic distribution and fitted in a conditional logit model (McFadden and Zarembka, 1974).

In summary, this article focuses on estimating farmers' utility as a function of attributes of contract options and farmer characteristics as shown in equation 1 to analyze how farmers value the contract attributes.

4. DATA AND METHODS

4.1 Sample

Our study stems from a choice experiment (CE) during a third round of survey of vegetable farmers of central Kenya between June and July 2015, baseline survey having been conducted at the time period in 2008 and a follow up in 2012. Stratified random sampling procedure was employed in 2008 to select farmers from 31 administrative locations within Kiambu County of central Kenya.

The sample comprises supermarket farmers and TC farmers without contracts. Participation in supermarket channels and TCs was dynamic between years 2008 and 2015 as presented in Figure 1 whereby the number of supermarket farmers declined by 53% between 2008 and 2012 but increased by 44% in 2015. The number of TC farmers however increased by 19% between 2008 and 2012 but declined by 4% in 2015. From the 2015 data, we analyzed the proportion of farmers who have: consistently supplied supermarkets and TCs (hereafter referred to as stayers) between 2008 and 2015; Supplied supermarkets in 2008 but ceased to supply by 2015 (supermarket drop-outs); and those who supplied TCs in 2008 but began supplying supermarkets either in 2012 or 2015 (supermarket Newcomers). Proportion of TC stayers (69%) was greater than of SP stayers (8%). About 14% of the farmers had dropped out of the supermarket channels by 2015 whereas only 9% joined the supermarket channel. SP refers to supermarket in Figure 1.

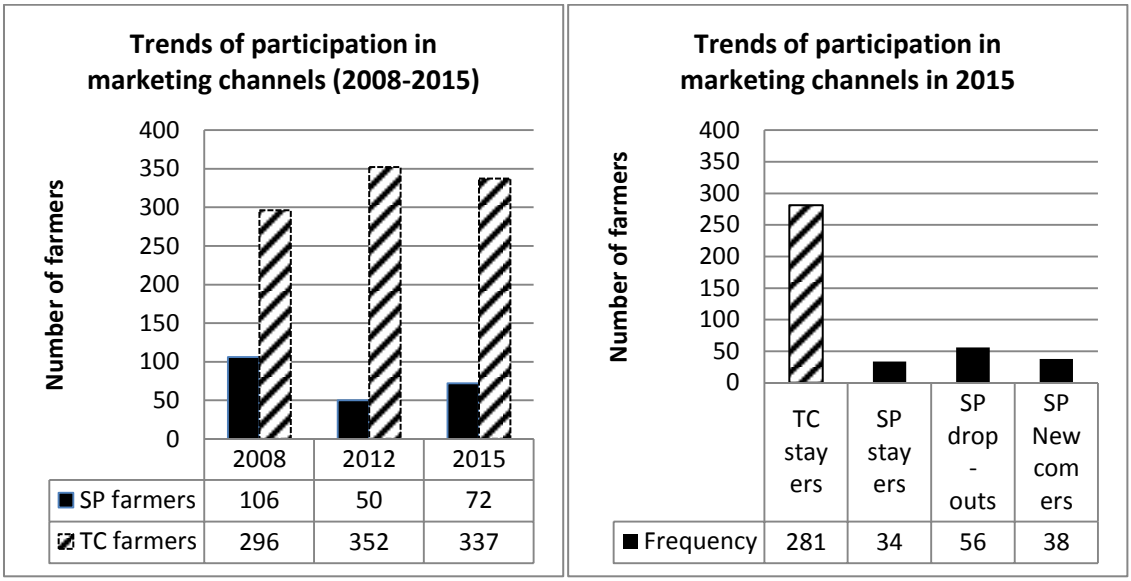

Figure 1. Trends of participation in supermarket and traditional marketing channels

Table 1 presents summary statistics of selected household variables, some of which are hypothesized to influence farmers' preferences for contracts and later included in the regressions. Male headed households constitute 86% of the sample. The household heads are 54 years old on average and have about 10 years of schooling. The average land size is 1.8 acres, and 30% is allocated to vegetable production which is the largest contributor of gross farm income (84%). Majority of the

households (over70%) had off-farm income but farm income remains the largest contributor of household income at 72%.

At the time of the survey in June 2015; majority of the households used advanced irrigation technology (72%), had access to asset credit (72%), and at least one of their members belonged to a farmers' group (86%). However, only 8% of the households were involved in group marketing of vegetables.

Table 1. Summary of selected household variables

Variable	Description of variable	Mean	SD
Gender	Male household heads dummy (male=1)	.86	.35
Age	Age of the household head (years)	54.31	14.15
Education	Number of years of schooling of household head	9.67	3.66
Land owned	Land owned by household (acres)	1.81	2.89
Land_veg	Land under vegetables in year 2015 (acres)	.54	.81
propveg	Contribution of vegetable income to gross farm income (%)	.84	.28
veg_years	Number of years the household has grown vegetables	23.61	12.72
Off-farm income	Households with off-farm income (1=YES)	.78	.42
Asset credit	Households' access to asset credit in year 2014 (1=YES)	.72	.45
Group_mem	Group membership by any household member in 2015 (1=YES)	.86	.35
Group_mkt	Households' involvement in group marketing of vegetable(1=YES)	.08	.27
Irrigation	Households' access to advanced irrigation technology (1=YES)	.72	.45
livestock	Households' ownership of livestock (1=YES)	.84	.37
Distance	Distance to the nearest bus terminus (kilometers)	1.16	1.16
Farm income	Annual net farm income in "000" Kenya shillings	418.63	938.81
Total income	Annual household income in "000" Kenya shillings	580.48	1153.90

Source: Survey data. Notes: SD denotes standard deviation; Number of observations = 409; 1 US dollar=103 Kenya shillings.

4.2 Survey design

Data were collected using structured questionnaire to capture the farm and off-farm activities, other socioeconomic characteristics, and the farmers' preferences for contracts (through a choice experiment). The five enumerators were graduates competitively recruited and trained to collect data. For ethical reasons, enumerators emphasized that farmers' participation was voluntary and confidential, therefore would neither interfere with their sales activities nor opportunities whatsoever. Respondents were either the household heads, spouses, or whoever was responsible for vegetable production and marketing.

4.3 Choice experiment and attribute selection

Selection of relevant attributes and their corresponding levels is the first step in designing a choice experiment. The attributes were identified and chosen from focus group discussions (FGDs) held with farmers in 2014, interviews with supermarket officials, extension officers, and specialized traders, augmented by findings from previous studies (Abebe et al., 2013; Sartorius and Kirsten, 2007; Singh, 2002).

All the elicited attributes were ranked in order of importance and the top five attributes were selected for the experiment: price per bundle of kales sold; place of sale; form of sale; timing of payment; and mode of payment (Table 2). Price had six levels ranging from 10 shillings to 20 shillings per bundle of kales sold and farmers were assumed to prefer higher prices. The price of 10 shillings was the prevailing price at the TCs that do not involve contracts whereas 20 shillings was the highest price the farmers reported to have received for their supplies through contracts in any contract marketing channel. An equidistant six price levels between 10 to 20 were used in the choice experiment design. Price specification in contracts reduces market uncertainty among farmers in contract farming literature (Berdegué et al., 2005 and Singh, 2002).

Place of delivery of the goods and form in which they are delivered influence transaction costs of both supplier (vegetable producer) and buyer (supermarkets). Place of sale had three levels namely sales at farm gate, nearby market, or deliver at the buyers' premises. If transaction is done at farm gate the costs borne by farmer is lower whereas it is highest for buyer (supermarket), but it would be the reverse if the transaction is made at buyers premise. In our contract design, the transportation cost is born by the farmer. TC sales are commonly made at farm gate or nearby markets whereas supermarket sales are made at the premises. Farmers from remote areas with limited transportation infrastructure thus high transportation costs are likely to prefer no-contract marketing channels (Blandon et al., 2009b; Holloway et al., 2000).

From the FGDs with farmers, there were no standard quality measurements by buyers beyond arbitrary visual inspections of vegetable leaf sizes and appearance. We therefore considered the attribute "Form" as a proxy for quality in our study. It had two levels, either sale of vegetables as harvested or cleaned, sorted and packaged before sale. The later activities have additional cost implications to farmers in terms of extra labor and other investment in post-harvest handling facilities therefore influencing contract preferences. FFVs are usually sold as harvested in TCs but contract marketing channels such as supermarkets require them to be cleaned, sorted and packaged.

Table 2. Attributes of contracts and their levels

Attribute	Levels	Description of attribute levels
Price	PRICEW	10 Ksh per bundle*
		12 Ksh per bundle
		14 Ksh per bundle
		16 Ksh per bundle
		18 Ksh per bundle
		20 Ksh per bundle
Place of sale	Place1	Farm gate*
	Place2	Nearby market
	Place3	Buyer's premise
Form of sale	Form1	Sold as harvested*
	Form2	Sold in washed and sorted form
Timing of sale	Timing1	Sales possible at any time*
	Timing2	Sales at times specified in a contract
	Timing3	Sales based on phone orders by buyer
Payment mode	Payment1	Payment based on quantity delivered*
	Payment2	Payment based on quantity delivered
	Payment3	Payment based on quantity buyer sold to customers as verified by the farmer physically
	Payment4	Payment based on quantity buyer sold to customers as verified by the farmer through bar coding
	Payment5	Payment based on quantity buyer sold to customers, but not verifiable

*Attributes of the traditional marketing channels; only Payment1 is immediate, others are delayed; Ksh= Kenya shillings.

Supermarkets have stringent quality requirements and farmers unable to meet them opt for no-contract marketing channels. Even though supermarkets offer higher prices on average, the cleaning and packaging activities are time consuming and labor intensive (Rao and Qaim, 2013), translating to higher labor costs. "Form of sale" is included as one of the attributes to capture this influence.

Outlining the timing of sale in a contract enables farmers to schedule their production as well as assure the market for their produce. The three attribute levels for timing of sale included sales at any time by the farmer which mimics TC sales, sales at times specified in the contracts as also common in supermarket contracts, and sales based on phone orders by buyers which is not common in supermarket contracts but with other buyers such as restaurants and hotels. The three levels reflect the timing of sales options available to the farmer considering the existing marketing channels.

Majority of rural farming households are usually cash-strapped and rely on frequent payments from marketing agricultural produce to cover daily household expenditures. Any delayed payments affect household consumption and therefore, payment mode in contract design can significantly influence their contract choice. The attribute had two broad options, either spot payment as observed in TCs, or delayed payment by up to two weeks as in supermarket contracts. Delayed payment was further differentiated into four options, one based on quantity delivered while others were based on quantities finally sold to consumers, with provisions of verification by the farmers or otherwise. Any delayed payments pose risks to farmers given that most contracts are largely oral with weak enforcement mechanisms and farmers are not sure of payments within the specified periods. Payments based on quantities sold to consumers also increases risks of losses from unpredictable breakages and exploitation by buyers in cases where sales cannot be verified. Modalities of verification of sales also brings into focus the issue of trust between farmers' and buyers as noted by Singh (2002). Sales with option for verification through bar coding may not only improve on transparency but also facilitate traceability of the produce thereby reinforcing quality of supplies to supermarkets.

Using R, we developed a D optimal choice design from the 540 profiles ($6 \times 5 \times 2 \times 3^2$). Fractional factorial design yielded a subset of the full factorial design choice alternatives while retaining the main and first-order interaction effects (Hensher et al., 2005). The choice design comprised 30 choice sets, blocked into five. Respondents were randomly assigned to the five blocks, each having 6 choice cards. Each choice card had three options, two varying contract options and the no-contract option,

representing the no-contract marketing channel[1] so the respondent was expected to only choose one option in each of the six choice cards. We did not encounter any cases of non-response by the respondents. Figure 2 at the appendix presents a sample of a choice card used.

4.4 ESTIMATION PROCEDURE

We employed ML model that relaxes the restrictive IIA property of conditional logit models by allowing the unobserved factors (captured in the error term) to be correlated over choice alternatives (Green, 2000). Considering preference heterogeneity among farmers, it is possible to elicit multiple choice sets from them and unrestricted substitution patterns are allowed (Hensher et al., 2005). The priori expectation of the signs of the attribute coefficients is anchored on farmers' utility maximization objective in the scenario of contracts. Any improvements of the contract attributes that maximize utility would be reflected in the positive coefficient signs of the attributes. *Ceteris paribus*, farmers prefer higher prices per bundle of vegetables sold therefore the coefficient takes a positive sign. Improvements in the other contract attributes that increase transaction costs, reduce profits, and reduce likelihood of contracting would have negative coefficient signs. Price coefficient was fixed whereas the coefficients of other attributes were assumed to be normally distributed.

(a)Farmers' preferences for contracts

To assess farmers' preferences for contracts, farmers' choices were modeled solely as a function of attributes of contract alternatives as specified in equation 2.

$$Y_{njt} = \beta_0 ASC + \beta_1 Pr_{njt} + \beta_2 Pl_{njt} + \beta_3 FO_{njt} + \beta_4 Ti_{njt} + \beta_5 Pa_{njt} + \varepsilon_{njt} \quad (2)$$

[1] In addition to the detailed explanations about the choice cards in local language, each of the options had pictures of each attribute to simplify the experiment hence farmers were able to value the options and state their preferences. We are therefore able to assess the preferences through perceived financial gains from choosing a contract.

where *Y* equals 1 if farmer *n* chooses choice alternative *j* given choice options t, ASC captures the preference for no-contract option (base scenario) , $Pr, Pl, Fo, Ti,$ and Pa are attributes price, place, form, timing of delivery, and payment mode respectively and ε is the error term. The base scenario was dummy coded to assume a value of 1 if the no-contract option was chosen, meaning a positive ASC coefficient inferred negative attitude towards contracts. However, positive coefficients of other attributes would be an indicator of preference for contracts with such attributes and vice versa.

(b) Previous contract experience and farmers' preferences for contracts

We analyzed the influence of previous contract experience on farmers' preferences for contracts using panel data collected in years 2008, 2012 and 2015 that detailed farmers' participation in the TC and supermarket channels. Participation dynamics were observed in the channels whereby some farmers had dropped out of the supermarket channels, hereafter referred to as supermarket drop-outs (SD), while some did not, denoted as stayers (SS). Similarly, some TC farmers consistently supplied traditional channels, referred to as TC stayers (TS), whereas others joined the supermarket channels, referred to as supermarket newcomers (SN). Dummy variables for the four categories of farmers were modeled as interactions with ASC to test the influence of participation dynamics in the supermarket and traditional channels of preferences as shown in equation 3. The reference category was the TC stayers who had no previous contract experience and positive sign of the interaction coefficients (γ) inferred negative attitude towards contracts.

$$Y_{njt} = \beta_0 ASC + \beta_1 Pr_{njt} + \beta_2 Pl_{njt} + \beta_3 Fo_{njt} + \beta_4 Ti_{njt} + \beta_5 Pa_{njt} + \gamma_1 ASC * SS + \gamma_2 ASC * SD + \gamma_3 ASC * SN + \varepsilon_{njt} \quad (3)$$

(c) Influence of other factors on farmers' preferences

In the third model specification in equation 4, other farm, farmer, and contextual characteristics (denoted as FC) were interacted with ASC to test their influence on farmers' preferences for contracts. The characteristics comprised: total annual household income; households' involvement in

group marketing of vegetables (dummy); age, education, and gender of the household head (Dummy of 1=male); dummies for Westlands, Githunguri, Lari/Limuru, and Kikuyu regions. Influence of these characteristics have been analyzed in previous empirical studies however without consensus on their signs and significance on the likelihood of participation in contracts (Wang et al., 2014). Positive signs of the interaction coefficients (λ) inferred negative attitude towards contracts.

$$Y_{njt} = \beta_0 ASC + \beta_1 Pr_{njt} + \beta_2 Pl_{njt} + \beta_3 Fo_{njt} + \beta_4 Ti_{njt} + \beta_5 Pa_{njt} + \lambda ASC * FC + \varepsilon_{njt} \quad (4)$$

To analyze the influence of the other factors (FC) specified in equation 4 on the preference for contract attributes, FC were interacted with all the attribute levels as shown in equation 5. Positive signs of the interaction coefficients (δ) implied a positive preference for contracts with such attribute level specifications.

$$Y_{njt} = \beta_0 ASC + \beta_1 Pr_{njt} + \beta_2 Pl_{njt} + \beta_3 Fo_{njt} + \beta_4 Ti_{njt} + \beta_5 Pa_{njt} + \delta_1 Pl_{njt} * FC + \delta_2 Fo_{njt} * FC + \delta_3 Ti_{njt} * FC + \delta_4 Pa_{njt} * FC + \varepsilon_{njt} \quad (5)$$

Using dummy coding, the models were estimated in preference space and assumed a fixed coefficient of price ($\boldsymbol{\beta} = \boldsymbol{\beta}_i$) while those of normally distributed non pecuniary attributes varied across respondents ($\boldsymbol{\beta} \neq \boldsymbol{\beta}_i$). Estimations in preference space fit ML models better than in willingness to pay space even though the willingness to pay (WTP) estimates are higher in preference space (Hole and Kolstad, 2012). Following Hole (2007), parameters of the ML were estimated using simulated maximum likelihood method .

5. EMPIRICAL RESULTS AND DISCUSSION

5.1 Model estimates

(i) Farmers' preferences for contracts

From Table 3, preference heterogeneity among farmers is clearly observed by the significant standard deviations of coefficients of the attributes as shown in Model 1. The positive and significant price coefficient for all the models in Table 3 suggests that farmers prefer marketing channels that offer higher prices thus increasing their utility. Higher vegetable price specifications in any sales,

ceteris paribus, increase preference to contract. Farmers generally are indifferent as to whether to participate in contracts or not since the coefficient of ASC is not statistically significant. Their participation in contracts therefore would depend on the contract design attributes.

In Model 2, we examined the influence of farmers' experience with supermarket contracts on contract preferences by interacting ASC with dummies for supermarket stayers, dropouts, and newcomers. The coefficient of ASC interaction with supermarket newcomers dummy is negative and statistically significant, meaning that the supermarket newcomers generally prefer contracts more than TC stayers. The coefficient of ASC for Model 2 is also greater than for Model 1, indicating that generally farmers who have never supplied supermarkets have more negative attitudes towards contracts than those with previous experience. Qualitatively, supermarket farmers mentioned during the FGDs that stable prices and assured market were the most important reasons for supplying supermarkets and these reasons have also been mentioned in previous studies (Hernández et al., 2007; Michelson et al., 2012).

(ii) *Influence of other factors on farmers' preferences*

For Model 3, the ASC was interacted with: annual household income; dummies for region and participation in group marketing; and demographic variables including age, level of education, and gender of the household heads. The coefficient of interaction with group marketing dummy is negative and statistically significant, indicating that group marketing increases farmers preferences to contract. This is plausible given the stringent requirements before supplying supermarket (contract) channels. First, most smallholders are unable to meet the orders individually owing to their small scale production but as a group, they can consistently supply while enforcing quality requirements.

Table 3. Mixed logit model estimates of farmers' preference for contracts

	Model 1	Model 2	Model 3
Parameters	**Mean**	**Mean**	**Mean**
PRICEW	0.51*** (0.06)	0.66*** (0.12)	0.48*** (0.06)
ASC	0.37 (0.35)	1.05* (0.59)	0.81 (1.50)
Place2	-2.13*** (0.40)	-2.39*** (0.51)	-2.10*** (0.38)
Place3	-2.75*** (0.50)	-3.69*** (0.82)	-2.43*** (0.43)
Form2	-1.00*** (0.29)	-1.20*** (0.39)	-0.95*** (0.27)
Timing2	-0.84*** (0.32)	-0.75*** (0.37)	-0.49 (0.31)
Timing3	-1.57*** (0.47)	-2.33*** (0.69)	-1.36*** (0.40)
Payment2	-3.11*** (0.51)	-4.06*** (0.90)	-2.77*** (0.45)
Payment3	-6.82*** (0.97)	-9.03*** (2.14)	-6.94*** (1.19)
Payment4	-15.37*** (2.89)	-21.60*** (5.18)	-11.33*** (2.11)
Payment5	-16.36*** (3.04)	-24.17*** (5.35)	-14.55*** (2.68)
Interactions			
ASC * SP stayers dummy[a] (1=yes)		-1.10 (0.73)	
ASC * SP drop-outs dummy[a] (1=yes)		-0.97 (0.70)	
ASC * SP Newcomers dummy[a] (1=yes)		-1.25* (0.65)	
ASC * Githunguri region dummy[b] (1=yes)			1.78** (0.72)
ASC *Westlands region dummy[b] (1=yes)			-1.02 (0.89)
ASC *Kikuyu region dummy[b] (1=yes)			0.21 (0.37)
ASC * Group marketing dummy (1=yes)			-1.66** (0.64)
ASC * Age (years)			0.01 (0.02)
ASC *Education (years of schooling)			-0.02 (0.06)
ASC *Gender dummy (1=male)			-0.58 (0.59)
ASC * Household income ("000" shillings")			-0.00022 (0.00014)
Standard deviations			
ASC	0.71 (0.47)	1.72** (0.81)	0.92 (0.68)
Place2	2.71*** (0.51)	3.66*** (0.81)	2.20*** (0.47)
Place3	3.79*** (0.61)	5.31*** (1.09)	3.27*** (0.50)
Form2	1.27*** (0.40)	1.95*** (0.57)	1.33*** (0.35)
Timing2	2.30*** (0.51)	2.90*** (0.68)	2.22*** (0.49)
Timing3	3.03*** (0.55)	4.94*** (1.04)	3.01*** (0.56)
Payment2	3.52*** (0.53)	4.37*** (0.93)	3.28*** (0.59)
Payment3	3.56*** (0.66)	5.12*** (1.21)	3.60*** (0.78)
Payment4	8.81*** (1.70)	12.56*** (2.99)	6.23*** (1.30)
Payment5	7.77*** (1.51)	12.36*** (2.80)	6.85*** (1.27)
Log likelihood at start	-1393.21	-1386.34	-1380.62
Log likelihood at convergence	-1314.09	-1308.55	-1310.79
LR chi-square (55)	586.94	533.14	522.89
Pseudo R^2	0.3058		

Source: Survey data

Notes: Standard errors in parentheses; Observations: 7362 (6 cards*3 options*409 respondents)

*, **, *** denotes statistical significance at the 10%, 5%, and 1% level, respectively

ASC (alternative specific constant) refers to the Traditional no-contract channels, TCs

[a]Reference category is Traditional channel (TC)stayers

[b]Reference category is Lari/Limuru region

SP refers to supermarket or supermarket channel

Supermarket farmers complained of the high rejection rates and breakages during the FDGs and group marketing is one of the ways to reinforce quality thus overcome the problem. Secondly, group marketing increases marketing margins by reducing per unit marketing costs for farmers and supermarkets as well.

The interaction coefficient for Githunguri region is positive and statistically significant (Table 3). Githunguri is the farthest from the capital city, Nairobi, compared to other three regions of our study. Farmers from this region generally have more negative attitude towards contracts compared to those from Lari/Limuru region. This is plausible given the poor road infrastructure in the region, the longer distances not only to local markets but also to the city where most supermarkets are located and unreliable transportation means. The Longer distances increase transportation costs and risk of quality losses during deliveries to distant markets. This could explain why most farmers complained of high rejection rates at the supermarket branches during delivery. A study by Moustier et al. (2010) also document locational remoteness of the farms as impeding smallholder commercialization and access to better but usually distant markets.

(iii) Influence of other factors on preferences for contract attributes

From Model 3 in Table 3, age, years of education, and gender of the household head, and annual household incomes had no significant effect on farmers' attitudes towards contracts in general. However, these factors were found to affect preferences for individual contract attributes when interacted with each attribute levels as presented in Table 4 at the appendix.

From Table 4, older farmers have more negative preference for contracts requiring deliveries at any place other than farm gate than younger farmers. They however have greater preference for any contracts with arbitrary sales through phone call orders (Timing3), and delayed payments based on quantities sold to consumers as verified through scanner data (Payment4) or without any verifications means (Payment5) than younger farmers. Better educated farmers dislike more any contracts requiring deliveries at places other than farm gate compared to less educated farmers.

They however prefer more arbitrary sales through phone call orders (Timing3), and delayed payments, based on quantities sold to consumers even without any verification means (Payment5) than less educated farmers.

Richer farmers prefer contracts with delayed payments more than poorer farmers even when payments are based on quantity delivered to buyers or quantities sold to consumers as verified through scanner data or without any verification provision. Rural farming households usually experience cash flow constraint to meet daily household purchases but with increased incomes, they can engage in contracts with delayed payments. Farmers from Githunguri region have lower preference for contracts than those from Lari/Limuru region as earlier shown by model 3 estimates and this is corroborated by results in Table 4 whereby they dislike more any contracts requiring deliveries elsewhere apart from the farm gate than farmers from other regions. Poor road network, longer distances to markets, and unreliable transportation means increase transportation costs and risks of quality losses therefore impeding access to distant markets including supermarkets located in the city.

Compared to female household heads, male household heads have greater preference for contracts requiring supplying cleaned and sorted vegetables (Form2), and with delayed payments by up to two weeks based on quantity delivered to the buyer or quantities sold to consumers without any verification provision. Study by Chege et al. (2015) also noted that female household heads had higher opportunity cost of time since they have other household chores and would not prefer marketing channels requiring labor intensive work of cleaning and sorting vegetables.

Farmers involved in group marketing have greater preference for contracts that specify timings of sale, with delayed payments based on quantities sold to consumers, with or without any verification provision compared to those who do not market collectively. Group marketing offers opportunities for smallholders to access supermarket channels requiring quantities they may not aggregate individually. The aggregation process takes time and this explains why farmers prefer contracts

specifying delivery times to provide ample time to aggregate required quantities. From the FGDs, farmers mentioned that group marketing had reduced rejection rates through the trainings on quality requirements and also the breakages had reduced significantly. Group marketing also offered an assurance of payment even when delayed and this explains why they do not have negative preference for contracts with delayed payments.

5.2 Farmers' willingness to accept contracts

Willingness to pay (WTP) estimates are the measures of how much the farmers are willing to pay for any improvement in attributes of a contract, obtained using formula shown in equation 6.

$$WTP = -1 \times \frac{Coefficient\ of\ attribute\ (s)}{Coefficient\ of\ price} \quad (6)$$

The farmers in our case are instead receiving a price for vegetables sold therefore we measure their willingness to accept (WTA) a price for changes in attributes of a contract. The WTA results are shown in Table 4 but the confidence intervals are in Table 5 at the appendix 2.

The mean WTA of ASC is -0.65, meaning that farmers are willing to accept a price reduction by 6.5% to participate in contracts. This is plausible, given that contracts generally offer lower prices than prevailing market prices. However, in the context of our study, farmers alluded to preferring lower prices per bundle of vegetables sold through contracts because they were more stable over time and market was assured in contract marketing channels. The farmers could therefore organize their production and marketing activities better.

Regarding place of sale, farmers require a price that is 38.9% higher when they have to deliver produce at a nearby market, not at the farm gates. The acceptable price gets much higher by 10% (additional 1.04 shillings) when they have to deliver at the buyers' premises than at the nearby market. The logistics of delivering produce at buyers' premises or nearby market incur additional costs to the farmers such as transportation, and local authorities' cess. In the context of the experiment, nearby market was closer to the farmer than buyers' premises which characterize sales

to buyers mainly from the city, including supermarkets. Longer distances coupled by poor transportation infrastructure also present additional risk of quality losses leading to high rejection rates in cases of supermarket channels.

Table 4. Mean estimates of willingness to accept (WTA) contracts

Attribute	Full sample	SP farmers	TC farmers
ASC	-0.65	-0.22***	-0.74
Sales at a nearby market	3.98	2.70***	4.26
Sales at buyers' premises	5.02	2.75***	5.51
Sold in washed and sorted form	1.88	1.32***	2.00
Sales as scheduled in contract	1.56	0.99**	1.68
Sales based on phone orders	2.99	3.09	2.97
Payment for quantity delivered	5.94	4.09***	6.33
Payment for quantity sold to consumers as physically verified by farmer	13.41	12.79	13.55
Payment for quantity sold to consumers as verified through bar code data	29.61	24.81***	30.64
Payment for quantity sold to consumers without possibility of verification	31.67	27.33***	32.59

Source: Survey data; All the payments are delayed by up to 2 weeks from delivery of vegetables; ***, ** differences between supermarket farmers and TC farmers at 1% and 5% levels respectively; N=72 and 337 for supermarket and TC farmers respectively.

Farmers require a price that is 18.8% higher when the sales involve improving the form of the produce. This entails cleaning, sorting and packaging in some instances especially for supermarkets and other high value channels. These activities generate additional costs to time and labor constrained farmers who then have to hire laborers. Farmers faced with high opportunity cost of time would not prefer contracts with such requirements.

For timing of sale, farmers have greater preference for contracts that specify timings of sale than otherwise as reflected in the mean WTA. They require 14% higher price when sales are based on arbitrary phone call orders than when timings are specified in a contract. Certainty of timing of sale enables more coordinated production and marketing activities by farmers. This is more profound in the case of supermarket channels that require greater volumes than individual farmers can sometimes aggregate. The farmers therefore aggregate from neighboring farms to meet the demands and the activity takes time. Arbitrary orders would not suffice especially considering the longer distances to the city and unreliable transportation means.

Wide disparities are observed in the WTA estimates for the payment mode attribute. The estimates are higher for any payments not based on quantities delivered by the farmer. For instance, farmers require a 59.4% higher price when payments are based on quantities delivered. They however require more than double the price when payments are based on ultimate quantities sold to the buyer, with an option for the farmer to physically verify the breakages. Physical verification of breakages by the farmer generates additional travel costs to farmers particularly when the deliveries are spread over several supermarket branches. The acceptable price triples when farmers can either verify sales through the bar code scanner data or no when no verification is possible. This underscores the importance of trust in any contractual arrangements with farmers. Farmers clearly do not trust buyers' claims of breakages that cannot be physically verified or verified through a buyer-controlled system such as scanner data.

As a robustness check, we additionally compare WTA estimates for supermarket farmers to those of TC farmers. There are statistically significant differences between the two groups of farmers for most of the attribute levels, except for sales based on phone orders and on quantities sold to consumers as physically verified by the farmer. There is however a similar pattern in the magnitude of estimates for the two groups, a sign of no systematic bias between the groups in the sample.

The WTA results should be interpreted with caution as is common with choice experiments but we place more emphasis on the significance, signs, and pattern in the coefficient estimates rather than actual values for many reasons. First, WTA estimates for ML models estimated in preference space are always higher compared to estimations in willingness to pay space but nonetheless, estimations in preference space fit ML models better (Hole and Kolstad, 2012). Second, owing to the perishable nature of vegetables and marketing risks involved, farmers marketing decisions are largely driven by losses aversion. Third, smaller sample sizes are associated with high WTA estimates. Lastly, WTA distributions are significantly affected by choice experiment design features particularly the abstractness of the attributes. While we cannot rule out these effects on our study, the pattern and magnitudes of the estimates show that potential bias is not confined to a particular attribute.

4.3 Limitations of the study

Bryan and Dolan (2004) pointed the cognitive burden CEs in general place on respondents and confine interpretation of results. It is relevant to our study but nonetheless do not challenge methodological and theoretical underpinnings of CEs (Lancsar and Donaldson, 2005). Respondents' cognitive capacities to evaluate choice alternatives is always an issue since cognitive burden could result in inconsistent choices for scenarios involving complex choices. It also leads to attribute non-attendance thereby yielding downward biased coefficients. To minimize this, we applied a blocked design with few choice sets presented to respondents, mainly household heads, who had 10 years of schooling on average, and knowledgeable on vegetable marketing. The enumerators also clearly explained the choice scenarios to respondents to facilitate informed choice and consequently all the 409 respondents completed the experiment.

6. CONCLUSIONS

Supermarket growth in developing countries provides an opportunity to enhance smallholder commercialization through the marketing contracts offered to farmers. Emerging literature documents mixed results of welfare implications of farmers' participation in supermarket contracts. Empirical studies of farmers' preferences for such contracts and their attributes remain scarce. In this article employ mixed logit model on choice experiment data to examine farmers' preferences for contracts, contract attributes and possible effects of socio-economic characteristics on preferences.

We find that smallholder farmers' are open to contracting and their participation in contracts is largely influenced by contract attributes. Farmers with previous contract experience also have positive attitudes towards contracts in general. Further, the supermarket newcomers prefer contracts more than the TC stayers. Designing contracts mutually beneficial contracts could incentivize farmers to participate in supermarket contracts thereby increasing their incomes. The contracts offer market assurance thus enabling more coordinated production and marketing activities.

The results also underscore the importance of trust between farmers and buyers. Even though all the contract options have delayed payments, farmers are only willing to accept higher prices per bundle of vegetables when the contracts have no option to verify sales to consumers than when such provisions exist, either through physical verification or scanner data. There is a need for trust building mechanisms to minimize suspicions of the farmers thereby sustaining participation in supermarket contracts. This could be made possible through frequent interactions between supermarket officials and farmers, a more transparent means to verify sales, and standardized grading system to assure farmers of fairness in pricing.

Farmers prefer contracts with payments for quantities delivered rather than those sold to consumers as noted in the supermarket contracts. Farmers dislike contracts with any form of delayed payments especially those with unpredictable variations in expected sales proceeds as observed in current supermarket contracts that shifts all risks to farmers, potentially leading to great losses. Designing contracts with risk sharing clauses therefore would encourage farmers' participation in the supermarket contracts.

Group marketing is clearly important to sustain smallholder participation in supermarket contracts as shown by the results. It helps reinforce the stringent quality requirements of supermarket contracts while simultaneously ensuring consistent timely supplies that would otherwise be a challenge to individual farmers. Farmers benefit through collective access to supermarket channels, reduced rejection rates when quality requirements are met. Study by Trebbin, (2014) also document higher prices from increased bargaining power, reduced transaction costs for farmers, and continuous timely supply of fresh produce to buyers as some of the benefits of group marketing.

Implications of the findings are not confined to vegetable farmers and supermarkets alone but also extend to other smallholder horticultural farmers with similar marketing opportunities besides supermarkets. Poor road infrastructure still hinders smallholder commercialization particularly for remote farms. From policy perspective, there is need to improve road network to shorten

transportation time and minimize quality losses when transporting horticultural products. Beyond group marketing, policies that increase smallholders' access to productive assets would increase production and post-harvest handling capacities thereby enabling even non-group farmers to supply contract channels individually. There is need for quality regulatory framework to standardize quality of horticultural produce for the benefit of both farmers and buyers. This would minimize exploitation of smallholder farmers and also improve trust between them and buyers.

Further research is required on supermarket contracts since we did not cover other issues affecting farmers' decisions to contract, but are indirectly manifested in the socio-economic characteristics influencing contract attribute preferences. For example, issues around productivity, extension, input access, and supermarkets' view of the contractual arrangements. Further improvements in experimental approaches to analyze preferences would also be beneficial.

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APPENDIX 1:

Figure 2. Sample choice card

APPENDIX 2

Table 4. Correlated mixed logit models with Interactions between contract attributes and socioeconomic characteristics

	Variables interacted with attribute levels						
MODELS	**1**	**2**	**3**	**4**	**5**	**6**	**Base Model**
	Age of household head	**Education level of household head**	**Household Income in ''000''shillings**	**Githunguri Region dummy**	**Male Gender dummy**	**Group marketing dummy**	
Interactions							
_placee2	-0.06**(0.03)	-0.05***(0.02)	0.0003(0.0002)	-2.37**(1.03)	0.90 (1.07)	-0.61 (0.78)	
_placee3	-0.02 (0.03)	-0.04 (0.02)	0.0004 (0.0003)	-1.51 (0.96)	0.06 (1.05)	0.34 (0.92)	
_Form2	-0.02 (0.02)	-0.02 (0.01)	0.0001 (0.0002)	-0.75 (0.67)	1.396*(0.84)	-0.57 (0.58)	
_Timing2	-0.002 (0.02)	-0.02 (0.02)	0.0002 (0.0002)	-0.54 (0.75)	-0.06 (0.88)	1.36*(0.73)	
_Timing3	0.09***(0.03)	0.05**(0.02)	-0.0003(0.0003)	0.36 (1.10)	0.15 (1.12)	-0.45 (0.92)	
_Payment2	-0.004 (0.03)	-0.002 (0.02)	0.0008***(0.0002)	0.05 (1.02)	2.063*(1.24)	1.38 (1.00)	
_Payment3	0.04 (0.03)	0.02 (0.03)	0.0003 (0.0004)	-1.47 (1.54)	1.09 (1.27)	3.28***(1.07)	
_Payment4	0.12**(0.06)	0.02 (0.04)	0.0010**(0.0005)	-0.261 (1.84)	1.36 (1.89)	5.49***(1.81)	
_Payment5	0.137**(0.06)	0.20***(0.07)	0.0017*(0.0009)	-0.364 (2.81)	9.04**(4.34)	7.18***(1.70)	
Parameters							
PRICEW	0.69***(0.12)	0.51***(0.07)	0.56*** (0.08)	0.53*** (0.07)	0.62*** (0.12)	0.49*** (0.06)	0.51*** (0.06)
ASC	0.27 (0.47)	0.36 (0.33)	0.15 (0.34)	0.30 (0.39)	0.77 (0.52)	0.17 (0.34)	0.37(0.35)
Place2	0.09 (1.35)	0.86 (1.01)	-2.86*** (0.56)	-1.65*** (0.37)	-3.24*** (1.16)	-2.29*** (0.43)	-2.13*** (0.40)
Place3	-2.92*(1.63)	-0.77 (1.26)	-3.43*** (0.69)	-2.47*** (0.55)	-3.12*** (1.10)	-3.09*** (0.55)	-2.75*** (0.50)
Form2	-0.63 (0.92)	0.14 (0.77)	-1.33*** (0.36)	-1.12*** (0.34)	-2.20**(0.90)	-1.10*** (0.32)	-1.00*** (0.29)
Timing2	-0.87 (1.12)	0.27 (0.88)	-1.02*** (0.37)	-0.70**(0.32)	-0.71 (0.87)	-0.97*** (0.34)	-0.84*** (0.32)
Timing3	-7.33***(2.17)	-4.22*** (1.31)	-1.57*** (0.49)	-1.94*** (0.54)	-1.93 (1.25)	-1.68*** (0.47)	-1.57*** (0.47)
Payment2	-4.24***(1.56)	-3.06**(1.28)	-3.94*** (0.68)	-3.30*** (0.62)	-5.50*** (1.52)	-3.11*** (0.55)	-3.11*** (0.51)
Payment3	-12.11***(3.12)	-8.20*** (1.94)	-7.68*** (1.51)	-6.47*** (0.96)	-8.75*** (1.96)	-7.17*** (1.06)	-6.82*** (0.97)
Payment4	-24.73***(5.90)	-16.61*** (4.10)	-16.04*** (3.18)	-13.57*** (2.60)	-17.23*** (3.99)	-13.57*** (2.92)	-15.37*** (2.89)
Payment5	-36.56***(7.99)	-37.87*** (9.78)	-21.57*** (5.07)	-17.85*** (3.03)	-35.60*** (9.85)	-17.34*** (3.13)	-16.36*** (3.04)

Table 4. CONTINUED

Standard deviation							
ASC	0.74 (0.63)	0.44(0.57)	0.32 (0.53)	1.42*(0.74)	2.09**(0.97)	0.04 (0.52)	0.71(0.47)
Place2	0.35*** (0.98)	2.53*** (0.58)	3.09*** (0.59)	2.87*** (0.53)	3.55*** (0.84)	2.73*** (0.52)	2.71*** (0.51)
Place3	4.80*** (1.02)	4.16*** (0.76)	4.55*** (0.77)	3.96*** (0.65)	4.52*** (0.93)	4.06*** (0.64)	3.79*** (0.61)
Form2	1.40*** (0.46)	1.66*** (0.46)	1.81*** (0.43)	1.46*** (0.36)	1.74*** (0.57)	1.29*** (0.31)	1.27*** (0.40)
Timing2	3.16*** (0.83)	2.44*** (0.50)	2.45*** (0.62)	2.15*** (0.43)	3.12*** (0.74)	2.53*** (0.50)	2.30*** (0.51)
Timing3	5.23*** (1.15)	3.48*** (0.74)	3.54*** (0.63)	4.04*** (0.48)	4.12*** (0.98)	3.15*** (0.48)	3.03*** (0.55)
Payment2	5.50*** (1.17)	4.34*** (0.82)	3.78*** (0.62)	3.86*** (0.74)	4.53*** (1.07)	3.73*** (0.63)	3.52*** (0.53)
Payment3	4.86*** (1.13)	3.96*** (0.76)	4.16*** (0.95)	3.05*** (0.61)	4.22*** (1.06)	3.17*** (0.62)	3.56*** (0.66)
Payment4	9.69*** (2.46)	9.15*** (2.03)	8.91*** (1.88)	7.61*** (1.69)	8.88*** (2.02)	7.00*** (1.61)	8,81*** (1.70)
Payment5	13.76*** (3.10)	14.57*** (3.68)	10.93*** (2.62)	8.45*** (1.49)	15.41*** (3.91)	8.11*** (1.65)	7.77*** (1.51)
LL at start	1383.,78	1382.39	1380.99	1388.17	1395.11	1379.56	-1393.21
LL at convergence	1301.22	1315.58	1304.80	1310.69	1314.23	1303.52	-1314.09
LR chi² (55)	596.91	568.19	579.50	575.67	567.11	569.52	586.94

Notes: Observations=7362; Standard errors in parentheses; *, **, *** denotes statistical significance at the 10%, 5%, and 1% level, respectively;"_ "denotes interaction with covariates

Table 5. Confidence intervals for full sample estimates of willingness to accept (WTA) contract

Attribute	Mean	Lower limit	Upper limit
ASC	-0.65	-0.76	-0.54
Sales at a nearby market	3.98	3.60	4.37
Sales at buyers‘ premises	5.02	4.43	5.63
Sold in washed and sorted form	1.88	1.71	2.06
Sales as scheduled in contract	1.56	1.30	1.82
Sales based on phone orders	2.99	2.66	3.32
Payment for quantity delivered	5.94	5.51	6.36
Payment for quantity sold to consumers as physically verified by farmer	13.41	13.04	13.79
Payment for quantity sold to consumers as verified through bar code scanner data	29.61	28.60	30.63
Payment for quantity sold to consumers without possibility of verification	31.67	30.80	32.54

Notes: N=409; estimates are derived using delta method at 95% confidence interval.