Heterogeneous Demand for Quality Soybean in Northern Ghana

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Selected Poster prepared for presentation at the 2018 Agricultural & Applied Economics Association Annual Meeting, Washington, D.C., August 5-August 7

P14250

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Hypotheses

Hypothesis 1. *Significant differences exist in the level of discounts across key soybean attributes.*

Hypothesis 2. *Significant differences exist in the level of discounts across buyer types operating in the soybean value chain.*

Background

Over the last 20 years soybean has been the fastest growing broad land crop in terms of land under cultivation; outpacing rice and maize, by one-third **(**Tamimie & **Goldsmith, 2017**). Soybean's growth results from the rise in incomes and the change in diets and food consumption patterns involving shifts to animal-sourced and processed foods. While global demand has risen rapidly, Sub Saharan African (SSA) farmers and the rural economy have not benefited. To date less than 0.5 of 1% of all the soybean produced originates from SSA, excluding South Africa. Regional policy makers and development operatives in Africa now are looking to develop local soybean value chains as a way to increase economic development and reduce the imports of food oil and livestock feeds (see IFDC, 2013).

Introduction of new commercial crops and the associated market interactions presents many challenges to smallholders as they navigate new norms associated with long commercial value chains (Tamimie & Goldsmith, 2017). Fundamental to this commercial transaction is the definition of quality by the buyer, and the discounting that result when grain fails to meet the expected standard. This study aims at improving the symmetry of quality information across actors and contribute to agricultural commercialization literature in developing country. We estimated WTP and preference heterogeneity across buyer types using choice experiment.

Method

Experimental design

Figure 1: Example of a choice experiment

Please check (√) the option (A, B or C) that you would be most likely to choose

Market attributes	Option A	Option B	Option C
Color	Deep brown	Deep brown	Light brown
Size	Small	Small	Big
Debris	Not sorted	Not sorted	Sorted
Variety	Salintua 1	Salintua 2	Jenguma
Price per bag (104kg)	GHS170	GHS200	GHS200
I will choose…			

Trader Survey and Choice experiment survey

A. Possible combinations of attributes is 72 ($2^3 x 3^2$)

B. Use Orthogonal fractional design to generate to generate 18 choice set scenarios devoid of strong correlations among attributes

C. 18 choice sets put into 3 blocks with each block consisting of six choice sets

Table 1: Soybean trade attributes and levels

Attributes	Levels		
	1	2	3
Color	Light brown	Deep brown	
Size	Small	Big	
Debris	Sorted	Not sorted	
Variety	"Jenguma"	"Salintua I"	"Salintua II"
Price	GHS170	GHS200	GHS230

Estimation Technique

Following Train (2009), we estimated the following model:

$$U^*_{ijt} = X'_{ijt}\beta_i + Z_{ij} + \varepsilon_{ijt} \quad (1)$$

Given that β_i is unknown, we estimate the unconditional choice prob.:

$$P_{ij} = \int \frac{\exp(X'_{ijt}\beta_i + \lambda Z_i)}{\sum_{g=1}^{G} \exp(X'_{igt}\beta_i + \lambda Z_i)} f(\beta|\Theta)d\beta \quad (2)$$

To allow for preference heterogeneity across buyers, we estimated the Latent Class Logit (LCL) model:

$$P_i(j|C) = \frac{\exp(X'_{ijt}\beta_i + \eta Q_{ijt} + \lambda Z_i X_j)}{\sum_{g=1}^{G} \exp(X'_{igt}\beta_i + \eta Q_{igt} + \lambda Z_i X_g)} \quad (3)$$

The joint probability of belonging to a class (h) and selecting alternative (J) and WTP is specified as:

$$P_n(j) = \sum_{h=1}^{H} \left(\frac{\exp(\gamma_h R_j)}{\sum_{h=1}^{H} \exp(\gamma_h R_j)}\right) \prod_{s=1}^{S} \left(\frac{\exp(\beta_h X_j)}{\sum_{h=1}^{H} \exp(\beta_h X_g)}\right) \quad (4)$$

$$\text{MWTP} = -\frac{\beta_{attribute}}{\beta_{cost}} \quad (5)$$

Data

The study was conducted in northern Ghana in the summer of 2017. The actors are Wholesaler, Processors and Retailers.

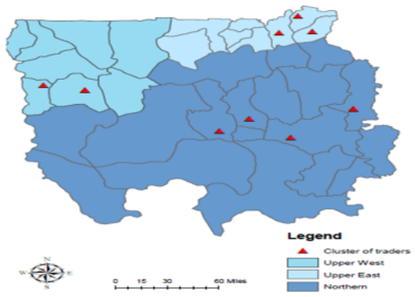

Figure 2: Cluster of buyers

Sample consist of 228 buyers

Results

Figure 3: Demand for improved soybean attributes

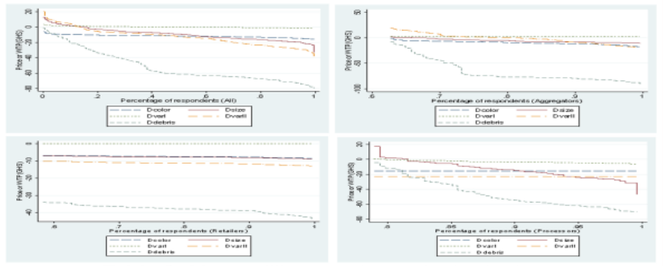

Table 3: Mean willingness to pay by trader type

Attribute	All Sample (N=228)		Aggregators (N=85)		Retailers (N=95)		Processors (N=48)	
	Mean WTP (GHS)	Percent	Mean WTP (GHS)	Percent	Mean WTP (GHS)	Percent	Mean WTP (GHS)	Percent
Color	**-11.789**	**-5.888**	**-9.824**	**-5.046**	**-15.48**	**-20.746**	**-15.494**	**-7.240**
Size	**-9.297**	**-4.643**	**-5.604**	**-2.879**	**-13.626**	**-18.261**	**-14.088**	**-6.583**
Variety 2	0.019	0.009	2.568	1.319	-5.636	-7.553	-3.255	-1.521
Variety 3	**-12.777**	**-6.381**	**-1.527**	**-0.784**	**-4.495**	**-6.024**	**-22.839**	**-10.672**
Debris	**-51.725**	**-25.833**	**-66.502**	**-34.160**	**-60.749**	**-81.414**	**-46.829**	**-21.882**
ASC	200.225		194.678		74.617		214.01	

Discussion and Conclusion

Our results suggest three classes of soybean buyers "high price discount", "big soybean size supporters", and "soybean variety skeptics". Two main facts: (1) farmers lack clear signals about incentives for quality thus unable to respond positively; (2) lack of consistent information on quality and standards among the supply chain actors. Traders are willing to pay US$45.92 for a bag (104kg) of soybean that satisfies all the preferred attributes. Processors WTP (US$50) is higher than wholesalers (US$45) and retailers (US$17).

There is the need for a multi-stakeholder meeting (MSM) with all relevant stakeholders in the soybean value chain to build consensus on quality standards on production and market attributes.

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ACKNOWLEDGEMENTS: *This material is based upon work supported by the United States Agency for International Development, as part of the Feed the Future initiative, under the CGIAR Fund, award number BFS-G-11-00002, and the predecessor fund the Food Security and Crisis Mitigation II grant, award number EEM-G-00-04-00013. Soybean Innovation Lab , Office of International Program and CSIR-SARI are acknowledged for financial support.*