HOW DO STORAGE PRACTICES AFFECT SMALLHOLDER FARMERS' MARKET PARTICIPATION IN BENIN?

Didier Kadjo[1], Jacob Ricker-Gilbert[2], Abdoulaye Tahirou[3], [4]Nasser BACO

[1]PhD candidate, [2]Associate Professor; Purdue University, USA

[3]Outcome /Impact Economist; IITA; Nigeria

[4]Assistant Professor; University of Parakou, Benin

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Corresponding author

Didier Kadjo, Purdue University

dkadjo@purdue.edu

Phone: +1 765-494-7960

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Abstract

Rural households market a smaller share of their grain stocks when they have better knowledge about quality issues and also invest in improving quality. This is most likely because there is no quality control and the price premium received for higher quality maize is not sufficient to incentivize improvements or investments in storage. Farmers who sell a larger share of their maize stocks into markets might perceive that their storage practices impair quality. This behavior is observed in the use of chemical protectant for which knowledge and information are limited in rural areas. Our findings highlight the need to develop long term grades and standards in African grain markets to ensure product differentiation and therefore develop rural markets through improved sale transactions.

Introduction

- Well-functioning markets depend on consistent supply of good quality grain (Hodges et al., 2011). But many food markets in SSA fail to provide consistently high quality.
- A lack of quality standards for grains creates additional market inefficiencies which prevent smallholder farmers from participating in cereal markets.
- Farmers are less likely to sell good quality maize into the markets because there is no quality control or sufficient price premium for quality.
- Farmers place more value on their own grain compared with grain sourced from markets (Hoffman and Gatobu, 2014).

Objective & hypotheses

The objective of this study is to investigate how farmers' storage practices and perceptions associated with maize quality affect their market participation during the post-harvest season.

Hypotheses

- The use of chemical protectant for storage has no statistically significant effect on the amount of maize a farmer allocates to sales during the post-harvest season.
- Perceptions about the potential health risks associated with chemical-contaminated maize have no statistically significant effect on the amount of maize a farmer allocates to sales during the post-harvest season.

Maize quality from chemical use

Chemical use provides two quality characteristics: (i) direct effect of pesticides used to control pests and (ii) an indirect human health effect, operating through the potential exposure has on farmers' health (Antle and Pingali, 1994).

$$Quality: \begin{cases} Observable\ (o) = Insect\ damage \dashrightarrow Good\ attribute \Rightarrow No\ damage\ (\bar{o}) \\ Unobservable\ (u) = pesticide\ residues \dashrightarrow Good\ attribute \Rightarrow No\ residues(\bar{u}) \end{cases}$$

A farmer's perception (information) about her storage practice affects her belief about maize quality.

$$\begin{bmatrix} 1-p(damage|chemical) & 0 \\ 0 & 1-p(residues|chemical) \end{bmatrix} * \begin{bmatrix} No\ damage \\ No\ residues \end{bmatrix}$$

Insect damage

Identification Strategy and Data

A model of market participation in two steps following a double hurdle approach

$$\text{Step (1)} \begin{cases} m_{it} = 1 : y_{it}^{*} = \mu_{it} + g(Chemical\ use, Risk\ perception, Drying\ duration, X_{it}) + e_{1it} > 0 \\ m_{it} = 0 : \ y_{it}^{*} = \mu_{it} + g(Chemical\ use, Risk\ perception, Drying\ duration, X_{1t}) + e_{1it} \leq 0 \end{cases}$$

Where m_{it} is the probability of a farmer to sell maize during the post-harvest season and y_{it}^{*} the latent variable associated with the decision to sell.

The hurdle (2) is conditioned on a farmer's probability to sell maize

$$\text{Step (2): } Quantity\ sold_{it} = \beta_1 Chemicale\ use_{it} + \beta_2 Risk\ perception_{it} + \beta_3\ Chemical_{it} * Risk\ perception_{it} + \beta_4 Drying\ duration_{it} + \boldsymbol{\delta} X_{it} + u_i + \boldsymbol{\varepsilon_{it}}$$

The identification strategy deal with endogeneity caused by:

- Omitted variable bias ← controlling for farmers' unobserved heterogeneity (u_i), storage goal (consumption, sale, consumption & sales), access to chemical, & observable characteristics (X_{it}).
- Non-random access to chemical protectant ← A control function approach → No endogeneity

The study uses a two-wave of data collected after the harvest seasons 2011/2012 and 2013/2014 for a total of 618 rural households in 6 of the 12 departments in Benin.

Econometric results

Table. Double hurdle of factors that affect the amount of maize sold during the post-harvest period

	Hurdle 1		Hurdle 2	
	Probit-MC		Trunc-Normal-MC	
Variable	APE	P>z	APE	P>z
Chemical cost (1,000 F CFA)	**0.03*** **	**(0.01)**	**-44.36*** **	**(0.00)**
=1 if Risk of chemical contamination	**-2E-04**	**(1.00)**	**-226.55**	**(0.11)**
Chemical cost x Risk of chemical contamination	**-0.03***	**(0.08)**	**29.91** **	**(0.03)**
Drying duration (# days)	-1E-03	(0.84)	-56.29	(0.30)
=1 if risk of mold contamination	-0.01	(0.65)	193.50	(0.17)
Drying x Risk of mold contamination	0.00	(0.60)	56.04	(0.30)
Knowledge about chemical use (# Years)	-0.04	(0.16)	17.06	(0.89)
Post-harvest Price (F CFA /Kg)	8E-04	(0.02)	2.47	(0.19)
Maize stock (Kg)	3E-05***	(0.01)	0.52***	(0.00)
=1 if goal includes sales	0.50	(0.00)	-274.03	(0.19)
% of maize produced sold at harvest.	-0.18*	(0.07)	181.85	(0.62)
Total Farm size (Ha)	0.01	(0.19)	11.97	(0.20)
Savings (x 1,000 F CFA)	0.00	(0.32)	-0.12	(0.37)
Age	9E-04	(0.85)	-3.51	(0.85)
Age square	-1E-05	(0.81)	0.05	(0.78)
=1 if gender is Male	-0.01	(0.72)	166.76	(0.15)
=1 if HH attended school	0.02	(0.51)	-183.22*	(0.09)
Household size	-0.01**	(0.03)	-32.41	(0.18)
distance from market (Km)	0.01	(0.05)	-5.07	(0.65)
=1 if input dealer in the village	0.15**	(0.01)	20.89	(0.93)
=1 if extension agent in the village	0.06*	(0.07)	-118.15	(0.34)
# Observations		618		432
Pseudo R2		0.65		

*** p<0.01, ** p<0.05, * p<0.1; 1 $ = 513 F CFA at the time of the survey

Conclusions

- An increase in expenditure for chemical protectant is associated with a higher probability that farmers will participate in markets. This likely occurs because they need to cover the cost of chemical application.
- Farmers who use chemical protectant sell less stored maize when they are unaware of the risk of chemical use. They expect high marginal value for maize quality (No insect damage & Residues) that markets cannot pay for.
- Farmers who use chemical protectant sell more stored maize when they are aware of the risk of chemical use. They might perceive a health risk from applying chemicals to stored maize. They can move risky maize stocks into markets as chemical contamination decreases the marginal value of stored maize.

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