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CASH SALE OF PEANUTS AMONG SMALL FARMERS IN THE NORTHERN REGION OF GHANA[1]

SPRZEDAŻ GOTOWKÓWA ORZESZKÓW ZIEMNYCH PRZEZ DROBNYCH ROLNIKÓW Z PROWINCJI PÓŁNOCNEJ W GANIE

Key words: storage, survey, Tobit model, price

Słowa kluczowe: przechowalnictwo, badania ankietowe, model Tobit, cena

JEL codes: Q13, Q12

Abstract. Small farmers grow peanuts to feed their families and to sell a portion of the crop to raise cash to pay, among others, their children school fees. The dual nature of peanut crop has been recognized, but not rigorously examined. The amount of sold peanuts depends on a number of factors and varies by location. This paper specifies an empirical relationship modeling the volume of sold peanuts using the survey data collected among small farmers in northern Ghana. The truncated nature of the dependent variable, the number of sold bags of peanuts, led to the application of the Tobit model. Among variables significantly influencing the number of sold bags are respondent and farm characteristics, prices, and general features of the environment in which a farmer sells peanuts, including distance to markets and credit access. Farmers choose to store peanuts rather than selling them at harvest because prices tend to increase, although by a small amount.

Introduction

Selection of crops on small farms in northern Ghana aims at providing adequate amounts and varieties of foods to support a farm household as well as crops for cash sale. Among such crops are peanuts and vegetables, grown as foods to be used in the household and sold in the marketplace [Tsigbey et al. 2003]. Cash from sales is used to purchase products not grown on the farm, such as spices, non-food items, services (e.g., transportation) and, especially, to pay fees for children attending school. For farmers in the region who generally lack opportunity to have an off-farm job, sales of farm-raised crops are essential and the amount of cash raised from sales is tied to the timing of each sale. Typically, a sale at harvest results in obtaining a low price because of the temporary abundance of a given commodity. Farmers benefit from storing a commodity between harvests because the price tends to rise over time as the crop is utilized and inventory depleted. Although Ghana's climate permits raising crops year-round, the precipitation pattern still largely dictates the type of crops grown as irrigation on small farms is non-existent. Northern Ghana has only one rainy season and the majority of peanuts are produced during that season.

Harvested and stored peanuts play the role of savings in an environment where banking services are not easily accessible, farmer knowledge of banking functions inadequate, and ability to borrow severely constrained by lack of assets. Consequently, peanut sales by individual inventory holders are dictated by cash flow needs. Deferring sales generally favors the inventory owner, especially a small farmer, for whom the cost of storage is negligible as he uses available space,

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e.g., in an unoccupied hut, protecting peanuts from the elements. The quality of stored peanuts can deteriorate due to insect [Dick 1987] or rodent presence, lowering the price received by a farmer. Low cost methods exist to prevent some insect damage to stored peanuts [Anda et al. 2014] but are not widely applied. Revenues from peanut sales have different significance to a man and woman in a farm household, but if a spouse fails in his or her responsibilities, the other steps in, including the payment of school fees. Varying gender responsibilities in household finances add importance to the analysis of factors determining peanut sales.

This study examines factors influencing the amount of sold peanuts by small farmers from villages in the Northern Region of Ghana. The region, located in the Guinea savannah, accounts for 70% of the country's peanut production [Oteng-Frimpong et al. 2017] and supplies other regions in the country, including the major cities in the south. Peanuts and various peanut products are eaten daily throughout the country [Meng et al. 2014], but are especially popular in northern Ghana. Knowledge of factors influencing peanut sales provides insights into the functioning of rural households. Additionally, because of the importance of peanuts for farm household food security, factors determining sales may also be helpful in monitoring farm families' nutrition, especially in years of reduced crop.

Peanut growing in northern Ghana

There are three main varieties of peanuts grown in northern Ghana: Bugla (a local variety yielding large kernels), Simkarzie (an improved variety), China (simbaligu), and Abain (Manipintar). The names do not represent genetically pure strains and all varieties represent various crosses with some dominant traits allowing visual distinction such as kernel size or skin color. The different varieties have specific uses, but that distinction is disappearing. For example, initially, China and Abain varieties were specifically used for oil extraction.

Planting peanuts in the areas surveyed is done by both males and females. The majority of women farmers planted simbaligu which is easy to harvest. Peanut harvesting is generally done by females and sometimes young boys. If a variety cannot be easily pulled out of the ground at harvest, the husband will dig out the peanut plants in exchange of a portion of the crop. Sharing a crop lowers the amount available to the wife and lowers future sale revenues. Dug plants are left to dry and peanut pods are plucked by female family members or other females from the village. The latter are paid by taking a share of the crop, typically a third of plucked pods (as measured by a bowl).

Storage of peanuts is done in jute sacks, synthetic bags (up to 100 kg), or puppuri made of thatch and located in the harvest field. The latter form of storage is disappearing although evidence suggests that this method might have been effective in maintaining peanut quality [Butts et al. 2006]. Peanuts stored in jute sacks, or polyethylene bags are stored in rooms. Plastic sacks are light, convenient, and keep moisture away from the stored peanuts, but they also prevent the circulation of ambient air, which helps to dry harvested peanuts. The low moisture level is essential for proper storage because otherwise, in combination with the high temperatures of storage rooms, peanut kernels are subject to gradual contamination by molds and aflatoxin, whether they in-shell or shelled [Florkowski, Kolavalli 2016].

In a developed economy, where farmers grow crops for commercial markets rather than to support their own household and farm enterprises, the price between harvests is expected to increase reflecting the gradual disappearance of the crop and payment for providing the service of storage. To store a crop, a farmer can chose own on-farm storage or rent space, for example in an elevator. Since the size of the crop fluctuates in response to changing weather during the growing season from year to year, the exact volume is not known until the harvest is completed. A farmer is unlikely to invest in storage capacity anticipating the highest possible volume because part of space would in some years remain unused while, over time, gradually increasing

yields due to new variables would require storage expansion. Moreover, the on-farm storage must cost less than commercially rented space or a farmer incurs a relative loss. Numerous studies have examined the issue of storage by commercial farmers.

However, a small farmer who grows peanuts for household use as well as for generating cash has somewhat different motives driving the storage decision. The cost of storage is not considered in their decision because most farm households have empty huts in the studied area. The crop potential is stable because the planted seeds represent the same mix of genes. Farmers lack access to certified seeds and limited resources and the habit of saving seed from prior harvest has discouraged commercial seed distributors from entry into Ghana. The seed distribution system has been improving [Tripp, Mesah-Bousu 2013], but many small farmers depend on saved seeds [Ibrahim, Florkowski 2015]. As a result, storage space is not a constraint and the main motive is to store enough peanuts to secure food for the household between harvests and to sell a portion for needed cash. The timing of various payments, for example school fees, may influence the sale. In years of reduced crops, some farmers may have to choose between consuming the peanuts left in storage and buying seeds at the market to plant a new crop, or withdraw some peanuts from consumption to save as seed.

The decision to sell peanuts by a small farmer is driven by factors seldom examined in empirical studies because of the lack of data and the highly variable local conditions. More importantly, the sheer volume is small although important for a farm family. And the multiple transactions would require an extraordinary effort in collecting such information between harvests. This study relies on recall with regard to sales and models the number of sold bags of peanuts between harvests.

Material and methods

Prior to the survey implementation, a list of villages and towns within each district in the survey area of the Northern Region was created. The villages and towns to be surveyed were randomly selected with numbers assigned by Microsoft Excel's random number generator. Next, leaders in each location were approached with the request to collect names of peanut farmers after being first briefed about the purpose of the study. Every other farmer placed on the list was contacted by enumerators and participated in a face-to-face interview. A total of 241 farmers participated in the survey although some interviewers missed responses to selected questions.

Table 1 shows the descriptive statistics of the sample. The average farmer was 38 years old, the majority of the interviewed farmers were male, and the average household included nearly 15 members. Slightly more than one half (55%) received some formal education. The average income in the month preceding the survey was 125 cedis. The average area planted with peanuts was 3.87 acres and a farmer sold about six bags of peanuts (nearly 600 kg). Peanut yields in Ghana are low compared to yield potential [Tanzubil 2016]. Few farmers (14%) had access to credit but that result is consistent with earlier studies [Dankyi et al. 2005]. The nearest market was, on average, 3.15 km away. Only about 15% of farmers sold in-shell peanuts in the preceding season. In-shell peanut sales are rare because buyers prefer to visually assess the quality of kernels. Visual assessment allows identifying heavily molded kernels, which could lower the quality of a purchased lot. The average price during the harvest season preceding the survey was 16.33 cedis and reached 17.39 cedis six months after the harvest. The price difference amounted to 6.5%.

Table 1. Summary statistics of the dependent and explanatory variables
Tabela 1. Opisowe miary statystyczne zmiennej zaleznej i zmiennych objasniajacych

Variable name/*Nazwa zmiennej*	Units/*Jedn.*	Mean/ *Średnia*	Standard deviation/ *Odchylenie standardowy*	Min.	Max.
Dependent variable/*Zmienne zależne*					
– sold bags/*sprzedane opakowania*	number/*liczba*	5.92	9.08	0[a]	70[a]
Socio-demographics/*Społeczno-demograficzne:*					
– gender of household head/*płeć głowy domu*	1 = male/ *mężczyzna*	0.83	0.37	0	1
– age/*wiek*	years/*lata*	38.01	11.78	18	75
– household size/wielkość gospodarstwa domowego	number/*liczba*	14.80	9.10	1	80
– education of household head/*wykształcenie głowy domu*	1 = formal/ *formalne*	0.55	0.50	0	1
Income/money variables/*Zmienne dochodu/pieniądza:*					
– monthly income/*miesięczny dochód*	cedis	125.44	201.54	0	1500
– access to credit/*dostępnośc kredytu*	1 = access/ *dostęp*	0.14	0.35	0	1
Production and marketing/*Produkcja i maketing:*					
– area of grown groundnuts/*powierzchnia uprawy*	acre/*akr*	3.87	2.95	0	20
– distance to nearest market/*odległość do najbliższego sklepu*	km	3.15	5.38	0	15
Sales and prices/*Sprzedaż i ceny:*					
– sale of fresh in-shell groundnuts last year/ *sprzedaż orzeszków w poprzednim roku*	sale/*sprzedaż* = 1	0.15	0.35	0	1
– price six months after last harvesting season/ *cena 6 miesięcy po zbiorach*	cedis	17.39	33.22	1.2	200
– price during last harvesting season/*cena w ostatnimo sezonie zboru*	cedis	16.33	29.81	0	100

Source: own study
Źródło: badania własne

Estimation approach

The Tobit model is appropriate when using a dependent variable with a corner solution response. Such a variable is zero for a non-trivial fraction of the population but is roughly continuously distributed over positive values [Wooldridge 2002]. In the sample used in the current study, 82 out of 215 surveyed households did not report any sale of groundnuts in the previous season. The Tobit model, also called a censored regression model, is designed to estimate linear relationships between variables when there is either left or right censoring in the dependent variable. The model is defined as:

$$y^* = x\beta + \varepsilon \qquad \varepsilon \sim N(0, \sigma 2) \tag{1}$$

$$y = y^* \quad \text{if} \quad y^* > 0$$

where: y^* is a latent variable that satisfies the classical linear model assumptions.

In particular, the Tobit approach has a normal, homoscedastic distribution with a linear conditional mean, x is a vector of independent variables, and is a normally distributed error term that captures the random influences in the relationship [Greene 2000]. Further:

$$y = 0 \quad \text{if} \quad y^* \leq 0 \tag{2}$$

$$p\,(y^* \leq 0) = p\,(x\beta + \varepsilon \leq 0)$$

$$p\left(\frac{E}{\sigma} \leq \frac{-x\beta}{\sigma}\right) = \Phi\left(\frac{-x\beta}{\sigma}\right) \tag{3}$$

where: p is the probability, $\frac{\varepsilon}{\sigma}$ has a standard normal distribution and is independent of x; in the presentation, the intercept has been absorbed into x for notational simplicity.

Rearranging the terms obtains:

$$p\,(y^* \leq 0) = 1 - p\,(y^* \leq 0) = \Phi\left(\frac{x\beta}{\sigma}\right) \tag{4}$$

where Φ is the cumulative distribution function evaluated at the standard normal, N(0,1), random variable $x_i'\beta$.

From (4), we obtain the log-likelihood function for each observation i:

$$l_i\,(\beta, \sigma) = \left[\frac{e^{-\frac{(y_i - x_i\beta)^2}{2\sigma^2}}}{\sigma\sqrt{2\Pi}}\right]^d \left[\Phi\left(\frac{-x_i\beta}{\sigma}\right)\right]^{1-d} \tag{5}$$

Notice that the log-likelihood function depends on σ, the standard deviation of ε, as well as on β_i. The log likelihood for a random sample of size n is obtained by summing (5) across all observations i and $d = 1$ if $y > 0$, or $d = 0$ otherwise.

Results

Table 2 shows results of the estimated Tobit equation. Several factors are found to have statistically significant influence on the number of sold bags of peanuts. Specifically, the larger the acreage planted with peanuts, the larger the number of bags sold likely reflecting a larger crop. The choice of how large an area to plant with peanuts is most likely dependent on the total farmland area. However, the available labor determined by household size was not significant and labor requirements grow with the increase of the planted area. Male farmers sold a larger number of bags compared to female farmers. This result is consistent with the responsibility of wives to provide an adequate amount of peanuts to feed the family in spite of the duty to pay for schooling children. It is not a surprise that almost one half of the surveyed farmers did not receive any formal schooling because the use of peanuts as food likely outweighed any sales. Interestingly, access to credit lowered the number of sold bags suggesting that farmers may choose credit over peanut sales to obtain cash. However, the issue calls for additional investigation because the lending system is not based on modern banking principles, but rather embedded in local traditions and habits that make the system opaque.

Farmers do observe prices and seem to consider them in making the decision about peanuts (tab. 2). The confirmed behavior is consistent with the response of farmers in commercial agriculture where a price increase leads to a positive response in supply, but because of the importance of peanuts as food for the household, the result has to be treated with caution. The caution is dictated to some extent by the rather small price change between the harvest and the later period (see tab. 1).

Perhaps the positive influence of the distance to the nearest market on the number of sold bags supports the responsiveness of a farmer to price. Namely, a farmer can expect higher prices at markets located farther from the village. This result is consistent with the existence of the wholesale market for peanuts in the capital of the region and the behavior of jobbers, who travel

Table 2. Estimation results of the equation modeling the number of sold bags of peanuts using the Tobit regression
Tabela 2. Wyniki obliczen rownania modelujacego liczbe sprzedanych workow orzeszkow ziemnych z uzyciem regresji Tobit'a

Variable name/*Nazwa zmiennej*	Sold bags/ *Sprzedane opakowania*	Standard errors/*Błąd standardowy*
Monthly income/*Miesięczne dochody*	0.000	0.00
Education of household head/*Wykształcenie głowy domu*	-0.558	1.81
Gender of household head/*Płeć głowy domu*	6.916***	2.65
Age/*Wiek*	-0.081	0.08
Household size/*Wielkość gospodarstwa domowego*	-0.091	0.10
Area of grown groundnuts/*Powierzchnia uprawy orzeszków*	0.831***	0.31
Sale of fresh in-shell groundnuts last year/ *Sprzedaż* świeżych *orzeszków w roku poprzednim*	8.370***	2.35
Price during last year's harvesting season/*Cena w osttanim roku zbiorów*	-0.105**	0.04
Price six months after last year's harvesting season/ *Cena 6 miesięcy po ostatnich zbiorach*	0.085**	0.04
Distance to nearest market/*Odległość do najbliższego sklepu*	0.285*	0.16
Access to credit/*Dostępność kredytu*	-4.829*	2.68
Constant/*Stała*	-3.122	4.10
Sigma constant/*Sigma*	11.249***	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$
Source: own study
Źródło: badania własne

with their trucks to village markets in an attempt to purchase crops directly from farmers there. The convenience of having a buyer-jobber at a local market comes at the cost of lower prices than could be expected at markets in distant locations. Finally, experience in sales seems to matter as suggested by the positive influence on the number of bags sold if a farmer sold any volume of peanuts in the preceding season. The experience involves not only improved familiarity with the method in which the market operates, but may also include establishing business relationships with buyers and learning sources of market and price information to make future sales decisions.

Conclusions

Farmers in sub-Saharan Africa commonly grow peanuts for food and for sale to raise cash. The volume of sold peanuts thus depends on food and cash needs. Selling peanuts at harvest implies low prices because of the abundant supply so farmers benefit from storing them. As peanuts become depleted between harvests, prices increase and farmers may earn higher revenues by deferring the sale. However, the dual role of peanuts in a farm household, fluctuating cash needs, and the environment in which a farmer operates complicate the choice to sell. Given available survey data, this study identified factors influencing the volume of sold peanuts between harvests. Price at different times of the season, past experience in sales, and distance to markets influence the volume sold, which is also determined by the planted acreage. The sold volume is also influenced by gender, reflecting involvement in the crop motivated by different needs, where a wife has to provide peanuts as food and raise cash to buy food ingredients not produced on farm. Access to credit seems to replace the dependence on peanut sales as the volume sold decreases among credit users.

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Streszczenie

Przedstawiono empiryczną relację kształtującą wielkość sprzedaży orzeszków ziemnych na podstawie danych z ankiet zebranych wśród drobnych rolników w północnej Ganie. Drobni rolnicy produkują orzeszki ziemne przede wszystkim w celu wyżywienia rodziny, ale także sprzedają swoje zbiory w celu uiszczenia opłaty za szkołę swoich dzieci. Wolumen sprzedaży zależy od wielu czynników, które ulegają zmianie w zależności od miejsca. Odcięty charakter zmiennej zależnej, którą jest liczba sprzedanych worków orzeszków ziemnych, spowodowała zastosowanie modelu Tobit'a. Wśród zmiennych objaśniających, które wpływają na liczbę sprzedanych worków orzeszków były: cechy respondenta i gospodarstwa, ceny i czynniki ogólne otoczenia, w którym rolnik dokonuje sprzedaży, w tym odległość od rynku i dostęp do kredytu. Rolnicy nie sprzedawali orzeszków ziemnych w czasie zbiorów, lecz przechowywali je, ponieważ ceny miały wzrostową tendencję w miarę upływu czasu, chociaż wzrost ten nie był wielki.

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