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Determinants of Yam Production and Choice of Market Outlet in Ghana: A Case Study in the Upper West Region

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Abstract:

This study investigates the determinants of yam production and choice of market outlet in Ghana: a case study in the Upper West Region. Primary data were used for econometric analysis of the selected area. One hundred families of farmers involved in yam production and marketing were selected using random sampling technique. Well-structured questionnaires were the main tool for data collection. The data collected was analyzed using Cobb-Douglas production and binary logistic regression model. Multicollinearity and heteroskedasticity were corrected using the variances inflation factor (VIF) and robust standard errors respectively The results indicates that the land size, quantity of yam minisett, labour size and working capital have statistically significant effect on yam production; and that the quantity of yam produced, access to transportation, market distance and access to credit also influence the farmer choice of a particular market outlet significantly. Based on results of this research paper, it is recommended that all distributional blockages, which affect the availability and cost of land, labour and other inputs, should be removed. This would increase yam production in the region. Again, it is recommended that participatory approaches should put in place to strengthen farmers' active involvement in policy making for commercial yam production and marketing in the region.

Key words: Econometric, yam production, determinants, participatory approaches, market outlet, Ghana.

1.0 INTRODUCTION

Yams belong to the botanical genus *Dioscorea*. Of over 600 species only six are important worldwide, four of which are particularly so in tropical Africa. These are in order of importance *Dioscorea. rotunda* (white yam), which accounts for over two-thirds of total yam output, *Dioscorea. alata*(water yam), *Dioscorea cayenensis*(yellow yam) and *Dioscorea. Dumet .orum* (trifoliate yam) (Courier, 1987) Yams constitute an important food crop in West Africa, where about 95% of the world's production occurs, it is one of the comparatively few words of West African origin that have entered European Languages. The word was derived from Mande 'niam' or Temme 'en yame'. This was adapted into Portuguese as 'ynhame" and hence into Spain 'igname' and English 'yam' (Adenyi, 1997). In Ghana it is an important food crop where 45-55% of the population consumes it as their staple food. Varieties of yams are grown in Ghana but the white yam (Pona or sometimes Puna) variety, are preferred by both the domestic and export market. In Ghana Pona is so desirable that it is often difficult to find enough Pona tubers, especially from June to August, when it is off season. Other popular varieties include Dente, Asana and Serwaa. The growing cycle for yams ranges from six to eight months depending on the variety, with planting occurring between February and April, and harvesting occurring in October (MiDA 2006).

In upper west region and Ghana at large, yam is planted at random on manually constructed mounds 1–2 m. According to Coursey (1967), in other parts of Africa yam may be planted 'on the flat', on mounds or ridges, or on raised beds; or they may be planted in trenches or holes. Yams are grown by small scale farmers using traditional methods for seed generation. This involves "milking" or harvesting the yam tubers (also known as ware yams) early and using the seed yams that result from this process for planting. However, this results in a poorer quality, and sometimes diseased, tubers. Other methods for growing yams include using the yam head or other parts of the yam that can sprout to produce seeds. Yams, for instance, require well pulverized, loose soil consistency with high organic matter levels, for easy penetration and swelling of the tubers (Ezumah, 1986).

Yam is an important crop in Ghana and is produced throughout most of the country. The tuber can be eaten boiled, roasted, fried, mashed or pounded, it is also acknowledged to provide some 200 calories of energy per capita daily and also, contains a higher value in protein (2.4%) and substantial amount of vitamins and some other minerals like calcium, phosphorus and iron than any other common tuber crop (Osunde, 2008).

Yam is an extremely vital crop, not only to the domestic market but also to the export market. Domestically, it is not only a main source of income but it is a staple crop vital to food security. Internationally, customers desire the sweeter taste of the well known "Ghana yam" (MOFA, 2000). Yam has played a key role in the reduction of under-nourishment in Ghana and Nigeria, with yam consumption increasing from 63–129 kg/person/year in Nigeria and from 126–232 kg /person/year in Ghana (FAO, 2000).

Ghana is the third largest producer of yams in the world, behind Nigeria and Coted'Ivoire (FAOSTAT, 2006). Ghana produced approximately 4 million metric tons of yam in 2005, compared to approximately 34 million metric tons produced in Nigeria and 5 million metric tons produced in Cote d'Ivoire. Following Ghana is Benin, with a production of about 2.1 million metric tons, and Colombia, Brazil, and Japan with smaller quantities of production at around 200,000 metric tons in 2005 (FAOSTAT, 2006).

Internationally, according to the Ghana Export Promotion Council (GEPC, 2009), Ghana is the world's largest exporter of yams. Ghana is currently exporting approximately

21,000 metric tons of yams annually, a number that has been increasing over the last decade. The compound annual growth rate of yam exports between 2000 and 2008 is 6.6%.

1.2 PROBLEM STATEMENT

Internationally, yam production in Ghana has been increasing at a decreasing rate as compared to Nigeria and Cote d Ivoire, (FAOSTAT, 2013).

Yam production occurs in all regions, except for the Central, Greater Accra and Upper East regions with Upper West being the fourth region in terms of its production (9%), while Brong Ahafo being the first (39%), (MoFA and SRID 2011). Based on the above statistics, the focus of this research is to find out why Upper West region with favorable conditions for yam cultivation is still not producing to expectations.

Despite the importance of yams to people, the attention to its production is still questionable in the upper west region. Some researchers have empirically investigated factors that determine the level of yam production in Ghana and Nigeria. They are however, controversies as to what really determine yam production, whereas others found a positive relationship between the various factors that influence yam output (farmers' education, family labor, extension contact, experience of farmers and fertilizer application), others found a negative relationship between these factors. For instance, Bamire and Amujoyegbe (2005) have carried out a research on net returns in yams output and land improvement techniques in Nigeria and found out that both have a positive relationship with yam output. Again, Zaknayiba and Tanko (2013) also find that lack of access to farm inputs, high cost of inputs, poor producer prices, high incidences of pests and diseases and inadequate storage facilities have negatively affected yam production.

These Published empirical works within the context of yam production in Ghana and other countries have focused mainly on determinants of yam production and more on pre-production issues to the neglect of post-harvest issues like marketing, storage and consumer demand. But the problems associated with transportation, wholesaling and retailing activities, commonly referred to as distribution activities in the yam sector, have been largely overlooked by researchers, particularly in upper west region. In view of the foregoing, this study is designed to analyze yam production and marketing in the upper west region of Ghana. The study will seek to answer the following questions:

1. What factors influence the output of yam produced in the region?
2. What factors influence farmer's decision to participate in a particular market?

1.3 LITERATURE REVIEW

J. F. Shehu and J. T. Iyortyer (2010) also used the Cobb-Douglas production function model to analysed "Determinants of Yam Production and Technical Efficiency among Yam Farmers in Benue State, Nigeria". The results of the study indicated that educational level, household size, experience of the farmer, age of the farmer, quantity of yam minisett and working capital were the significant factors, this is also in line with O. B. Izekor & M. I. Olumese (2010) findings. However, Okeke Charity C. (2013) found that fertilizer application has a negative impact on yam output.

Chinwuba Ike and Odjuvwuederhie Emmanuel Inoni (2006) reveal that the age of the farmer does not necessarily seem to influence yam output. However, quantity of labour, land size, fertiler application, quantity of yam minisett and working capital does. They found out in their studies "Determinants of yam production and economic efficiency among small-holder farmers in south eastern Nigeria" that land size, labour and fertiler application were positive and statistical significant at 1% while yam minisett, working capital were significant at 5% and 10% respectively.

Mekonin Abera (2015) and Moyo.T (2010) reveals that the quantity of yam sold in a given year is positively and significantly affect the main choice of yam market outlet. Also, transportation access is positively and significantly related to a farmer choice to sell in a particular marke.

1.4 RESEARCH METHODOLOGY

1.4.1 Source of data

Primary data constitutes the main sources of data for this research. The sample size considered is100 yam farmers/sellers in the region. Random sampling probability method was used to select the sample units and both structured and semi structured questionnaires were used to collect the data.

1.4.2 COBB- DOUGLAS PRODUCTION FUNCTION

In economics, the Cobb-Douglas functional form of production function is widely used to represent the relationship between output and inputs.

The study uses the Cobb- Douglas production function to examine how the various inputs influence the output of yam. The Cobb-Douglas production function assumes that the logarithm of the total output is a homogenous function of the logarithms of the labor force, the capital stock among other inputs variables (Douglas, 1948). It is stated as;

$Q=aL^{p}K^{q}$. (1)

where

Q is the output

L the quantity of labour,

K is the quantities of working capital,

p, q and a, are positive constants.

This is a homogenous (of degree p+q= 1) function implying constant returns to scale. Computing the logarithm of both sides results in,

$\text{Log } Q=C+P\log L+q\log K$ where $C = \log a$. (2)

We adopt equation (2) to include the explanatory variables as;

$Q_{I1}=Q_{I1}$ (K, LS, L, F, QYS, HHS, FEXP) (3)

Specifying the double-log function, the empirical production function for the study is of the form;

Log Q=β_0+ $\beta_1$log K + $\beta_2$log LS + $\beta_3$log L + $\beta_4$log F +$\beta_5$log HHS+ $\beta_6$log QYS+ $\beta_7$log FEXP + ε_i (4)

where β_0……… β_7 are the parameters of the function to be estimated, Q is output of yam, K is working capital, LS is land size, L is labour used, F is fertilizer application, QYS is quantity of yam minisett/seed,

HHS is household size, FEXP experience of the farmer, i is the i^{th} respondent, log is logarithm of the variables to be estimated, ε_i is the error term.

1.4.3 LOGISTIC REGRESSION MODEL

The logit model was used to analyze the various factors that influence yam farmers' decision to choose a particular market.

In statistics, logistic regression, or logit regression, is a regression model where the dependent variable is binary (Fox, 2010). This study covers the case of binary dependent variables—that is, it takes only two values. Logistic regression measures the relationship between the binary dependent variable independent variables by estimating probabilities of these independent variables, using a logistic function, which is the logistic cumulative distribution function. The logit model is given by;

$Y_i = ß_0 + ßX_{in} + \varepsilon_i$ (1)

Where Y_i is binary dependent variable,

Xin are observable variables that relate to alternative i and decision maker n,

ß is a vector of coefficients of the variables $ß_0$ constant and

$\varepsilon_{i\ in}$ is random error term.

From the above, the probability that a farmer will choice a particular market outlet is given by:

$Pi=\frac{e^{z_i}}{1+e^{z_i}}$, where $z_i=X_{in}\ ß + \varepsilon_i$ (2)

The ratio of the probability that a farmer will choice to sell in a particular market to the probability that he/she will not.
Taking the natural log to obtain the logit model implies;

$$L_i = \ln\left(\frac{P_i}{1-P_i}\right) = Z_i = X_{in}\,ß + \varepsilon_i \qquad (3)$$

L_i is therefore linear in both X and ß (parameters), hence the logit model.
We adopt equation (3) to include the empirical study variables as;

Y_i = (EDU, MKDIS, Q, ACPINFO, HHS, ACTTRP ACRDT)

$$Yc = ß_0 + ß_1 MKTDIS + ß_2 Q + ß_3 EDU + ß_4 ACPINFO + ß_5 HHS + ß_6 ACTTRP + ß_7 ACRDT + e_i \qquad (4)$$

Where $ß_0$......... $ß_7$ are the parameters of the logistic regression function to be estimated, ε_i is the error term, Yc is farmer's/seller choice of a particular market outlet, EDU is educational level of the farmer, MKTDIS is distance to the market, Q is the quantity of yam produced, ACPINFO is access to price information HHS is household size, ACTTRP is access to transportation (weather a household owns a transportation facility or not) i is the i^{th} respondent.

The preferences and reasons for the preference of certain farmer's decision to either sell in a particular market to the other are determined by the levels of correlation between the variables influencing the preferences, such as access to price information, the quantity of yam produced, educational level of the farmer and distance to the market.

4.0 RESULTS AND DISCUSSIONS

4.1 COBB-DOUGLAS PRODUCTION FUNCTION ESTIMATES

Dependent variable: Q

ln Q	Coeffficient	Std. Error	t-ratio	P-value
lnLS	.4685661	.2136221	2.19	0.032**
lnL	.2147454	.105457	2.04	0.046**
lnF	.1480204	.1270536	1.17	0.248
lnQYS	.07738	.0453471	1.71	0.093*
lnHHS	-.0223112	.0942941	-0.24	0.814
lnFEXP	-.0967973	.0679294	-1.42	0.159
lnK	.1843427	.1060964	1.74	0.087*
constant	4.548555	.8424537	5.40	0.000***

Root MSE	.31518
Adj R-squared	0.6351
R-squared	0.6721
P- value (F)	0.0000
F (7,93)	21.16
*** , ** and *	Significant at 1%,5% and 10% respectively

The results of the Cobb-Douglas production function are presented in table 4.1. It can be observed that among the 7 variables considered in the model, four 4 were found to have statistical significant effect on the output of yam. They are, land size, the quantity of labour used, quantity of yam minisett and working capital. The coefficients of the other 3 explanatory variables, namely, household size, quantity of fertilizer applied and experience of the farmer were not statistically different from zero at the conventional levels of significance. The coefficients of the significant variables are 0.4685661, 0.2147454, 0.07738 and 0.1843427 respectively. This implies that a percentage increase in the respective significant variables will leads to a 47%, 21%, 7% and 18% increased in the output of yam respectively.

The R-square was 0.67 which implies that 67% of the output of yam is explained by the independent variables and this is very strong. The P-value (F) reports that the model is statistically significant at 1%.

4.2 LOGISTIC REGRESSION ESTIMATES

DEPENDENT VARIABLE: YC

VARIABLES	Coefficient	Robust Std.Error	p- value	Marginal effects	Std. Error
Q	.0016448	.0005745	0.004***	.0001948	.0001
HHS	.0004954	.1858291	0.998	.0000587	.02201
EDU	.1505777	.1296786	0.246	.0178385	.01381
MKTDIS	-.2324109	.1224428	0.058*	-.027533	.01248
ACPINEFO	.8031694	2.332481	0.731	.116336	.42519
ACTTRP	2.338015	1.005206	0.020**	.2680629	.09382
ACRDT	-3.252018	.8523649	0.000***	-.4371232	.12818
Constant	-8.365221	3.788811	0.027**		

Number of observation	100
Wald Chi Square (7)	23.81
P-Chi Square	0.0012
Pseudo R Square	0.5958
Pseudo Likehood	-17.91261
MFX	0.13732529
VIF	1.37
*** , ** and *	Significant at 1%,5% and 10% respectively

The results of the logistics regressions are represented in table 4.2. It is clearly observed that four variables were found to have statistical significant impact on the farmer choice of particular market outlet. They include quantity of yam produced, access to transportation, access to credit and market distance. The marginal effects of these variables are 0.0001948, -0.027533, 0.2680629, and -0.4371232. This means that the probability that a farmer or a seller to choice or sell in a particular market outlet will increase or decrease base on the magnitude of the effects.

The Pseudo R^2 was 0.59 which implies that 59% of the likelihood of a farmer or a seller to choice a market outlet is explained by the independent variables and this is very strong. The pseudo R^2 reported in the output explains up to 59% of the variation in the dependent variable. The chi square reports that the model is statistically significant at 1%.

Multicollinearity and heteroskedasticity were corrected using the variances inflation factor (VIF) and robust standard errors respectively.

5.0 CONCLUSION AND RECOMMENDATIONS

This study investigates the determinants of yam production and choice of market outlet in the Upper West region of Ghana. The study uses primary data collected from 100 respondents using random sampling method. The results suggest that farmers could increase output through more extensive use of land, labour, quantity of yam minisett and working capital given the prevailing state of technology. The results further indicate that land size and labour has positive effects on the output of yam at 5% significant levels and quantity of yam minisett and working capital also have positive effects on the output of yam at 10% significant levels. Also, the quantity of yam produced, access to transportation facility and access to credit are the major factors that influence yam farmers/sellers' choice to sell in a particular market outlet. The quantity of yam produced and access to transportation were found to influence yam farmer's choice positively, were as access to credit has negative influence. Base on the findings, it has been realized that the output of yam is influenced by land size, quantity of yam minisett, working capital and number of labour employed in the studied area while farmer's choice to sell in a particular market is influenced by the quantity of yam produced, access to transportation, market distance and access to credit in the studied area.

It is recommended that all distributional blockages, which affect the availability and cost of land, labour and other inputs, should be removed. This would booze yam production in the region

Lastly, it is recommended that participatory approaches should be put in place to strengthen farmers' active involvement in policy making for improvement in yam production and marketing in the region. This is because most farmers sell mainly at the farm gate in rural markets. Only a handful of the total output is taken to the more lucrative (but distant) urban markets. Majority of these farmers do not participate effectively in the urban markets which offer better opportunities for increasing their farm incomes.

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