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Evalution of factors that influence gross margin of cassava producers in Enugu State, Nigeria

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ABSTRACT

The increasing food and industrial uses of cassava and rising demand internationally for cassava products have made cassava production and processing an exit-route from the vicious cycle of poverty faced by most farm households in Nigeria. In conclusion, results of each of the four functional forms of OLS regression model reveal some variables included in the model that are significant determinants of gross margin in cassava production and they include coefficients of the independent variables, value of constant, coefficient of multiple determination R^2, and F-ratio. The results of the OLS regressionanalysis.

Keywords: Cassava, gross margin, factors, OLS regression model

INTRODUCTION

Cassava is predominantly the key income generating arable crop for farm households in south eastern Nigeria [1,2,3,4]. As a cash crop, cassava generates more cash income for the largest number of farm households in Nigeria than other staples, contributing positively to poverty alleviation and rural welfare [5,6,7,8]. In addition to providing food for consumption and employment to rural youths, cassava products can be processed and exported to generate more foreign earnings [9,10,11]. The increasing food and industrial uses of cassava and rising demand internationally for cassava products have made cassava production and processing an exit-route from the vicious cycle of poverty faced by most farm households in Nigeria [12,13,14]. Its relative ease of production, high resistant ability, ability to withstand drought in the face of any prevailing climate variability also give cassava an added advantage over other crops as regards hunger and poverty reduction [15,16,17,19]. These features of cassava according to [20] endowed it with the special capacity to bridge the gap in food insecurity and poverty. [20], rightly identified cassava production and processing as having potential as a poverty reduction tool. Poverty which is a situation where an individual lives on less than US $1.25 a day or incapable of meeting basic requirements of life is a phenomenon that is multidimensional, widespread and severe in Nigeria [21,22,23,24]. World Bank in 2001 summarized the various dimensions of poverty as conditions of lack of opportunity, lack of empowerment and a lack of security. Windows of opportunities remain closed to the poor making them practically unheard and inactive in the society [25]. Absence of empowerment to the poor limits their choices in many social and economic endeavours and the lack of security makes them vulnerable to diseases, violence and deprivation. The poverty situation in Nigeria is quite severe.

Objectives of the Study

The broad objective of this study was to determine factors that influence gross margin of cassava producers in the study area.

RESEARCH METHODOLOGY

The Study Area

The study was carried out in Enugu state of Nigeria. The state is one of the five states in South Eastern Nigeria and is purposively selected for this study because of its agricultural potential, high proportion of farmers as well as concentration of agricultural institutions. The study covered major

cassava producing and processing communities in Enugu state. Enugu State is bounded to the Northwest and Northeast by Kogi State and Benue State respectively, to the East by Ebonyi State, to the South by Abia State and Imo State and to the West by Anambra State. The state is located between latitudes 58° 50´ and 78° 01´ N of the Equator and longitudes 68° 50´ and 78° 55´ E of the Greenwich Meridian. The state comprises of 17 Local Government Areas (LGAs) namely; Aninri, Awgu, Enugu East, Enugu North, Enugu South, Ezeagu, Igbo Etiti, Igbo Eze North, Igbo Eze South, Isi Uzo, Nkanu East, Nkanu West, Nsukka, Oji River, Udenu, Udi and Uzo Uwani which form the three agricultural/senatorial zones (Enugu North, Enugu East and Enugu West) of the state. It comprises four hundred and seventy three (473) communities. The state is made up of two tiers of government, the state government and the local government. The State Government is responsible for economic development policy including implementation of development projects in the state while the Local Governments have jurisdiction over activities confined within their boundaries. Enugu state has an estimated population of 3.891,339 million persons comprising 1,990,773 females and 1,900,566 males, with an annual projected percentage increase of 2.6% from base year (National Population Commission, [9]. Average population density of the State is 780 persons/km^2.Enugu state has a tropical savannah climate. Its climate is humid and this humidity is at its peak between March and November. For the whole of Enugu State, the mean daily temperature is 26.7 °C (80.1 °F) with an average annual rainfall of 2,000 mm, which arrives intermittently and becomes very heavy during the rainy season. The State is characterised by two prominent seasons, namely; rainy season which usually occur from April to October and dry season which occurs from November to March. Other weather conditions affecting the city include Harmattan, a dusty trade wind lasting a few weeks in December and January. Like the rest of Nigeria, Enugu is hot all year round. The land is 223 metres above sea level and because of its topography; the soil is naturally well drained during its rainy seasons. Erosion is one of the problems of some places due to the sloppy nature of its terrain and incidence of land slide. Economically, the state is predominantly rural and agrarian, with a substantial proportion of its working population engaged in farming, mining, transportation, although trading (18.8%) and civil services (12.9%) are also important. In the urban areas trading is the dominant occupation, followed by public and private services. A small proportion of the population is also engaged in manufacturing activities, with the most pronounced among them located in Enugu, Oji, Ohebedim and Nsukka [16]. The Profile of Major Mineral Resources in Enugu State are; Coal, Limestone, Gypsum, Glass sand, Copper, Bauxite, Calcite, Bentonite, Dolorite, Iron-Stone, Clay, Fire-clay, Brine. There are also traces of Petroleum and Natural gas in Ugwuoba in Oji-River Local Government area and Uzo-Uwani in Enugu state.Enugu state is located in a tropical rain forest zone with a derived savannah. Enugu has rich fertile soil conditions over a wide range of agro-ecological zone which allow for a very diverse crop production such as cassava Tree crop: cashew (*Anacardium occidentale*), kola nut (*Cola nitida*), oil palm (*Elaesis guineensis*), cocoa (*Theobroma cacoa*), mango (*Mangifera indica*), breadfruit (*Treculia africana*), guava(*Psidium guajava*), pawpaw (*Carica papaya*), Plant sucker: plantain (*Musa paradisiaca),* banana (*Musa sapientum*), Fruit crop: pineapple (*Ananas comosus*), maize (*Zea mays*), Root crop: cassava (*Manihot esculenta*), yam (*Dioscorea spp*), coco-yam(*Esculenta spp*), sweet potato (*Ipomoea batatas*), Legume/vegetables: Bambara groundnut (*Voandzeia subterranea*), pigeon pea (*Cajanus cajan*), black bean (*Phaseolus vulgaris*), melon(*Cucumis melo*), groundnut (*Arachis hypogaea*), okra, (Abelmoschus esculentus), red pepper(*Capsicum annuum*), fluted pumpkin (*Telfairia occidentalis*), spinach(*Spinacia oleracea*), bitter-leaf(*Venonia amygdalina*), low-lying and seasonally flooded areas are being used for rice (*Oryza sativum*) production.

Sampling Procedure

In an empirical investigation, it is very difficult to collect information from the whole population. Therefore, researchers are often forced to make inferences based on information derived from a representative sample of the population. The size of the sample and amount of variation usually affect the quantity and quality of information obtained from the survey. Both factors can be controlled using appropriate sampling methods.

Population of the Study

Population in research could be described as a full set of numbers of objects or people. Classification of the population is the first step in the sampling procedure, namely, the sector or element under investigation, the sampling unit and the area of investigation. The population for this study are cassava farmers in Enugu State, Nigeria that are registered with Enugu State Agricultural Development Programme (ENADEP). They comprised registered cassava producers and processors from the 17 LGAs of Enugu State as presented in Table 1. It is worthy to note that in Enugu state, all cassava producers also process cassava at least for self and family consumption as against buying processed cassava products from the market. In this scenario and in the concept of study, qualifies the farmers as producers/ processors. This also ensures that there is no duplication in the sampling.

Table 1: Population and Sample Size of ADP Registered Cassava Producers and Processors in Enugu State, Nigeria

Agro-Ecological Zone	Local Government Areas	Registered cassava producers and processors	Sample size
Enugu East	Enugu East	67	
	Enugu North	46	
	Enugu South	39	
	Isi Uzo	121	
	Nkanu East	146	
	Nkanu West	84	
Sub Total		503	75
Enugu West	Aninri	134	
	Awgu	219	
	Ezeagu	172	
	Oji-river	121	
	Udi	146	
Sub Total		792	118
Enugu North	Igbo Eze North	112	
	Igbo Eze South	74	
	Igbo Etiti	163	
	Nsukka	226	
	Udenu	165	
	Uzouwani	246	
Sub Total		986	147
Grand Total		2281	340

Source: Cassava Desk ENADP, 2013

The sampling frame used for the study is a list of 2281 registered cassava producers and processors in Enugu State which was obtained from the Enugu State Agricultural Development Programme (ENADEP) at the time of study. During the period of sampling, Enugu state is demographically divided into 3 agricultural zones as follows Enugu East, Enugu West and Enugu North each with 6, 5 and 6 Local Government Areas (LGAs)

respectively.The formula used in selecting sample size proportionate to the population of registered cassava producers and processors in Enugu State is as given by Yamane (1967) as follows:

$$n = \frac{N}{1+N(e)^2}$$

n = sample size,
N= Population size,
e = limit of tolerable error or level of precision,
1= unity

The population of registered cassava producers and processors is 2281 and the limit of tolerable error was chosen at 0.05 probability level, to provide for an adequate confidence level. Therefore:

N = 2281 registered cassava producers and processors
e = 0.05 probability level
1= unity
Applying the above formula:

$$n = \frac{2281}{1+ 2281\ (0.05)^2} = \frac{2281}{1 + 2281\ (0.0025)} = \frac{2281}{1 + 5.7025} = \frac{2281}{6.7025} = 340.32$$

Therefore a sample size of 340 cassava producers and processors is statistically adequate for the study. Multi-stage random sampling technique was used to select sampling location and respondents for the study. In the first stage, 4 LGAs were selected randomly from each of the 3 agro-ecological zones in the study area, giving a total of 12 LGAs out of the 17 LGAs in the study area. The selected LGAs are Enugu East, Nkanu East, Nkanu West, Isi Uzo, Aninri, Awgu, Ezeagu, Oji-river, Igbo Etiti, Nsukka, Udenu and Uzouwani. In the second stage, proportionate random sampling technique was applied to determine 75, 147 and 118 registered cassava producers and processors that were selected from Enugu East (Enugu East, Nkanu West, Isi Uzo and Nkanu East LGAs), Enugu North (Igbo Etiti, Nsukka, Udenu and Uzouwani LGAs) and Enugu West (Aninri, Awgu, Ezeagu and Oji-river LGAs) agro-ecological zones respectively to give a sample size of 340 cassava producers and processors for the study as follows:

$$\text{Enugu East} = \frac{503}{2281}\ x\ \frac{340}{1} = 75$$

$$\text{Enugu North} = \frac{986}{2281}\ x\ \frac{340}{1} = 147$$

$$\text{Enugu West} = \frac{792}{2281}\ x\ \frac{340}{1} = 118$$

In the third stage, simple random sampling technique was applied in each stratum to select the already determined sample size. As a result of inadequate information pertaining to accurate population of all the cassava producers and processors in the state, the law of large samples or numbers was applied in choosing the size of sample. According to [16,19] the law states that the sample mean converges to the distribution mean as the sample size increases. It also stated in the mathematical premise that the greater the number of exposures: (1) the more accurate the prediction, (2) the less the deviation of actual losses from the expected losses (X-x approaches zero) and (3) the greater the credibility of the prediction. [6,7] further asserted that for any given study area without accurate population size, the chosen size of sample should be greater than 300, thus the sample size of this study is adequate since more than 300 respondents were selected.

Data Collection

Data for this study was gathered from primary source. Primary data were collected from the selected sample following a field survey conducted with a pre-tested semi-structured questionnaire in Enugu East local government area. The researcher employed services of twelve trained enumerators (one for each local government area) who are indigenes and familiar with the areas to assist in data collection. One set of questionnaire was

administered to the selected cassava producers and processors. The questionnaires were carefully structured to elicit responses on socio-economic characteristics such as age, sex, level of education, marital status, household size, farm size, farming experience, non-farm occupation, annual income, sources of finance, access to extension and membership of farmers organization and other relevant variables such as costs and returns from cassava production and processing, technologies available for cassava production and processing, production systems of cassava, products of cassava processed in the area, perceived effect of cassava production and processing by the respondents. In addition data on their farm income and household consumption expenditure details were collected.The secondary sources of information were journals, magazine, textbooks, publications and annual reports form World Bank, Food and Agricultural Organization (FAO), USAID, International Institute for Tropical Agriculture (IITA), National Root Crops Research Institute (NRCRI), and National Special Programme for Food Security (NSPFS), Agricultural Development Programme (ADP), FADAMA, CMP and other relevant reports.

Tools of Data Analysis

The data were analysed using both descriptive and inferential statistics. Descriptive statistics such as frequency, percentage and mean were used to organise and analyse the objective.Mean score was also used to realize part of objectives

Model Specification

The models were specified for this study as follows:

Poverty Indicators

The measurement of household welfare or standard of living is a question which has not been resolved completely. There are many ways one could go about addressing this issue depending on the context, need and availability of information. Since quality of life has to take into consideration all direct and indirect consumption, both tangible and intangible items, measuring welfare has become a daunting task. Poverty can be measured mostly on two scales- the relative scale measurement of poverty and the absolute scale measurement of poverty. However, the most common single indicator of welfare in the literature is to generate value of consumption basket both market purchases and consumption of own production, using appropriate price measures. In the present case, since expenditure is expressed only in terms of value, there is no need to construct a vector of prices which then can be used to convert the quantity information into a value. To determine the poverty status of households in the study area, a poverty line was constructed, using two-thirds of the mean per adult equivalent expenditure, below which a household was classified as being poor and above which a household was classified as being non-poor. The use of consumption to identify and measure poverty has a long tradition, right from the study of Rowntree. The World Bank has also been assessing global poverty by using expenditure data collected through household surveys. This is because consumption level, which is reflected in consumption expenditure, has been conventionally viewed as a preferred welfare indicator. Also, for practical reasons of reliability, consumption expenditure levels are thought to better capture long-run welfare levels than current income levels.

$H = q/n$ ... eq. 1

Where:

H = head count ratio;

q = number of cassava producers and processors that are poor;

n = total number of cassava producers and processors;

The poverty gap was calculated as:

$I = \{\Sigma (Z-Y)/Z\}$ ... eq. 2

I = poverty gap

Z = poverty line - estimated using the mean household expenditure (relative scale)

Y = average per capita household expenditure of poor cassava producers and processors.

The poverty severity was calculated as:

$I = \{\Sigma(Z-Y)^2/Z\}$ ...eq.3

I = poverty gap

Z = poverty line - estimated using the mean household expenditure (relative scale)

Y = average per capita household expenditure of poor cassava producers and processors.

The poverty line used in determining poverty among the cassava producers and processors is expressed following Osondu *et al.,* (2015a):

$Z = 2/3\ (Y)$

Where,

Z = poverty line measured in Naira (₦)

Y = mean per capita household expenditure measured in Naira (₦)

Given;

$$\text{Per capita expenditure/income} = \frac{\text{Total Monthly household expenditure}}{\text{Household size}}$$

$$\text{Mean capita household expenditure} = \frac{\text{Total per capita household expenditure}}{\text{Total number of households}}$$

Enterprise Budget Model

Profit of an enterprise according to [6] can be calculated from the gross margin as follows:

$GM = TR - TVC$ ... eq. 4

π = Gross margin – total fixed cost

Where:

GM = Gross margin

TR = Total revenue

GI = Gross income

TVC = Total variable cost

π = profit or net income

Cost function estimation model for cassava production and processing

$TC = TFC + TVC$ ... eq. 5

Where

TC = Total cost in Naira

TFC = Total amount of depreciation on fixed assets and rent in Naira

TVC = Total variable cost in Naira

Revenue estimation model for cassava production and processing

$TR = TP_x P$ ... eq. 6

Where

TR = Total Revenue in Naira

TP = Total output in Naira

P = Price per kg in Naira.

Specification for other parameters of estimation for cassava production and processing

Profitability index = NI/TR

Rate of returns on investment (%) = NI/TC x 100/1

Rate of return on variable cost (%) = TR-TFC/TVC x 100/1

Operating ratio (OR) = TVC/TR

OLS Regression Model

The ordinary least square multiple regression model was used to estimate the determinants of gross margin of cassava production and processing. This was similar to the procedure adopted by [5,9]. The implicit form of the model is as:

$Y = F(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12,} X_{13,} X_{14}, e)$ ... eq. 7

Where:

For cassava production

Y = Gross margin of cassava production (Naira)
X_1 = Age of farmers (years)
X_2 = Education level (number of years spent in school)
X_3 = Marital status (1= married, 0 = otherwise)
X_4 = Household size of farmer (number)
X_5 = Farm size (hectares)
X_6 = Farming experience (years)
X_7 = Quantity of fertilizer used (kg)
X_8 = Membership of farmers association (yes = 1; no = 0)
X_9 = Transport cost (Naira)
X_{10} = Price of product (Naira)
X_{11} = Labour cost (Naira).
X_{12} = Credit access (Amount of Naira accessed)
X_{13} = type of technology used (improved =1; otherwise = 0)
X_{14} = Use of improved variety (improved =1; otherwise = 0)
e = Error term assumed to fulfil all assumptions of the classical linear regression model. E.i~ N (0, δ^2).

For cassava processing

Y = Gross margin of cassava processing (Naira)
X_1 = Age of processors (years)
X_2 = Education level (years)
X_3 = Marital Status (Married =1; otherwise = 0)
X_4 = Household size of processor (number)
X_5 =Labour cost (~~₦~~)
X_6 = Processing experience (years)
X_7 = Quantity of cassava tuber processed (Naira)
X_8 = Membership to association (Yes =1; otherwise = 0)
X_9 = Type of Processing technology used (improved =1; otherwise = 0)
X_{10} = Transport cost (Naira)
X_{11} = Price of product (Naira).
X_{12} = Credit access (Naira)
X_{13} = Processing Cost (Naira)
e = Error term assumed to fulfil all assumptions of the classical linear regression model. E.i~ N (0, δ^2).

Four functional forms of the model (Linear, exponential, double logarithmic and semi- logarithmic) were fitted to the data. The lead equation was selected based on statistical and econometric criteria including number of significant variables, magnitude of the F- ratio, R^2 and the conformity of the variables to *a priori* expectation. The four functional forms are as stated thus:

Linear function:

$$Y = b_o + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_5x_5 + b_6x_6 + b_7x_7 \ldots + b_{14}x_{14} + ei$$

Semi – log function

$$Y = b_o + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 + b_5 \log x_5 + b_6 \log x_6 + b_7 \log x_7 \ldots + b_{14} \log x_{14} + ei$$

Double log function

$$\text{Log } Y = b_o + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 + b_6 \log x_6 + b_7 \log x_7 \ldots + b_{14} \log x_{14} + ei$$

Exponential Function

$$\text{Log } Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 \ldots + b_{14}x_{14} + ei$$

Paired-t-test Analysis

The paired treatment test was used to determine effect of use of improved cassava production/processing technologies on poverty of cassava

producers and processors in Enugu State.

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} \quad \text{---}$$

eq. 8

n_1+n_2 – 2 degrees of freedom

Where:

t = Student "t" statistic

$\overline{X}_1$ = Sample mean of poverty indicators of cassava producers and processors after using improved technologies;

$\overline{X}_2$ = Sample mean of poverty indicators of cassava producers and processors before using improved technologies;

S_1^2 = Sample variance of poverty indicators of cassava producers and processors after using improved technologies;

S_2^2 = Sample variance of poverty indicators of cassava producers and processors before using improved technologies;

n_1 and n_2= Sample size of cassava producers and processors using improved technologies;

Mean Score Analysis

Mean score was used to realize part of objective ii and to analyse objective x and xi. Mean score was used to realize part of objective ii (use of improved production technologies) using a 3-point likert scale graded thus: very often=3, often=2, never= 1. The values of the responses were added and further divided by 3 to obtain a mean score of 2.0, which was regarded as mean level of use of improved cassava production and processing technologies. Technologies with mean score of 2.0 and above were regarded as being used by the respondents. While technologies with mean score of below 2.0 were regarded as not used by the respondents. Mean score was also used to analyse objective x following use of a three point Likert scale to determine effect of cassava production and processing on poverty of cassava farmers and processors in Enugu State (where perception on effect of poverty was captured with a 3-point likert scale graded thus: high effect = 3; low effect = 2 and no effect = 1).

The Likert scaling is a method of ascribing quantitative values to qualitative perception to make it amenable to statistical analysis. The values of the responses were added and further divided by 3 to obtain a mean score of 2.0, which was regarded as mean level for effect of cassava production and processing on poverty. Responses with mean score of 2.0 and above were regarded as being influenced by cassava production and processing while responses with mean score of less than 2.0 were regarded as not being influenced by cassava production and processing.

Thus, mean effect of cassava production and processing = X

$X = \Sigma fx/N$, (the mean score).

Mean (X) of each item was computed by multiplying the frequency of positive response to each question with its appropriate likert nominal value and the sum was divided by the sum of the number of the respondent to the items. This is summarized with the equation below:

$\overline{X} = \Sigma fn/N$.

Where

$\overline{X}$ = mean score;

Σ = summation sign;

F = frequency or number of respondents who responded positively;

n = Likert nominal value;

N = Number of respondents.

To determine the problems constraining cassava production and processing, a three point likert type scale with three response options (very serious = 3; serious = 2; and not serious =1) were used. The values on the likert type scale

were summated to 6 and were divided by 3 to give 2.0. The respondents mean score were obtained for each response item such that any one higher or equal to 2.0 was regarded as a major problem and any one less than 2.0 was regarded as a minor problem.

Tests for Validity and Reliability of Research Instrument

This is an essential part of the research procedure. These tests were used to determine the adequacy and accuracy of the content of the measuring instrument.

Validity of Research Instrument

Validity is the extent a measuring instrument measures what is expected to measure. Validity is the most important attribute of the research procedure. It is always specific to the particular situation and purpose. An instrument that is valid in one situation may not be in different situation because of the differences in objectives or environment. For the purpose of this study, content and face validity were used to determine the adequacy of the content of the measuring instrument. The instrument was developed on the basis of the study objective, scrutinized and was validated via peer review mechanism. The questionnaire was given to my supervisor, professors in the department and experts in the field of Agricultural Economics for their constructive criticism and necessary input to improve its' content and face validity. Thereafter the necessary modifications were made; ambiguous items were amended while those considered irrelevant were removed.

Reliability of Research Instrument

Reliability of research instrument refers to the degree of consistency and precision (accuracy) with which an instrument measures what it is supposed to measure. That is, the degree to which the instrument measures the same thing time after time. It is the ability of an instrument to consistently produce the same result provided no real change has occurred in the respondent's characteristics. The three methods used to determine reliability include test – retest method, multiple form method and split-half method. The reliability test for the instrument used in this study was conducted using test-retest method involving a sample of 20 respondents randomly from the sample frame. After a period of 12 weeks, the exercise was repeated on the same set of the respondents. Scores were assigned to the items relating to socio economic characteristics, poverty and gross margin. The total scores for each exercise was computed and later subjected to Pearson Product Moment Correlation (PPMCC) analysis was used to test the reliability of the instrument. A reliability coefficient of 0.824 obtained. This was considered high enough to accept the instrument as reliable as the reliability coefficient exceeded the minimum threshold of 0.7.

RESULTS AND DISCUSSION

Sex Distribution of Respondents

The respondents, both male and female in cassava production and processing in the survey area were asked to indicate where they belong. Details are as shown on Table 1 below.

Table 1: Distribution of the cassava producers and processors according to sex

Sex	Frequency	Percentage
Male	197	57.9
Female	143	42.1
Total	340	100.0

Source: Field survey, 2015

Table 1 shows that 57.9% of the cassava producers and processors were males, while 42.1% of them were females. It shows that cassava production and processing in the study area was dominated by males. This could be as a

result of the stress attached to production and processing of cassava which the female folk sometimes cannot bear. This is in agreement with [12,14] assertion that male population dominated cassava production and processing in Nigeria. Another reason may be that cassava production and processing are capital intensive and males have better access than females to production resources especially credit [20].

Age Distribution of the Respondents

The ages of the respondents of both male and female producers and processors who participated in this survey were determined by categorizing them into five groups according to their age brackets. The age distribution of respondents is shown on Table 2 below.

Table 2: Distribution of the cassava producers and processors according to age

Age	Frequency	Percent	Mean
≤ 19	2	0.6	
20 – 39	61	17.9	
40 – 59	190	55.9	50.34 years
60 – 79	86	25.3	
≥ 80	1	0.3	
Total	340	100.0	

Source: Field survey, 2015

SD = 11.53yrs.

Table 2, shows that 55.9% and 25.3% of the cassava producers and processors are within the age brackets of 40-59 years and 60-79 years respectively. This indicates low involvement of youths in cassava production and processing enterprises. This finding agrees with [4,6] assertion that most youths in Nigeria have left agriculture in favour of employment in non-agricultural sector. The lowest percentages [(0.6%) and (0.3%)] of the respondents were between the age range of 0-19 years and 80-99 years respectively. This indicates that the very young and feeble do not participate prominently in cassava production and processing. According to [17], most of the very young are involved in academics and are not engaged prominently in agricultural production, while the very aged ones lack the strength to cope with the drudgery involved in cassava production and processing. The mean age of the respondents was 50 years and this indicates that majority of the cassava producers and processors in Enugu state fall within the productive ages. Farmers in their productive ages have the tendency to be very active in the enterprise's operation and more geared towards imbibing new innovation which in turn facilitates their adoption of new technology being a positive factor in agricultural production [19]. They can therefore put more effort into the value chain of cassava with particular emphasis in production and processing in order to increase their output.

Education Level of the Respondents

Formal or non-formal system of education designed to educate youths and adults in various subjects of learning were investigated in this study. It is generally believed that educational attainment of farmers is an essential factor that enhances their adoption of new practices and technology. In other words, farmers who have had formal education are more receptive to new ideas than those who are illiterate [9]. In this study the level of education was measured by asking the respondents to indicate the levels they attained and the result of the survey is presented in Table 3 below.

Table 3: Distribution of the cassava producers and processors according to level of educational qualification

Level of Education Attained	Frequency	Percentage (%)
No formal Education	56	16.5
First School Leaving Certificate	85	25.0
Junior Secondary School Certificate	28	8.2
WASC/GCE/SSCE/NECO/NABTAB	109	32.0
OND/NCE	38	11.2
HND/BSc/BA/Bed	21	6.2
Post graduate	3	0.9
Total	340	100.0

Source: Field survey, 2015

Table 3 reveals that 16.5% of the cassava producers and processors had no formal education and 25.0% of them had primary school education. Cumulatively, 40.2% and 18.3% of the cassava producers and processors had attended secondary and tertiary institutions respectively. In summary, 83.5% of the respondents had formal education. This means that majority of cassava producers and processors in Enugu State are literate. The ability to read and write would enable the farmers to better utilize effectively and efficiently whatever resources exist in the area. The level of education attained by a farmer not only increases his/her farm productivity but also enhances ability to understand and evaluate new production technologies [11,19]. According to [16] education raises human capital and significantly increases a farmer's ability to make correct and meaningful choices for farm operations.

Marital Status of the Respondents

Marital status is the fact of being married or unmarried such as a single, bachelor /spinster, formerly married that is husband or wife is late, married but separated or divorced. Marriage with family propels one to higher level of responsibility to cater for dependants and this is expected to facilitate sharp perception of new technology to increase productivity. Marital status in the study was determined by asking the respondents to indicate which of the categories they belong and the frequency distribution is as shown in Table 4.

Table 4: Distribution of the cassava producers and processors according to marital status

Marital status	Frequency	Percentage (%)
Single	39	11.5
Married	267	78.5
Widowed	30	8.8
Divorced	4	1.2
Total	340	100.0

Source: Field survey 2015

Table 4 shows that majority (78.5%) of the cassava producers and processors were married, with 11.5%, 8.8% and 1.2% of them being single, widowed and divorced respectively. The added responsibility of marriage could be the reason to venture into cassava production and processing for household survival. According to [20], married farmers are more involved in cassava production and processing in order to ensure household food security.

Household Size of the Respondents

A household is defined in English dictionary as people who live together in a single home. A household unit according to [21], is defined in dejure terms, which relies on the concept of normal residence whether or not an individual member of the household was present at time of interview. There are other criteria that are vital in classifying the household members. According to [21]; and Federal Office of Statistics (FOS) [22] a household refers

to a group of related or unrelated people, living in a dwelling unit or its equivalent, eating from the same pot and sharing a common housekeeping arrangement who take or are subject to others taking financial decisions. According to the concept of this survey, a household is recognized as people who live and eat together in a dwelling in the study area. This section describes the distribution of respondents according to household size as shown in Table 5.

Table 5: Distribution of the cassava producers and processors according to Household size

Size of Household	Frequency	Percent	Mean	SD
≤ 4	63	18.5		
5-9	170	50.0	7.88	3.57
10-14	92	27.1		
15-19	15	4.4		
Total	340	100.0		

Source: Field survey 2015

SD =Standard Deviation

Table 5 shows that a good proportion (50.0%) of the household unit of the cassava producers and processors had household size of between 5-9 persons. This is followed by 27.1% with 10-14 household members and the least (4.4%) with household members of between 15-19 persons. The mean household size of the respondents is 8 persons. This implies that family labour would be readily available when needed in cassava production and processing in the study area. The result lends credence to [16,18] assertions that farmers had reasonable farm hands from within the household that could help in cassava production. However, [19] reported that large household size could lead to economic inefficiency where small farm sizes are available for cultivation.

Farm Size of the Respondents

Land has always remained at any given time in the study area, an alarmingly appreciable resource, no matter how small it is. The land available to a household for cultivation depends on the size of land disposed to them. Hence, many farm households negotiate for more land to augment the one that is already in their possession, especially when the size of the lands to be used is small. Therefore in other to determine their farm size, the respondents in the survey were asked to indicate which of the eight categories they belong. The various household farm sizes of the cassava producers and processors are shown in Table 6.

Table 6: Frequency distribution of respondents according to their Farm size

Farm Size (hectares)	Frequency	Percentage	Mean	SD
≤1	178	52.4		
1.1 – 2.0	98	28.8	1.6	1.2
2.1 – 3.0	22	6.5		
3.1 – 4.0	13	3.8		
4.1 - 5.0	9	2.6		
5.1 - 6.0	6	1.8		
6.0 -7.0	9	2.6		
≥ 7.1	5	1.5		
Total	340	100.0		

Source: Field survey, 2015

Table 6 shows that more than half (52.4%) of the respondents had farm sizes that were less than one hectare. This confirms [8] finding that majority of farmers operate on fragmented farm holdings and apparently depend on manual labour. Also, 28.8% of the respondents have farm holdings that were within the brackets of 1.1–2 hectares. Cumulatively, 87.7% of the respondents cultivated on less than 3.1 hectares of land with a mean farm size of 1.6. This reflects the limited access of farmers to land which was a result of

high rent paid on hired land, problems of land tenure system (land fragmentation) that are prevalent in the study area. This is in accordance to [9,13,17] assertion that in Nigeria, cassava is generally cultivated by small holder farmers with low resources. Although Smallholder farmers control a vast proportion of the productive agricultural resources in Nigeria, they are characterized by low level of resource utilization, low levels of productivity, low returns to labour and low level of capital investment which limits their production potentials [20].

Farming/Processing Experience of the Respondents

Experience is an increased knowledge or skill gained through being actively involved in an enterprise over a period of time. The cassava producers and processors need to have skills and practical competence, to strengthen their ability in allocating scarce resources as well as making sound production decisions to increase productivity. It is this wealth of knowledge and skills acquired by the cassava producing and processing household in repeated performance over a number of years in an enterprise that is called farm enterprise experience. The production and processing experience of the cassava producers and processors are shown in Table 7.

Table 7: Distribution of respondents according to cassava farm enterprise experience

Farm enterprise experience (years)	Frequency	Percentage	Mean	SD
1-10	103	30.3		
11-20	78	22.9		
21-30	67	19.7	22 years	13.2
31-40	75	22.1		
41-50	13	3.8		
51-60	4	1.2		
Total	340	100.0		

Source: Field survey 2015

Table 7 Shows that 30.3% of the respondents have been in cassava production and processing enterprises for between 1- 10 years, followed by 22.9 % of the respondents who have between 11-20 years of experience in cassava production and processing enterprise respectively. Table 7 further shows that the mean years of experience in cassava production/processing is 22 years. This indicates that the respondents were well versed in the enterprise and are likely to adopt new technology if opportunity comes. High experience in both cassava production and processing enterprises would enhance the respondents' ability for efficient management practices that will ensure increased productivity, all things being equal. According to [14] farmers' years of experience impacted positively on their productivity and efficiency due to prudent allocation of resources overtime arising from acquired practical knowledge through trial and error over time. However, experience can sometimes become a limiting factor to production and processing improvement as farmers become set in their ways and refuse to change and take advantage of new ideas on production [17].

Primary Occupation of the Respondents

Occupation refers to job or profession which people engage in [15] to obtain their livelihood. Primary occupation refers to a person's major source of income. In rural Nigeria, especially in Enugu state, farming is the primary occupation of the rural dwellers and production and processing is mostly at subsistence level. Apart from farming, there are jobs in which the respondents engage in, as a means of earning a living or an added income. Some of these as indicated by the respondents are: civil service, food processing, trading, craftwork, transporter, food vendor, artisan, pensioner and clergy. The major source of income to the cassava producers and processors are as shown in Table 8.

Table 8: Distribution of the cassava producers and processors according to primary occupation

Primary occupation	Frequency	Percentage
Farming	152	44.7
Civil service	19	5.6
Food processing	81	23.8
Trading	29	8.5
Craft work	6	1.8
Transporter	5	1.5
Food vendor	11	3.2
Artisan	20	5.9
Retired/Pensioner	12	3.5
Clergy	5	1.5
Total	340	100.0

Source: Field survey 2015

The information gathered from Table 8 indicates that 44.7% of the respondents engaged primarily in farming. While the major source of income to 23.8% of them was food processing. Other activities engaged in by the respondents include, civil service (5.6%), trade (8.5%), craftwork (1.8%), transport (1.5%), food vendor (3.2%), artisan (5.9%), pensioner (3.5%) and clergy (1.5%). Cumulatively, majority (68.5%) of the respondent's main means of livelihood was farming and food processing. This highlights the important role which cassava production and processing play in the life of the respondents. This is in consonant with [9] which affirms that farming is the predominant occupation in rural parts of Nigeria and play the most important function in the livelihood of the people.

Factors that influenced Gross Margin of Cassava Producers

To determine factors influencing gross margin of cassava production, data were fitted into four functional forms of ordinary least square (OLS) multiple regression model (linear, semi logarithmic, double logarithmic and exponential functions). The computations of data were done using the statistical package for social sciences (SPSS) version 20.

Summary of the OLS regression estimates to determine the influence of gross margin on cassava production among the cassava farmers.

The summary results of each of the four functional forms of OLS regression model reveal some variables included in the model that are significant determinants of gross margin in cassava production and they include coefficients of the independent variables, value of constant, coefficient of multiple determination R^2 , and F-ratio. The results of the OLS regression analysis are presented in Table 9

Table 9: OLS regression estimates of determinants of gross margin of cassava production among the cassava farmers.

	Functional Forms			
Independent variable	Linear	Exponential+	Semi-log	Double-log
Constant	-51048.52	10.511	-1543959.030	7.430
	(-0.9698)	(96.908)***	(-3.545)***	(9.267)***
Age (X_1)	-283.295	0.0003	4820.157	0.047
	(-0.379.)	(0.185)	(0.045)	(0.237)
Education level (X_2)	13736.482	3.092	284850.229	1.084
	(7.980)***	(21.484)***	(3.374)***	(6.976)***
Marital status (X_3)	1227.886	-0.033	-57938.701	0.051
	(0.078)	(-0.849)	(-0.421)	(0.199)
Household size (X_4)	-1104.341	-0.005	-50229.034	-0.199
	(-0.454)	(-0.788)	(-0.853)	(-1.835)
Farm size (X_5)	19095.590	0.041	137048.910***	0.208
	(3.255)***	(2.776)***	(2.705)	(2.230)**
Farming Exp. (X_6)	2013.320	0.003	76867.756	0.187
	(2.567)***	(1.973)**	(1.763)	(2.326)**
Fertilizer Quantity (X_7)	278.274	0.001	53360.312	0.199
	(5.848)***	(4.229)***	(1.555)	(1.890)
Membershipto cooperative association (X_8)	911.316	0.015	14854.258	0.062
	(0.349)	(2.268)**	(0.625)	(1.417)
Transport cost (X_9)	-25444.605	1.126	-98673.183	-0.202
	(-1.187)	0.023	(-0.390)	(-0.434)
Price of product(X_{10})	-20001.618	0.047	41896.884	0.036
	(-1.203)	(1.126)	(0.469)	(0.0219)
Labour cost (X_{11})	-3.877	-0.130	-100789.562	-0.096
	(-1.926)	(-2.331)**	(-1.014)	(-0.522)
Credit access (X_{12})	0.489	0.102	58066.688	0.090
	(9.766)***	(3.974)***	(2.158)**	(1.823)
Technology used (X_{13})	30935.402	3.232	-39811.767	-0.023
	(2.618)***	(7.283)***	(-0.558)	(-0.178)
Use of improved cassava varieties	0.213	0.213	-0.0344	-0.119
	(28.037)	(2.102)**	(-0.718)	(-1.075)
R Squared (R^2)	0.687	0.712	0.619	0.707
Adjusted R^2	0.677	0.708	0.550	0.697
F-value	92.383***	232.126***	10.420***	20.938***

Source: Field survey data, 2015.

*** and ** indicate variables significant at $p < 0.01$, and $p < 0.05$ respectively.

Figures in parenthesis are the t-values; + = lead equation. The estimates of the factors influencing gross margin of cassava production among the cassava producers are presented in Table 9. All the tried functional forms of the regression model were significant at $p<0.01$, implying that any of the functional forms can be used for predictive purposes. However, the exponential functional form gave the best fit to the data having produced highest R^2 value of 0.712, F-value of 232.126 ($p < 0.01$) and highest (9) number of significant variables that conformed to *a priori* expectations. The coefficient of multiple determinations (R^2) of 0.712 implies that 71.2% of the variation in gross margin among the cassava producers was explained by the independent variables while the remaining 28.8% was explained by the joint action of other variables not included in the model. The F-value (232.126; $p < 0.01$) confirms the overall equation of the regression to be statistically significant. The significant variables that explained variation of cassava production in gross margin are education level, farm size, farming experience, fertilizer quantity, membership to farmers association, labour cost, credit access and technology. The gross margin equation

using the exponential functional form is as follows: $Y = 10.511 + 0.0003X_1 + 3.092X_2 - 0.033X_3 - 0.005X_4 + 0.041X_5 + 0.003X_6 + 0.001X_7 + 0.015X_8 + 1.126X_9 + 0.047X_{10} + 0.130X_{11} + 0.102X_{12} + 3.232X_{13} + 0.213X_{14} + 0.224$)

Where;
Y= Gross margin of cassava production,
X_1 = Age
X_2 = Education
X_3 = Marital Status
X_4 = Household Size

X_5 = Farm Size
X_6 = Farm Experience
X_7 = Fertilizer Quantity
X_8 = Membership of Association
X_9 = Transport
X_{10} = Price of Product
X_{11} = Labour Cost
X_{12} = Credit Access
X_{13} = Technology Use
X_{14} = Use of Improved Varieties

The coefficients of the producer's level of education (X_2), farm size (X_5), fertilizer quantity (X_7), credit access(X_{12}) and technology (X_{13}) are found significant at 1% level, while the coefficients of farming experience (X_6), membership of association (X_8), labour cost (X_{11}) and use of improved varieties (X_{14}) are significant at 5% level.

The coefficient of age (X_1), marital status (X_3), household size (X_4), transport (X_9) and price of product (X_{10}) are not significant, this implies that the farmers, marital status, household size, transport cost, and price of product do not meet the necessary criteria to significantly impact on the gross margin of cassava production, so these variables played no role at this stage of the analysis, this suggest that the non significant variables are not the determining factors that influence the gross margin of cassava production in Enugu state hence were ignored in the discussion.

The coefficient of education level (3.092) was positive and highly significant ($p < 0.01$) implying a positive significant contribution of education level to gross margin of cassava production. The coefficient's value of 3.092 implies that one percent increase in years of education will tend to increase gross margin by 3.092 units. This conforms to *a priori* expectation. This finding agrees with [9] assertion that education is an investment in human capital which is able to raise the skills and qualities of farmers and increase farmers' allocative abilities thereby leading to better productive performance. According to [6], a person's level of educational attainment is likely to affect his or her degree of business alertness and ability to seize business initiatives and advantages, hence increased gross margin.

The coefficient of farm size (0.041) was positive and highly significant ($p < 0.01$). This implies that increase in farm size brings about increase in the gross margin of cassava production. This finding is in consonance to *a priori* expectation and compares favourably with finding of [9] study on profitability determinants among cassava farmers in Delta state, Nigeria. According to [6] increased farm size with the desired agronomic/management practices, will improve farm output and gross margin.

The coefficient of farming experience (0.003) was positive and significant ($p < 0.05$). This implies that as farming experience of the cassava farmers increases, the gross margin from cassava production also increases. This finding is in line with *a priori* expectation. Experience gained while operating a farm enterprise makes significant impact in the managerial ability of a farmer, hence increased profit. This result corroborates the assertions of [7] that more years of farming experience allows farmers to be better positioned to make rational

choice and decision among alternative farm inputs for higher gross margin.

The coefficient for amount of fertilizer used (0.001) was positive and highly significant ($p<0.01$) implying that fertilizer had a positive significant contribution to profit. This is in agreement to *a priori* expectation. Use of fertilizer increases soil fertility which boosts cassava output, and helps farmers to generate a higher gross margin. According to [4] fertilizer is required in its optimal level for the improvement of soil fertility. However, this finding disagrees with findings of [7,9].

Membership to cooperative association had a positive coefficient (0.015) and was statistically significant at $p<0.05$ level. This implies that membership to cooperative societies exerted a significant positive effect on gross margin of cassava production. This is expected and conforms to *a priori* expectation. The benefits inherent in cooperative membership enable the farmers to obtain inputs at reduced price due to bulk purchase and subsidy given by various institutional bodies. Collective endeavour make necessary arrangements for better inputs supply, extension support, credit facilities, collection of produce, processing and marketing facilities [9], which translates to increased gross margin.

The coefficient of labour cost (-0.130) exerted a negative significant effect ($p<0.05$) on gross margin. The sign is in accordance with *a priori* expectation. This implies that the higher the price of labour used in the production of cassava, the lower the gross margin. Also, high labour cost could lead to sub-optimal use of labour which is an important input in cassava production. This result supports the findings of [3] that as the input prices increases, reduced inputs are used.

The coefficient (0.102) of access to credit was positive and statistically significant at 1% probability level. The sign of the variable is consistent with *a priori* expectation. This implies a direct relationship with gross margin of the cassava farmers. This finding lends credence to [8] assertion that acquisition and proper utilization of credit for any agricultural purpose promotes productivity and enhances profit.

The coefficient of use of improved technologies (3.232) was positively correlated and statistically significant at 1% implying that the more the farmers have access to technology and use them, the greater will be the level of increase in production. This in real sense can be translated to a greater level of use of technology will effect the increase in output of cassava and hence increase in gross margin. This implies that increasing the farmers use of technology will result to 3.232 unit increase in the gross margin of cassava production; again statistically significant indicates that the use of technology will be associated with the output of cassava farmers hence their gross margin in Enugu State. This collaborates with a priori expectation which points that the knowledge and use of improved technology increases output level and in line with [14]. This agrees with *a priori* expectation and [8] that improvement in agricultural technology leads to improvement in farm productivity. This implies that policies to develop and distribute improved technologies to farmers should be encouraged in order to increase productivity, income and reduce poverty among the farmers in Enugu state.The coefficient of use of improved cassava stem cuttings (0.213) was positive and significant at 5% implying a positive significant contribution of use of improved cassava varieties to gross margin. The coefficient's value of 0.213 implies that 1% change in use of improved cassava stem cuttings would tend to change gross margin by 0.213%. This result is line to *a priori* expectation since improved varieties are developed and distributed to farmers to raise their farm yields [5]. Improved cassava varieties perform optimally under optimum production environments such as adequate amounts of the correct nutrients, soil temperature and climatic requirements [9].

CONCLUSION

In conclusion, results of each of the four functional forms of OLS regression model reveal some variables included in the model that are significant determinants of gross margin in cassava production and they include coefficients of the independent variables, value of constant, coefficient of multiple determination R^2 , and F-ratio. The results of the OLS regression analysis.

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