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ECONOMETRIC ANALYSIS OF AGRICULTURAL LAND VALUES IN IMO STATE, NIGERIA (A HEDONIC PRICING APPROACH)

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Abstract

Overtime, land values have continued to diminish due to unsustainable land management practices engaged by the farmers. This study evaluated the econometric analysis of agricultural land values in Imo State, Nigeria. Multi-stage random sampling technique was used to select 75 farmers for the study. Information on the objectives of this study was elicited from the sampled respondents through a well structured questionnaire and interview schedule. Data were analyzed using descriptive statistical tools, and multiple regression models. The socio-economic features of the farmers reveal a mean age of 58 years, 12 years educational attainment, 5 persons per household, 15 years farming experience, and a mean farm size of 1.07. Results further showed that Owerri zone recorded the highest land values across the zones, the land values (Ha/farmer) from the zone was ₦278, 193.52 which is considerably higher than other land values obtained from Orlu and Okigwe zones respectively. Double-Log function was selected as the lead equation and was used to interpret the factors influencing land values across the three agricultural zones in the State. Hence efficient land management practices such as (organic manuring, crop rotation, alley cropping, etc.) were recommended for the farmers to improve land value in the area.

Key words**:** *econometric analysis, agricultural land values, hedonic model, Imo State, Nigeria*

INTRODUCTION

Land prices are differentiated on the basis of its production attributes in agriculture as well as other activities [3]. In rural areas, where agricultural production dominates economic activities, land is of higher use, hence attracts higher values.
However, the value of land is not influenced by its demand for constructions, building and urban development. Moreover, the potential returns from agricultural activities are capitalized into current farmland prices [6] with other variables reflecting the economic returns to agriculture. In some studies land values have been estimated through the influence of returns to agriculture [2].
In recent times, returns from lands have depreciated due to unsustainable land practices used by farmers' overtime. Farmers in a bid to maximize productivity and income use variant land practices which is concomitant to soil erosion, leaching, desertification, deterioration, thus threatening land productivity of the farmers. This is in line with [14] and [8].
Hedonic price models have been used extensively to impute the value of agricultural land based on its attributes in farmland prices [12] and [17].
Hedonic pricing suggests that prices of any heterogeneous commodity are determined by the quality characteristics of that commodity. The model has been used to estimate implied value of individual farmland based on the characteristics and multi-attributes of land as a factor of production [12].
This has made the price of land to be a component of bundle characteristics of some factors of production, and natural endowment. [3] classified agricultural characteristics as those that; influence farm income and profitability; external economies and governmental influence; expectations about

future conditions, buyer characteristics, seller characteristics and land characteristics.

The attributes of farmland prices are classified based on location of land, agricultural factors and non-agricultural factors [7] and [3]. Location reflects the proximity of the farmland vis-à-vis metropolitan area and developed area. Agricultural factors include characteristics related to the productivity of a specific parcel of farmland relative to others as well as attributes of the agricultural economy.

These could be drawn from arable crop production and returns from forest resources. Non- agricultural factors consist of economic characteristics of the region related to the potential demand to convert farmland to a non-agriculture [16].

The hedonic price approach is estimated using the ordinary least square of multiple regression analyses.

This is an econometric model that assesses the causal relationship between one variable and a group of other explanatory variables [1].

The agricultural variables are further split into two sub-groups. The first one is concerned with returns from agricultural production (monetary variables) like the price of output, market revenues, and government payments (like categories of government support such as input subsidy) amongst others.

There are also other non-monetary variables which have a clear influence on returns from land like yield, soil quality, market variables, and access to irrigation facility, etc. Furthermore, hedonic model captures only some internal and external land markets quantities which exclude urban pressure and some macro-economic factors like interest rate, inflation rate, property tax rate and unemployment rate amongst others [16].

The internal/agricultural variables are concerned with returns from agricultural production; government payments, etc. The external variables include variables describing the market, prices, and other related macro-economic factors.

MATERIALS AND METHODS

This study was carried out in Imo State, Nigeria. The State is located in the South-Eastern rainforest belt of Nigeria. Imo State has a total of 27 Local Government Areas which is divided into 3 Agricultural Zones namely; Owerri, Orlu and Okigwe.

Across these zones, agriculture is a major economic activity predominant amongst the people of the State. A multiple-stage random sampling technique was adopted in selecting the sample.

Three local government areas (LGAs), one from each of the agricultural zone, were selected using simple random sampling to get a representative sample of the State.

From each LGA, 3 communities were randomly selected. The list of arable crop farmers in each chosen community forms the sampling frame.

The list had farmers who cultivated on inherited or leased and rented farmlands from which 10 crop farmers were selected making a total of 90 farmers.

Out of these only 75 farmers were found useful for data analysis. Data collected using structured questionnaire and interview schedule were analyzed using descriptive statistical tools, and the hedonic model pricing approach.

The hedonic model pricing approach is anchored in consumer utility theory based on the assumption that price of a good (in our case land) can be explained by a set of characteristics (e.g. land quality, etc) affecting it. An estimable function of agricultural land price is a function of Z_i factors. i.e.

$$Li = \sum_{i=0}^{y} Zi + \mathcal{E}i ----------------------Eqn. 1$$

Where Z_i are variables representing characteristics that explained the quality of land and other factors affecting it. Z_i= 1 for all observation.

The model can be further expressed as follows:

$$Li = \beta o + \sum_{i=0}^{n} monetary\ returns\ from\ the\ land + \sum_{i=0}^{m} Non - monetary\ returns + \sum_{i=0}^{w} Macro - economic\ variables + \sum_{i=0}^{y} Government\ payments + \sum_{i=0}^{z} Market\ variables \quad -- \quad Eqn.2$$

$$Li = \beta o + \sum_{i=0}^{n} \beta iXi + \sum_{i=0}^{m} XiYi + \sum_{i=0}^{y} YiVi + \sum_{i=0}^{z} ViN + \sum_{I=0}^{U} \lambda Qi -- \quad Eqn.3$$

Where:
L_i = potential output or net income from land
X_i = monetary returns from the land
Y_i = non-monetary values or returns from the agricultural farm land
V_i= macro-economic variables
N= government payment
Q_i = market variables
The hedonic price approach is estimated using the ordinary least square multiple regression analyses.
Hence, the implicit form of the model is presented as follows;
P = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, e)
Where:
P = Farmland value or price (Naira)
X_1= Potential income from i[th] class of land
X_2=Yield in the form of productivity (Naira)
X_3= Soil quality (using soil quality score)
X_4=Government payments (Dummy: if there is any form of government support such as input subsidy or loan from government or market for the product =1; and otherwise, 0)
X_5= Average farm size (hectares)
X_6 = Irrigation facility (Dummy: if the farmer has any form of irrigation facility on the land =1; and otherwise, 0)
X_7=Credit availability (Dummy; 1; if there is an institutional source of credit and 0, if otherwise)
e= error term
However, the Economic value of land = E(P_L). This is expressed as:

$$E(P_L) = \beta_o + \beta_1\bar{X}_1 + \beta_2\bar{X}_2 + \beta_3\bar{X}_3 + \beta_4 X_4 \pm \beta_5 X_5 \pm \beta_6 X_6 \pm \beta_7 X_7$$

These regression equation are then fitted into four functional forms as follows:

Linear $Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7$

Exponential $\ln Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7$

Double-log $Y= b_0 + b_1\ln x_1 + b_2\ln x_2 + b_3\ln x_3 + b_4\ln x_4 + b_5\ln x_5 + b_6\ln x_6 + b_7\ln x_7$

Semi-log $Y = b_0 + b_1\ln x_1 + b_2\ln x_2 + b_3\ln x_3 + b_4\ln x_4 + b_5\ln x_5 + b_6\ln x_6 + b_7\ln x_7$

RESULTS AND DISCUSSIONS

Socio-Economic Characteristics of the Respondents

The mean age of the respondents was 58 years. It implies that the farmers were beyond their active stage of life to produce the needed quantities of output. It is generally believed that farmers output and productivity diminishes with advancing age. At this age farmers are growing weaker and as such loss of farming strength which declines maximum output. This finding agrees with [15] and contradicts [11] who reported that farmers at this age are more knowledgeable enough to scale through farm production constraints and have acquired enough farming experience to increase farm production in a short time.

The mean education level was 12 years and this implies that the farmers attended up to secondary school which qualifies them to take critical decision concerning their farming enterprises. This further implies that the farmers were better positioned to take advantage of new innovation techniques that could boost their farming. The result agrees with [10], assertion who stated that improved education level brings about positive changes in the knowledge, attitude and skills through research and extension. Educational attainment does not only raise agricultural productivity but also enhance farmer's ability to understand and evaluate information on new techniques. This supports the finding of [13]. The mean household size was 5.0 which fall within the range of 6-10. This is desirable and of great importance to rural household as they rely more on their family members than hired laborers in their farming, thereby reducing production cost. This finding is consistent with [15]. The mean farming experience was 15.4 years which implies that the farmers were relatively experienced to carry on with their production activities. According to [5] the years of farming experience of a farmer enables him to acquire practical and relevant farming knowledge which drive his ability to efficiently utilize available resources with discretion. The mean of the farm size was 1.07. This implies that farmers in the area operated small farm sizes which have an inverse relationship on productivity of the farm. This further implies that most of the farmers were operating on subsistence level.

This might not be unconnected with the difficulty in acquiring land for farming purposes. Studies have shown that most rural farmers in Nigeria operated on small scale basis [8].

Table 1. Socio-Economic Characteristics of the Respondents

Variable	Mean
Age (years)	58
Education (years)	12
Household size (No. of persons)	5
Farming experience (years)	15.4
Farm size (Ha)	1.07

Source: Field Survey, 2014

Estimation of Land Values across the three Agricultural Zones in Imo State

The Table 2 showed that Owerri zone recorded the highest land productivity of 2.76 than the productivity obtained from other agricultural zone. Orlu zone showed a land productivity of 1.96 while Okigwe zone had 1.84 respectively. The land productivity of 2.76 obtained in Owerri zone possibly led to the zone having higher returns of ₦76, 068, relative to Orlu and Okigwe zones that had values of ₦50,764 and ₦67,090 respectively. This implies that Owerri zone has favourable socio-economic factors that enhance the productivity of the farmers as well as their income. This agrees with the findings of [14]. The soil quality recorded in Owerri zone was higher in value in comparison with other zones. Owerri zone shows a value of 1.17 against Orlu and Okigwe zones with values of 0.93 and 1.12 respectively. This implies that Owerri zone had good soils which are very fertile for growth of arable crops. This is consistent with the findings of [4]. Orlu zone had the least farm size of 1.0 which is marginally lower than the value obtained in Okigwe zone while Owerri zone further recorded a higher farm size of 1.24. It is generally believed that larger farm size enhances land productivity of the farmers. This agrees with the findings of [15]. Again, the result showed evidence of government payments in terms of input subsidy across the various zones of the State. The irrigation facilities used in Okigwe zone was higher across the zones. This could be due to the nature of the soils found in the area. It could be further deduced from the Table that Orlu zone had the least volume of credit, ₦100,400 while

Okigwe and Owerri zones recorded an upward increase of ₦120,800 and ₦180,800 respectively. This implies that farmers in Owerri zone had more access to credit relative to other zones. The Table further showed that Owerri zone had higher land values than other zones, the land values (Ha/farmer) from the zone was ₦278,193.52 which is considerably higher than other land values obtained from Orlu zone and Okigwe zone respectively. This stems from the fact that variables such as productivity, soil quality, farm size, and volume of credit from the zone were higher across the zones and this might have resulted to higher land values recorded in Owerri zone. This agrees with the findings of [9].

Table 2. Land Value Estimates across the three Agricultural Zones in Imo State

Variables	Owerri zone (ha/farmer)	Orlu zone (ha/farmer)	Okigwe zone (ha/farmer)
Returns	76,068	50,764	67,090
Productivity	2.76	1.96	1.84
Soil quality	1.17	0.93	1.12
Farm size	1.24	1.0	1.1
Government payments	0.4	0.47	0.5
Irrigation facilities	21,320	29,200	74,400
Volume of credit	180,800	100,400	120,800
Land values	278,193.52	180,368.36	252,294.61

Source: Field survey, 2014

Factors Influencing Land Values Across the Three Agricultural Zones in Imo State

The four functional forms of the model were fitted in to establish the factors influencing land values across the three agricultural zones in Imo State. Double-Log function was selected as the lead equation based on having the highest number of significant variables, highest R^2 and F-statistics and was used to interpret the factors influencing land values across the three agricultural zones in the State. The model is expressed as:

Double-log: $Y = 3.303 + 0.742\ln x_1 + 0.029\ln x_2 - 0.169\ln x_3 + 0.000614\ln x_4 + 0.0059\ln x_5 - 0.008\ln x_6 + 0.0616\ln x_7$

The result showed that the co-efficient of multiple determination (R^2) was 0.834. This implies that about 83.4% variation of the endogenous variable was explained by the exogenous variables used in the model. The f-value which is highly significance at 1% reveals that all the included variables in the double-log model jointly account for the variation in land prices or the values.

The coefficient of returns was positive and significant at 1% level. This implies that any increase in returns in terms of higher output or yield from the land increases land values. This is consistent with the findings of [14].

Farm size showed a positive relationship with land values and was significant at 5% level. This implies that a unit percent increase in farm size will lead to a corresponding increase in land values. This agrees with the findings of [14] who stated that higher farm sizes are sine qua non for increase land values. Increase in farm size leads to adoption of improved soil management practices which enhance land values.

The coefficient of soil quality was negatively related to the land values and statistically significant at 10% level. This implies that an increase in soil quality by 1.00 units will give a less than proportionate decrease in land values by 0.169 units. This result is not consistent with the findings of [4]. The negative value could be as a result of farmers' use of unsustainable farming methods or practices like (bush burning, continuous cropping, etc) which poses an adverse effect on soil fertility, thus reducing land values of the farmers. The productivity of the farmers was positive and also significant 5% level which implies that any increase in productivity of the farmers will equally increase land values. According to [5] land value rises when the productivity of the land is on the increase.

The coefficient of credit availability showed a positive relationship with land value and was also significant 10% level. This further implies that a percent increase in credit availability of the farmers will lead to a corresponding increase in land values. Farm credit is a very necessary tool for increased output of the farmers. Credit enhances the acquisition of farm inputs and other logistics which induce higher productivity hence, higher land values. This is consistent with the findings of [14].

Table 3. Factors Influencing Land Values across the three Agricultural Zones in the State

EXPLANATORY VARIABLES	LINEAR FUNCTION	EXPONENTIAL FUNCTION	+DOUBLE-LOG FUNCTION	SEMI-LOG FUNCTION
Constant	46104.79	11.829	3.303	-20293
(t-stat)	(0.686)	(34.64)***	(10.993)***	(-12.720)***
Returns (x_1)	0.398	191E-06	0.742	19179
(t-stat)	(4.234)***	(9.489)***	(29.259)***	(14.253)***
Farm size (x_2)	-25398.4	-0.0815	0.029	66483
(t-stat)	(-4.157)***	(-0.761)	(2.611)**	(2.632)**
Soil quality (x_3) (t-stat)	49236.52 (0.918)	-0.1107 (-0.408)	-0.169 (-1.801)*	-1811.86 (-0.028)
Productivity (x_4) (t-stat)	5262.89 (2.936)***	-0.0193 (-0.656)	0.00061 (2.023)**	5903.16 (0.419)
Govt.ppt (x_5)	-15971.5	0.1914	0.059	-975.17
(t-stat)	(-0.769)	(1.849)*	(1.338)	(-0.041)
Irrigtn. (x_6)	38255.5	0.2578	-0.008	-22304
(t-stat)	(1.469)	(1.959)*	(-0.154)	(-0.731)
Credit (x_7)	-2515.1	0.0836	0.0616	-37873
(t-stat)	(-0.113)	(0.752)	(1.991)*	(-1.495)
R^2	0.813	0.636	0.834	0.7435
Adjusted R^2	0.794	0.598	0.817	0.7166
F-ratio	41.855***	16.729***	48.176***	27.729***
N	75	75	75	75

Source: Field survey, 2014.
+ = Lead Equation
***= 1% significance level
** = 5% significance level
* = 10% significance level

CONCLUSIONS

The findings of the study showed that farmers in the area operated on small scale basis which have an inverse relationship on the productivity and land values of the farmers. Results further showed that Owerri zone had higher land values across the zones. This stems from the fact that variables from the zone such as productivity, soil quality, farm size, and volume of credit were higher across the zones and this might have resulted to higher land values recorded in Owerri zone. Double-Log function was selected as the lead equation and was used to interpret the factors influencing land values across the three agricultural zones in the State. Hence efficient land management practices such as (organic manuring, crop rotation, alley cropping, etc.) were recommended for the farmers to improve land value in the area.

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