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EMPIRICAL ESTIMATES OF DETERMINANTS OF FARMLAND PRODUCTIVITY AMONG SMALL-HOLDER FARMERS IN ABA AGRICULTURAL ZONE, ABIA STATE, NIGERIA

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ABSTRACT
This study ascertained the determinants of farmland productivity in Aba Agricultural Zone, Abia State. A Multi-stage sampling procedure was used to select 144 respondents for the study, and data were elicited with the use of structured and open-ended questionnaire. Data were analyzed using descriptive statistics, partial factor productivity and ordinary least square regression model. The mean productivity of farmland in Aba Agricultural Zone was N172,994.89/ha, ranging from N136,722.22/ha in Aba South to N205,027.78/ha in Obingwa LGA in the area. The result of the determinants of farm land productivity showed that extension contact (0.2341), occupational status (1.7103), farm size (-0.7550), fertilizer use (2.0404), hired labour (0.0009) and farming experience (23190) significantly influenced the productivity of land. The important factors limiting farmland productivity in the study area were land fertility, improvement of land, proper use of land and ownership of land. However, there were no significant differences in the farmland productivity across Aba agricultural zone. The study recommended that sustainable farmland management practices should be adopted by farmers as well as new farming practices for enhanced productivity.

Keywords: Determinants, Farmland, Productivity, and Aba Agricultural Zone

Introduction

Agriculture is not only the economic mainstay of the majority of households in Nigeria (Udoh, 2000) but also a significant sector in Nigeria's economy (Amaza, 2000). The sector provides feed and food for livestock and the teeming populace, generates foreign exchange and contributes to the increasing gross domestic product (GDP) in Nigeria. Before the independence in 1960, CBN (2005) noted that agricultural sector was a dominant sector in Nigerian economy providing employment to the growing labour force and raw materials for agro-allied industries. The sector accounted for about 90% of Nigerian foreign exchange earnings and economic growth raising about 70% of the Gross Domestic Product (GDP) (Omobowale *et al*., 2009). Until the early 1970s, agricultural exports were the main source of foreign exchange earnings. The early period of post-independence up until the mid-1970's saw a rapid growth of industrial capacity and output as the contribution of the manufacturing sector to GDP rose from 4.8% to 8.2%, (Emeka, 2007; Omobowale *et al*., 2009 and Mesike *et al*., 2010).

The current dismal performance of the agricultural sector in Nigeria is alarming. According to Ukeje (2004), the principal constraint to the growth of the agricultural sector is the fact that the structure and method of farming have remained the same since independence. The situation is worsened by a wide variety of factors including poor soil quality caused by environmental pollution, erosion, flooding and leaching, negative externalities due to climate change, scarcity and high cost of lands, rudimentary implements and high cost of mechanized farm tools where they are available, outdated farming practices and conversion of farm or agricultural land to other different uses are adduced to be responsible for the poor performance of arable farmlands in Nigeria (Omobowale *et al*., 2009). The United Nations and

the Food and Agriculture Organization have rated the productivity of Nigeria's farmland as low but can move from medium to enhanced productivity, if the land is properly managed (NPC, 2004). This implies that agricultural sector in Nigeria can be effective, and or attain higher level of productivity and growth, if it can address the major issues affecting arable land.

According to Dreschel *et al*., (2001) there is a significant relationship between population density, reduced fallow periods, and soil nutrient depletion in the farming system when pressure on land conversion to other uses becomes prevalent. In most cases, small holder farmers have little control over these land acquisition and conversions from agriculture to non-agricultural uses (Hardoy *et al*., 2001). Hence, farmers who were at liberty to efficiently allocate land for optimal use are highly constrained by deprivation of fertile lands needed for agricultural purposes (Fazal, 2001). It becomes a household issue when the decisions to convert agricultural land to alternative uses are not been borne by the small holder farmers themselves, yet the pressure of reduced farm sizes affects the viability of the farm business and its productivity, as well as their standard of living.

Methodology

The study was conducted in Aba Agricultural Zone (AAZ) of Abia state, Nigeria. AAZ is made up of seven Local Government Areas namely: Osisioma, Aba North, Aba South, Obingwa, Ukwa East, Ukwa West and Ugwunagbo. The zone is located between latitudes 5^0 and 39^0N and Longitudes 2^0 and 0^0 E, has a total land mass of 810,160ha and with a population of 1,167,698 persons, (NPC, 2006). The choice of Aba was as a result of its rapid population growth. The pre-dominant soil of the area is sandy loam while the natural vegetation is the tropical rain forest, characterized by two distinct seasons; the dry season and the wet season. The dry season lasts from November to March while the wet season lasts from April to October. Aba is a commercial and industrial town. But the main owners of the land are farmers. The farmers in the area are primarily involved in food crop production but they are also involved in livestock production including poultry, and so on. The major food crops cultivated include cassava, maize, yam, plantain, banana and vegetables. It is a major urban settlement and commercial center. As a result of that land is a scarce commodity in the area. It is important to state that Abia State has three (3) Agricultural Zones namely: Aba, Umuahia and Bende Agricultural Zones. For this study, Aba Agricultural Zone was selected because it is the most urbanized zone in Abia State. A Multi stage sampling technique was used in selecting 144 respondents from a total of 1450 registered crop farmers for the study. In the first stage, a purposive selection of four (4) Local Governments Areas (LGAs) out of the 7 LGAs in the zone was done for the study. The LGAs selected were Aba North, Obingwa, Osisioma and Aba South LGAs. The selection of these 4 LGAs was due to rapid population growth, farming activities and other non-farming activities going on in the LGAs selected from the areas for the study. The second stage is a random selection of 12 communities from a list of 43 communities across the already selected LGAs in the zone. There are an unequal number of communities across the selected LGAs, hence a proportionate sampling was done to select the 12 communities used for the study. Aba North and South have ten (10) and eight (8) communities respectively while Obingwa and Osisioma have thirteen (13) and twelve (12) autonomous communities respectively. Three (3) communities were randomly selected from Osisoma, and Aba North LGAs each while four (4) and two (2) communities respectively were randomly selected from Obingwa and Aba South LGAs making a total of 12 communities used for the study. The third and the final stage, involved the random selection of 144 farmers from the list of farming households obtained from the Aba zonal office of the Abia State Agricultural Development Programme (ADP) for this study. Due to the unequal number of farmers across these communities, proportionate selection of only 30% of the farmers sampled from each community in the list was done. About 40 and 37 of them were drawn from Obingwa and Osisioma LGA's while 35 and 32 were drawn from Aba South and Aba North respectively and used for the study. The 144 farmers were sampled from a sample frame of 1450 crop farmers. Primary data for the study were collected using structured and open-ended questionnaire, and secondary information was obtained from the State Agricultural Development Programme. Data that were obtained was the list of farmers in the Agricultural Zone.

Model Specification

Analysis of the partial productivity of arable farmland was determined using the partial factor productivity analysis. This is expressed as:

$$\text{Farm land Productivity (₦/Ha)} = \frac{Value\ of\ output\ (mix\ crop)(₦)}{Area\ of\ land\ cultivated\ (ha)} \quad (1)$$

following Ehirim *et al*., (2013)

The factors affecting arable farmland productivity was analysed using the Ordinary Least Square (OLS) regression analysis. The general form of the model is explicitly given as:

$$Y = P_L = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + e \quad (2)$$

Where,

Y = Farm Land Productivity (₦/Ha); X_1= number of extension contact (number); X_2 =Occupational

Status (full time farmer=1, otherwise=0); X_3 = Farm size (Hectare); X_4 = Fertilizer use (Kg); X_5 = Labour (mandays); X_6 = Land ownership (market based=1, otherwise=0); X_7 = Farming Experience (years); and e = error term.

Testing of significant differences in land productivity in different parts of the zones was done using the analysis of variance (ANOVA) as specified following Osuji *et al* (2012).

$$F = \frac{MSSB}{MSSW} = \frac{SSB/(k-1)}{SSW/(n-k)} \quad (3)$$

TSS (total sum of square)= SSW + SSB (4)

SSW (sum of square within group)

$$= \sum_{i=1}^{nj} \cdot \sum_{j=1}^{n} (Xij - Xj)^2 \quad (5)$$

$$SSB = \sum_{i=1}^{n} (\mu j - \mu)^2 \quad (6)$$

Where,
X_{ij} = i^{th} Land productivity measure score of farmers from LGA j;
μj = Mean Land productivity score of responding farmers in LGA j;
μ = Grand mean Land productivity score of farmers in the study area;
F = Value by which the statistical significance of the mean differences was judged;
SSB = Sum of squared deviations between the scores on Land productivity in the four selected LGAs.;
SSW = Sum of squared deviations within the scores on Land productivity in the four selected LGAs;
n_j = Sample size of farmers from selected LGA j;
n = Sample size of farmers in study area;
K = Number of LGAs selected in study area;
k-1 = Degrees of freedom for SSB (numerator); and
n-k = Degrees of freedom for SSW (denominator)
After these tests, the F calculated was compared with the F tabulated. The rule that null hypothesis be accepted if the estimated is less than the tabulated value of F at 5% level of significance was adopted.

Results and Discussion

Productivity of Farmland by Local Government

The distribution of the respondents based on the productivity of farm land by local government is presented in Table 1. The result showed varying mean farm land productivity of arable farmland among the locations. Ehirim *et al.,* (2013) noted that this situation could be possible with varying suitability of farm lands for arable crop production. The farm productivity in Aba North and South was N155, 888.89 and N136, 722.22 per hectare respectively while in Osisoma and Obingwa LGAs, a mean farm productivity of N195, 222.22 and N205, 027.78 were obtained respectively. The mean farm productivity in the entire zone was N172, 994.89 per hectare. It could be deduced from this result that farm productivity is relatively low in Aba North and South LGA's. The low farm productivity in these areas could be due to the proximity of the areas to the city centre in the zone. According to Nnaji and Duru (2007), uncertainties face most Nigerian cities including Aba zone since growth in population is matched by corresponding development of infrastructure with little improvement in soil fertility. Secondly, farming activities and low productivities among the farmers in Aba North and South LGA's are drastically reduced possibly because alternative use of arable farmlands as perceived by the farmers' in the LGA's may have high opportunity cost and inadvertently affect the productivity of such farm lands in the area. High land value may not be cost effective for farming activities and farmers may likely reduce the size of their farmland to favour other economic activities that came with urban encroachment, hence reducing farm output. In other LGAs of the zone like Osisoma and Obingwa, arable farmland productivity was relatively higher compared to the other areas. This might be because of suitability of these arable farmlands to crop production (Ehirim *et al*., 2013). This finding is consistent with the findings of Umunakwe *et al*., (2011) who observed that remote areas away from urban pressure have quality factors such as quality air, water and soil and the amount of green space available favourably affect the farming activity and peoples' way of life. Hence, increased farming activities in the areas remote from city center is an advantage to increased productivity (Senecal, 2002).

Determinants of Farm Land Productivity

The determinants of farm size productivity are presented in Table 2. From the results in Table 2, the double-log functional form was chosen as the lead equation based on the highest co-efficient of multiple determination (R^2), conformity to *apriori* expectations and number of significant explanatory variables. The results showed that the double-log form gave the highest value of coefficient of multiple determination (R^2), highest number of significant explanatory variables and hence the best fit given an F-value of 27.7188. The F-value is higher than the tabulated value of 4.29 at 0.01 critical level, hence making the double-log functional form the best fit. The coefficient of R^2 was 0.7185, which implies that about 72% of the variations in the determinants of farmland productivity were accounted for by the joint action of the independent variables included in the multiple regression model.

The coefficient of extension contact was positive and significant at 1% level. This implies that any increase in frequency of extension contacts will lead to a corresponding increase in farm land productivity. Also, farmers with more extension contact are

exposed to several information and innovative technologies that help them to improve their productivity. This finding is consistent with that of Tessema (2015), who stated that farmers who have contact with extension agents have increased farm productivity. The coefficient of occupational status of the farmer was positive and significant at 10% level. This implies that farmers whose main occupation is farming performed better than those that are into farming as a minor occupation. This follows the findings of Surendra *et al* (1981) who noted that full time farmers produce higher value of output per acre.

The coefficient of farm size was negative and significant at 5% level. This implies that the larger the farm size the less the productivity of the land. Ordinarily, it is expected that as one increases his farm size, the productivity of land should increase but this is not the case as small farms are easy to transverse and maintain. The coefficient of fertilizer use was positive and significant at 5% level. This implies that the use of fertilizer increases the productivity of the farm land. Fertilizer has been found to increase yield per hectare of farm land and as such the application of fertilizer help in improving the land productivity which in turn boost yield per unit area. This is in line with the findings of Tessema (2015), that fertilizer use is a determinant of agricultural productivity.

The coefficient of labour use was positive and significant at 10% level. The number of man-days of labour helped improve the productivity of land thus increasing the yield per unit area. The coefficient of farming experience was positive and significant at 5% level. This implies that any increase in farming experience, the higher the productivity of the land. Farmers with more experience were exposed to more innovative technologies than their in-experienced counterpart's and new entrants and have over time improved on their farming practices.

Analysis of variance for test of significant difference in land productivity in the four LGAs

The analysis of variance for test of significant difference in land productivity in the four LGAs is presented in Table 3. The null hypothesis that there is no significant difference in the farmland productivity across the selected local government areas in Aba agricultural zone was tested using the analysis of variance. The F-calculated is lower than the tabulated value $F_{(0.01;\ 140)}$ value of 4.29 as shown in Table 4. This implies that the null hypothesis is accepted and the alternative hypothesis rejected in the study. It could be deduced from this finding that there is no significant difference in the farm land productivity across the four selected LGA's in Aba agricultural zone of the state.

Conclusion

The study concludes that the factors that influence land productivity were extension contact, occupational status, farm size, fertilizer use, labour and farming experience. Similarly, land productivity in Aba Agricultural zone was high and that of Obingwa LGA was slightly higher than the other three (3) LGA's in the zone. Moreover, there is no significant difference in the farmland productivity across the four selected LGA's in Aba agricultural zone of the state. In view of the findings, the study recommends that farmers in the region should be taught new farming practices and agricultural input should be provided at subsidized rates. Sustainable farmland management practices such as return of plant materials to the soil, soil erosion control, soil nutrient management, improvement of soil aeration, use of improved crop varieties etc. should be adopted by farmers.

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Table 1: Distribution of respondents by Farm Land Productivity in the 4 LGAs

Farmland Productivity (₦'000/Ha)	Aba North +Freq. (%)	Aba South +Freq. %	Osisioma +Freq. %	Obingwa +Freq. %	Aba Zone Pooled Freq. %
100 – 284	10 (31.3)	12 (34.3)	5 (13.5)	6 (15.0)	33 (22.9)
285 – 290	7 (21.9)	8 (22.9)	6 (16.2)	6 (15.0)	27 (18.8)
291 – 296	6 (18.8)	7 (20.0)	7 (18.9)	7 (17.5)	27 (18.8)
297 – 302	4 (12.5)	3 (8.6)	8 (21.6)	7 (17.5)	22 (15.3)
303 – 308	3 (9.4)	3 (8.6)	7 (18.9)	8 (20.0)	21 (14.6)
309 – 314	2 (6.3)	2 (5.7)	4 (10.8)	6 (15.0)	14 (9.7)
Total	32 (100)	35 (100)	37 (100)	40 (100)	144 (100)
Mean (₦/Ha)	155,888.89	136,722.22	195,222.22	205,027.78	172, 994.89

Source: Field Survey, 2017; [+]multiple responses recorded, figures in parenthesis are the percentage values

Table 2: Regression Estimates of the Determinants of Farm Land Productivity

Explanatory Variables	Linear	Semi-log	Double-log+	Exponential
Constant	0.0081(3.10)***	5.3686 (2.33)*	3.3409 (3.41)***	1.2308 (2.55)**
Extension Contact	0.0012 (1.82)*	0.0567 (2.61)**	0.2341 (3.10)***	1.7203 (1.86)*
Occupational status (x4)	8.2130 (1.12)	3.4116 (0.43)	1.7103 (1.69)*	0.5000 (0.41)
Farm size (x5)	-1.1876 (-2.46)**	-4.8163 (-1.92)*	-0.7550 (-2.72)**	-0.1629 (-2.11)*
Fertilizer use	0.0267 (1.32)	1.2376 (1.88)*	2.0404 (2.61)**	5.7321 (1.73)*
Hired labour	5.8690 (2.1)*	3.9642 (1.12)	0.0009 (2.31)*	2.3458 (0.61)
Land ownership	2.1960 (0.82)	7.0214 (0.11)	2.8287 (1.01)	0.0030 (0.01)
Farming Experience	21094 (0.21)	0.1174 (1.94)*	23190 (2.5)**	72.231 (1.31)
R^2	0.5792	0.5187	0.7185	0.6209
F-Value	15.359**	12.172**	27.7188**	42.768
Sample size (n)	144	144	144	

Source: Field Survey, 2017. Figures in parentheses are t-ratios. *significant at 10%, ** significant 5%, *** significant at 1%

Table 3: Test of significant difference in land productivity in the four LGAs

Source of Variation	SS	Df	MSS	F	Sig. F
Between Groups	78036	3	26012	1.186	02805
Within Groups	3069419	140	21924.42		
Total	3147455	143			
F(3; 140) @ 0.01 = 4.29					

Source: Field Survey, 2017