COMPARATIVE ANALYSIS OF TECHNICAL EFFICIENCIES BETWEEN COMPOUND AND NON COMPOUND FARMS IN IMO STATE, NIGERIA

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This study was designed to compare the level of technical efficiency in the compound and non compound farms in Imo state. A multi-stage random sampling technique was used to select 120 food crop farmers from two out of the three agricultural zones in Imo state. Using the Chow (1960) analysis of covariance technique the farmers were found to be equally technically efficient in the two farm types. The result showed that capital, labour and other inputs such as seeds, fertilizers and agro-chemicals are highly significant determinants of technical efficiency in the two farm types. The results of the returns to scale showed that the farmers operated in region one of their production functions. This is suggestive of the possibility of higher crop output with an increase in the level of aggregate input use in both farm types at the prevailing level of technology.

Key words: technical efficiencies, compound and non compound farms

INTRODUCTION
The production of food in Nigeria has not increased at the rate that can meet the increasing population. While food production increases at the rate of 2.5% food demand increases at a rate of more than 3.5% due to the high rate of population growth of 2.83% [FOS 1996] or 3.2% according to the provisional estimate of the 2006 population census The disparity between the rate of food production and consumption has led to: (a) an increasing resort to food importation; (b) high rates of increase in food prices; (c) widening gap between domestic food and total food requirement.

Consequent upon the above, widespread hunger and malnutrition are evident in different parts of the country (Ojo, 2003). Despite the dominance of the petroleum sector, Agriculture is still the mainstay of Nigeria's economy. Agriculture is the largest non oil export earner and the largest employer of labour accounting for 88% of the non oil foreign exchange earnings and 70% of the active labour force .of the population (FGN 2001).

Analysis of food production in Nigeria shows that a large part (80-90 %) is derived from small scale farmers operating at or near the subsistence level ,with only modest excess production to supply the rapidly growing urban centers (Ajayi , 2001). Food crops constitute the largest component of the crops sub-sector of Nigeria's agricultural sector .They are categorized broadly into cereals, pulses, roots, tubers and plantain, oil seeds and nuts, vegetables and fruits, sugar and beverages. The target date for self sufficiency or at least self reliance in respect of most food crops was set at 1992. It was expected that the target output set for various food crops would provide each Nigerian with at least 2100 calories and 60 grams of protein per day (CBN 2003).

However over the years, the growth rate of agricultural production has either stagnated or failed to keep pace with the country's rapid population growth resulting in perennial   food shortages. Productivity led growth appears to be the main determinant of income growth and poverty reduction. Government views increasing and sustaining agricultural productivity as a means to over all growth, poverty reduction and promotion of food security. In particular agricultural productivity growth is more poverty alleviating than non- agricultural productivity led growth (Nomaan Majid 2004). The measure of the performance of a production system is normally assessed in terms of the achievement of its objective. The concept of efficiency is concerned with the relative performance of the

processes used in transforming given inputs into outputs. In a market economy, the commonly assumed goal of a production system is economic efficiency. The strategies of the best production system can be used to advise farmers lagging behind. Economic theory according to Timmer (1970, Carlson, (1972); Mijindadi and Norman (1982) distinguish between at least two types of efficiency: allocative and technical efficiencies. Technical efficiency refers to the ability of firms to employ the "best practice" in an industry so that not more than the necessary amount of a given set of inputs is used in producing the "best" level of output (Farrell, 1957). Criticisms have been raised about the interpretation of efficiency measures (Pasour, 1981, Okorji, and Obiechina 1985, and Ellis 1988). To avoid many of these criticisms levied upon efficiency concepts, Ellis (1988) advised that the producers' performance should be estimated only in terms of technical efficiency. This according to him is because measures of technical efficiency rely less heavily on assumptions of perfect knowledge, perfectly competitive markets and the profit maximization objective.

In Imo state, compound and non compound farming are the predominant practice (Lortha 1982, IITA 1985, and Anyanwu 1993). Mbagwu, (1974) defined compound farms as relatively small portions of land immediately surrounding the people's homes and are cultivated year after year with the aid of kitchen and compound refuse while non compound farms are the much larger farm lands beyond the limits of the family farm environment which form the main cultivated areas. While soil fertility is maintained in the compound farms with the aid of household refuse, and animal droppings (Mbagwu 1974, Lortha 1982, Chidebelu 1984, Okigbo 1972, Anyanwu 1993, Agboola 1979, Wortmann and Kaizi 1998, Onduru et al 1999 and Briggs and Twomlow 2002) the fertility of non compound farms are maintained with the aid of rotational bush fallowing and inorganic fertilizer application (Anyanwu 1993, Lortha 1982, Agboola 1979).

The upward trend in fertilizer consumption in the early 1980's and 1990's which peaked in 1993 with total consumption reaching 1590 thousand metric tones was as a result of subsidy which was as high as 75% of the total cost per bag . The level of subsidy gradually fell to between 50 and 25% as reflected in the sharp decline in fertilizer use from 80kg/ha to 23kg/ha in 1996 and 2000 respectively, compared with the minimum of 200kg/ha internationally recommended standard (CBN, 2003). Given the compound- non compound farm stereotype in Imo state, the dearth of productivity enhancing high external input such as inorganic fertilizer and the rapid population growth rate estimated to be 3.2% ; one may wish to identify the farm type where the farmers are more technically efficient and why?

METHODOLOGY.

Imo state is divided into three main agricultural zones, namely Owerri, Okigwe and Orlu. It is further divided into 21 local government councils. Through a pilot survey of the state, Owerri and Okigwe agricultural zones were selected out of the three zones. The selection was based on the existence of compound and non compound farms in the zones. A total of 240 farmers- 120 from each of the two farm types – were sampled using the multi-stage sampling technique. Usable primary data were colleted from the field using structured questionnaires. Major variables on which data were collected include method of land acquisition and rental values of cropped land, labour utilization, expenses on seed and planting materials, fertilizers and agro-chemicals as well as expenses on durable capital inputs. Data were also collected on per hectarage cultivation, farmers' age, market value of crops and distance between farm types and households. The Chow's test was used in making inference about the relative technical efficiency in the two farm types.

Model Specification.
Technical Efficiency.
In determining the technical efficiency among compound and non compound farms, an econometric model of the type specified implicitly:

$$Q_i = f(X_1, X_2, X_3, X_4, U); i = 1, 2, \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.(1)$$

Where

Q = Naira value of total output in either of the two farm types..
i = (1) for compound farms and (2) for non compound farms
X_1=Expenses on durable capital (N)
X_2= Man days of labour
X_3= Hectares of farmland cultivated
X_4= other inputs (fertilizers, seeds and agro-chemicals)
U = random error term

RESULTS

Here the linear, semi-log, double-log and exponential functional forms were fitted to the data. Based on economic, statistical and econometric criteria the linear model was chosen as the lead equation. Technical efficiency in any of the two farm types is the ability to maximize output with a specified bundle of resources. For instance the farmer in the compound farm is said to be more technically efficient than he is in the non compound farm if given the same quantities of resource inputs for both farm types he consistently produces larger output in the compound farm. As in Onyenweaku and Fabiyi, (1991) the Chow (1960) analysis of covariance technique was used to compare the technical efficiency levels attained in both farm types. Presence of structural changes is suggestive of a significant difference in the estimated parameters of the production functions of the two farm types and thus we reject the hypothesis that farmers are equally technically efficient in both farm types. However absence of structural changes indicates that the estimated parameters of the production functions of the two farm types are identical denoting equal technical efficiency and hence the acceptance of the null hypothesis that farmers are equally technically efficient in both farm types. The estimated production function, by methods of ordinary least squares technique for the two farm types as well as the pooled data are presented in table 1, with standard errors in parenthesis.

Table 1: Production function Statistics for compound farms, non compound farms and pooled data.

Explanatory variable	Compound farm	Non compound farm	Pooled data
Expenses on capital (X_1)	29.364***	35.886***	63.248***
	(7.567)	(11.588)	(6.408)
Man days of labour (X_2)	49.124***	53.074***	-0.794***
	(7.354)	(9.351)	(0.382)
Farm size (X_3)	-478.542	4272.405***	5753.818***
	(1049.368)	(1203.733)	(813.260)
Other inputs (X_4)	1.226***	1.236***	1.560***
	(0.190)	(0.246)	(0.173)
Constant term	155.339	-1047.598	-408.377
R^2	0.808	0.845	0.774
F	120.950	156.265	201.114

E	1083.338	1688.952	1656.242
N	120	120	240

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   * Significant at 10%
  ** Significant at 5%
 *** Significant at 1%

   In carrying out a structural stability tests, the Chow [1960] F – test gave an F* value of -18.52 which is not significant at 5% level of probability. The implication is that the farm production function is stable across the two farm types and thus technical efficiency   [which is given by the slope coefficient in the form of elasticity measure] is statistically the same for the two farm types.

Elasticity of Production and Returns to Scale.
Estimates of the elasticity of production of each of the resources were obtained using the following formula;

$$ERX_i = b_i \frac{\overline{X}}{\overline{Y}} \quad \text{...(2)}$$

Where ERxi   = Elasticity of production of a given resource
        bi   =regression coefficient of the given resource
        X   =   Mean value of input i
        Y   =   mean value of output in each farm type.

The results are presented in table 2. The figures in table 2 indicate the percentage change that would occur in total yield as a result of a 1% change in the level of the given resource, keeping the other resources constant.
In the compound farm a 1% change in capital inputs, labour inputs and other inputs such as seeds and agro-chemicals will change outputs by 1.7, 0.4 and 0.02 respectively. However in the non compound farms a 1% change in capital inputs, labour inputs, farm size and other inputs will change output by 1.6, 0.40, 0.30, and 0.010 respectively.

Returns to scale
The estimate of the returns to scale are presented in the last column of table 2 as the sum of ERxi. The result suggested that the surveyed farmers operated at the level of increasing returns to scale. This finding is in accordance with the assertion of Olayide and Heady (1982) p.26, that " actual cases of increasing returns … occurs at relatively low levels of output that are characteristic of small scale peasant farming "

Table 2 Elasticity of Production of Resources in Compound and Non compound farms.

Farm type	Elasticity of production				Sum of ERxi
	X_1 Capital	X_2 Labour	X_3 farm size	X_4 other inputs	
Compound farm	1.7	0.400	NS	0.020	2.120
Non compound	1.60	0.400	0.3	0.010	2.310

NS: Not significant.

The results in table 1 shows that capital inputs, labour, and other inputs such as seeds and agro-chemicals etc are highly significant determinants of technical efficiency in both farm types. Farm size is however not a significant determinant of technical efficiency in compound farms where as it plays a significant role in the non compound farms. The R^2 values of 0.808 and 0.845 show that more than 80% of the variations in the outputs of compound and non compound farms are accounted for by the variations in the explanatory variables.

CONCLUSION
The significance of these results is that higher aggregate crop output is possible with an increase in the current level of aggregate input used in the compound, and non compound farms at the prevailing level of technology.

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