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# Economic Efficiency of Pig Production in Oyo State, Nigeria: A Stochastic Production Frontier Approach

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## ABSTRACT

This study investigated the economic efficiency of pig production in Ogbomoso zone, agricultural zone in Oyo State, Nigeria, between June and October 2009 using stochastic production frontier approach. A multistage sampling technique was employed in the selection; Ogbomoso North and South Local Government Areas were purposively selected because of the larger population of pig farmers and structured questionnaires were used to collect data from randomly chosen one hundred and ten (110) pig farmers. Descriptive statistics, cost benefit analysis and stochastic frontier production function were used for analyzing the data. It was revealed from the findings that mean benefit cost ratio for pig production was 2.82, this means that the enterprise is profitable. The result of the Cobb-Douglass stochastic production frontier function also showed that stocking cost, cost of feed and cost of labour had positive significant effects on the production output, the estimated gamma parameter (γ) was 0.780 and highly significant at 99% (0.01). Sex, age and household size had negative significant effects on economic inefficiency. The sum of elasticity was 1.191, indicating a positive increasing return to scale in the study area which might lead to over utilization of inputs in terms of excess spending on inputs. Although, the pig farmers were found to be operating on the frontier and were generally economically efficient, higher improvement could still be achieved through easy accessibility to institutional credit, pens expansion, improved breeding stocks and provision of technical assistance.

*Keywords: Stochastic frontier; economic efficiency; pig; production; Nigeria.*

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## 1. INTRODUCTION

Agriculture belongs to the real sector of Nigerian economy. Agriculture provides primary means of employment for Nigerians and account for more than one-third of the total gross domestic product (GDP) and labour force (FAO, 2003). The livestock sub-sector is equally vital to the national economy since it is the main supplier of the highly essential animal protein. The importance of livestock sub-sector is in line with recommendation of the F.A.O (2003) that on an average basis, a man's daily protein intake should be between 65-72 grams and 53% (about 35 grams) of this should be animal based.

Animal protein is essential in human nutrition because of its biological significance. In realization of this the various governments in Nigeria have been pursuing programmes at national, state and community levels to boost the mass production of food and livestock. Some of the programmes include the farm settlement scheme, agricultural development project (ADP), better life programme, microcredit scheme for livestock parent/foundation stock and community level in Nigeria.

Pig production is an example of such community level livestock programmes. The name pig is broadly applied to all mammals of the family *Suidae* and order *Artiodactayla* but specifically to the domestic animal known scientifically as *Sus scofa* from which domestic pig was developed. One of the major advantages of pigs is the ability to convert different kinds of feed even including kitchen waste to meat (Rahman et al., 2008). Considering general feed conversion, pig is by far the most efficient among farm animals in the conversion of feed energy to body energy (Pond and Manner, 1974).

The high rate of productivity is another major advantage of pigs. CTA (1995), identified the average litter size of pig to be 9.3 live piglets per sow. Okoli (2006) also identified the litter per sow to be 9.96, though, before weaning, an average of 1.51 died. Leaving the average number of piglet weaned per sow to be 8.45. So a sow farrowing twice a year comes up with an average of 16.9 piglets per year, this is a remarkable advantage over ruminants like cattle whose maximum are two young one within such period. Tewe and Adesehinwa (1995) revealed that the pig is a more efficient carcass yielder than cattle, sheep or goat, dressing out at about 70% compared to 52.5% for cattle and about 50% for sheep and goat. In addition, pig carcasses have a smaller proportion for bones and higher proportion of edible meat.

It is relatively easy to establish intensive pig production in a developing country like Nigeria, if capital are available and adequate feed supplies are assured (Ogunniyi and Omoteso, 2011). Profitable pig production will however not be achieved unless the right products are produced in the right place at the right price. It is therefore important for the intending pig producer to understand the economic, physical, social and religious forces which operate to determine the effective way of producing swine. All over the world, meat production remains overwhelmingly the main purpose of keeping pigs. The pork can be utilized by the producer and his family or sold as a source of income. Processed meats such as bacon sausage are also being produced and are increasingly gaining recognition. Lard or fat from pig is the least popular. By-products such as pigskin and bristle are used in the manufacture of light leather and brushes especially in Asian countries (Young 2005). Pig manure is a valuable fertilizer and can be aerobically digested to produce cooking gas, it also stimulates the growth of microorganisms and plants for feeding fresh water fish and ducks (Okoli, 2006).

Social factors that could influence pig production in Nigeria include a general preference for ruminant meat and lack of incentives for investing in large scale pig production due to economic and political factors. The large Moslem populations of northern Nigeria may also not favour profitable pig production in that part of the country. Other social factors that have militated against pig production in Nigeria include the belief that pigs are dirty and constitute a health hazard. This is absolutely untrue for pigs that are produced under modern intensive production techniques since under suitable modern husbandry pigs can be very clean animals (Ajala et al., 2007.)

## 1.1 Statement of Problems

There is no doubt that human food supply must be improved both in quantity and quality and better shared within countries. Nigeria, like many other developing countries is facing the problems of shortage of dietary animal protein. The gravity of this problem is increasing with the growing population and urbanization. In Nigeria, the daily animal protein intake is below the recommended minimum level of 65 gm per caput per day. Ajala et al.*(*2007) observed that only 8.4gm of the 53.8gm of protein consumption level of Nigerians is derived from animal sources , less than 16% contribution of animal products to protein consumption of Nigerians, this is very poor indeed when compared with countries like USA with about 69% of the total protein derived from animal sources. Due to this acute shortage of animal protein in the diet of average Nigerians, there is need to increase the production of domestic animals, which are conventional sources of animal protein. The swine- as pigs are commonly called, has some unique advantages over all other animals, which make them a good species of animals to multiply extensively to combat protein shortages.

For nation's foreign exchange earnings to be maintained efforts need to be made by Nigerian pig farmers to improve total factor productivity that can raise the animals' output to meet the country's food consumption needs. Low level of farm size, technical and economic inefficiency of food and primitive technology may draw back the effort to achieve the progress in food production. The crucial role of efficiently increasing agricultural outputs has been widely recognized by researchers and policy makers alike. Therefore it is no surprise that considerable efforts have been devoted to the analysis of farm level efficiency in developing countries. Some schools of thought makes it clear that if farmers are not making efficient use of existing technology, low production will be recorded both in food and livestock (Ajibefun and Daramola, 2003).

Hence the study examines economic efficiency of pig production in Ogbomoso zone of Oyo state. The study will therefore address the following research questions:

i. What socio economic factors of the farmers are responsible for the economic efficiency of pig production?

ii. Which of the resources are the pig farmers in the study area using efficiently?

### 1.1.1 Objectives of the study

The general objective of this study is to determine the economic efficiency of pig production in Ogbomosho zone of Oyo state. To meet the general objective, the study focuses on the following specific objectives which are to:

i. Identify and describe some selected socio economic characteristics of the pig farmers in the study area.
ii. Determine the cost and return for pig production by the respondents.
iii. Assess the economic efficiency level of pig production in the study area.

## 1.2 Theory of Production and Productive Efficiency

The earliest work on the frontier approach dated back to Farrell (1957). The economic theory of production provided the analytical framework for most empirical researches on productivity and efficiency. Ajibefun and Daramola (1999) defined efficiency in agriculture in association with the possibility of farm production to attain optimum level of output at least cost. The fundamental idea underlying all efficiency measures, however, is that of the quantity of goods and services per unit of input. Consequently, a production unit is said to be technically inefficient if too little output is being produced from a given bundle of inputs. There are two basic methods of measuring efficiency-the classical approach and the frontier approach. The classical approach is based on the ratio of output to a particular input, and is termed partial productivity measure. Dissatisfaction with the shortcomings of this approach led economists to develop advanced econometric and linear programming methods for analysing productivity and efficiency. The frontier measure of efficiency implies that efficient firms are those operating on the production frontier. The amount by which a firm lies below its production frontier is regarded as the measure of inefficiency (Ajibefun and Daramola, 2003).

## 1.3 Stochastic Frontier Production Function

Stochastic frontier modeling is becoming increasingly popular because of its flexibility and ability to closely marry economic concepts with modeling reality. And based on this, the model can be employ to provide the basis for measuring farm level technical and allocative efficiencies, which are the basis of estimating the economic efficiencies (Kumbhakar, 2000). The modeling estimation and application of stochastic frontier production function to economic analysis assumed prominence in econometrics and applied economic analysis following Farrell's (1957) seminar paper where he introduced a methodology to measure technical, allocative and economic efficiency of a firm. According to Farrell, technical efficiency (TE) is associated with the ability of a firm to produce on the isoquant frontier while allocative efficiency (AE) refer to the ability of a firm to produce at a given level of output using the cost minimizing input ratio. Thus defining economic efficiency (EE) as the capacity of a firm to produce a predetermined quantity of output at a minimum cost for a given level of technology (Bravo-Ureta and Pinheiro, 1997). However over the years, Farrell's methodology had been applied widely, while undergoing many refinement and improvement. And of such improvement is the one to measure firm level technical and economic efficiency using maximum likelihood estimate (a corrected form of ordinary least square, OLS). Aigner et al. (1997), Meeusen and Broeck (1977) were first to proposed stochastic frontier production in the analysis of US agricultural data. Battese and Corra (1997) applied the technique to the pastoral zone of eastern Australia.

Research on efficiency of swine producers is in itself limited and has focused on several different issues. Rowland et al., (1998) examined input use efficiency for 43 farrow-to-finish operators in Kansas for three sequential years. They found that inefficient farms tend to remain inefficient over time and that there is more variability in technical and allocative efficiency over time than in scale efficiency. In addition, they found overall efficient firms

typically produced more pork per litter, fed a higher percentage of their own feed grains, and had lower debt-to-asset ratios. Boland and Patrick (1994) analyzed the economic performance for 60 pork producers (primarily farrow-to-finish operators) across 21 quarters spanning from 1986 to 1991. Feed efficiency and pigs sold per sow had the largest impacts on returns. Consistent with Rowland et al. (1998) they found that producer's performance relative to competition tends to be stable over time. Sharma, et al. (1997) compared the use of output-oriented Data Envelopment Analysis (DEA) models and stochastic frontier production functions in analyzing technical efficiency of 60 swine producers in Hawaii. They found DEA derived efficiency estimates to be lower and attribute this occurrence to the DEA approach attributing all deviations from the frontier to inefficiency. The authors proceed to suggest that production could be increased by 25-40% if producers operated on the efficient frontier.

The model used in this paper is based on the proposed by Battese and Coelli (1995) and Battese et al. (1996) in which the stochastic frontier specification incorporates model for the technical inefficiencies effects and simultaneously estimate all the parameters involved in the production and cost function models.

## 2. MATERIALS AND METHODS

The study was conducted in Ogbomoso zone, Oyo State Nigeria. Ogbomoso zone comprises of five local government areas namely: Ogbomoso North, Ogbomoso South, Surulere, Orire and Ogo-oluwa local government areas. Ogbomoso is the second largest town in Oyo State with an urban population of about 334,000 (NPC, 2007) and lies between latitude 80° 07′ North of the equator and between 40° 30′ east of the Greenwich Meridian. It has an area landmass covering about 37,984 square kilometres and lies within the derived savannah region. Ogbomoso is the gateway to the northern part of Nigeria, it is 57km south west of Ilorin and 53km north east of Osogbo.

A multistage sampling technique was employed in the selection; Ogbomoso North and South Local Government Areas were purposively selected because of the larger population of pig farmers and data were collected from 110 pig farmers, which were randomly chosen from the two local government areas. Structured questionnaires were used to collect information on socio economics characteristics, inputs and output, cost and returns etc. Analysis was done with the use of descriptive statistics, cost benefit analysis and stochastic frontier production function.

### 2.1 Cost Benefit Analysis

Cost benefit was used to analyse farm net revenue for pig production. Theoretically, net revenue (NR) is the total revenue (TR) less the total cost (TC);
$NR = TR – TC$

Total cost is the addition of the entire variable cost (VC) and fixed cost (FC) items;
$TC = VC + FC$

Total revenue is the total amount of money that a farmer received from the sale of stock;
$TR = \sum PnQn.$

In order to know the performance or economic worth of the farmers, the profitability ratios were computed from the above specifications;

Benefit cost ratio; BCR = TR/TC
Rate of Returns; RRR = NR/TC
Gross Ratio; GR = TC/TR

## 2.2 Stochastic Frontier Production Function

The stochastic frontier production function model used by Parikh and Shah (1994), which was derived from the composed error model of Aigner et al. (1977), Meesusen and Broeck (1977), and Forsund et al. (1980) was applied in the analysis of data. The stochastic frontier analysis deals with the estimation of frontiers, with envelop data, rather than with functions with intersect data.

The frontier production model begins by considering a stochastic production function with a multiplicative disturbance term of the form:

$$Y = f(X; \beta)\, e^{\varepsilon} \quad \ldots\ldots (1)$$

Where:

Y = Total value of farm output measured in naira (₦).
X = a vector of input (measured in naira ₦).
β = a vector of parameters; and
e = error term.

Where ε is a stochastic disturbance term consisting of two independent elements μ and ν, where;

$$\varepsilon = \mu + \nu \quad \ldots\ldots (2)$$

The symmetric component, ν, accounts for random variation in output due to factors outside the farmer's control, such as weather and diseases. It is assumed to be independently and identically distributed as N~ (0, σ2 ν). A one-sided component υ≤0 reflects technical inefficiency relative to the stochastic frontier as │N ~ (0, σ2 ν) │, i.e. the distribution of υ is half-normal.

The stochastic production frontier model can be used to analyze cross-sectional data. The frontier of the farm is given by combining "1"and "2"

$$Y = f(Xa; \beta)\, e\, (\mu + \nu) \quad \ldots\ldots (3)$$

And μ in equation (3) is defined as:

$$\mu = f(Zb; \delta) \quad \ldots\ldots (4)$$

where:
Zb = a vector of farmer-specific factors, and
δ = a vector of parameters.

### 2.2.1 The empirical stochastic frontier production model

The empirical stochastic frontier production model that was applied to the analysis of data is specified as follows:

Stochastic frontier production function is specify as follows;

$$LnYij = Ln\ \beta o + \beta 1 LnX1ij + \beta 2 LnX2ij + \beta 3 LnX3ij + \beta 4 LnX4ij + Vij - \mu ij \quad (5)$$

Where subscripts ij refers to the jth observation of the ith farmer;

In = logarithm to base e
Y = Total value of farm output measured in naira (N).

X1, X2, X3, and X4 are the cost of land, 'stocking', feeding and labour in naira (N) respectively.

Vi = is a two-sided normally distributed random error.
μi = is a one-sided efficiency component.

The 'stocking cost' is the cost of swine, that is the amount that each farmer purchased pigs on farm and this cost is in depreciated form, therefore it is a variable cost.
It is assumed that the inefficiency effects are independently distributed and μij arises by truncation (at zero) of the normal distribution with mean uij and variance σ2, where uij is defined by the equation:

$$\mu i = \delta o + \delta 1\ Z1 + \delta 2\ Z2 + \delta 3 Z3 + \delta 4 Z4 + \delta 5 Z5 \quad (6)$$

Where:
μij = economic efficiency of the ith farmer.
Z1 to Z5 are sex, age, household size, education and religion.
δo – δ5 are parameter to be estimated.

These are included in the model to indicate their possible influence on the variances of the random error. The estimates for all the parameters of the stochastic frontier production function and the inefficiency model (β and δ-coefficients) were simultaneously obtained by the method of maximum likelihood using the program FRONTIER 4.1 (Coelli, 1996).

### 2.2.2 Economic efficiency

$$\text{Ɛ}\text{Ɛ} = Y/Y^* = \frac{f(Xi\ ;\ \beta)\ \exp(Vi - \mu i)}{f(Xi\ ;\ \beta)\ \exp(Vi)} \quad (7)$$

$$\text{Ɛ}\text{Ɛ} = \exp(-\mu i)$$

'ƐƐ' was measured on a scale of 0 to 1, a value of 1 indicates that farm i displays complete 'ƐƐ' while a value of zero indicates level of inefficiency.

According to Coelli (1995, 1996), Ike and Inoni (2006), Awoniyi and Omonona (2006), economic efficiency can also be measured by using values for both outputs and inputs instead of physical quantities (that is input costs and output price).

## 3. RESULTS AND DISCUSSION

### 3.1 Socioeconomic Characteristics of the Respondents

Analysis of the socio-economic characteristics of the respondents showed that the percentage of the male farmers (78%) was higher than the female (22%) (Table 1).

**Table 1. Socioeconomic characteristics of the respondents**

| Socioeconomic variables | Frequency | Percentage | Cumulative % |
|---|---|---|---|
| **Age (years)** | | | |
| < 29 | 21 | 19.1 | 19.1 |
| 30 – 39 | 64 | 58.2 | 77.3 |
| 40 – 49 | 19 | 17.3 | 94.6 |
| 50 – 59 | 4 | 3.6 | 98.2 |
| >60 | 2 | 1.8 | 100.0 |
| **Total** | **110** | **100** | |
| Mean Age | **35 years** | | |
| **Sex** | | | |
| Male | 86 | 78.2 | 78.2 |
| Female | 24 | 21.8 | 100 |
| **Total** | **110** | **100** | |
| **Marital Status** | | | |
| Single | 15 | 13.6 | 13.6 |
| Married | 95 | 86.4 | 100 |
| **Total** | **110** | **100** | |
| **Household size** | | | |
| < 2 | 0 | 0 | 0 |
| 2 – 4 | 62 | 56.4 | 56.4 |
| 5 – 7 | 42 | 38.2 | 94.6 |
| 8 – 10 | 06 | 5.4 | **100** |
| **Total** | **110** | **100** | |
| **Mean size** | **04** | | |
| **Education** | | | |
| 1 – 6 | 18 | 16.3 | 16.3 |
| 7 – 12 | 30 | 27.3 | 43.6 |
| 13 – 18 | 56 | 51.0 | 94.6 |
| ≥ 19 | 6 | 5.4 | **100** |
| **Total** | **110** | **100** | |
| **Mean Years** | **13** | | |
| **Years of Farming Experience** | | | |
| 1 – 6 | 77 | 70.2 | 70.2 |
| 7 – 12 | 24 | 21.7 | 91.9 |
| 13 – 18 | 2 | 1.8 | 93.7 |
| ≥ 19 | 7 | 6.3 | **100** |
| **Total** | **110** | **100** | |
| **Mean Years** | **6 years** | | |

*Source: Field Survey, 2009*

The breakdown of the age distribution showed that the highest percentage (58.2%) was found among 30-39 years old age group. They were mostly married (84%) and their household size was 4 members, on the average. On the level of education of the farmers, 51% spent an average of 13 years in school. And many of the farmers had only spent 6 years on the farming business. This presentation (in table 1) indicates that majority of the pig farmers in the study areas are male, young, married, educated and experienced in this type of farming.

## 3.2 Cost and Returns for Pig Production

Table 2 gave full detailed information of the costs, return and the profitability ratios of pig production. The average total cost per kilogram (kg) was ₦ 177.02k while the average total revenue per (kg) was ₦ 499.20k. The estimated net return was ₦ 322.18k. The benefit cost ratio is high (2.82), this showed an increase in returns. The indication is that the enterprise is profitable even with little capital invested. The rate of return in pig production was 182% (1.82). This means that for every one naira invested in pig production, ₦ 1.82k is gained by the farmer. The gross ratio was 0.355, this implies that for every one naira gained in the enterprise, ₦ 35.5k is spent.

**Table 2. Cost and returns for pig production (per kilogram)**

| **Variables** | | **₦** |
|---|---|---|
| Total Revenue | (TR) | **499.20** |
| Total Cost | (TC) | **177.02** |
| Net Revenue | (NR) | **322.18** |
| Benefit Cost Ratio | (BCR) | **2.82** |
| Rate of Returns | (RRR) | **1.82** |
| Gross Ratio | (GR) | **0.35** |

*Source: Computed from field Survey data 2009*

## 3.3 Estimation of Parameter of the Production Factors

The parameters and related statistical test results obtained from the stochastic frontier production function analysis are presented in Table 3. For pig production using maximum likelihood estimates (MLE), all the coefficients in the model have the expected a priori signs and they are mainly significant except the cost of land (X1) the significant variables were stocking cost (X2) at 0.01level of significance, feed cost X3, at 0.01level of significance and labour cost X4 at 0.10 level of significance. While only cost of land X1 was not significant. All these variables have positive effects on pig production which means that all these variables will increase the output of the enterprise; a unit increase in amount spend on feeds, stocks and labour will definitely give 0.705, 0.271 and 0.169 units increase in total value of the output, but this may lead to over utilization of inputs.

The estimated sigma square ($\sigma 2$) is 8.66 (t value 6.872). The value was large and significant at 0.01level. This indicates a good fit to the model and correctness of the specified distributional assumptions. The value of Gamma ($\gamma$) is 0.780 (t value 8.159) and highly significant at 0.01 level.

### 3.4 Inefficiency Model

The sources of inefficiency were examined by using the estimated δ-coefficients associated with the inefficiency effects in Table 3. The inefficiency effects are specified as those relating to sex, age, household size, education and religion. All estimated coefficients are negative and significant, except religion (Z5). This implies that Muslims tends to be more inefficient in pig production than Christians due to religion beliefs and biasness in pig production. The variables like sex, age, and education had significant (0.01) negative effect on economy inefficiency and this means increase in economic efficiency. Also household size had a significant (0.10) negative effect on economic inefficiency. The negative signs obtained from these variables all conformed to a priori expectation and were similar to the findings of Ajibefun and Daramola (1999). The result indicated that the more the age, household size and the higher the education status, the more likely farmers are to improve on the production, adopting new technology, disease control and be more economically efficient.

**Table 3. Maximum likelihood estimates for the parameters of the stochastic frontier production function for pig production**

| Production Variable | Model Parameter | Estimates | SE | t-value |
|---|---|---|---|---|
| Constant | βo | 1.71 | 1.006 | 1.164 |
| Cost of Land | β1 | 0.046 | 0.081 | 0.564 |
| Stocking cost | β2 | 0.271*** | 0.088 | 3.089 |
| Cost of feed | β3 | 0.705*** | 0.103 | 6.835 |
| Labour cost | β4 | 0.169* | 0.099 | 0.719 |
| **Inefficiency effects** | | | | |
| Constant | δ0 | 1.724 | 0.455 | 3.789 |
| Sex | δ1 | -0.158*** | 0.016 | 10.26 |
| Age | δ2 | -0.057*** | 0.007 | 8.678 |
| Household size | δ3 | -0.068* | 0.039 | 1.746 |
| Education | δ4 | -0.129*** | 0.036 | 3.557 |
| Religion | δ5 | -0.002 | 0.018 | 0.093 |
| **Diagnostic Statistics** | | | | |
| Log Likelihood function | | -129.33 | | |
| Sigma-squared | (σ2) | 8.660*** | | 6.872 |
| Gamma | (γ) | 0.780*** | | 8.159 |

*** Significant at the 0.01 level; ** at the 0.05 level; * at 0.1 level*
*Source: Computed from Survey data, 2009.*

The predicted farm specific economic efficiency (ƐƐ) ranged between 0.9235 and 1.00, with the mean of 0.9858. Thus, in the short run, there is a scope for an average farmer in the study area to increase pig production about 2% (1- 0.9858) by adopting the technology and techniques used by the best practiced pig farmers. Such farmers could also realize 2% cost savings in order to achieve economic efficiency level of his most efficiency counterpart (Bravo-Ureta And Evenson, 1994; Bravo-Ureta And Pinneiro, 1997). The least efficient farmer can save a cost of 8% (1- 0.9235) to achieve efficiency of the most efficient farmer. The decile range of the frequency distribution of economic efficiency revealed that 81.8% of

the farmers had economic efficiency exceeding 0.98 and about 19% of them had economic efficiency ranging between 0.92 to 0.97. This means that all the pig farmers in the study area are economically efficient in their production and they have ability to maximise profit.

The rate of returns (RTS) which is the sum of elasticity in a Cobb-Douglas production function was 1.191. This indicates a positive increasing return to scale in the study area. In essence, there was over utilization of inputs leading to excess spending on inputs. It could therefore be inferred that there is inefficiency in the utilization of farm inputs.

**Table 4. Efficiency distribution of pig farmers**

| Efficiency Level | | Frequency | Percentage |
|---|---|---|---|
| <0.90 | | 3 | 2.93 |
| 0.90 – 0.93 | | 4 | 3.64 |
| 0.94 – 0.97 | | 13 | 11.82 |
| >0.98 | | 90 | 81.8 |
| Mean efficiency (%) | 98.58 | | |
| Minimum (%) | 92.35 | | |
| Maximum (%) | 100 | | |

*Source: computed from field survey data 2009.*

## 4. CONCLUSION

The study had empirically examined economic efficiency of pig production in Oyo state. Stochastic frontier production function was estimated for pig production with inputs costs as explanatory variables. Stocking, feed and labour costs were however found to be the significant factors that influenced pig production. In order to ascertain the level of economic efficiency, a model of inefficiency effects in the frontier function which included farmer's socio economics variables such as sex, age, household size, education and religion was also estimated. All the variables except religion, significantly accounted for the observed variation in efficiency level among the producers.

The implication of the study therefore, is that the level of efficiency among pig farmers in the study area is high (0.98). Higher improvement could still be achieved in the area of easy accessibility to institutional credit, pens expansion, improved breeding stocks and provision of technical assistance for effective utilization of the existing resources.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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