ECONOMIC ANALYSIS OF SMALLHOLDER RICE PRODUCTION IN IHIITTE-UBOMA LOCAL GOVERNMENT AREA OF IMO STATE

Ohaka, C. C., Adiaha, M. M. and Amanze, P. C.

ABSTRACT

Department of Agricultural Science, Alvan Ikoku Federal College of Education, Owerri, Nigeria

The study examined the economics of small scale rice production in Ihitte Uboma Local Government Area of Imo State. Specifically, it estimated costs and returns, determined the profitability, identified the determinants, estimated elasticity of production, and examined return to scale of rice production in the area. Five rice producing communities in the area were purposively selected from which twenty smallholder rice farmers were randomly selected, bringing the sample size for the study to hundred. Data were analyzed using gross margin, regression analysis, elasticity of production, and return to scale. The study found that small scale rice production in the area was profitable; determinants of rice production in the area included land, labour, fertilizer application, agrochemicals while seeds used were not significant. The study recommended that more input resources should be added by small scale rice producers in the area to increase output, rice holdings in the area should be increased, and that policy interventions aimed at protecting local producers should be put in place.

Keywords: economic analysis, smallholder, rice production, return to scale.

INTRODUCTION

Rice belongs to the gramineae family. It is one of man’s oldest food items (Omotesho et al. 2010). Rice provides the principal food for about half the world’s population next to wheat (Chandler, 1979; Eleanar, 1975). The crop constitutes one of the major crops produced in Nigeria. According to Babafada (2003), rice is the fourth major cereal crop in Nigeria after sorghum, millet and maize in terms of output and cultivated land area. It is a major staple and most popular cereal crop of high nutritional value grown and consumed in all ecological zones of the country (Omotesho et al. 2010).

Due to the increasing contribution of Nigeria’s per capita calorie consumption of rice, the demand for rice has been increasing at a much faster rate than domestic production more than in any other African country since the mid 1970’s (FAO, 2001). For instance, during 1960’s, Nigeria had the lowest per capita annual consumption of rice in West African sub-region with an annual average of 3kg. Since then, Nigeria’s per capita rice consumption levels have grown significantly at the rate of 7.3 per cent per annum (Bamidele et al. 2010). Consequently, per capita consumption during the 1980’s increased to an annual average of 18kg and reached 22kg between 1995 and 2000 (Bamidele et al. 2000). Yuguda (2003) is of the view that before the advent of crude oil, Nigeria produced almost enough rice for local consumption. However, with the discovery of petroleum in the 70’s, its production declined steadily over the years in relation to consumption with the result that lately rice importation takes away huge sums of money from the country’s hard earned foreign exchange. It is therefore noteworthy that despite numerous Nigerian government policies on rice, demand-supply gap for rice still exists due to increased consumption rate of the crop. This explains why rice imports account for approximately one-third of Nigeria’s rice supply (FAS, 2010). Rice imports represent more than 25 per cent of agricultural imports and over 40 per cent of domestic consumption (FMARD, 2004). Rice is a basic food for most people in Sub-Saharan Africa and West Africa in particular. In Nigeria for instance, rice has moved from being a luxury food eaten once a year (probably at Christmas) as was the case in 1960’s to a major source of calories for most Nigerians. The average Nigerian presently consumes 24.8 kg of rice per year representing 9% of the total calories (Omotosho et al. 2010).

However, rice production world wide has been on the increase. For instance, world rice production in metric tonnes since 1970 shows that in 1970, production was 316.346 million metric tonnes which increased to 396.871 million metric tonnes in 1980, 518.568 million tonnes in 1990, 599.355 million metric tonnes in 2000 and 672,015 million metric tonnes in 2010 (GeoHive, 2013). Similarly, data on the production of rice in Africa show that Africa produces an average of 14.6 million tonnes of rough rice on 7.3 million hectare, equivalent to 2.6 and 4.6 per cent of the world’s total production and rice area, respectively. In the same vein, data on rice production in Nigeria has equally shown steady increase. Nigeria produced 0.343 million metric tonnes of rice in 1970; 1.09 million metric tonnes in 1980; 2.5 million metric tonnes in 1990; 3.298 million metric tonnes in 2000; and 3.219 million metric tonnes in 2010 (GeoHive, 2013). Imo State is gifted with the ecology for rice production especially in Ihitte Uboma Local Government Area. The lowland flood plain of the area with rich alluvial deposit provides the right ecology for the production of the all important crop.

Despite the place of rice in contributing to food supply in Nigeria, it’s production is still put at about 3.2 million tonnes (Babafada, 2003). This has been shown to be far below the national requirement, as over $600 million worth of rice is imported annually into the country (Adeoye, 2003). This is appalling given the fact that Nigeria is
largely endowed with the ecology and climatic conditions to produce enough rice to satisfy domestic consumption and even export the commodity to other countries of the world. This drawback is mainly due to the fact that the production of the all important crop is still in the hands of smallholder farmers using traditional methods, characterized by inaccessibility to formal credit and, therefore, drudgery associated with poor capital investment. Similarly, it is worthy of note that though previous governments embarked on policy interventions on rice, little has been done in the area of return to scale of rice production. This, coupled with the fact that these small scale farmers can hardly estimate the profitability or otherwise of rice production in the area. This is the gap this study seeks to fill.

The broad objective of this study was therefore to examine the economics of small scale rice production in Ihitte Uboma Local Government Area of Imo State. The specific objectives include: to estimate cost and returns, determine the profitability, identify the determinants, estimate elasticity of production, and examine return to scale of rice production in the area.

MATERIALS AND METHODS

The study was carried out in Ihitte Uboma Local Government Area (LGA) of Imo State, Nigeria. The local Government is located within latitude 7° 21’ and 5° 21’ N and longitude 6° 45’ and 7° 20’ E. It is bounded on the east by Obowo LGA, on the south by Umuahia in Abia State, on the west and north by Ehime Mbano and Okigwe respectively. The LGA produces crops like rice, cassava, maize, yam, cocoyam, and okra even though it is on small scale basis. It is note-worthy that Ihitte Uboma is rice production hub of Imo state. In addition to crop farming, the farmers also engage in piggery, poultry, sheep and goat production. There are also pockets of civil servants and petty traders among the people. Rainfall distribution is bi-modal with a range of 1700 – 2500mm while its peak is in July and September. The wet season starts in March and lasts up to October and November. The rainfall pattern to a large extent supports rice production. The temperature range is between 27° – 30° C. There is also wide stretch of low land plain with ample alluvial deposit supporting cultivation of the crop.

Three stage sampling procedure was adopted in the choice of sample for the study. The first step involved the purposive selection of five communities where rice is produced in relatively large quantity, which includes Ezimba, Onicha-Uboma, Umuanwuchi, Umulumu and Abueke. The second stage was the identification of the registered small scale rice farmers in the five rice producing communities already selected with the help of Agricultural Development Projects (ADP) extension agents. This list served as the sampling frame for the study. The third stage was a random sampling of twenty small scale rice farmers from each of the five rice communities bringing the sample size for the study to hundred. Well structured questionnaires were administered on the hundred respondents used for the study.

Analytical Technique

Gross margin analysis

This was adopted in determining the cost returns to rice production in the area. This involved the determination of the value of fixed cost items, value of variable cost items and value of total output; then deducting value of variable cost from value of total output after adding 5% depreciation value on fixed assets to value of variable cost (Pandy, 2000). This is because fixed cost contributed to cost of production by provisions of depreciation. The following relationships were adopted in the analysis:

\[
\text{GM} = \text{TVO} - \text{TVC}
\]

Where:
\[
\text{GM} = \text{Gross Margin (N/ha)}
\]
\[
\text{TVO} = \text{Total Value of Output (N/ha)}
\]
\[
\text{TVC} = \text{Total Variable Cost (N/ha)}
\]

Net Income = GM - TFC

Where:
\[
\text{GM} = \text{as described above}
\]
\[
\text{TFC} = \text{Total fixed cost}
\]

Profitability index = \(
\frac{\text{NI}}{\text{TVC}}
\)

Rate of return on investment (RRI).

This was obtained by dividing net income (NI) by total revenue. The relationship is expressed as follows:

\[
\text{RRI} = \frac{\text{NI}}{\text{TR}} \times 100
\]
The production function
The production function analysis was implored to determine the effects and sizes of factors affecting rice production in the area. It is merely a technical relationship between input and output in a production process (in this case small scale rice production in the area) (Koutsoyiannis, 1979). The implicit form of the relationship is given by:
\[ Y = f (X_1, X_2, X_3, X_4, X_5, \ldots, \mu) \]
Where:
- \( Y \) = Output of rice in kg
- \( X_1 \) = Farm size in hectares
- \( X_2 \) = Labour input in man days
- \( X_3 \) = Fertilizer applied in kg
- \( X_4 \) = Agro-chemical applied in litres
- \( X_5 \) = Quantity of rice seeds planted in kg
- \( \mu \) = error term.

Three functional forms were tried namely: linear, semi-log, double log and in order to determine which one that fits the data best.

Elasticity of Production
Elasticity of production (Ep) measures percentage change in output due to percentage change in input (ceteris paribus). It is mathematically given by the following:
\[ EP = \frac{b_i}{Q} \frac{dQ}{dX_i} \]
(Dowling, 1993).

Given Cobb-Douglas production function
Where:
- \( b_i \) = regression coefficient
- \( Q \) = output obtained
- \( X_i \) = resource use whose elasticity is being estimated

Decision rule:
If \( Ep = 1 \), production elasticity is unity
\( Ep > 1 \), production is elastic
\( Ep < 1 \), production is inelastic

Returns to scale
The return to scale was estimated by adding up the regression coefficients of all explanatory variables obtained in Cobb-Douglas production model (Koutsoyannis, 1977). Mathematically it is given by:
\[ RTS = \sum_{i=1}^{n} b_i \]
Where:
- \( RTS \) = return to scale
- \( n \) = number of regressors
- \( b_i \) = regression coefficient

Decision rule:
\( RTS > 1 \), implies increasing return to scale
\( RTS = 1 \), implies constant return to scale
\( RTS < 1 \), implies decreasing return to scale

RESULTS AND DISCUSSION
Gross margin analysis
The results in table 1 show that the total value of output (TVO) per hectare was #131,235.74, while variable cost per hectare was #66,532.97. Five percent depreciation on the value of fixed assets was also added to the variable cost to obtain the total cost. Therefore, while the gross margin was #65,032.97 the net income was #61,202.77. The return on investment (ROI) was calculated to be 46%. This implied that, for #1.00 earned in rice production in the area, the small scale farmer realized #0.47 as profit. It was therefore concluded that rice production was profitable. This finding is in consonance with the findings of Omotesho et al. (2010) who found that small scale rice production is profitable in Kwara State.
Factors affecting rice production in the area.
According to table 2, of the three functional forms estimated, the coefficients in the linear regression were the most significant as can be observed from their t-values, as well as the appropriateness of their signs with relationship to their apriori expectations. The R² for the three models were high, ranging from 83.5% to 86.6%, indicating that changes in the explanatory variables highly accounted for changes in the dependent variable. Based on the afore-mentioned, linear model was adopted as the lead equation. The linear model is therefore given as:

\[ Y = -248610.191 + 96.56511X_1 + 224.769X_2 + 0.243X_3 + 14.493X_4 + 0.041X_5 \]

The lead equation therefore showed that variable X₅ (farm size in hectare) had positive coefficient and was also significant at 5% level of significance. The import of this finding is that increase in hectare of land will invariably lead to increased output of rice among the small scale farmers in the study area. The coefficient of labour input in mandays (X₂) was also positive and significant at 5% level of significance. This also meant that increase in labour will also bring about increase in output of rice in the area. Similarly, for (X₃) the coefficient was also significant and positive too. The implication of this is that fertilizer used had direct relationship with output level of rice. Agrochemicals (X₄) had a positive and significant coefficient at 5% level of significance. This implies that increase in chemicals will lead to increase in production. However, in the case of quality of planting materials (seeds) for rice it was not significant but positive. This finding does not very much agree with aprori expectation.

Factors affecting rice production in the area.
According to table 2, of the three functional forms estimated, the coefficients in the linear regression were the most significant as can be observed from their t-values, as well as the appropriateness of their signs with relationship to their apriori expectations. The R² for the three models were high, ranging from 83.5% to 86.6%, indicating that changes in the explanatory variables highly accounted for changes in the dependent variable. Based on the afore-mentioned, linear model was adopted as the lead equation. The linear model is therefore given as:

\[ Y = -248610.191 + 96.56511X_1 + 224.769X_2 + 0.243X_3 + 14.493X_4 + 0.041X_5 \]

The lead equation therefore showed that variable X₅ (farm size in hectare) had positive coefficient and was also significant at 5% level of significance. The import of this finding is that increase in hectare of land will invariably lead to increased output of rice among the small scale farmers in the study area. The coefficient of labour input in mandays (X₂) was also positive and significant at 5% level of significance. This also meant that increase in labour will also bring about increase in output of rice in the area. Similarly, for (X₃) the coefficient was also significant and positive too. The implication of this is that fertilizer used had direct relationship with output level of rice. Agrochemicals (X₄) had a positive and significant coefficient at 5% level of significance. This implies that increase in chemicals will lead to increase in production. However, in the case of quality of planting materials (seeds) for rice it was not significant but positive. This finding does not very much agree with aprori expectation.

Table 1: Costs and returns analysis of small scale rice production per hectare

<table>
<thead>
<tr>
<th>S/N</th>
<th>Item</th>
<th>Amount</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>Total value of output (TVO)</td>
<td>131,235.74</td>
<td></td>
</tr>
<tr>
<td>B.</td>
<td>Fixed cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land for production</td>
<td>50,000.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outlet stall for sale</td>
<td>10,000.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measures for scale</td>
<td>5,000.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>65,000.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Less 5% depreciation value on value of fixed assets</td>
<td>3,250.00</td>
<td></td>
</tr>
<tr>
<td>C.</td>
<td>Variable cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Labour</td>
<td>52,441.41</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fertilizer</td>
<td>7,059.48</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Agrochemicals</td>
<td>2,071.38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Seeds for planting</td>
<td>4,510.70</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>66,202.77</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>NI</td>
<td>61,202.77</td>
<td></td>
</tr>
</tbody>
</table>

2012. Gross margin (GM) = # 65,032.97, Net income (NI) = # 61,202.77. Rate of return on investment (RRI) = 46% Profitability Index (PR)=0.466. Source: field study,

Factors affecting rice production in the area.
According to table 2, of the three functional forms estimated, the coefficients in the linear regression were the most significant as can be observed from their t-values, as well as the appropriateness of their signs with relationship to their apriori expectations. The R² for the three models were high, ranging from 83.5% to 86.6%, indicating that changes in the explanatory variables highly accounted for changes in the dependent variable. Based on the afore-mentioned, linear model was adopted as the lead equation. The linear model is therefore given as:

\[ Y = -248610.191 + 96.56511X_1 + 224.769X_2 + 0.243X_3 + 14.493X_4 + 0.041X_5 \]

The lead equation therefore showed that variable X₅ (farm size in hectare) had positive coefficient and was also significant at 5% level of significance. The import of this finding is that increase in hectare of land will invariably lead to increased output of rice among the small scale farmers in the study area. The coefficient of labour input in mandays (X₂) was also positive and significant at 5% level of significance. This also meant that increase in labour will also bring about increase in output of rice in the area. Similarly, for (X₃) the coefficient was also significant and positive too. The implication of this is that fertilizer used had direct relationship with output level of rice. Agrochemicals (X₄) had a positive and significant coefficient at 5% level of significance. This implies that increase in chemicals will lead to increase in production. However, in the case of quality of planting materials (seeds) for rice it was not significant but positive. This finding does not very much agree with aprori expectation.

Table 2: Regression results on determinants of rice production in the area

<table>
<thead>
<tr>
<th>Functions</th>
<th>Constant</th>
<th>Land</th>
<th>Labour</th>
<th>Fertilizer</th>
<th>Agrochemical</th>
<th>Seed</th>
<th>R²</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear</td>
<td>-248610.191*</td>
<td>96.56511*</td>
<td>224.769*</td>
<td>.243*</td>
<td>14.493*</td>
<td>.41</td>
<td>.866</td>
<td>50.015*</td>
</tr>
<tr>
<td>SE</td>
<td>(34004525)</td>
<td>(35.30899)</td>
<td>(66.753)</td>
<td>(.099)</td>
<td>(3.294)</td>
<td>(.962)</td>
<td>.43</td>
<td></td>
</tr>
<tr>
<td>t-value</td>
<td>-7.123</td>
<td>2.73</td>
<td>3.367</td>
<td>2.454</td>
<td>4.400</td>
<td>3.43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semi log</td>
<td>-2408291.452*</td>
<td>153194.063</td>
<td>28162.456</td>
<td>.248*</td>
<td>27164.576</td>
<td>.085</td>
<td>.835</td>
<td>56.751*</td>
</tr>
<tr>
<td>SE</td>
<td>(810397.140)</td>
<td>(163935.416)</td>
<td>(23778.815)</td>
<td>(.099)</td>
<td>(24778.051)</td>
<td>.057</td>
<td>.467</td>
<td></td>
</tr>
<tr>
<td>t-value</td>
<td>-2.972</td>
<td>0.934</td>
<td>1.184</td>
<td>2.505</td>
<td>1.0963</td>
<td>1.493</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double log</td>
<td>-1.732</td>
<td>0.199</td>
<td>1.535</td>
<td>.085</td>
<td>.968</td>
<td>.467</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE</td>
<td>(1.944)</td>
<td>(0.393)</td>
<td>(0.368)*</td>
<td>.057</td>
<td>(.252)*</td>
<td>(.372)</td>
<td>.836</td>
<td>44.693*</td>
</tr>
<tr>
<td>t-value</td>
<td>-0.891</td>
<td>0.278</td>
<td>4.170</td>
<td>1.493</td>
<td>3.847</td>
<td>1.254</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*F-values significant at 5%; *coefficient significant at 5% level of significance; Source: field study; 2012

Elasticity of production
Using Cobb-Douglas production function, the coefficient of a given resource is its elasticity of production. The result in table 3 showed that output from labour input in mandays was elastic (2p>1). This implied that one unit of labour input added, yielded more than one unit of output in the production process. However, all other inputs were inelastic, indicating that one unit addition of the factors brought about less than one unit addition in output.

Return to scale
The result in table 3 also indicates that there is increasing return to scale, meaning that the farmers were yet not operating within the rational stage of production. The implication of this finding is that if these resources are increased proportionately, more output will be obtained.
Table 3: Production elasticity of resources used

<table>
<thead>
<tr>
<th>Resources</th>
<th>Elasticity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm size ($X_1$)</td>
<td>0.109</td>
<td>Inelastic</td>
</tr>
<tr>
<td>Labour ($X_2$)</td>
<td>1.535</td>
<td>Elastic</td>
</tr>
<tr>
<td>Fertilizer ($X_3$)</td>
<td>0.085</td>
<td>Inelastic</td>
</tr>
<tr>
<td>Agrochemicals ($X_4$)</td>
<td>0.968</td>
<td>Inelastic</td>
</tr>
<tr>
<td>Seed planted ($X_5$)</td>
<td>-0.467</td>
<td>Inelastic</td>
</tr>
<tr>
<td>Return to scale ($2\beta$)</td>
<td>2.230</td>
<td>Increasing return to scale</td>
</tr>
</tbody>
</table>

Source: field study, 2012

CONCLUSION

The study concluded that rice production in Imo state is profitable. However, if more resources were adequately allocated to rice production, more output will be obtained. This could be viewed from the perspective that the farmers were still operating at irrational stage of production. They needed to add more input resources in order to come up to the rational stage of production.

RECOMMENDATION

The study recommended as follows:

Rice production in the area has not reached the maximum level. There is room for increased production. Therefore, more input resources should be added to increase output of the crop. The farmers should be given aid especially by providing them with production credit which will enable them to increase their resource use. This is because their present level of resource use may be due to scarcity of production credit given the fact that their equity in business is low. Even though the use of agro-chemicals had a significantly positive relationship with output, its use was low. This could be due to lack of awareness on its use or paucity of funds to enable its purchase. Therefore, extension agents should make efforts geared towards educating the farmers on the need for and method of use of these additives. Subsidizing these inputs could also encourage their use by the small scale farmers. Policy interventions aimed at protecting local production of rice are needed as this could improve the profitability of the enterprise. This is because affinity to foreign rice consumption, largely because of its availability in the market has affected local production negatively. Total ban on importation of rice or increase in tariff will be helpful in this area. The smallholder farmers are also advised to form micro credit groups and cooperatives aimed at accessing credit, subsidies. This to a large extent will improve their output in rice production. Seminars and trainings are also proposed for small scale farmers on resource use. This will improve their production.

REFERENCES