Current Research Journal of Economic Theory 4(1): 6-10, 2012
ISSN: 2042-485X
© Maxwell Scientific Organization, 2012
Submitted: December 16, 2011 Accepted: January 08, 2012 Published: February 25, 2012

Poverty and Efficiency among the Farming Households in Nigeria: A Guide for Poverty Reduction Policy

[1]B.C. Asogwa, [1]J.C. Umeh and [2]V.A. Okwoche
[1]Department of Agricultural Economics,
[2]Department of Agricultural Extension and Communication, University of Agriculture,
P.M.B. 2373, Makurdi, Benue State, Nigeria

Abstract: This study analysed the relationship between poverty and efficiency among the farming households in Nigeria using farm level data from Benue State. The P-alpha measure of poverty and the Food Energy Intake (FEI) method were used for the measurement of poverty gap among the respondents, whereas Stochastic Frontier was used to obtain the efficiency estimates. Correlation analysis was used to achieve the objective of the study. The study showed that average level of technical, allocative and economic efficiency was estimated at 30, 12 and 36%, respectively. Allocative inefficiency was worse than technical inefficiency, implying that the low level of overall economic efficiency was the result of higher cost inefficiency. The study further showed an inverse relationship between poverty gap and technical efficiency estimates among the respondents, implying that as average productivity increases poverty decrease. Furthermore, the study showed a direct relationship between poverty gap and allocative efficiency estimates, implying that as the cost of technical efficiency increases poverty increases. The study also showed a direct relationship between poverty gap and economic efficiency estimates among the respondents, implying that as the cost of maximizing output increases poverty increases. Overall economic efficiency and hence poverty reduction among the respondents resulted more from technical efficiency than allocative efficiency. The policy implication is that poverty reduction among the farming households is linked with improving farm efficiency. If poverty is to be eradicated among the farming households, farming activities must be efficient.

Key words: Correlation analysis, efficiency, farming households, poverty, poverty reduction policy

INTRODUCTION

The link between poverty status and poverty reduction among the farming households is indirect through the relationship between productivity (efficiency), growth and poverty (Norman, 1975; Ajibefun, 2000b; Ajibefun, 2002; Ater, 2003; Ajibefun and Daramola, 2003; Amalu, 2005). Bigsten *et al*. (2003), Federal Republic of Nigeria (2005), Amalu (2005) and Federal Republic of Nigeria (2007) argued that in order to reduce poverty, it is fundamental that economic policies should aim at promoting rapid economic growth. Furthermore, many authors believe that an effective approach towards more comprehensive poverty reduction is to enhance economic growth (Dollor and Kraay, 2002; Ravallion, 2001). Others argued that growth in incomes of the poor is strongly correlated with overall growth of the economy especially growth in the agricultural sector, and this fact has been demonstrated in cross-country and individual country studies (Hoekman *et al*., 2001). Chirwa (2005) therefore argued that macroeconomic policies that promote growth in income are likely to lead into poverty reduction. For instance, with respect to agriculture, changes in price will provide incentives for agricultural production and specialization, which in turn may lead into growth and distribution of income through employment generation and revenue enhancement, and consequently poverty reduction (Chirwa, 2005). Similarly, at the micro level, enterprises that promote income growth and distribution and enhance the revenue of the poor households are most likely to lead into poverty reduction among the poor households. For instance, improvement in farmers' productivity and output would lead to income growth (all things being equal) and consequently poverty reduction (Norman, 1975; Ajibefun, 2000b; Ajibefun, 2002; Ater, 2003; Ajibefun and Daramola, 2003).

Hoekman *et al.* (2001) argued that for growth to have some meaningful impact on poverty, that growth must occur in sectors in which a large proportion of the poor derive their livelihood. It is worth noting that the agricultural sector remains the important sector for livelihood especially in rural Nigeria, which accounts for more than 70% of the population. According to Ajibefun (2002), there is crucial need to raise agricultural growth as

Corresponding Author: B.C. Asogwa, Department of Agricultural Economics, University of Agriculture, P.M.B. 2373, Makurdi, Benue State, Nigeria

such growth is the most efficient means of alleviating poverty. For Nigeria, raising productivity per area of land is the key to effectively addressing the challenges of achieving food security, as most cultivable land has already been brought under cultivation, and in areas where wide expanse of cultivable land is still available, physical and technological constraints prevent large-scale conversion of potentially cultivable land.

There is little empirical work on the relationship between poverty and efficiency among the farming households in Nigeria to guide the development of agricultural policies aimed at reversing the deteriorating poverty situation. This study is therefore aimed at providing empirical evidence of the relationship between poverty and efficiency among the farming households in Nigeria, which would serve as a guide for poverty reduction policy.

The purpose of this study is to analyse the relationship between poverty and efficiency among the farming households in Nigeria, and in order to accomplish the objective of this study, the following hypotheses were stated and tested:

- There is no significant relationship between the poverty and efficiency among the farming households in Nigeria
- There is no significant relationship between technical efficiency and allocative efficiency among the farming households in Nigeria
- There is no significant relationship between technical efficiency and economic efficiency among the farming households in Nigeria
- There is no significant relationship between allocative efficiency and economic efficiency among the farming households in Nigeria.

METHODOLOGY

The study area: For this study, farm level data were collected on 393 farmers in Benue State. Benue State is one of the 36 states of Nigeria located in the North-Central part of Nigeria. The State has 23 Local Government Areas, and its Headquarters is Makurdi. Located between Longitudes 6º35′E and 10ºE′ and between Latitudes 6º30′N and 8º10′N. The State has abundant land estimated to be 5.09 million ha. This represents 5.4% of the national land mass. Arable land in the State is estimated to be 3.8 million ha. This State is predominantly rural with an estimated 75% of the population engaged in rain-fed subsistence agriculture. The state is made up of 413,159 farm families. These farm families are mainly rural. Farming is the major occupation of Benue State indigenes. Popularly known as the "Food Basket" of the Nation, the State has a lot of land resources. For example cereal crops like rice, sorghum and millet are produced in abundance. Roots and tubers produced include yams, cassava, cocoyam and sweet potato. Oil seed crops include pigeon pea, soybeans and groundnuts, while tree crops include citrus, mango, oil palm, guava, cashew, cocoa and *Avengia* spp.

Sampling technique: In this study, the multi-stage random sampling technique was used for sample selection. Benue State is divided into three (3) agricultural zones viz: Zone A, Zone B and Zone C, respectively. Zone A and Zone B are made up of seven Local Government Areas each while Zone C is made up of nine Local Government Areas. Using a constant sampling fraction of 45%, three Local Government Areas were randomly selected from Zone A and Zone B while four Local Government Areas were randomly selected from zone C under the guide of Benue ADP workers in BNARDA. From each of the selected Local Government Areas, one rural community was randomly selected. Finally, from each community, households were randomly selected on the basis of the community's population size using a 1% constant sampling fraction in order to make the sampling design to be self-weighting thereby avoiding sampling bias (Eboh, 2009). Based on the foregoing, 393 farming households were randomly selected for the study.

Data collection: Data were collected mainly from primary sources. The primary data were obtained through the use of a structured questionnaire, copies of which were administered to the selected 393 farming households in Benue State.

Analytical technique: The P-alpha measure of poverty and the Food Energy Intake (FEI) method were used for the measurement of poverty gap among the respondents, whereas Stochastic Frontier was used to obtain the efficiency estimates. Correlation analysis was used to achieve the objective of the study. The hypotheses were tested using the Pearson correlation coefficients.

Model specification:

Estimation of poverty line: The FEI method was adopted in estimating the poverty lines for this study. This was done in two stages. The first stage was to run a regression of the cost of a basket of commodities consumed by each household in the sample over the calorie equivalent as represented in Eq. (1):

$$\text{Log } E = \alpha + \beta C + \varepsilon \quad (1)$$

where, E is food expenditure and C is calorie consumption and ϵ is the error term.

To derive the values for the variables in this equation, the following steps were taken. First, the total value of food expenditure (E) was obtained by summing the value of consumption from own product. This was converted to its per capita value by dividing it by the household size

(where the adult equivalent cannot be calculated due to absence of information on household composition). The calorie equivalent C was obtained by summing the calorie equivalent of the food items listed for each household.

The next stage was to calculate the cost of the basket by estimating Eq. (2):

$$Z = e^{(\alpha + R\beta)} \quad (2)$$

where, e is natural constant (2.71829), R is the recommended daily allowance of calorie intake. This gives the food poverty line or the cost of acquiring the Recommended Daily Allowance (RDA) of calories, which for the study is, 2,900, the minimum energy intake requirement recommended by FAO (Federal Republic of Nigeria, 2005; NBS, 2005).

P-alpha poverty measures (Foster-greer-thorbecke index): Foster *et al*. (1984) proposed a family of poverty indices based on a single formula capable of incorporating any degree of concern about poverty through the poverty aversion parameter α. This is the so called P-alpha measure of poverty or the poverty gap index. The index is defined as:

$$P_\alpha = \frac{1}{N}\sum_{i=1}^{q}\frac{(z - y_i)^\alpha}{z} \quad (3)$$

where, z is the poverty line, q is the number of households below the poverty line, N is the total sample population, y_i is the per capita expenditure of the ith household, and α is the Foster *et al*. (1984) parameter, which takes the value 0, 1 and 2, respectively, depending on the degree of concern about poverty. The quantity in parentheses is the proportionate shortfall of expenditure or income below the poverty line. By increasing the value α, the aversion to poverty as measured by the index is increased. For example, where there is no aversion to poverty α = 0, the index is simply:

$$P_0 = \frac{1}{N}q = \frac{q}{N} = H \quad (4)$$

which is equal to the head count ratio. This index measures the incidence of poverty. If the degree of aversion to poverty is increased, so that α = 1, the index becomes:

$$p_1 = \frac{1}{N}\sum_{i=1}\frac{(z - y_i)^1}{z} = HI \quad (5)$$

Here the head-count ratio is multiplied by the income gap between the average poor person and the line. This index measures the depth of poverty; it is also referred to as "income gap" or "poverty gap" measure.

Efficiency predictions: The computer program (Frontier 4.1) calculates predictions of individual firm technical efficiencies from estimated stochastic production frontiers, and predictions of individual firm cost efficiencies from estimated stochastic cost frontiers. The measures of technical efficiency relative to the production frontier and of cost efficiency relative to the cost frontier are both defined as:

$$EFF_i = E(Y_i^*/U_i, X_i)/ E(Y_i^*/U_i, = 0, X_i) \quad (6)$$

where, Y_i^* is the production (or cost) of the i-th firm, which will be equal to Y_i when the dependent variable is in original units and will be equal to exp (Y_i) when the dependent variable is in logs. In the case of a production frontier, EFF_i will take a value between zero and one, while it will take a value between one and infinity in the cost function case.

Economic efficiency is the product of technical efficiency and allocative (cost) efficiency.

Linear correlation: The Product Moment correlation coefficient r, can take any value between -1 and +1. A statistically significant correlation coefficient in the range $0<r\leq0.3$ will be regarded as week correlation; $0.3<r\leq0.6$ will be regarded as moderate correlation; $0.6<r<1$ will be regarded as strong correlation, while a correlation coefficient of 1 will be regarded as perfect correlation.

A positive correlation implies co-movement in the same direction. A negative correlation implies co-movement in opposite direction. Zero correlation implies a complete absence of joint linear movement.

RESULTS AND DISCUSSION

Poverty status among the respondents: Consumption poverty as measured by the head-count index is 0.6158 (Table 1). This implies that 61.58% of the population was living in absolute poverty.

The depth of poverty, severity of poverty, welfare gap and contribution to poverty are 0.2719, 0.1546, 0.4415 and 0.4767, respectively. The results further indicate that the coefficient of variation of household food

Table 1: Poverty status among the farming households in rural and peri-urban communities of Benue State

Poverty index	Value
Total poverty gap	400371.3
Average poverty gap	1018.76
Average expenditure shortfall	1654.43
Normalised expenditure shortfall	0.4415
Poverty incidence (P_o)	0.6158
Poverty depth (P_1)	0.2719
Poverty severity (P_2)	0.1546
Welfare gap (P_1/P_o)	0.4415
Contribution to poverty (Co)	0.4767
Coefficient of variation (Cv_p)	0.4240

Field survey (2009)

Table 2: Average technical, allocative and economic efficiency of Nigerian farming households

Total farm-level	Mean efficiency Gestimate	Minimum efficiency Gestimate	Maximum Gestimate	Average efficiency (%)
Technical efficiency	0.30	0.00000006	0.83	30
Allocative efficiency	1.88	1.05000000	67.10	12
Economic efficiency	0.36	0.00000006	1.11	36

Field Survey (2009)

expenditure among the poor is 0.4240. This indicates that household food expenditure vary widely among the poor, suggesting that there is poverty inequality among the respsondents.

Predicted efficiency: Table 2 shows that predicted technical efficiency varied widely among the respondents, with minimum and maximum values of 0.00000006 and 0.83, respectively and a mean technical efficiency of 0.30. Furthermore, predicted allocative efficiency varied widely among the respondents, with minimum and maximum values of 1.05 and 67.10, respectively and a mean allocative efficiency of 1.88. Similarly, predicted economic efficiency varied widely among the respondents, with minimum and maximum values of 0.00000006 and 1.11, respectively and a mean economic efficiency of 0.36.

The average level of technical, allocative and economic efficiency is estimated at 30, 12 and 36%, respectively. The wide range of values indicates large variations in performance across farms. The results further indicate that allocative inefficiency is worse than technical inefficiency, which implies that the low level of overall economic efficiency is the result of higher cost inefficiency. This suggests that solving the allocation problems may be more critical for improving the farmers' overall economic efficiency than solving technical problems.

Correlation analysis of poverty and efficiency: The result in Table 3 shows that the null hypothesis that there is no significant relationship between poverty gap and efficiency estimates among the farming households in Nigeria is rejected at 5% level of probability. The results show that there is a significant negative correlation between poverty gap and technical efficiency estimates among the respondents, suggesting an inverse relationship between poverty gap and technical efficiency estimates among the respondents. The implication is that as technical efficiency estimate increases (that is increase from zero towards one, which is the production frontier), poverty gap decreases (and this means that the ratio of total output to total inputs for a farm is increasing). This implies that as average productivity increases poverty decreases, suggesting that output is being maximized from a given quantum of inputs. Furthermore, the results show that there is a significant positive correlation between poverty gap and allocative efficiency estimates among the respondents, suggesting a direct relationship between poverty gap and allocative efficiency estimates among the respondents. The implication is that as allocative efficiency estimate increases (that is increase from one, which is the cost frontier towards infinity), poverty gap increases (and this means that the ratio between total cost of producing one unit of output using actual factor proportions in a technically efficient manner and total cost of producing one unit of output using optimal factor proportions in technically efficient manner is increasing). This implies that as the cost of technical efficiency increases poverty increases, suggesting that production cost is not being minimized. Similarly, the results also show that there is a significant positive correlation between poverty gap and economic efficiency estimates among the respondents, suggesting a direct relationship between poverty gap and economic efficiency estimates among the respondents. The implication is that as economic efficiency estimate increases (that is increase from one, which is the economic frontier, towards infinity), poverty increases (and this means that the costs per unit of output for a farm is increasing). This implies that as the cost of maximizing output increases poverty increases, suggesting that profit is not being maximized.

Table 3: Correlation analysis of poverty and efficiency among Nigerian farming households

	Poverty gap	Technical efficiency	Allocative efficiency	Economic efficiency
Poverty gap	1.00			
Technical efficiency	-0.7*	1.00		
Allocative efficiency	0.6*	0.332**	1.00	
Economic efficiency	-0.2*	0.894**	0.706**	1.00

Field survey (2009); *: Correlation coefficient (r) is significant at 5% level (2-tailed); **: Correlation coefficient (r) is significant at 1% level (2-tailed)

The results further indicate that poverty is more strongly correlated with technical efficiency than allocative efficiency among the respondents. This suggests that technical efficiency is more related to poverty reduction among the respondents than allocative efficiency.

The result in Table 3 also show that the null hypothesis that there is no significant relationship between the efficiency estimates of any two of the three efficiency measures (technical, allocative and economic efficiency) among the farming households in Nigeria is rejected at 5% level of significance. The result shows that there is a significant positive correlation between the efficiency estimates of any two of the three efficiency measures among the respondents, suggesting that the efficiency estimates tend to rise or fall together among the respondents.

The results further indicate that economic efficiency is more strongly correlated with technical efficiency than allocative efficiency among the respondents. This suggests that technical efficiency is more related to economic efficiency improvement among the respondents.

The implication of the foregoing findings is that technical efficiency was stronger than allocative efficiency in reducing poverty among the respondents. This was because the farmers were more efficient technically than allocatively. In other words, overall economic efficiency and hence poverty reduction among the respondents resulted more from technical efficiency than allocative efficiency. The policy implication is that poverty reduction among the farming households is linked with improving farm efficiency. If poverty is to be eradicated among the farming households, farming activities must be efficient.

CONCLUSION

The study showed that allocative inefficiency is worse than technical inefficiency, implying that the low level of overall economic efficiency is the result of higher cost inefficiency. The study further showed an inverse relationship between poverty gap and technical efficiency estimates among the respondents, a direct relationship between poverty gap and allocative efficiency estimates among the respondents, and a direct relationship between poverty gap and economic efficiency estimates among the respondents. Overall economic efficiency and hence poverty reduction among the respondents resulted more from technical efficiency than allocative efficiency. The policy implication is that poverty reduction among the farming households is linked with improving farm efficiency. If poverty is to be eradicated among the farming households, farming activities must be efficient.

REFERENCES

Ajibefun, I.A., 2000b. Use of econometric models in technical efficiency analysis as application to the Nigerian small scale farmers: 2000 Annual Conference on Transport Statistics and National Development, Held at Lagos Airport Hotel, Ikeja, Lagos, 29th November, Publication by Nigerian Statistical Association Programme and Summary of Conference Papers, pp: 15.

Ajibefun, I.A., 2002. Analysis of policy issues in technical efficiency of small scale farmers using the stochastic frontier production function: With application to Nigerian Farmers. Paper Prepared for Presentation at the International Farm Management Association Congress, Wageningen, Netherland, pp: 8.

Ajibefun, I.A. and A.G. Daramola, 2003. Determinants of Technical and Allocative Efficiency of Micro-Enterprises: Firm-level Evidence from Nigeria. African Development Bank, pp: 353-395.

Amalu, U.C., 2005. Poverty alleviation and agriculture in sub-Saharan Africa: The Nigerian experience. J. Food, Agric. Environ. 3(2): 230-236.

Ater, P.I., 2003. A comparative analysis of productivity response and poverty alleviation among beneficiaries and non beneficiaries of world bank assisted dry season fadama entreprises in Benue state Nigeria. Ph.D. Thesis, Department of Agricultural Economics. Federal University of Agriculture, Makurdi, pp: 202.

Bigsten, A., B. Kebede, A. Shimeles and M. Taddess, 2003. Growth and poverty reduction in Ethiopia: Evidence from household panel surveys. World Dev., 31(1): 87-106.

Chirwa, E.W., 2005. Macroeconomic Policies and Poverty in Malawi: Can We Infer from Panel Data Research Report. Global Development Network (GDD), Suite 1112, 2600 Virginia Avenue, NW Washington D.C., 20037, USA, pp: 33.

Dollor, D. and A. Kraay, 2002. Growth is good for the Poor. J. Econ. Growth, 7(3): 195-225.

Eboh, E.C., 2009. Social and Economic Research: Principles and Methods. 2nd Edn., Enugu, African Institute for Applied Economics, Nigeria. pp: 262.

Federal Republic of Nigeria, 2005. Poverty Profile for Nigeria. National Bureau of Statistics, pp: 98.

Federal Republic of Nigeria, 2007. Nigeria Poverty Assessment 2007. The National Bureau of Statistics in Collaboration with the World Bank, pp: 225.

Foster, J., J. Greer and E. Thorbecke, 1984. A class of decomposable poverty measures. Econometrica, 52(3): 761-766.

Hoekman, B., C. Michalopoulos, M. Schiff and D. Tarr, 2001. Trade Policy and Poverty Alleviation, World Bank Working Paper No. 2733, Washinton DC: World Bank, 57 pp.

National Bureau of Statistics (NBS), 2005. The Nigerian Statistical Fact Sheets on Economic and Social Development. National Bureau of Statistics (NBS), pp: 115.

Norman, D.Y., 1975. Economic analysis of agricultural production and labour utilization among the Hausa in the North of Nigeria. Afr. Rural Employment, 4: 58.

Ravallion, M., 2001. Growth, inequality and poverty: Looking beyond averages. World Dev., 29 (11): 1815-2001.