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ESTIMATION OF NORMALIZED PROFIT FUNCTION AND FACTOR SHARE EQUATION FOR CASSAVA-BASED FARMERS IN ODUKPANI LOCAL GOVERNMENT AREA, CROSS RIVER STATE

BY
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Abstract

The study centered around the estimation of normalized profit function and factor share equation for 120 cassava-based farmers of Odukpani Local Government Area of Cross River State. The study revealed that profit level of farms have inverse relationship with variable input, but positive relationship with fixed inputs in the short run. Also, factor share function estimation revealed that family labour have the highest share in profit function and that the farm's demand for the variable inputs is inelastic. In essence, the cassava-based farmers are rational economic agents who can respond to price changes. This therefore requires input subsidy by of government to help reduce the cost of production of farmers. *(International Journal of Social Science and Public Policy 2000:3(2) pp 201-208).*

INTRODUCTION

Crop production is noted to be a small scale phenomenon in Nigeria as it is dominated by over 60 per cent of the small-scale farmers who are basically poor in resource endowments (Olayemi, 1981). Their production activities have always been restricted to the use of less productive crude tools in the light of multifarious problems. This has resulted in relative decline in output and productivity over time with a resultant decline in the overall agricultural growth rate. For instance, the average growth rate of agriculture between 1990 and 1995 was 3.7 per cent but between 1995 and 1998 it had dropped to about 3.4 per cent.

Besides the endogenous problems that characterise crop production, the farmers still have to contend with other exogenous problems like incessant price fluctuations and market characteristics. These problems coupled with low resource productivity often will affect the profit levels of the small farmers in any crop enterprise.

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It should be noted that both input and output prices are highly unstable and in view of the supply response of crops, the ability of farmers to adjust production to or against price cycling is always illusive.

Since production is basically a decision making exercise of allocating and using resources to achieve certain goals (especially profit maximization) can it then be said that small-scale farmers engaged in cassava based production are rational in resource allocation and use? Irrespective of input and output price cycling, is it possible for small-scale cassava based farmers to cover their cost of production as well as equating their marginal revenue with their marginal cost? Answering these fundamental questions therefore require empirical modelling of the normalized profit function and factor-share functions which forms the cardinal objective of this study. Empirical studies on profit function and normalized profit function estimations are numerous in economic literature. Many studies on relative efficiency of resource use by farmers and derivations of both supply and demand functions adopted the normalized profit functions for their estimation (see Lau and Yotopoulos, 1971; Lau and Yotopoulos, 1974; Yotopoulos and Lau, 1993; Adeyeye, 1987; Odii, 1994 and Adesina, *et al.*, 1997). These studies were built on the principle of duality that exist between the profit and production functions. This study is also modelled along the premise of previous works and is consistent with the seemingly unrelated regression estimation procedure proposed by Zellner (1962).

METHODOLOGY

Area of Study, Sampling Procedure and Data Collection:

The study was carried out in Odukpani Local Government Area (L.G.A) of Cross River State, a rainforest zone where farming is the principal occupation of the people. The people grow crops such as Cassava, Yam, Cocoyam, Cucumber, Maize, etc. either as sole or in mixture. However cassava is the predominant crop in the area. A two stage sampling procedure was employed in selecting 120 cassava-based farmers. Cassava based farmer are regarded as those farmers that grow cassava either as sole or in mixture with other crops. In mixture, it is expected that cassava should accounts for more than 70 per cent of the total cropped area.

The first stage of sampling involved the random selection of four villages while in the second stage, 30 cassava-based farmers each were selected from the four villages giving a total of 120 farmers. Primary data obtained via the cost itinerary survey carried out during the 1998/99 cropping season with the use of structured questionnaires were used for the analysis. Data collected include inputs and their costs, farm gate prices and market prices of the product and general information on crop production. However, the primary data obtained were complemented with some secondary data from the records of the Cross River State Agricultural Development Project (CRADP).

ANALYTICAL PROCEDURE

Based on the cardinal objectives of this study, a normalized, but restricted profit function, modelled after Yotopoulous and Lau (1972) was used to fulfil the stated objectives.

Assume a transformation function as:

$$Q = g(X_i, F_i) \quad \ldots\ldots\ldots\ldots \quad (1)$$

where Q = total quantity of output

X_i = vectors of variable inputs

F_i = vectors of fixed inputs

then by assumption of profit maximization, the first order necessary condition with respect to X_i require

$$\delta Q/\partial X_i = r_i/p = q^* \quad \ldots\ldots\ldots\ldots \quad (2)$$

where r_i = unit price of ith input

p = output price

q_i^* = normalized price of ith variable input

From equation (2), the demand for the ith variable input profit maximizing farm is defined as

$$X_i^* = g(q_i^*, F) \quad \ldots\ldots\ldots\ldots \quad (3)$$

where X_i^* = optional (profit maximizing) quantity of ith variable input.

It then follows that a profit function is given as

$$\pi = PQ - \sum_{i=1}^{n} qx_i \quad \ldots\ldots\ldots\ldots \quad (4)$$

where p = Price of output

Substituting eqn. (1) and eqn. (3) into eqn. (4) permits the expression of profit as a function of the normalized prices of the variable inputs and the quantities of the fixed inputs.

$$\pi = p[F(g,(q,F), \ldots, gm(q,F) - \sum_{i=1}^{n} r_i g_i(q,F)] \quad \ldots\ldots\ldots\ldots \quad (5)$$

Then, normalized but restricted profit, π^* is given as

$$\pi^* = \pi/p = g(q^*, F) \quad \ldots\ldots\ldots\ldots \quad (6)$$

with the use of Cobb Douglas production function, the normalized profit function is given as

$$\pi^* = A^* \sum_{i=1}^{m} q_i^{\alpha *} \cdot \sum_{i=1}^{n} z_i^{\beta *} \quad \ldots\ldots\ldots\ldots \quad (7)$$

where α_i^*, β^* and A^* are parameters to be estimated.

The Cobb-Douglas functional forms was fitted for the farm profit equation given as

$$\ln \pi = \ln A^* + \alpha^*_{HL} \ln q^*_{HL} + \alpha^*_{HL} \ln q^*_{HL} + \alpha^*_{SP} \ln q^*_{SP} + \alpha^*_{f} \ln q^*_{f} + \beta^*_{k} \ln X_5 + \beta^*_{FS} \ln X_6 + e \quad \ldots\ldots\ldots\ldots \quad (8)$$

where A^*, α^*_i and β^*_i are parameters to be estimated

q^*_{fL} = Normalized price of family labour; $\partial\pi/\delta q_{fL} < 0$

q^*_{HL} = Normalized price of hired labour; $\partial\pi/\delta q_{HL} < 0$

q^*_{SP} = Normalized price of planting material (₦/kg); $\partial\pi/\delta q_s < 0$

q^*_f = Normalized price of fertilizer; $\partial\pi/\partial q_f < 0$

X_5 = Capital investment or durable tools like cutlasses, hoe, etc.

X_6 = Size of land cultivated.

Specifically, demand function of each variable input was estimated by differentiation of the normalized profit function with respect to the normalized prices of each of the variable inputs. Actually, the demand for each variable was;

$$X_i = -\partial\pi/\partial q_i, \text{ (FL, HL, S, F)} \quad \text{.................... (9)}$$

which implies the following factor share equations

$$-q_{FL} X_{FL}/\pi^* = \alpha^*_{FL} \quad \text{.................................. (10)}$$

$$-q_{HL} X_{HL}/\pi^* = \alpha^*_{HL} \quad \text{.................................. (11)}$$

$$-q_{SP} X_{SP}/\pi^* = \alpha^*_S \quad \text{.................................. (12)}$$

$$-q_f X_f/\pi^* = \alpha^*_f \quad \text{.................................. (13)}$$

where X_{FL} is total family labour days

X_{HL} is total hired labour days

X_{Sp} is total quality of planting material

X_F is total fertilizer used.

The factor share equation are equivalent to the demand for the inputs. Note that, the study utilized the Zellner's seemingly unrelated regressions estimated procedure to jointly estimate the profit function equation with the factor share equations.

RESULTS AND DISCUSSIONS

A. Normalized Profit Function

The result of the profit function equation is presented on Table 1. The estimation was done using the ordinalry Least squares (OLS) and the Seemingly Unrelated Regression Estimation method (SURE).

From Table 1, both OLS single equation and profit maximizing equations show that the explanatory factors considered in the estimation explained significant variations in profit function of cassava based farmers; 76 percent for OLS single equation and 58 percent for profit maximizing equation. For both equations, all the coefficients of the variable factors except fertilizer are statistically significant and consistent with *a priori* expectations. The same goes for the fixed factors with the profit level. Therefore, increase use of any of the variable inputs will reduce profit levels while increase use of fixed inputs will lead to expansion in the level of production and invariably increase profit level.

Table 1: Estimates of the Normalized Profit Function for Cassava Based Farms in Odukpani Local Government Area of Cross River State

Factors	Parameter	Single Equation (OLS)	Profit Max. Equation
Family labour	α^*_{FL}	-0.96 (0.20)***	-0.57 (0.31)**
Hired labour	α^*_{HL}	-0.66 (0.18)***	-0.47 (0.16)***
Planting materials	α^*_s	-1.88 (0.19)***	-0.76 (0.27)***
Fertilizer	α^*_f	0.12 (0.09)	0.12 (0.10)
Durable tools	β^*_K	0.53E01(0.41E-01)	0.42E-01(0.34E-01)
Land	β^*_{FS}	0.79 (0.31)***	0.63 (0.35)**
Constant	In A*	3.44 (1.05)***	2.39 (0.87)***
Diagnostic Statistics			
	R^2	0.76	0.58
	$\bar{R}^2$	0.52	0.51
	F(G,194)	31.62***	26.63***

Note: Values in parentheses are asymptotic standard errors

Source: **Field Data, 1999.**

To explain the functional relationship existing between factors of production (both variable and fixed) and profit level, we will restrict our discussion to the estimates of profit maximizing equation.

i Family Labour:

Its coefficient (-0.54) is statistically significant at $\alpha = 0.05$ and has inverse relationship with profit level. This implies that a unit increase in family labour reduces profit level by 0.57. Increasing the number of family labour in the short-run when farm size can not be increased immediately, will lead to over crowding in the farm and decrease family labour productivity, which invariably decreases profit level. The result therefore shows that on the average, more than required family labour is available and used in cassava-based farms, leading to situation of family labour saturation.

ii. Hired Labour:

With the coefficient of -0.47 which is statistically significant at $\alpha = 0.01$, a unit increase in hired labour cost reduces profit level by 0.47 per cent. This portrays a situation of less than proportionate decrease in profit level as hired labour cost increases. This inelastic nature of hired labour cost shows that the cassava based farms are operating at stage two of production process. The sign of the coefficient however confirms the cost implication of hired labour to profit level of farms, especially in labour intensive situation.

iii. Planting Materials:

This appears to be the most important variable input that determines profit levels in cassava-based farms with a coefficient of -0.76. This shows the indispensable nature of seeds/seedlings in crop production. It therefore means that a 10 percent increase in cost of purchasing planting materials will depress profit level of cassava-based farms by 7.6 percent.

iv. Fertilizer:

The coefficient (0.12) is not statistically significant at any of the alpha levels (0.01 and 0.05) considered. This shows that fertilizer is not a major determinant of profit level in cassava-based farms. This result however is contrary to the apriori expectation. However, the most plausible reason for this result could be that, majority of the farmers do not have fertilizer to apply and those who apply do not have enough. As such, cost involvement in fertilizer procurement is quite low and negligible when compared to other cost items. This confirms that cassava-based farms are low external input producers.

v. Durable Tools:

The coefficient (0.24E-01), though carries right sign is statistically not significant. The coefficient is highly inelastic in nature and appears not to be a major determinant of profit level of cassava farms. The nature of crop production, which is labour intensive and low external input, likely explains the result obtained. Basically farmers in the area use crude tools-cutlass, hoes, spade, etc for crop production that do not require huge capital outlay.

vi. Land:

The estimated coefficient (0.63) is positively related to profit level and is statistically significant at $\alpha = 0.05$. The positive sign and inelastic nature of the coefficient explain the importance of farm land, as a fixed asset in crop production. Therefore, the result shows that a 10 percent increase in farmland will lead to increase in profit by 6.3 percent; (which is a less than proportionate increase).

B. Factor share equations

These are presented in Table 2

Table 2: Estimates of Factor Share Equations

Factors	Parameter	Single Equation (OLS)	Profit Max. Equation
Family labour	α^{**}_{FL}	-1.50 (0.19)***	-0.97 (0.12)***
Hired labour	α^{**}_{HL}	-1.04 (0.37)***	-0.63 (0.21)***
Planting materials	α^{**}_{sp}	-0.98 (0.27)***	-0.54 (0.14)***
Fertilizer	α^{**}_{f}	-0.076(0.068)	-0.031(0.024)

Note: Values in parentheses are asymptotic standard errors

Source: **Field Data, 1999.**

The factor share equations as presented on Table 2 is consistent and similar to the normalized profit equations in terms of signs, magnitudes and significance of the parameters. The economic implications of the results are that the cost of production is highly significant in determining the level of farmer's profit. Therefore every effort to reduce variable costs in production process will improve farmer's profit status.

Table 2 shows that the farm's demand for family labour, hired labour, planting material and fertilizer are inelastic (considering the profit maximizing equation) with respect to their own prices. It is also revealed that family labour have the highest share while fertilizer has the lowest share. This goes a long way to show the level of significance of each of the variable input to profit level of cassava-based farms.

SUMMARY/CONCLUSION

Estimation of normalized profit function and factor share equations was the main thrust of this study. It adopted Zellner estimation procedure - Seemingly Unrestricted Regression Estimation (SURE) to estimate the profit level of cassava-based farms.

The results of the analysis confirmed that family labour, hired labour, planting materials have significant effects on profit level of the farms. Land also have significant effect on profit level as a fixed asset. The results confirmed that increase use of any of the variable inputs will reduce profit levels while increase use of fixed inputs will lead to expansion in production level, hence profit level. Moreso, in terms of responsiveness of the inputs considered to profit level, the study also reveals inelasticity and that cassava-based farms are operating in state II of production process.

Furthermore, the result of factor share equation showed that the farm's demand for family labour, hired labour, planting material and fertilizer are inelastic. Also, the cost of production (especially for the variable inputs) is highly significant in determining profit level of farmers in the short-run.

Therefore, the economic implications and policy options of these findings are that:

* the cassava-based farmers in the study area can be regarded to be rational farmers as they respond to price changes in an efficient manner.
* Cassava-based farmers should be given necessary assistance like input subsidy to achieve optimum productivity since they are profit maximizers.
* Fertilizer should be provided to the farmers to increase the level of usage by the farmers.
* Off-farm employment opportunities should be created to help take care of family labour saturation on the farm.
* The need for land consolidation should be encouraged amongst the farmers to enhance their profit level.

REFERENCES

Adesina, A.A. and Djata, K.K. (1997). "Relative Efficiency of Women as Farm Managers: Profit Function Analysis in Co'te d'Ivoire". Agricultural Economics, 16, pp. 47 - 53.

Adeyeye, V.A. (1987). "Relative Economic Efficiencies in Farm Organizations: A Comparative Study of Cooperative and Non-Cooperative Farms in Oyo and Kwara States, Nigeria". An Unpublished Ph.D. Thesis, University of Ibadan.

Lau, L.J. and Yotopoulos, P.A. (1971). "A Test of Relative Efficiency and Application to Indian Agriculture". American Economic Review, 61: 94-109.

Lau, L.J. (1976). "A Characteristics of the Normalized Restricted Profit Function". Journal of Economic Theory, 12: 131 - 163.

Lau, L.J. and Yotopoulos (1974). "Profit, Supply and Factor Demand Functions". American Journal of Agricultural Economics, 54: 1 - 18.

Odii, M.A.C.A. (1994). "Gender Consideration in the Resource Allocation and Food Security Behaviour of Farming Households in South Eastern Nigeria", An Unpublished Ph.D. Thesis, University of Ibadan.

Olayemi, J.K. (1980). "Food Crop Production by Small Farmers in Nigeria Small Farmers". Problems and Prospects in Integrated Rural Development, Edited by S.O. Olayide, J.A. Eweka and V.E. Bello-Osagie, CARD, U.I.

Yotopoulos, P.A. and Lau, L.J. (1979). "Resource Use in Agriculture: Applications of the Profit Function on Selected Countries". Food Research Institute Studies, Vol. xvii, (1): 14 - 15.

Zellner, J.T. (1962). "An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias". Journal of American Statistical Association, 57: 348 - 368.