GLOBAL JOURNAL OF PURE AND APPLIED SCIENCES VOL. 7, NO. 1, JANUARY 2001:37-42
 ISSN 1118-0579

TECHNICAL AND ALLOCATIVE EFFICIENCIES OF SMALL SCALE CASSAVA GROWERS IN FIVE SELECTED LOCAL GOVERNMENT AREAS OF CROSS RIVER STATE

S. O. ABANG, EKPE EKPENI, and W. W. USANI

(Received 20 July, 1999; Revision accepted 5 July, 2000)

ABSTRACT

In this paper, the single equation estimation technique using the ordinary least square (OLS) multiple approach was used to estimate the relationship between farm size and such factors as Capital, Labour and Education of Small Scale Cassava growers in five Local Government Areas of Cross River State. In addition, technical and allocative efficiencies as well as resource elasticities were estimated based on the results of the specified production functions.

The R^2 (which is the explanatory power) for the production function was .71. For the estimated marginal value product functions, the R^2 ranged from .29 to :40. Two of the explanatory variables in the production function, land and labour were significant at the 95% confidence level. The results of the marginal value products functions indicated an inverse relationship between productivity and farm size while technical and allocative efficiencies for land, show that the relatively smaller farm sizes were more efficient. Resource elasticities were also found to be inelastic implying that strategies aimed at decreasing resource prices to improve productivity of cassava growers would have minimal effect.

KEYWORDS: Technical, Allocative, Productivity, efficiency

INTRODUCTION:

The last two decades have witnessed increasing importance of cassava production and consumption in Nigeria. Infact, it has become a major occupation of most small scale producers and ranks the number one staple food crop for both the rural and urban communities. Its dominance in the economy is also often credited to its productive capacity which results in yields well over 31.2million kilogramme-calories per ha when compared to 2.4 million kilogramme-calories per ha for guinea corn and maize (IITA, 1990).

Productivity of these small scale cassava producers have been described in many studies as being characterised by low levels of resources utilization, low levels of productivity, low levels of capital investment, low returns of labour and capital and high levels of inefficiency in spite of its predominance in the nations' farming system (***Olayide*** *and Heady 1982, Khan and Maki, 1979*). Similar studies in the area by Juanankar (1975), Everson (1994), Liewely and Williams 91996) and Okon (1997) have tended to produce mixed or contradictory results when compared to the earlier studies indicated above. This latter class of studies are of the view that whatever inefficiencies exist are either the results of differences in objective functions or the absence of adequate information and insufficient skills. It is therefore the

S. O. ABANG, Department of Agricultural Economics and Extension, University of Calabar, Calabar, Nigeria
EKPE EKPENI, Department of Agricultural Economics and Extension, University of Calabar, Calabar, Nigeria
W. W. USANI, Department of Agricultural Economics and Extension, University of Calabar, Calabar, Nigeria

focus of this paper to:

1. determine the relationship between farm size, capital investment, labour and formal education and small-scale cassava growers and

2. estimate the technical and allocative resource efficiencies as well as resource elasticities of cassava growers in five Local Government Areas of Cross River State.

THEORETICAL FRAME WORK:

Helcrow (1980), defines the production function as the technical relationship between resources and output in any production process. *Byrns and Stone (1989)*, in the same vein indicate that a production function is a summary of the current state of technology and specifies the amounts of output that can be produced from various combinations of resources. The basic structures of a production function are the technical conditions, based on the state of art or knowledge and the limitations or constraints imposed on the supply of factors of production. In the production function, the productivity of labour, capital and other relevant factors, as well as the contributions to the total output caused by technical progress are actually measurable. When this is done, it becomes possible to attribute the growth of output to their proximate causes such as the growth of the labour force, the increase in the stock of capital (Investment), economies of scale etc. If these factor-product relationships are defined either in terms of ratios or indexes, they are then referred to as productivity. *Whitemash (1982)*, identifies two measures of productivity based on the above ratios or indexes. There are (1) the Partial Factor Productivity (PFP) and (2) the Total Factor Productivity (TFP). The earlier ratio relates one factor to output while the latter refers to the aggregate input ratios or indexes. From the above discussions, there is an obvious relationship between optimal productivity and efficient resources utilization. An increase in productivity will arise either by using the same amount of resources to [illegible] greater output or a reduction of the resource to produce the same level of output. Therefore, according to *Lloyd's and Heady (1982)*, and *Walters (1972)* productivity and efficiency measures are synonymous and that when efficiency is defined in terms of marginal productivity farmers would employ factors up to the point where the marginal productivity of the resources are equal to their prices ratio [illegible] factor cost in competitive output market.

Productivity of agricultural [illegible] therefore be related with the factors ables apriori: Land, Capital (human non-human) and Labour. productivity and farm size inverse relationship [illegible] positive relationship between farm size and labour productivity. These relationships are attributed to labour [illegible] farms (*Julien, Byiringiro and Reardon, 1996*). The relationship between farm size and economic efficiency, the sign on the coefficient is indeterminate, *(Barnum and Squire, 1978; Liewelyn and Williams, 1996)*. On the relationship between capital invested in agriculture and productivity, the signs on the coefficients are positive. These investments, involve the injection of either capital directly through the substitution of adaptive or new mechanical power for labour or the substitution of biological innovations for labour *(Roy and Blaise, 1978, Adams and Bumb, 1978; and Byiringiro and Reardom, 1996)*. These substitutions, whatever their source(s) have two major effects on production. The first is the output effect while the second is the substitution effect. The sum total of these effects result in the displacement of labour for mechanized power and an increase in investments in agriculture. The secondary effect of these changes in technology, is the creation of specialized skills through training in the sector. Infact, studies have found a strong positive statistical relationships between formal education and agricultural productivity *(Makeja and Reese, 1981, Liewelyn and Williams*

1996). On the relationship between efficiency and level of experience, measured n years, these same studies have also illustrated positive and strong correlation relationships.

1.1 METHODOLOGY:

Five predominantly Cassava growing Local Government Areas of Etung, Ikom, Yakurr, Ogoja and Yala with total farm size holdings ranging between .1 and 4.99 ha were selected for this study. Fifty (50) questionnaires were distributed per Local Government Area through the assistance of block extension agents (BEA) of the Cross River State Agricultural Development Project. Data were collected from this category of farmers between January and June, 1996. These extension agents collected and returned a total of (250) questionnaires which were used for the analysis. The productivity function and equations for the small scale cassava growers used for the study are specified below:

$$CA = F(LA, LB, CP, DE) \quad \text{----} \quad (1)$$

$$CA = \mu_0 + \mu_1 LA + \mu_2 LB + \mu_3 CP + \mu_4 DE + e_t \ldots \quad -(2)$$

Where:

CA = Cassava output in kg
LA = Farm size in ha
CP = Capital Invested in Naira
DE = Dummy Variable for Education

μ_0 is the coefficients of the intercept while $\mu_1, \mu_2 \ldots \mu_4$ are the true coefficients of the parameters estimated and e_t is disturbance term.

For the marginal value Products (MVPS) of Land, Labour and capital, the equivalent equations are represented in equations 3 through 5 respectively.

$$MVP_{LA} = b_0 + b_1 LB + b_2 CP + b_3 DE + U_1 \quad - (3)$$

$$MVP_{LB} = y_0 + y_1 LA + y_2 CP + y_3 DE + Z_1 \ldots -(4)$$

$$MVP_{CP} = I_0 + I_1 LA + I_2 LB + I_3 DE + N_t \ldots \quad - (5)$$

Where:

MVP_{LA}, MVP_{LB} and MVP_{CP} are the marginal value products of the specified parameters of land, labour and capital, b_0, y_0 and I_0 are the intercepts for equation (3), (4) and (5) respectively, while the bis, yi's and Iis are the true coefficients of the parameters of interest.

The data were subjected to analyses for the estimation of production functions and the marginal value products of the various resources using the ordinary least squares (OLS) technique.

III. RESULT OF THE OLS REGRESSION ANALYSIS:

Table 1, presents information on relevant characteristics of the small scale cassava grown in the five local government areas of interest of this study. From the table, it can be seen that the mean farm size, is 3.2ha, while the farm sizes ranged from .09 to 4.99 mean, capital invested in this class of farms is estimated to be N122.1.4 and capital invested ranged from as low as N277 to as high as N2603.8. The very small farms were rather more labour intensive (i.e used predorminantly farmily labour) what the relatively larger farms within this category depended on wild

TABLE 1

SELECTED SAMPLE CHARACTERISTICS OF SMALL SCALE CASSAVA GROWERS IN THE FIVE LOCAL GOVERNMENT AREAS OF CROSS RIVER STATE.

S/N	Characteristics	Unit of Measurement	Value
1	Farm Size	HA	
	i. Minimum	"	.09
	ii. Maximum	"	4.99
	iii. Mean	"	3.2
2.	Labour	Mandays	
	i. Minimum	8	80
	ii. Maximum	2	250
	iii. Mean	"	150
3.	Capital Invested	N (Naira)	
	Minimum	"	277
	Maximum	"	2603.8
	Mean	"	1221.4
4.	Types of Mgt.	Percent (%)	
	Self Managed	"	100
5.	Educ. Level	Percent (%)	
	i. No. School	"	25
	ii. Primary School	"	45
	iii. Secondary Sch.	"	20
	iv. Tertiary (Higher school Voc. University etc.)	"	10
6.	Source of Land Acquisition	Percent (%)	
	i. Inheritance	"	78.4
	ii. Lease	"	12.3
	iii. Pledge (include share cropping)	"	8.3
	iv. Outright Purchase	"	0

labour. The table also shows that the primary source of land acquisition for the cassava enterprises was from inheritance as only 78.4% of the farmers required its use by this sourc e. Educationally, about 70% of the farmers had with no primary education or completed only primary school. Twenty (20%) percent of the farmers had completed secondary education while the balance of the 10% had attended a farming tertiary institution or the other as explicated on the table.

Table 2 on the otherhand, contains the results of the multiple regression analyses of the cassava production function and the marginal value product functions of land, labour and capital as specified in equation 3, 4 and 5 respectively. The results from equation 3, 4 and 5 represent the economic efficiencies of the resources being investigated. They are the first derivative of the production function multiplied by the cassava output prices as indicated previously.

The R^2 used to determine the level of total variations that has been explained by the included variables in the equation 2 was .71 (table 2). It ranged from .29 to .40 for equations 3 through 5. From the above results the explanatory power of the cassava production function is satisfactory while those in equations 3 through 5 are not satisfactory, which means that there are other explanatory variable such as weather and technology and perhaps policy shifts by government which are needed for inclusion. However, the results in all the equations are significant as indicated by the various F-statistics on the table.

Out of the four explanatory variables in equation 2, Land, Labour and Capital have positive coefficients but the coefficient on capital was not statistically significant at the 95% confidence level. The sign on the Dummy coefficient was negative and statistically not significant at the same level as above. Capital is negative for equation 3 and positive for equation 4 and 5 on table 2. Based on the results in equation 4 and 5 it can be inferred that increases in farm sizes would have positive correlations with the marginal value products of labour and capital invested which is consistent with the results of *Junanakar (1975), Khan (1977) and Byringiro (1996).* However, the sign on the coefficient of capital invested (equation 3) and marginal value product of land was negative, implying an inverse relationship between capital and farm size in this small scale cassava enterprises that were investigated. This means that as more investments are made on these class of farms, the marginal values will decrease even if the coefficients were not statistically significant at the 95% confidence level. All the coefficients on formal education presented in equations 2 through 4 were also not statistically significant at the .05 probability levels except for equation 5 which was positive. The rest have inverse relationships with their dependent variables. This would therefore imply that the level of education was not important in cassava production enterprises probably because of the low level of technology and specialization that are required for entry into the production system. Perhaps the improved varieties, which were distributed in the middle of the 1980 decade have influenced significantly the entire farming system and which perhaps have been adopted in these farms without additional knowledge and at minimum explicit cost to the new entrants or expanding farm enterprises. For capital, its statistical insignificance in all the equations could be because; these farmers were usually cash trapped and therefore preferred to utilize family labour or work longer hours and these types of cost are not usually included in the production system The above situation would have had the effect of creating a downward bias on the true statistical significance of the investment variable. The relationship between the marginal value product of capital and formal education which was positive and significant at the 95% confidence level shows that improvements in the level of education could improve capital investments in these farms. Aprori, the results in equation 3 showing the relationship between capital and marginal value productio

would seem to compliment those of many studies which tend to portray that the small scale farmer is irrational in credit use, because part or all of its credit capital is diverted for other purposes instead of farming. Clearly then, to solve this irrational behaviour of farmers there is the need for more formal education.

TABLE 2

PARAMETER ESTIMATES OF CASSAVA PRODUCTION AND MARGINAL VALUE PRODUCTIVITY FUNCTIONS

EQUATION	DEPARTMENT VARIABLES	CONSTANT	INDEPENDNET VARIABLES				F. RATO	R^2	DW
			LA	LB	CP	DE			
2	CA	-0.145 (248.371)	371.0196** (160.169)	8.625* (2.409)	.0025 (0.58)	-30.879 (55.594)	7.97	71	2.21
3	MVP_{LA}	9727.697** (1626.77)	-	-3229.63* (1259.74)	-1.0635 (417)	-335.701 (446.591)	21.87	86	2.16
4	MVP_{LB}	117.351** (33.71)	38.979 (23.24)	-	.0008 (.00077)	- 2837 (6243)	23.39	.29	1.87
5	MVP_{CP}	6.331** (1.45)	134.29 (136.421)	.059 (.86)	-	.2242* (.1088)	22.14	.40	1.94

Table 3, presents the technical and allocative efficiencies of small-scale cassava growers, re-classified into five, based on Heady and Olayide's 1982 Classification. The result on technical efficiency shows, on the average, that as land increase among the small holders, their technical efficiency decline.

The allocation efficiency for the land tended to show signs of instability as efficiencies varied widely in each group, rising and falling between the classes. In fact, this variable had also the highest coefficient of variability as shown on table 3. Efficiency ranged from as low as 5.26 to as high as 73 for this class of farms. For instance, the size range of <1 ha had a mean of .69 ha and produced an average of 1228.25kg of garri while the range of 1.1-2, 2.1-3, 3.1-4, >4.1<4.99 had means of 1.4, 2.6, 3.2, 4.2 and produced 1771.4kg/ha, 704.11kg/ha, 985.57kg/ha and 789.74kg/ha respectively.

The converse however is the case with the allocative labour efficiency. Its allocative efficiency increased as the farm size ranges increased, beginning with 425 for the farm range of less than one ha to 1101 for the range that is greater than 4.1ha but less than 4.99ha.

TABLE 3

TECHNICAL AND ALLOCATIVE EFFICIENCIES OF SMALL SCALE CASSAVA GROWERS

S/N	DEPARTMENT VARIABLES	SIZE DISTRIBUTION (HA) (RANGE)					
		<1ha	1.1-2ha	2.1-3ha	3.1-4ha	>4.1<4.99	CV(%)
1.	Technical	1228.25	1771.25	704.11	985.57	789.74	
2.	Allocative						
	i Land	73	14.06	5.59	5.26	6.21	49.45
	ii B	425	620	790	920	1 101	60.0

Table 4 on the other hand, presents the production elasticity coefficients of all the explanatory variables. These elasticities range from .39 to .78, implying that all the variables unde study were production inelastic.

TABLE 4

ELASTICITY COEFFICIENT OF CASSAVA PRODUCTION FUNCTIONS

S/N	VARIABLE	ELASTICITY
1	Land (LA)	0.399
2	Labour (LB)	0.638
3	Capital (CP)	0.78
4	Education (FD)	0.695

Source: Computed from Results obtained from table 2 above.

IV. SUMMARY AND CONCLUSION

This paper set out to examine the technical and allocative efficiencies of small-scale cassava growers in five Local Government Area of Cross River State. The explanatory variables identified in the study include, land, labour, capital and education. The single-equation regression result shows that land, labour and capital had positive correlations with output while education had an inverse relationship. It was found that education had a positive relationship to the marginal value products of land and labour. In terms of technical efficiency, it was found that the very small farms were technically more efficient than the relatively larger ones within the small-scale

cassava growers. The converse was, however, found to be true in allocation efficiencies of labour. Based on the findings of the relationship between education and the marginal value product of capital it was proffered that to enhance credit delivery and its utilization efficiently there is the need to provide general education to the farmers. This policy instrument will tend to improve both capital inflow to the farmers and at the same time assist in its rational utilization.

Production elasticity were found to be less than unity while aggregate elasticity were greater than unity indicating the presence of economies of scale in cassava production enterprises. From the foregoing, it can be seen that small-scale cassava growers are economically efficient and to improve their levels of efficiencies, there is need to concentrate on policies which will influence intensive land utilization and management.

REFERENCES

Adams, J. and Bumb, B., 1978. Patterns of Agricultural Development in India: Determinants of Land Productivity in Maharashtra's District. The Developing Economies. Tokyo XVI(1) pp 80-88.

Byrns, R.T. and Stone, G.N., 1989. Economics. Scott Foresman and Co. Glenvier, Illinois, London, pp 463-989.

Conray, R.K., 1990. Agricultural Productivity: Measurement and Explanation. The Journal of Agricultural Economics Research, USDA Economic Research Service, 42(1) pp 27-31.

Helcrow, G.H., 1980. Economics of Agriculture. McGraw Hill Inc. New York, pp 79-120

International Institute of Tropical Agriculture (IITA), 1990. Research Horizon for Cassava as a Crop; IITA, Ibadan, Nigeria, 109-114.

Junanakar, P.N., 1975. Land Tenure and Indian Agricultural Productivity; The Journal of Development Studies. 6(1) pp 43-56.

Khan, M.H., 1977. Land Productivity, Farm Size and Return to scale in Pakistan Agriculture. World Development. Pergamon Press Ltd. Oxford 5(4) pp 317-330.

Khan, M.H and Maki, D.R., 1979. Effects of Farm Size on Economic Efficiency; American Journal of Agricultural Economics. U.S.A. 61(1) pp 64-69.

Llewelyn, R.V., and William, J.C., 1996. Non Parametric Analysis of Technical and Pure Technical and Scale Efficiencies for Food crop Production in East Java, Indonesia; Association of Agricultural Economists IAAE Elsevier 15(2): 113-121.

Markey, S.R., and Ress, H., 1981. An Index of Management Efficiency for Egyptian Agriculture; Journal of Agricultural Economics 32(2): 189-192.

Olayide, S.O. and Heady E.O., 1982. Introduction to Agricultural Production Economics. Ibadan University Press, Ibadan.

Roy, S. and Blaise, M.G., 1978. Farm Tructorization, Productivity and Labour Employment: A Case Study of India Punjab; World Development Studies, Oxford 5(4) 193-201.

Walters, A.A., 1970. An Introduction to Economics. 2nd Edition, Macmillian, London; 276-310.

Whitemash, D. 1982. Productivity. The Concept and its Uses in Economics. The Journal of the Economic Association. XVIII Part 2 (78): 43-51.