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INCOMES AND FACTOR PRODUCTIVITY IN NIGERIAN PEASANT AGRICULTURE

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PROBLEM SETTING

The Nigerian agricultural sector employs over 70 per cent of the population thus representing a substantially large market for the products of the industrial sector. But the extent of the market can be said to be circumscribed by the purchasing power of the agricultural population rather than by their number. The level of income in the agricultural sector also determines labour mobility between this sector and the industrial sector. As demonstrated by Todaro (10)† and empirically verified by many studies (4, 1), the rate of out-migration of labour from agriculture to the urban industrial sector is positively related to the differential between the income levels in the two sectors.

What is the level of rural income and how low is it relative to income in other sectors is not clear. Empirical evidence bearing on the level of earnings in the rural areas in Nigeria are at best scanty and whatever studies are available are often limited for use in policy formulations due to methodological problems. As shown in Table I, different researchers define and measure rural incomes in many diverse ways. As could be observed from the table, no consensus obtains in terms of what can be regarded as the correct estimate of the level of earnings in the rural areas. In nearly all of the studies referred to, gross farm income is measured as the value of sales of crops and livestock, while net income is the difference between sales and farm expenses. It is our belief that such a measure of farm income by not taking into account important variables as (*a*) income of dependants, (*b*) non-farm income, (*c*) value of home consumed goods, (*d*) value of seeds stored for replanting, and (*e*) value of agricultural products used as gifts will undoubtedly result in under-estimation of gross income.

TABLE I—ESTIMATED MEASUREMENT OF INCOME IN NIGERIAN AGRICULTURE

Researcher	Measurement used	Estimated earning (N£)
Flint (2)	Average net income per man-day	0·91
Nwosu (7)	Net farm income per man-day	6·24
Upton and Petu (11)	Net farm income per annum	4—392
Osifo (9)	Gross farm income	0·06—0·13
Norman (6)	Net farm income per annum	34·8

Note:—These studies obtained their net income figures by deducting from gross farm income, all operating expenses such as expenditure on seeds, fertilizers, labour and chemicals.

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† Figures in brackets denote references cited at the end of the paper.

In conducting surveys of farming activities one is confronted with scarcity of information and lack of records. Dealing with this problem necessitates a detailed collection of input-output data covering at least one entire growing season or a year. This requires a substantial amount of resources which are not always available to the investigators in this field.

A second problem of the above-mentioned studies is the valuation of non-marketable inputs or inputs that are not sold or bought in the market. A visible example of this are the seeds or planting materials which a farmer keeps from his previous harvest for use next season. The choice of whether to value it as this season's output or next season's input depends largely on the whims of the researcher and the period the survey covers. Be that as it may, what is important is that this volume of output (or input) be valued at a given point in time. Generally during the harvest time, agricultural product prices are often lower than the yearly average and towards the beginning of the planting season, they are higher. This means that the value of seeds stored for planting by a farmer is likely to appreciate in value over time. Should the seeds be valued at its current price or its acquisition cost? It is our approach that the latter provides the appropriate measure.

The relationship between output and input is not as straight-forward as many investigators seem to think. It is too simplistic to impute value to outputs and inputs, find the difference and call it net returns. Admittedly, such an accounting technique is correct but economic analysis of peasant activities requires a more rigorous approach.

This study aims at presenting a rigorous methodological approach to measurement of factor productivity and incomes in the Nigerian agricultural sector. Our method of analysis relies basically on the conventional neo-classical theory of production (3).

THE STUDY AREA

The Nigerian agricultural population can be regarded as homogeneous with respect to farming techniques—which is mainly labour intensive. Similarly, farm sizes are generally small all over the country, being on the average between three to ten hectares. With respect to other characteristics the major source of variation seems to be due to ecological factors which determine what crops are planted in which area (8). This is especially true with respect to tree crops such as cocoa, palm tree and coffee. All over the country, one finds similar food crops being grown. From north to the south the basic staple food crops are tubers and cereals. These crops are cultivated in small parcels of land and with the same technique.

We therefore define our sampling population as the food crop producers in the country, who constitute over 80 per cent of the Nigerian agricultural population. And since the type of crops they produce and their method of operation is invariant to location any enumeration area or locality could be as good as the other. In other words, we expect that the variance due to location to be negligible. We define our enumeration area as five local government council areas in Imo State. The five areas—Okigwi, Isikwato,

Mbano, Ohazara and Etiti—are located in latitude 5.30 and 7.50 north in the rainy forest zone of Nigeria. The farm population in these areas ranges from 12,000 farm families in Etiti to 20,000 in Mbano. The population density is about 500 persons per square kilometre.

For the purpose of this study, we define our sample size to be a random 3 per cent of the food producing farmers in each of the enumeration areas. To obtain this sample size a list of farming households in the area was obtained from agricultural extension agents. Discussions with these agents indicated that only about half the population was actively engaged in food production—the rest being in commercial export crop production or in petty trading. From the frame thus compiled, a random sample of farmers was drawn. The size of the sample as well as the choice of location was prescribed by logistic, economic and social factors. Important among these are the limited resources available for the survey, access to the enumeration areas and barriers due to language and customs. To overcome some of these factors field enumerators familiar with the people and their customs were employed for the survey. Assistance was also sought from government extension workers located in the area.

DATA COLLECTION

Studies of farming systems in peasant agriculture require a painstaking effort and close observation and record keeping which is not in general performed by the farmers themselves. In initiating this survey our approach involved the collection of input-output data, information on stocks of equipments and farming materials as well as inventories of farm products in each household. To do this a stock form was used to record information on equipment, inventories, etc., while a flow form was used to collect the input-output data. At the onset of the production season, each farmer was visited twice a week by an enumerator. This twice-weekly visits lasted throughout the peak production and harvesting period (between March and May, and October and November) and provided information on capital and labour utilization, the inputs purchased by the farmer and the commodities harvested and sold or consumed at home. Between June and September, and between December and February, the visits were reduced to once a week while the type of information collected however remained the same.

For the purpose of this study, output (Q) is defined as the sum of the value of farm produce sold on the market, those consumed by the farm family and/or given out as gifts and those reserved for planting. Labour input (L) encompasses family labour input, that is the labour input of adult members of the family and expressed in man-days. Capital stock, expressed in value terms, is the sum of equipment (cutlasses, hoes, knives, baskets, etc.) and buildings used mainly for production activities. Expenditure on purchased inputs (E) is the sum total of cash outlays by each farm family on seeds, fertilizer, insecticides and hired labour. Lastly, we define capital services (R) as follows:

$$R_i = \frac{rV_i}{1-(1+r)^{-n}} \text{ where}$$

R_i is the constant annual capital service flow or the rental value of capital, V_i is the acquisition cost of the asset, r is the rate of discount (assumed to be 20 per cent—the rate of borrowing in non-institutional capital markets in the country (5) and n is the life expectancy of the capital.

THE PRODUCTION PROCESS

As mentioned earlier, our sample farmers, being limited to those growing food crops, exclude those engaged in export crop production. While farmers producing for export have for years benefited from advances in agronomic research, input subsidies and extension service counselling, unfortunately food producing farmers received little or no attention from the government until recently. Among our sample farmers the main crops grown are maize, rice and tubers which are, in most cases, the low yielding varieties obtained from local sources.

To the extent that yields per hectare of land is an important determinant of the revenue accruing to a farm family, this reliance on and use of traditional varieties of planting materials will no doubt affect their earnings. Moreover, given the traditional varieties, characterized by little or no response to fertilizer application, and the scarcity of land in these areas and the consequent shortage of the fallow period, attempts by the farmers to increase output per hectare either by the application of fertilizers or by cultivating their plots more intensively could only result in rapid diminishing returns and a high ratio of cash expenditure (or inputs) to total revenue. As shown in Table II, the proportion of gross farm sales going to the purchase of inputs (especially hired labour) ranged from 56 per cent in Ohazara to 80 per cent in Okigwi for each farm family.

TABLE II—PROPORTION OF EXPENDITURE ON INPUTS TO GROSS SALES PER FARM FAMILY

Village	Expenditure/gross sales (per cent)
Okigwi	80·2
Mbano	69·9
Isikwato	69·9
Ohazara	56·3
Etiti	74·0

Source: Survey data.

The production activities in the area of study, in consonance with the practices in other parts of the country, are limited to land clearance, planting, weeding and harvesting and are carried out by the use of hand tools such as hoes and cutlasses. This method of production, basically labour intensive in nature, is dependent on the availability of family and hired labour.

Our estimated factor proportions presented in Table III show that little amount of capital relative to labour is employed in all the five areas. The labour intensive method of production is also reflected in the output-labour ratio which averaged about one and half naira (N£ 1.50 or $1.00) for each man-day worked. The output-land ratio ranged from nearly 160:1 to over 200:1. Analysis of variance when applied to the data, however, showed that there is no significant variation between the villages with respect to the output-land ratio.

TABLE III—FACTOR PROPORTIONS IN THE ENUMERATION AREA

Factor proportions	Okigwi	Mbano	Isikwato	Ohazara	Etiti
Output-labour* ratio	1·47	1·45	1·65	1·47	1·57
Output-capital service ratio	64·27	44·31	46·12	93·32	99·55
Output-land ratio	213·76	155·66	171·62	152·49	168·44
Capital-labour ratio	0·23	0·03	0·04	0·02	0·02

* Labour here is defined as the sum of family and hired labour input measured in man-days.
Source: Survey data.

PRODUCTION RELATIONS

The neo-classical production, often specifiedas $Q=f(X_1, X_2 \ldots\ldots X_n)$ where Q is output and X_i $i=1 \ldots n$ are the inputs can provide, when fitted to the input-output data generated from the survey, indications of the factors determining the supply of food products, scale economies and the marginal productivities of the inputs used.

In analysing the data a Cobb-Douglas production function commonly specified as $Q = AX_1^{\alpha} X_2^{\beta}$ is used. The variables used in this study (and which have been defined earlier) included output (Q), expenditure on purchased inputs excluding hired labour (E), value of capital services (R), size of farm (L), and total labour input (family and hired labour in man-days) (N).

The values of the parameters of the Cobb-Douglas function were obtained by using ordinary least squares techniques to estimate the following formulation of the function:

$$\text{In } Q = \text{In } A + \beta_1 \text{ In } E + \beta_2 \text{ In } N + \beta_3 \text{ In } R + \beta_4 \text{ In } L + e.$$

The results of the Cobb-Douglas production function analysis for the five locations are summarised in Table IV. Judging by the value of the R^2 it appears that the function provides a good fit for the underlying data especially for a cross-section study of this nature. Empirical evidence of increasing returns to scale appears only for two of the five study areas (Okigwi and Isikwato). Another important result evident from the analysis is the variation with respect to the estimated coefficients. With respect to family labour, the elasticity coefficient (β_2) was negative in Mbano, almost zero in Ohazara but as high as 0.69 in Okigwi. The coefficient of capital service in general was not significantly different from zero. Similarly, the elasticity coefficient of farm size was not significant in any village—an indication that proportionate increases in capital and land may not necessarily result in a more than proportionate increase in farm output in these areas.

TABLE IV—ESTIMATED COEFFICIENTS OF THE COBB-DOUGLAS PRODUCTION

Area	Expenditure on inputs			Family labour (man-days)			Capital services			Size of farm (hectares)			Constant	R^2	$\sum_{i=1}^{4}\beta_i$	n
	β_1	AP	MP	β_2	AP	MP	β_3	AP	MP	β_4	AP	MP				
Okigwi	0·22 (0·15)	1·25	0·27	0·69* (0·15)	1·47	1·01	0·03 (0·10)	64·27	1·93	0·07 (0·10)	213·76	14·96	—10·29	0·56	1·01	40
Mbano	0·66 (0·07)	1·50	0·99	—0·08 (0·11)	1·50	—0·12	0·07 (0·36)	44·31	3·10	0·30 (0·13)	155·66	46·70	2·37	0·81	0·95	50
Isikwato	0·52*	1·43	0·74	0·19 (0·16)	1·65	0·31	0·13 (0·10)	46·12	6·00	0·34 (0·18)	171·62	58·35	1·37	0·77	1·18	45
Ohazara	0·82*	1·78	1·46	0·03	1·47	0·04	0·00	93·32	0·00	0·13	159·49	20·73	1·84	0·86	0·98	35
Etiti	0·44* (0·09)	1·35	0·59	0·34 (0·23)	1·57	0·53	0·09 (0·05)	99·55	6·97	0·02 (0·15)	168·44	3·37	1·57	0·76	0·87	40

AP = Average product (in value terms)
MP = Marginal product (in value terms)
} at mean levels.

Figures in parentheses are standard errors.

* Significant at 5 per cent leve .

n = Number of observations.

Using the relationship $MP_i = \gamma_i (AP_i)$ where MP_i is the marginal product of input i, γ_i its elasticity coefficient and AP_i its average product, the marginal productivity of each input was calculated. An examination of Table IV shows that the MPs varied by location and by type of input. Among the highlights of the estimates, (*a*) the marginal product of family labour was relatively low, being negative in one of the villages. (*b*) The MP of capital services was zero in one of the areas but greater than one in the remaining four locations. (*c*) With respect to farm size, its marginal productivity appears high in nearly all the villages.

RETURNS TO FAMILY LABOUR

In this section, an attempt is made to estimate the returns to peasant family labour and compare the estimates with earnings in other sectors of the economy. Returns to farm family labour (a measure of the real income of farmers) is defined as the difference between each farm family's value added and the opportunity costs of its annual capital services and land, and its annual non-family labour services. To obtain the opportunity costs of the inputs land and non-family labour, each input's value of marginal product was multiplied by the total amount of the input employed for the year by each household. The capital service value was obtained (as defined earlier)by using a discount rate of 20 per cent, the assumed opportunity cost of capital in Nigeria.

A summary of the computed returns shown in Table V indicates that the average returns ranged from as low as N£ 8.55 in Isikwato to as high as N£ 260 in Etiti. In nearly all the villages many farm families had negative returns. For example, in Isikwato 62.5 per cent of the farm families had negative returns. Farm families making above N£ 300 formed as much as 40 per cent in Okigwi and as small as 2 per cent in Mbano. The observed low returns to the farm families in the five locations of the study can be ascribed to

TABLE V—DISTRIBUTION OF FARM FAMILIES BY EARNINGS AND LOCATION

Returns (N£)	Okigwi		Mbano		Isikwato		Ohazara		Etiti	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
0 and below	1	1·5	7	12·7	25	62·5	11	31·4	4	10·0
0-100	9	22·5	21	38·2	11	27·5	20	57·1	—	—
101-300	14	35·0	26	47·3	1	2·5	4	11·4	21	52·5
301-500	14	35·0	1	1·8	1	2·5	—	—	14	35·0
501-700	2	5·0	—	—	1	2·5	—	—	1	2·5
701-900	—	—	—	—	1	2·5	—	—	—	—
> 900	—	—	—	—	—	—	—	—	—	—
	40	100·0	55	100·0	40	100·0	35	99·9	40	100·0
Mean returns (N£)	255·60		104·28		8·55		25·13		260·50	

(*a*) the high proportion of their gross sales going to hired agricultural workers, (*b*) low land productivity and the low yielding varieties of planting materials commonly used in the areas. As shown earlier (Table II), the proportion of gross sales that goes to purchased inputs ranged from 56 to 80 per cent in these areas.

Generally, the farmers in the five study areas plant similar crops but the fertility of their land varies from one area to the other as evidenced by the length of rotation periods on the farmer's plot. In Mbano, Isikwato and Ohazara little rotation is done because of the high man-land ratio; rather plots are intensively cultivated throughout the year. With little or no application of fertilizer it is expected that yields per hectare will be low in these areas and hence the level of earnings.

In order to compare returns in peasant farming with returns in other sectors of the economy, Table VI was adapted from a study of returns in the informal sub-sector in Western Nigeria, the same method of calculation being used in both the studies.

TABLE VI—AVERAGE RETURNS TO FAMILY LABOUR IN THE INFORMAL SUB-SECTOR IN NIGERIA

Occupation	Average returns (per annum) (N£)
Tailoring	251·50
Furniture craft	907·32
Auto repairs	379·26
Blacksmithing	259·90

Source: Mabawonku (5).

The average returns in Okigwi and Etiti compare favourably with returns to tailoring, and blacksmithing. With respect to other occupations such as furniture craft and auto repairs the returns in all the five study areas were pathetically low. In the urban large scale industrial sector of the country, the average (institutionally determined) wage rate of an unskilled worker is estimated at N£ 720 per annum. Thus when compared with returns in non-farm employment the opportunity cost of farm employment seems relatively high. This perhaps explains why so many youths in the country are abandoning the farm to look for jobs in the urban areas. Indeed it is now a common feature of the Nigerian economy to have depopulated rural areas and congested cities.

CONCLUSIONS

The main highlights of our findings are as follows: (*a*) Little amount of capital relative to labour is employed in the Nigerian peasant production. (*b*) Cash expenditure, the most importance of which is payment to hired workers, constituted a large proportion of the revenue of the farmers. (*c*) Returns to family labour are generally low when compared with returns in other non-agricultural enterprises or employment. The implication of these findings is that unless agricultural productivity in food production is raised,

through the infusion of modern technology such as improved seed varieties and fertilizer, farm returns will remain low and out-migration from agriculture will continue.

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