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OIL PALM HECTARAGE RESPONSE TO CHANGING  
PRODUCT AND INPUT PRICES IN THE SOUTH-SOUTH ZONE  
OF NIGERIA: 1975 - 1996

I.C. Idiong, D.S. Udom, G.N. Odok

*Department of Agricultural Economics & Extension  
University of Calabar*

and

E.J. Udoh

*Department of Agricultural Economics  
University of Ibadan*

## ABSTRACT

*This study analyses the influence of product and input prices on hybrid oil palm hectarage expansion by smallholder farmers in the South-South zone of Nigeria between 1975 and 1996, using Akwa Ibom State as a case study. A single equation multiple regression, involving the use of the ordinary least squares (OLS) estimating technique was used in the analysis.*

*The findings indicate that, agricultural policy instruments aimed at engendering increased cultivation of hybrid oil palm by smallholder farmers should also be geared towards reduction in investment costs which must include subsidy on inputs among others.*

JEL classification: Q15, Q18, R14, R32

## 1. Introduction

THE dwindling resources from the oil palm industry has been a source of concern to the government of Nigeria. Before crude oil was discovered in the early 70s, the industry had been a major foreign exchange earner for the country. This industry once generated the funds used to finance the development of projects in the then Eastern Region of Nigeria and the South Eastern State in particular, through the commodity board marketing activities. Production was mostly from semi-wild oil palm groves which were exploited by millions of small-scale farmers who made little or no effort to rehabilitate the groves due to inadequate capital (Olomola, 1991).

Semi-wild oil palm groves are low-yielding, and difficult to maintain and harvest. Their excessive height and the dwindling labour force – a consequence of rural-urban migration – have made the maintenance and harvesting of these

palms rather costly. To turn around the fortunes of the oil-palm industry, government initiated a number of development projects aimed at encouraging the planting of hybrid oil palm by smallholder farmers. This made it possible for seedlings and fertilizer to be provided free of charge or at subsidized rates.

In the then Cross River State (Akwa Ibom State inclusive), the participants of the oil-palm development scheme (ODS), were given cash subsidies in addition to free seedlings and fertilizer. The Nigerian Palm Produce Board (NPPB), established in 1977, provided farmers with free seedlings and fertilizer, but the low producer prices offered the farmers made them unenthusiastic about expanding the hectareage under oil palm cultivation, given that there existed alternative uses for land in the production of arable crops such as cassava, yams, etc., as well as land tenure problems in the state. Similar findings were reported by Zeven (1967).

The abolition of the NPPB in 1986, when the Structural Adjustment Programme (SAP) – based on market forces, which determined the prices of agricultural inputs and products domestically consumed and exported – was introduced to motivate farmers to increase the cultivation of most cash crops, including oil palm. The ban on importation of vegetable oils in 1986 was also expected to result in an increase in the prices of locally produced edible vegetable oil and oil seeds, and consequently lead to increased cultivation of hybrid oil palm, coconut, soya beans, beniseed, etc.

Akwa Ibom, which is the most important oil palm producing state in the country (Udom, 1986), was expected to increase the cultivation of hybrid oil palm seedlings.

Udom (1988) reported a declining trend in the planting of improved hybrid oil palms during the 1975 to 1985 period under the Cross River State Oil Palm Development Scheme (ODS) despite rising domestic and world prices for oil palm products (palm oil and kernel). He also reported that between 1986 and 1996, the prices of seedlings were constantly on the increase and a lot of farmers were discouraged from cultivating hybrid oil palm.

In spite of the increasing demand for oil palm products in the country, very few studies have been carried out to ascertain which government agricultural policy instruments can bring about an increase in the number of hectares cultivated with tree crops in Nigeria generally, and the oil palm in Akwa Ibom State in particular. This study was carried out to ascertain the influence of product and input prices on hectareage expansion by smallholder oil palm growers, who form the bulk of the producers in the state.

Several factors influence the decision of farmers to either increase or maintain their cultivated hectareage of crops, especially tree crops. These include, product and input prices, institutional factors, profitability of competing enterprises, and the weather (Tomek and Robinson, 1978). Several studies carried out in Ghana, Uganda and Nigeria have shown that economic factors,

resource allocation decisions. The difficulty they have faced in constructing a model has been defining the prices and costs to which farmers respond. The price variables often used include pre-sowing and post harvesting prices, real prices, lagged prices as proxy for expected prices for the present year, price ratios, and moving averages.

Farmers' price expectations, obtained by the use of distributed lags, are often based on the gestation period of the crops. For arable crops, a one-year lag is often used while for perennial crops, it varies between 3 and 5 years for oil palm and 4 to 8 years for rubber and cocoa (Nerlove 1956; Helleiner, 1977; Madhavan, 1972; Abang, 1984).

2. Model

A Nerlovian model portraying the structural relationship of hectareage response to input and product prices used by Stern (1965) and Saylor (1974) which was modified and adapted to estimate the oil palm hectareage response to changing input and output prices in the zone over the study period was specified thus:

$$Ho_t - iHo_{t-1} + L(Ho_t^* - Ho_{t-1}) \dots \dots \dots (1.1)$$

$$Ho_t = f(Po_{t-5}^*, Ho_{t-1}, Ps_t, Pg_{t-1}^*, T, D, U_t) \dots \dots \dots (1.2)$$

where:

- $Ho_t^*$  = expected hectareage cultivated with hybrid oil palm in year  $t$
- $Ho_{t-1}$  = actual hectareage cultivated with hybrid oil palm in year  $t-1$
- $Po_{t-5}^*$  = expected real producer price of palm oil in year  $t$ , (this was taken as moving average price for the past five years)
- $Pg_{t-1}^*$  = expected real price of garri in year  $t$  (proxy for price of cassava being an alternative crop)
- $Ps_t$  = price of hybrid oil palm seedlings in year  $t$  (This is the most important input in smallholder oil palm production after land).
- $T$  = trend (indicating time)
- $L$  = coefficient of hectareage adjustment
- $D$  = dummy, indicating impact of government policy during the two periods from 1975 - 1985 = 0  
1986 - 1996 = 1
- $U_t$  = error term

To arrive at the real producer price of palm oil used in the analysis, real prices lagged three and five years were tried, but the past five years moving average prices appeared satisfactory.

By substituting the linear functional form of equation (1.2) into equation (1.1), assuming a one-year lag as expected price of garri (proxy for price of cassava being an annual crop) and the past five years moving average price for palm oil, the estimating equation in reduced form using the linear and log linear forms were obtained as follows in order to obtain the lead equation.

$$Ho_t = b_0 + b_1Po_{t,5} + b_2Ho_{t-1} + b_3Ps_t + b_4Pg_{t-1} + b_5T + b_6D + e_t \dots \dots (1.3)$$

$$\ln Ho_t = \ln b_0 + b_1 \ln Po_{t,5} + b_2 \ln Ho_{t-1} + b_3 \ln Ps_t + b_4 \ln Pg_{t-1} + b_5 \ln T + b_6 \ln D + e_t \dots \dots (1.4)$$

**3. Sources of Data**

Oil palm hectarage and seedling prices data were obtained from the records of the Tree Crop Unit of the Ministry of Agriculture and Natural Resources in Cross River and Akwa Ibom states. Prices of garri and palm oil were obtained from the Economic Planning Unit of the Ministry of Finance and Economic Planning in the two states.

**4. Method of Analysis**

The analytical tool used for the study was the single equation, involving the use of the ordinary least squares (OLS) multiple regression technique. This was preferred to other methods because it has less computational complexities (Olayemi and Olayide, 1981). To take care of the problems of multicollinearity, autocorrelation, etc., that may result from the inability to assess the reliability of parameter estimates, the following econometrics and statistical tests were carried out. The Durbin-Watson test, which was adjusted to in-statistic as a result of the inclusion of a lagged endogenous variable (Durbin, 1970; Dittoh and Ogunfowora, 1978), the F-test, student t-test, coefficient of determination ( $R^2$ ) and adjusted coefficient of determination ( $\bar{R}^2$ ).

**5. Results and Discussion**

**5.1 Linear functional form estimates**

$$Ho_t = 1675.40 - 0.20Ho_{t-1} + 0.210Po_{t,5} + 30.33Ps_t - 31.52Pg_{t-1} - 86.44T - 191.01D_t \dots (1.5)$$

(924.40) (0.242) (46.82) (30.40) (19.35) (59.75) (383.15)

$R^2 = 0.76, \bar{R}^2 = 0.61$   
 $F\text{-ratio} = 5.16, DW = 1.78, h = 6.77$

**5.2 Double logarithmic functional form estimates**

$$Ho_t = 11.35 + 0.661 Po_{t,5} - 0.573 Ho_{t-1} - 0.288 Ps_t - 0.569 Pg_{t-1} - 0.65 T - 1.19 D_t \dots (1.6)$$

(2.41) (0.59) (0.24) (90.12) (0.19) (0.22) (0.32)

$R^2 = 0.95, \bar{R}^2 = 0.92$   
 $F\text{-ratio} = 32.15, DW = 1.87, h = 1.86$

Standard errors in parentheses

\* Significant at the 1 per cent level

\*\* Significant at the 5 per cent level

Equations (1.5) and (1.6) show the estimates of the two functional forms used in the analysis. The results of the double logarithmic function produced better estimates and hence, were chosen as the lead equation.

The coefficients of the real producer price of palm oil ( $Po_{t,5}$ ) and price of seedlings ( $Ps_t$ ) carried the expected positive and negative signs respectively. The price of garri lagged one year ( $Pg_{t-1}$ ), the dummy ( $D$ ) and the trend ( $T$ ) variables carried negative signs. The coefficient of determination ( $R^2$ ) was 0.95 indicating that the variables explained about ninety five per cent of the variability in the dependent variable. The inclusion of the lagged hectarage ( $Ho_{t-1}$ ) improved the goodness of fit as was obtained by Saylor (1974). The  $F$ -ratio (32.25) indicated the overall significance of the equation. The Durbin-Watson statistic which was modified to h-statistic as a result of the inclusion of a lagged endogenous variable did not indicate any problem on serial correlation ( $h = 1.86$ ).

The correlation between the price of palm oil and the trend variable ( $r = -0.57$ ) indicated a slight case of multicollinearity. This however was not a serious problem. The coefficients of the price of seedlings ( $Ps_t$ ) and the real price of garri ( $Pg_{t-1}$ ) carried negative signs and were significant at the 5 per cent level. By implication, the increase in the price of hybrid oil palm seedlings as a result of the removal of subsidy, must have discouraged the expansion of oil palm hectarage by smallholder farmers, while the higher prices of garri and the shorter gestation period of cassava must have engendered the devotion of the limited landholdings to cassava production. This may be expected since soils in the oil palm belt are also suitable for the cultivation of arable crops such as cassava, yam etc. (Agiobenebo, 1995). The negative sign of the coefficient also indicates that cassava is competing with the oil-palm for land in the area.

The dummy variable was significant and carried a negative sign indicating that government policy during and after SAP had a negative impact on oil palm plantation development by smallholder farmers. It will be recalled that during the 1975 to 1985 period, the federal government provided farmers with free seedlings and cash subsidies, but with the withdrawal of this subsidy, in the

period between 1986 and 1996, and the concomitant increase in the prices of inputs, most farmers were not able to pay for the required inputs. The trend variable ( $T$ ) also carried a negative sign and was significant at the 5 per cent level. This confirms Udom's (1988) assertion that, there has been a declining trend in the hectarage of cultivated hybrid oil palm in the state. The coefficient of the real price of palm oil is not significant at the 5 per cent level. This implies that smallholder oil palm growers in the state have not been very responsive to the increase in the real price of palm oil over time. This may indicate that product price alone may not be the only economic incentive needed to encourage investment in hybrid oil palm plantation development.

Reducing the cost of oil palm plantation development via input subsidy may be a complementary short run option that could engender an increase in the number of hectares cultivated by smallholder oil palm growers.

**Table 1. Short-Run and Long-Run Hectarage Elasticities**

Explanatory Variable	Short Run	Long Run
$P_{O,t-5}$	0.66	1.55
$P_{G,t-1}$	-0.57	-1.33
$P_s$	-0.288	-0.67
Coefficient of adjustment	0.427	

Table 1 shows the short-run (SR) and long-run hectarage elasticities with respect to the important explanatory variables at their mean values. The coefficients of the explanatory variables are their elasticities in the logarithmic functional form in the short run. The results indicate that hectarage elasticity with respect to the price of palm oil is 0.661. This implies that a unit increase in real price of palm oil will lead to 0.661 per cent increase in the number of hectares cultivated, while a unit increase in the price of garri will lead to 0.569 per cent decrease in hectarage cultivated with hybrid oil palm.

Also in the short run, a unit increase in the price of hybrid oil palm seedlings will lead to 0.288 per cent decrease in the number of hectares cultivated with hybrid oil palm in the state. The long-run elasticities were obtained by dividing the short-run values by the coefficient of adjustment ( $1 - b_2$ ); where  $b_2$  is the coefficient of the lagged hectarage. The long-run elasticity with respect to the real price of palm oil was 1.55, implying that a unit increase in the real price of palm oil would lead to 1.55 per cent increase in the number of hectares cultivated. A unit increase in the prices of seedlings and garri would lead to a

0.67 per cent and 1.33 per cent decrease respectively in hybrid oil palm hectarage in the long run.

## 6. Conclusion

The findings from this study indicate that the provision of subsidized inputs (especially oil-palm seedlings) to farmers in the area, enhanced the cultivation of hybrid oil palm. It was also shown that cultivated oil palm hectarage will increase as oil palm seedlings and garri prices decrease.

## 7. Policy Implication

The results of the study suggest that, government agricultural policy instruments designed to encourage hectarage expansion by smallholder oil palm growers in the area, should also consider the provision of input subsidies. This stems from the fact that smallholder oil-palm growers are not encouraged to expand the number of hectares cultivated because of an increase in product price alone, but may also consider the opportunity cost of land.

## 8. Recommendations

1. Government should subsidize inputs oil palm cultivation. The subsidy will go a long way in reducing the cost of production and hence engender smallholder oil palm development (planting and rehabilitation) in the state.
2. The problem of instability in government agricultural policies over time should be properly addressed particularly where tree crop development is concerned, since it involves long term investment.
3. The take-off of the commodity exchange programme planned by the federal government should be expedited. The programme will not only bring about stability and transfer of risks by farmers, but will also provide the means for farmers to obtain information about prevailing prices of agricultural export commodities in general and oil palm products in particular.

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