DETERMINANTS OF RICE OUTPUT AMONG ADP CONTACT FARMERS IN MINING AND NON MINING LOCATIONS OF IVO LGA OF EBONYI STATE, NIGERIA

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ABSTRACT
The study analyzed factors affecting rice output among Agricultural Development Programme (ADP) contact farmers in the mining and non mining locations of IVO LGA of Ebonyi State, Nigeria. Multistage random sampling technique was used to select agricultural circles and rice farmers. The sample size was 120 rice farmers (60 mining area rice farmers and 60 non mining area rice farmers). Data for the analysis were collected from a structured questionnaire. The result indicates that mean ages of mining area rice farmers was 36.70 years, while non mining area rice farmers had 39.50 years. The mean farming experience for both farmers were 13.50 years (mining area rice farmers) and 14 years (non mining area rice farmers) with farm sizes of 1.10 and 1.30 hectares for mining area rice farmers and non mining area rice farmers respectively. The extension contact for both farmer groups was 2 times per month. The multiple regression (Exponential) estimates of the determinants of rice output in the two locations showed that the coefficients of farming experience, farm size, farm income and extension contacts as well as age in the non mining areas affected rice output. When the two groups were pooled, farm size, farm income and extension contacts significantly affected rice output at given levels of probability. The results of the test of equality between the two groups revealed that estimated relationships differed significantly, as the chow test showed that F – calculated (56.57) is greater than the F – tabulated (6.47). Review of Land Use Act of 1990, increased extension contacts, subsidy on farm inputs and formation of farmer groups were advocated for increased rice production and thus encouraging youths to engage in the business.

Keywords: Rice output, ADP farmers. Mining and Non-Mining

INTRODUCTION
Nigeria is the largest producer of rice in West Africa producing over 40% of the regions total production (Singh *et al*., 1997 and FAOSTAT (2007). In the past 30 years, production has increased six folds with Nigeria producing 3.3 and 3.6 million tons of paddy rice in 2000 and 2005 respectively (FAOSTAT, 2004 and 2007). Africa accounts for only about 2% of the world's output of rice. Current production stands at 2.8 million tons with a deficit of 1.6million tons excluding the quantity smuggled through the porous borders (USAID, 200; Hirose and Watatuski 2002). Rice (*Oryza sativa*) is a staple food for about 2.6 billion people in the world (Spore, 2005). The Asian continent account for about 92 percent and 3 percent for Africa (Spore, 2005). During the past three decades, the crop has seen a steady increase in demand and its growing importance is evident given its important place in strategic food security planning policies of many countries (Norman and Otoo, 2002). The Nigerian rice sector has a lot of potentials for increased rice productivity as the country is blessed with abundant rice growing environment. Rice is grown in paddies or on upland fields depending on the requirements of the particular variety, there is also limited mangrove cultivation. The cultivable land to rice is spread over five major ecologies; upland, inland or shallow swamp, irrigated rice, deep water or floating rice and tidal mangrove of swamp. The latter is not fully developed because there is a lack of appropriate technology (Singh *et al*., 1997; FAO 2008). Upland rice production is practiced on different ecologies by majority of farmers due to it less tedious operation. Upland contributes substantially less the total rice output in relation to its share in total area, but still accounts for an important means of rice production (WARDA 2003 and

Oyewole *et al.,* 2010). In West African sub region, Nigeria has witnessed a well established growing demand for rice as propelled by rising per caput consumption and consequently the insufficient domestic production had to be complemented with enormous import both in quantity and value at various times (Erenstein *et al*., 2004 and Daramola, 2005).

Majority of rice producers in Nigeria are small holders with average size of less than two hectares and can be found growing in mixtures on farms. In Nigeria, out of 4.6 million hectares available for rice production, only 1.7million hectares are put to rice cultivation, despite that its production is labour intensive and labour represents major production costs (Nwachukwu *et al.,* 2008). The successive programmes launched to increase rice production have not been able to reduce the resulting rice deficit. The imposition of a ban on rice import from 1985 to 1995 and ensuring increase in the relative price against other major staples boosted rice production mainly through area increase. Past policies did not help local rice producers to secure significant market share and imports have increased since the lifting of the ban and successive increase in the import tariff from 50% to 100%. Imported rice represents more than 20% of agricultural imports and half of total rice consumption (WARDA, 2003). Massive importation of food especially rice in recent years is an indicator of poor state of nations agricultural and technologies development, occasioned by poor productive propensity of the farmers. Many studies on rice production were geared towards maximizing profit, ignoring socio- economic factors of the farmers which influence and contribute to rice output. In view of the above, this study tends to determine socio-economic factors affecting rice output in IVO LGA of Ebonyi State, Nigeria. The specific objectives of this paper are to: describe selected socio-economic characteristics of rice farmers in miming and non mining areas, determine the factors that affect rice output in the two locations, compare the factors that affect rice output in the locations and ascertain the difference in rice output between the two locations studied.

MATERIALS AND METHODS

The study was conducted in IVO Local Government Area of Ebonyi State, Nigeria, which is an agricultural block in Ebonyi South Agricultural zone. The Local Government Area lies between Latitude 5^0 and 6^1North and Longitude 7^0 and 8^1 East of the Equator with annual rainfall of about 1,200 to 1,600mm and temperature range of 27^0 C to 33^0 C. The Local Government is located in south-west of Ebonyi State and is surrounded in the North by Awgu and Aninri Loca Government Areas in Enugu State and in the East by Akaeze in Ebonyi State, South by Acha and the West by Uturu both in Abia State. The area is endowed with solid minerals. The land is rocky, with bed rock mostly igneous and granite. This accounts to the establishment of quarry industries in the area. The main occupation of the people is farming and is noted for rice, okra and yam production. Purposive and multistage random sampling techniques were used in selecting agricultural circles and ADP contact rice farmers. Purposively IVO block was chosen for the research because of intensive rice farming experienced in the zone. First, three (3) circles namely Ngwogwo, Ogwor and Amaeze were selected from the mining areas. Also twenty rice farmers (20) each was randomly selected from the circles to give a total sixty (60) rice farmers. The circles randomly selected from the non mining areas were Mile II, Amagu and Ayaraagu. From the selected circles, twenty (20) rice farmers each were randomly selected to give a total of sixty (60) rice farmers. The grand sample size for the study was one hundred and twenty (120) rice farmers. Primary data were used for the research and were obtained by means of a structured questionnaire and interview schedule. Data were analyzed using descriptive statistics as frequency distribution, mean counts and tables. Inferential statistics (multiple regression analysis models and Chow's test were also adopted. Objective i was analyzed with frequencies, percentages and mean counts while objective ii was realised using multiple regression model and objective iii and iv with multiple regression and Chow's test.

Multiple regression analysis was used to determine the factors that affect output of rice from the mining and non mining areas. The four functional forms of regression model viz: linear, semi-log,

exponential and Cobb-douglas were tried in accordance with Nwaobiala (2010). The best fit was chosen as the lead equation based on its conformity with econometric and statistical criteria such as the magnitude of R^2, F-ratio and number of significant variables.

The four functional forms are expressed as follows:

i. **Linear Function**
$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + X_6 + X_7 + ei$

ii. **Semi – log function**
$Y = L_nb_0 + b_1L_nx_1 + b_2L_nx_2 + b_3L_nx_3 + b_4L_nx_4 + b_5L_nx_5 + X_6 + X_7 + ei$

iii. **Exponential function**
$LnY = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + X_6 + X_7\ ei$

iv. **Cobb Douglas Function**
$LnY = L_nb_0 + b_1L_nX_1 + b_2L_nX_2 + b_3L_nX_3 + b_4L_nX_4 + b_5L_nX_5 + L_nX_6 + L_nX_7 + ei$

Y= output from a hectare of rice in tonnes
X_1 = age (years)
X_2 = household size (number of persons)
X_3 = education (years of schooling)
X_4 = farming experience (years)
X_5 = farm size (hectare)
X_6= farm income (naira)
X_7 =extension contact (number of contacts in a month)
ei = error term

Data analysis involving chow's test was used to ascertain whether the factors that affect the output of rice in the two locations differed significantly.
The model is specified adopted in this paper followed that of Nwaobiala (2013)

Chow's
$$F^* = \frac{\frac{\sum e_3^2 - \sum e^2_2 - \sum e_1^2}{K_3 - (K_2 + K_1)}}{\frac{\sum e_2^2 + \sum e_1^2}{K_1 + K_2}} \qquad (1)$$

To verify the difference in the estimated relationship, chow's test was used again to test the stability of the intercepts of the fitted functions. This was computed as:

Chow's
$$F^* = \frac{\frac{\sum e_3^2 + \sum e^2_4}{K_3 - K_4}}{\frac{\sum e_4^2}{K_4}} \qquad (2)$$

Where,
$K_1 = n_1 - m$
$K_2 = n_2 - m$
$K_3 = n_1 + n_2 - m$
n_1 = Sample size for the first regression
n_2 = Sample size for the second regression
m = Number of independent variables plus the intercept
$\sum e_1^2$ = Residual sum of squares from the first regression
$\sum e_2^2$ = Residual sum of squares from the second regression
$\sum e_3^2$ = Residual sum of squares from the pooled regression
$\sum e_4^2$ = Residual sum of squares from the dummy variable (Areas)

RESULTS AND DISCUSSION

Selected Socio-economic Characteristics of ADP Contact Rice Farmers Mining and Non Mining Areas IVO LGA of Ebonyi State

The mean distribution of rice farmers in the study area is shown in Table 1. The result indicates that the mean age of mining area rice farmers was 36.70 years while the non mining area rice farmers was 39.50 years. The rice farmers in the mining and non mining areas had 13.50 and 14years of farming experiences respectively. The mean farm sizes of mining area farmers was 1.10 hectares while non mining area farmers cultivated on 1.30 hectares of farmland, with both farmer groups visited forthrightly by an extension agent.

Table 1: Mean Distribution of Selected Socio-E conomic Characteristics of ADP Rice Farmers in IVO LGA of Ebonyi State, Nigeria. (N= 60 Mining Area Rice Farmers and N= Non Mining Areas Rice Farmers

	Mining Area Rice Farmers	Non-Mining Area Rice Farmers
Variables	**Mean**	**Mean**
Age (years)	36.70	39.50
Farming Experience (years)	13.50	14
Farm Size (hectares)	1.10	1.30
Extension Contacts (monthly)	2	2

Source: *Field Survey, 2012*

Determinants of Factors influencing the Output of Rice in Mining Areas of IVO LGA of Ebonyi State, Nigeria

Among the functional forms of the regression analysis fitted into the data for rice output in the mining area; exponential was chosen as lead equation (Table 2). This is because the functional form had highest; level of R^2, F– value, number of significant variables of the estimated equation estimates and conformity with *a priori expectatio*n. The value of $R^2 = 0.7056$ which implies that 70.56% of variation in rice output was explained by the independent variables included in the model. The coefficient of farming experience is positive and significant at 10.00% level of probability, which is in consonance with a priori expectation. The implication is that an increase in farming experience will lead to a corresponding increase in rice output. This result conforms to the findings of Onwuka (2005). The coefficient of farm size was positive and significant at 5% level of probability, which is in agreement with *a priori expectation*. This implies that an increase in farm size will lead to a corresponding increase in rice output. Farm size has been found to determine the output of any farm enterprise. Ezeh (2006) affirmed that the larger the farm sizes the more quantity of farm products to be realized. Farm income had a positive coefficient and is highly significant at 1.00% level of probability. This implies that farm income is a strong determinant of output and in agreement with *a priori expectation*. This result concurs with the findings of Onyenweaku *et al*., (2010) were they found that sales of farm proceeds result to increased income. The coefficient of extension contact was positive and significant at 5% level of probability which conforms to *a priori expectation*. This implies that an increase in extension contact will lead to increased output. Nwaobiala (2013) asserts that frequency of contacts by extension agents has led to adoption of technologies thereby increasing farmers farm output.

Table 2: Regression Estimates of the Determinants of Output of ADP Rice Farmers in Mining Areas of Ivo LGA of Ebonyi State, Nigeria.

Variables	Parameters	Linear	Exponential +	Cobb-Douglas	Semi-log
Intercept	b_0	5202.238	10.65539	4.475635	-158417.9
		(1.39)*	(116.90)***	(40.97)***	(-0.75)
Age	X_1	-7.11466	-0.0001363	-0.0015266	-482.6856
		(-0.09)	(0.07)	(0.60)	(-0.10)
Household Size	X_2	-139.7066	0.002553	-0.0003001	-3438.369
		(-0.90)	(0.68)	(-0.24)	(-1.42)
Education	X_3	-186.4542	0.0015831	0.1641879	1550.219
		(-0.74)	(0.26)	(1.50)*	(0.53)
Farming Experience	X_4	165.7392	0.0068586	0.0001998	-2212.665
		(0.90)	(1.69)*	(0.15)	(-0.87)
Farm Size	X_5	148826.9	0.35293	-0.0399661	36.3237
		(21.86)***	(2.13)**	(4.31)***	(2..03)**
Farm income	X_6	0.0091349	0.0000592	0.0354511	14594.43
		(-0.37)	(9.96)***	(4.21)***	(0.88)
Extension Contact	X_7	2.559461	1.004936	-0.1856295	16552.81
		(2.421)**	(2.65)**	(0.14)	(3.11)***
R^2		0.6212	0.7056	0.6064	0.6355
F – Ratio		561.59***	174.03***	0.0000***	0.0000***

Source: *Field Survey Data, 2012.*

Variables in parentheses are t-values

+ = Lead equation

*, ** and *** is significant at 10.00%, 5.00% and 1.00% respectively.

Determinants of Factors influencing the Output of Rice in Non Mining Areas of Ivo LGA of Ebonyi State, Nigeria

The result in Table 3 shows that exponential regression model was chosen as lead equation based on the high level of R^2 value of 0.7140 implying that 71.40% variability in rice output was explained by the independent variables included in the model. The coefficient of age is positive and significant at 10.00% level of probability, which is in disagreement with *a priori expectation*. The implication is that an increase in age will lead to a corresponding increase in rice output. Age of the farmer has profound effect on output. Age as proxy for experience has been shown to enhance farming initiative and efficient use of resources (Nwaobiala (2010). The coefficient of farm size was positive and significant at 5% level of probability, which is in agreement with *a priori expectation*. This implies that an increase in farm size will lead to a corresponding increase in rice output. The coefficient of farm income was positive coefficient and is highly significant at 1.00% level of probability. This implies that farm income is a strong determinant of output and in agreement with *a priori expectation*. The coefficient of extension contact was positive and significant at 5.00% level of probability which conforms to *a priori expectation*.

Table 3: Regression Estimates of the Determinants of Output of ADP Rice Farmers in Non Mining Areas of Ivo LGA of Ebonyi State, Nigeria.

Variables	Parameters	Linear	Exponential +	Cobb-Douglas	Semi-log
Intercept	b_0	-56.14043	6.445131	-4.990873	-27817.91
		(-2.42)**	(52.22)***	(-45.59)***	(-8.77)***
Age	X_1	1.031458	0.0051286	0.0028356	-319.5852
		(1.80)*	(1.68)*	(0.29)	(-1.13)*
Household Size	X_2	1.932334	0.0020177	0.0069231	53.58162
		(1.61)*	(0.32)	(1.52)*	(0.40)
Education	X_3	1.01142	-0.00144611	0.0044113	296.7172
		(0.46)	(1.23)*	(0.78)	(1.81)*
Farming Experience	X_4	1.643802	-0.0010083	-0.0031886	6.365882
		(-1.61)*	(-0.19)*	(-0.73)	(0.05)
Farm Size	X_5	4.711327	0.3543666	-0.0005689	-299.0334
		(0.12)	(1.66)*	(-0.07)	(-1.26)*
Farm income	X_6	0.0071202	0.0000306	0.9945343	2005.654
		(13.34)***	(10.80)***	(12.63)***	(8.74)***
Extension Contact	X_7	0.000128	0.1856295	0.0081631	477.2116
		(0.67)	(1.14)*	(1.22)*	(2.44)**
R^2		0.6330	0.7140	0.6241	0.6111
F – Ratio		161.67***	106.91***	198.61***	109.77***

Source: *Field Survey Data, 2012.*
Variables in parentheses are t-values
+ = Lead equation
*, ** and *** is significant at 10.00%, 5.00% and 1.00% respectively.

Determinants of Factors influencing Rice Output in the two Locations

Data from mining and non mining areas were pooled and the significant differences between the two regression analyses were determined using chow's test (Table 4). The functional forms linear, semi log, double log and transcendental log were tried on the pooled data. Exponential was chosen as lead equation based on the highest; R^2 value, F value, number of significant variables of the estimated parameter and a *priori expectation*. The R^2 value of 0.7544 implies that 75.44% variability in rice output was explained by independent variables. The coefficients of farm size, farm income and extension contacts were significant were positive and significant at 1.00% level of probability. The coefficient for the dummy variable was negatively signed and highly significant at 1.00% level of probability. This implies that farmers in the non mining areas of Ivo LGA had more output than their counterparts in the mining areas.

Table 4: Regression Estimates of the Determinants of Output of ADP Rice Farmers in Mining Areas of (Pooled) Ivo LGA of Ebonyi State, Nigeria.

Variables	Parameters	Linear	Exponential +	Cobb-Douglas	Semi-log
Intercept	X_0	-2.84909	6.470528	-4.982995	-26197.84
		(-2.61)**	(61.55)***	(-70.04)***	(-8.39)***
Age	X	0.5710366	-0.0001128	0.0013611	250.4484
		(1.99)*	(-0.05)	(0.29)	(1.22)*
Household Size	X_2	1.098516	-0.0015205	0.0042509	111.5923
		(1.83)*	(-0.30)	(1.84)	(1.10)*
Education	X_3	0.5943434	-0.0004878	0.0032779	51.49605
		(0.57)	(-0.06)	(1.17)*	(0.42)
Farming Experience	X_4	-1.061178	0.042479	-0.0026052	-113.0188
		(-1.89)*	(0.91)	(-1.12)*	(-1.11)*
Farm Size	X_5	-10.0897	1.007349	-0.0009777	-422.3621
		(-0.43)	(5.16)***	(0.16)	(-1.81)*
Farm income	X_6	0.0071416	0.00000231	0.9969026	1804.399
		(23.43)***	(9.09)***	(23.39)***	(9.650)***
Extension Contact	X_7	0.0001428	0.00000198	-0.0058415	409.7234
		(1.09)*	(2.80)***	(-0.87)	(2.03)**
Dummy		-1.534173	-0.3868133	-0.0037182	11308.34
		(-0.22)	(-6.54***)	(-0.87)	(0.61)
R^2		0.9997	0.9298	0.9998	0.9000
F – Ratio		462.63***	183.81***	0.0006***	124.87***

Source: *Field Survey Data, 2012.*
Variables in parentheses are t-values
+ = Lead equation
*, ** and *** is significant at 10.0%, 5.0% and 1.0% respectively.

Difference in Estimated Relationship between Rice Outputs in the Two Locations

The result of Chow's test difference in rice output in mining and non mining areas in Table 5 revealed that the F- value was 56.57 which were highly significant at 1.00% level of probability. This implies that farmers in the mining areas had more rice output than those in the non mining areas.

Table 5: Test for Effect of Rice Output among ADP Farmers in Mining and Non Mining Locations of Ivo LGA of Ebonyi State, Nigeria

Locations	∑e2	Df	[F-calculated
Mining	1.44	52	
Non Mining	0.43	48	56.57***
Pooled	3.76	118	

Source: *Field Survey Data, 2012*
*** Significant at 1.00% level of Probability.

CONCLUSION

The study has determined socio- economic factor affecting the ouput of ADP contact farmers in mining and non mining areas of IVO LGA of Ebonyi State. The output of rice in the two locations was influenced by farming experience, farm size, farm income and extension contacts. Based on the findings the study therefore recommend review of Land Use Act of 1990 so that most of the fertile land held by government will be released to rice farmers, subsidy and availability of farm inputs as improved rice seeds, fertilizers, herbicides among others by relevant agencies and formation of farmer groups (cooperatives) in order to have access to credit advocated to rice boost production.

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