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Determinants of Income of Cocoa Production Contract Systems in Cross River State, Nigeria

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ABSTRACT

Background: The study is on determinants of income of cocoa (*Theobroma cacao*) production contract systems in Cross River State, Nigeria. Cocoa is a food and industrial crop of significant importance that has a role to play in terms of poverty reduction. Contracts are an integral part of the production of cocoa taking the form of leases, contracts for deed and contract for sharing of production.

Methods: Purposive and multi-stage random sampling techniques were employed in the selection of respondents for the study. Primary data were used and collected through field survey using structured questionnaire/interview responses from cocoa producers. Data were analyzed with the use of multinomial logit regression analysis. The income of the cocoa producers was set as the dependent variable and the rest of the variables were defined as the explanatory variable.

Result: Result of analyses indicated that six of the nine parameters included in the model affected the amount of income realized by owner managed producers significantly. These parameters included; age, educational level, household size, farm asset, credit, experience, membership of group, farm size and distance. The fixed rent contracts producer has the lead equation as the exponential; the significant variables were age, household size, farm asset, credit, experience and membership of group. The results for the Sharecropping contracts showed that the lead equation was also exponential, the significant variables were experience, membership, farm size and distance. Based on the result of findings, the following recommendations were made: The link between the various contract arrangements should be strengthened to improve the performance of cocoa production, young school leavers, should be encouraged to take advantage of these types of management systems to boost production.

Key words: Cocoa, Contract, Fixed rent, Logit regression, Owner managed, Sharecropping.

INTRODUCTION

Cocoa (*Theobroma cacao*) is a food-industrial crop of significant importance that has a role to play in terms of poverty reduction in depressed regions of the humid tropics (Ettah, 2017). In Nigeria as in many parts of Cross River State production is in the hands of small-holder cocoa farmers. These producers on the average hold between 1 and 10 hectares, using simple farm tools with little or no modern innovations in cultivation, but yet produces more than 80% of the total cocoa produced in the world (Poelmans and Swinnen, 2016 and Nkang *et al.,* 2009).

The world top ten producers of cocoa are Cote d'Ivoire, Ghana, Cameroon and Nigeria in West Africa; Indonesia in South East Asia; and Ecuador, Brazil, Peru, Dominican Republic and Colombia in Latin America. West Africa has consistently provided about 70% of the world's cocoa production and a higher contribution was observed in 2021/2022 when 72% of the global cocoa output was produced in West Africa Food and Agricultural organization Statistics (FAO Stat, 2023). The region has four major cocoa producers; Cote d'Ivoire, Ghana, Nigeria and Cameroon in order of their production, Cote d'Ivoire and Ghana produced 43% and 16% of the world production, respectively. Cocoa has been the main agricultural stay of Nigeria economy until 1970's when the crude oil was discovered in the country in commercial quantity. It has remained a valuable crop and major foreign exchange earner among other agricultural commodity export of the country (Ettah, 2017 and Fadipe, *et al.,* 2012). Apart from its contribution to the nation's economy, cocoa is a plant-based food that contains carbohydrates, fats, proteins, natural minerals and some vitamins and like several other plant foods such as tea, red wine, fruits, vegetables and nuts cocoa contains a group of compounds which exhibit health benefits (Ajayi and Oyejide, 2004).

According to Ackerberg and Maristella (2000) and Key and Runsten (1999) contracts are an integral part of the production of selected tree crops like cocoa and may take

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the form of leases, contracts for deed and contract for sharing of production. Production contractors receive a substantial share of farm receipts. Contractors typically provide much of the operating capital, bear a large share of production and risks and earn the majority of net income from the commodity's production (Cai *et al*., 2008), D'Stiva *et al*. (2009) and Key and Runsten (1999). Contracting is important because it can provide alternative governance mechanisms for the sector and can improve the efficiency of supply chains. The study is based on the following objectives:

i. Determine the income of owner managed producers of cocoa.
ii. Determine the income of fixed rent producers of cocoa.
iii. Determine the income of share cropping producers of cocoa.

MATERIALS AND METHODS

Study area

The study was conducted in cross river state, Nigeria. The choice of cross river state was informed by the number of cocoa farms and farmers across the State, being a coastal State in South-Eastern Nigeria where Cocoa thrives. Cross River State is located within the tropical rainforest belt of Nigeria and lies between latitude 4°28′N and 6°55′N and latitude 7°50′E and 9°28′E of the Greenwich Meridian. It is bounded in the North by Benue State, shares a common boundary with the Republic of Cameroon in the East, Abia and Ebonyi States in the West, Akwa Ibom State in the South and the Atlantic Ocean also in the south (Ettah and Agbachom, 2019). The state has a total land area of 22,342.176 square kilometers and an annual rainfall of between 2942 mm to 342 mm. The annual temperature averages 28°C. Cross river state records heavy rainfall during the wet season (May-october). The soils of the State are *utisols* and *alfisol,* which are suitable for food and tree crops production like; cocoa, oil palm, banana, plantain, rubber, groundnut, plantain, cassava, yam, maize and vegetables (Cross River State Geographic and Information Agency (CRGIA, 2016)). The state has an estimated population of approximately 2.89 million persons with an annual growth rate of 2.99%, giving a density of 120 persons per square kilometer and a gender distribution of 50.03% male to 49.97% female (National Population Commission, 2006).

Sampling procedure and size

For adequate coverage of respondents, purposive and multi-stage random sampling techniques were used as employed by Ettah and Chiemela (2018). This method is as shown below:

Stage 1

Six local government areas (LGAs), based on the areas where cocoa is predominantly produced were purposively selected. These are Akampa, Obubra Ikom, Boki, Etung and Obudu. A sampling list of registered cocoa farmers was compiled from Cross River State Agricultural Development Project office.

Stage 2

An exploratory survey from where twelve communities were selected from the six LGAs, based on the contract types (sharecropping, fixed rent and owner managed).

Stage 3

The third stage was drawn up with the help of cross river state agricultural development project (CRADP) where the registered cocoa farmers were identified in the twelve communities where cocoa is produced. A proportionate sample of ten per cent (10%) of cocoa producers were randomly selected in each of the community. Thus, a total of 320 cocoa producers were selected for the study, this information is presented in Table 1. However, 311 returned questionnaires with accurate information.

Table 1: Sample size selection of cocoa producers.

Zones	LGAs	Population of registered cocoa farmers	Communities	Number of registered cocoa farmers	Number of selected farmers
Southern	Akampa	2792	Uyanga	94	9
			Oban	121	12
Central	Obubra	3397	Ofat	209	20
			Ochon	209	20
	Ikom	6685	Olulumo	402	40
			Ikom urban 1	233	23
	Boki	6714	Ekpashi	124	12
			Buda	390	39
	Etung	6768	Nsofang	359	35
			Bendeghe ekiem	443	44
Northern	Obudu	3397	Ukpe	108	10
			Begiading	478	47
Total		29.753		3.170	311

Source: Cross river state ministry of agriculture, 2024 cocoa farmer count.

Table 1 showed the distribution of contract (sharecropping, fixed rent and owner manage) arrangement from each of the communities selected from the six LGAs.

Data collection and analysis

Primary data were collected through field survey using structured questionnaire/interview responses from cocoa producers and were analyzed with the use of multinomial logit regression analysis. Four functional forms (linear, semi- log, double-log and exponential) were used in the analysis. The income of the cocoa producers was set as the dependent variable and the rest of the variables were defined as the explanatory variables. The significance of the parameter estimate of the model was evaluated by means of t-test at 1%, 5% and 10% levels which is the most commonly used. The models are implicitly specified as follows:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, Ut) \quad ...(i)$$

The functional forms expressed as follows;

Linear

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + U \quad ...(ii)$$

Semi log

$$YL = \beta_0 + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \beta_5 \log X_5 + \beta_6 \log X_6 + \beta_7 \log X_7 + \beta_8 \log X_8 + \beta_9 \log X_9 + U \quad ....(iii)$$

Cobb-douglas

$$\text{Log } Y = \beta_0 + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \beta_5 \log X_5 + \beta_6 \log X_6 + \beta_7 \log X_7 + \beta_8 \log X_8 + \beta_9 \log X_9 U \quad ...(iv)$$

Exponential

$$\text{Log } Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \beta 7X7 + \beta 8X8 + \beta 9X9 + U \quad ...(v)$$

Where,

β_0 = Intercept.

β_1-β_9 = Parameters to be estimated.

Where,

Y = Income (Sharecropping or fixed rent or owner managed) in Naira (where $1 US = 1600 Naira).

X_1 = Age of the producers in years.

X2 = Educational level (number of years spent in school).

X3 = Household size (Number of persons in farmers house).

X4 = Farm asset (Naira value of all productive farm asset)

X5 = Credit (Naira value).

X6 = Experience (number of years spent in cocoa production).

X7 = Membership in a social group (Dummy where 1= Yes, 0 = No)

X8 = Farm size (in hectare).

X9 = Distance = Distance in kilometer.

UI = The error term which captures all other factors that can affect cocoa production but not taken into account in this study.

RESULTS AND DISCUSSION

Determinants of income of owner managed producers

Table 2 presents results of factors that affect the income of the owner managed producer, it showed the results of the four functional forms (linear, semi-log, double-log and exponential) of the ordinary Least square (OLS) estimation technique. The semi-log function was preferred due to the number of variables that were significant and the high R^2. The value of R^2 and adjusted R^2 were 0.914 (91%) and 0.909 (91%) respectively. This indicated that about 91% of the variation in the dependent variables (income) was due to the variables captured in the model. Six of the nine parameters included in the model affected the amount of income realized by owner managed producers significantly. These parameters included; age, educational level, household size, farm asset, credit, experience, membership of group, farm size and distance.

The coefficient of education was significant at 1% and positively related to amount of income generated. This implied that, the higher the educational attainment of the owner managed producer, the higher the amount of income made and vice versa. According to Ettah and Ukwuaba (2017) and Effiong *et al.* (2023) the more educated people are, the probability of making income is higher, since the more years spent to obtain formal education is believed to cumulate in better skills, which assist them do better in their chosen businesses.

The coefficient of household size was directly related to amount of income made by owner managed producers and significant at 1% probability level. The implication is that the more the number of persons in a household, the higher the income of the household head all things being equal. It is obvious that a large household size apart from offering cheap labor for owner managed producers, gives head of household the concern for consumption. This finding is in line with previous work done (Nkang *et al.,* 2009 and Agbachom *et al.,* 2023). The coefficient of farm asset was positively signed and significant at 1%, this implies that the more farm asset owner managed producers have, the higher the amount of income made from cocoa venture. Experience, which is the act of gaining knowledge by constant practice of skill, is expected to bring about specialization which will increase output of owner managed producers. The coefficient of experience was positively signed and significant at 5%, thus the more experience owner managed producers are, the higher their amount of income made.

Membership of a group was significant at 1% probability level and was negatively related to producers' income. The likelihood of the group insurance serving as collateral for contract agreement is apt. The use of group contract production among cocoa producers will reduce their income. The coefficient for farm size had a positive sign

and was significant at 5% for owner managed, this implied that the larger the farm size the higher the income of owner managed. Distance was significant at 5% probability level and was negatively related to owner managed income. This implies that distance affect the volume of income made by producers either positively or negatively in the study area. In this study distance affected income negatively. This is not a surprise because distance determines accessibility as it has a negative effect on income. Income and savings are expected to increase by discouraging long distances (Omoare *et al.,* 2016 and Ojobor *et al.,* 2022).

Determinants of income of fixed rent contracts

The results for the fixed rent contracts on Table 3 shows that the lead equation was the exponential; the significant variables were age, household size, farm asset, credit, experience, membership to a group. The value of the R^2, Adj. R^2 and F-test showed that the model performed relatively well. The value of the R^2 and Adj. R^2 were 0.836 (84%) and 0.804 (80%) respectively. This indicated that approximately 80% of the variation in the dependent variables (income) was due to the variables captured in the model. The coefficient of age has the expected negative

Table 2: Presentation of OLS regression results on determinants of income of owner managed cocoa production systems.

Model	Linear	Semi-log +	Double-log	Exponential
Constant	2232594.144 (7.788)***	-79.332 (13.442)***	8.052 (2.850)**	1515478.267 (12.460)***
Age	-.166 (-.347)	i.603E-5 (1.433)	.051 (-1.663)	-1164.171 (-.879)
Education	1173.800 (.123)	.846 (3.826)***	.652 (2.975)**	13836.003 (1.331)
HH size	3881.699 (.117)	6.501 (10.864)***	43.239 (11.825)***	-274382.825 (-1.775)*
F asset	-168235.607 (-9.588)***	4.986 (12.316)***	5.557 (12.309)***	-162353.745 (-8.075)***
Credit	-6845.574 (-.561)	.483 (1.667)7	-.051 (-.166)	7951.762 (.621)
Experience	.20953.244 (1.179)	.181 (2.887)**	2.729 (1.151)	16782.164 (-1.081)
Membership	497533.505 (4.520) ***	-7.821 (-2.887)**	-6.443 (-2.704)**	374376.173 (3.638)**
Farm size	.383 (.695)	7.821 (3.545)**	5.274 (2.432)**	18789.818 (.882)
Distance	5404.240 (-.051)	-2.172 (1.002)**	2.860 (1.419)	16839.323 (-1.87)*
R^2	.603.	.914	.919	.637
Adj. R^2	577	.909	.915	.613
F-ratio =	23.11	211.671	226.939	26.852
Std-error	459963.43958	11.00731	10.66160	440239.885

Source: Computation from field survey, 2022.

Reject the null hypothesis at one per cent level, Figures in brackets are the t-values, ***, **, * significant at 1%, 5% and 10% level respectively, + = The lead equation.

Table 3: Presentation of OLS regression results on determinants of income of fixed rent cocoa production systems.

Model	Linear	Semi-log	Double-log	Exponential +
Constant	1713190.92 (1.444)	1581636.95 (6.978)***	-1.725 (-.975)	-38.171 (-2.069)**
Age	2.100 (1.237)	-12281.14 (-.787)	.380 (3.114)***	-5.517E-5 (-2.091)**
Education	24545.89 (1.053)	-35486.98 (-1.576)	-.058 (-.330)	-.089 (-.246)
HH size	-8200.62 (-.175)	694002.49 (2.530)**	2.688 (1.255)	3.371 (4.614)***
F Asset	258987.10 (-3.992)***	-57762.92 (-.726)	.453 (.729)	4.113 (4.077)***
Credit	-2095.80 (-.106)	-7794.59 (-.315)	.025 (.128)	.932 (3.038)***
Experience.	-9325.72 (-.292)**	-179507.61 (-1.290)	4.840 (4.458)***	-.006 (-.012)
Membership	1065228.88 (4.631)***	-568820.54 (-3.114)***	-2.225 (-1.560)	-7.723 (-2.159)**
Farm size	.376 (.322)	9617.66 (.192)	-.439 (-1.124)	-1.032E-5 (-.569)
Distance	246778.14 (1.407)	-112431.53 (-.643)	.184 (.135)	-11.330 (-4.154)***
R^2	.498	.615	.968	.836
Adj. R^2	.402	.541	.962	.804
F-ratio =	5.185	8.348	159.052	26.525
Std-error	457905.04	400959.68	3.12993	7.11979

Source: Computation from field survey, 2022.

Reject the null hypothesis at one per cent level. Figures in brackets are the t-values ***, **, * significant at 1%, 5% and 10% level respectively, + = The lead equation.

Table 4: Presentation of OLS regression results on determinants of income of sharecropping cocoa production systems.

Model	Linear +	Semi-log	Double-log	Exponential
Constant	919136.650 (4.115)***	611925.975 (11.502)***	-1.725 (-.975)	-60.521 (-2.361)**
Age	-.020 (-.608)	-2928.184 (-1.777)	.380 (3.114)***	1.503E-6 (.404)
Education	-7223.469 (-1.426)	5931.716 (1.046)	-.058 (-.330)	.495 (.852)
HH-size	25173.882 (2.977)**	-533.676 (-.082)	2.688 (1.255)	.479 (.494)
F asset	5589.981 (.554)	13644.299 (1.269)	.453 (.729)	-1.585 (-1.368)
Credit	-8611.412 (-1.776)	-8682.296 (-1.472)	.025 (.128)	2.030 (3.648)***
Experience	-27556.675 (-4.123)***	-45702.150 (-3.639)***	4.840 (4.458)***	2.079 (2.710)**
Membership	246943.046 (3.305)***	-346990.851 (-5.801)***	-2.225 (-1.560)	6.053 (.706)
Farm size	.034 (.480)	-1359.854 (-1.500)	-.439 (-1.124)	3.831E-5 (4.654)***
Distance	17668.984 (.447)	1347.279 (.035)	.184. (135)	-11.789 (-2.597)**
R^2	.518	.515	.968	.681
Adj. R^2	.477	.474	.962	.654
F-ratio =	12.762	12.619	159.052	25.356
Std-error	162299.50273	162771.95229	3.12993	18.62726

Source: Computation from field survey, 2022.

Figures in brackets are the t-values,***, **, * significant at 1%, 5% and 10% level respectively, + = The lead equation.

sign but significant at 5%, this implies that the older the fixed rent producer the lower their level of income made from cocoa venture. Household size was positive and significant at 1% level. This implies that households size which are large can support fixed rent contracts by providing labor that can increase their income, this result conforms with that of Osarenren and Emokaro (2015) and Ettah, (2017). Farm asset was positive and significant at 1% level, this showed that the more asset the fixed rent has the higher their level of income. Furthermore, credit had a positive sign and significant at 1% level, indicating that the higher the amount of credit a fixed rent contract has if managed properly, the higher the amount of income. Membership to a group was also significant but negatively signed. This implies that belonging to a group has a negative impact on fixed rent contract's income. This may be due to the fact that, the fixed rent contract cannot afford to pay the dues required by members.

Determinants of income of share cropping contracts

The results for the Sharecropping contracts on Table 4 showed that the lead equation was exponential, the significant variables were experience, membership, farm size and distance. The value of the R^2, Adj. R^2 and F-test showed that the model performed relatively well. The value of the R^2 and Adj. R^2 are 0.681 (68%) and 0.654 (65%) respectively. This indicated that approximately 68% of the variation in the dependent variables (income) was due to the variables captured in the model. Thus, the values provided are reliable measures of the overall explanatory power of the regression model. The coefficient of experience showed that the variable was positive and significant at 5% level. This implies that the more experience a sharecropper the higher level of income. Farm size was also positive and significant at 1% level, implying that the large farm size of sharecropper increases their incomes. Distance was significant at 5% but negatively signed, for the sharecropper, the long distance reduces their level of incomes. This is due to the fact that long distances increase the cost of transportation and reduce incomes, in line with the result obtained by Osarenren and Emokaro (2015) and Sekumade (2014).

CONCLUSION

It is evident from the study that different contract systems exist in the production of cocoa in the State and included sharecropping, fixed rent and owner managed contract arrangements. Factors that affect participation in contract systems included, education, household size, farm assets, farm income, farm credit, age and membership group. Performance of cocoa production generally showed that production is profitable. Owner managed producers are more than sharecropping and fixed rents. The following recommendations were made resulting from the findings of the study: The link between the various contract arrangements should be strengthened to improve the performance of cocoa production and marketing, the study recommends also that young school leavers, should be encouraged to take advantage of these types of management systems so to boost cocoa production in the area. Cocoa farmers should look for ways and means of sourcing for credit to manage their farms especially through Agricultural Loans Schemes of the Federal Government of Nigeria.

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Authors contribution

Igiri, Ettah, provided the main concept of the work. Literature review was done by Abanyam, Uwah and Akin-Fakorede. Data were analysed by Igiri, Ettah, Okute and Edet while Agbachom, Odok and Okeme took charge of interpreting and formatting the manuscript. All authors read and approved of the manuscript.

Ethical approval

Authors declare that this manuscript does not include any studies using animal and human beings.

Consent to publication

All authors read and approved the final manuscript.

Conflict of interest

On behalf of all authors, I declare that we have no conflict of interests of any sort.

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